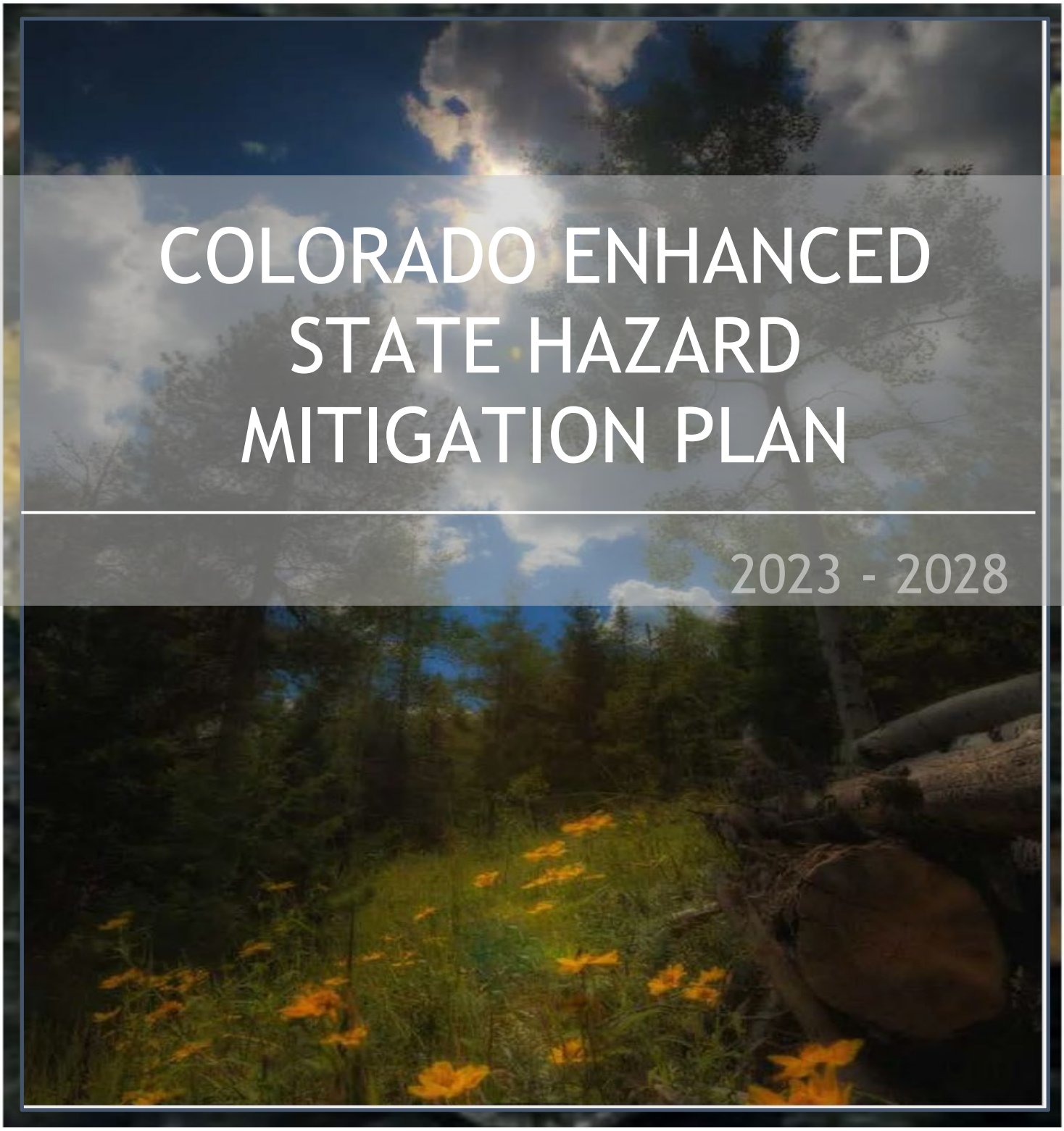

COLORADO ENHANCED STATE HAZARD MITIGATION PLAN

2023 - 2028

PREPARED BY

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Cover photo by DHSEM Mitigation Staff

EXECUTIVE SUMMARY

Hazard mitigation helps to reduce or eliminate potential losses from future disasters. Hazard mitigation planning helps to establish and maintain a process that leads to the implementation of hazard mitigation actions. The State of Colorado is intimately familiar with the impacts of hazards on its residents, visitors, infrastructure, environment, and economy. This 2023 update to the State's Enhanced Hazard Mitigation Plan (E-SHMP) re-affirms the state's commitment to continual improvements to its statewide mitigation strategy and program.

The E-SHMP demonstrates Colorado's commitment to a comprehensive mitigation program focused on reducing risks from hazards and serves as a guide for state and local decision makers as they commit resources to reduce the effects of hazards.

The hazard mitigation planning process began with the identification of a broad-reaching State Hazard Mitigation Team (SHMT), which helped to guide the development of the E-SHMP. The next steps involved a detailed identification of all natural hazards that can impact Colorado and an assessment of risk presented by those hazards. The next efforts included a thorough evaluation of the state's current mitigation capabilities, followed by an update to the state's mitigation strategy. This strategy identified eight overarching Mitigation Goals, and related Mitigation Objectives, that define Colorado's path forward to implementing hazard mitigation.

- Minimize the loss of life and personal injuries from natural hazard events
- Reduce losses and damages to state, tribal, and local governments, as well as special districts and private assets, and support similar local efforts
- Reduce federal, state, tribal, local, and private costs of disaster response and recovery
- Support mitigation initiatives and policies that promote disaster resiliency, nature-based solutions, cultural resources and historic preservation, and climate adaptation strategies

- Minimize interruption of essential services and activities
- Incorporate equity considerations into all mitigation strategies
- Support improved coordination of risk mitigation between and among the public, private, and non-profit sectors
- Create awareness and demand for mitigation as a standard of practice

These goals helped the SHMT to identify new and on-going mitigation actions that specific state agencies plan to implement over the next five years. The final and most important piece of the E-SHMP is defining the path forward. Through the planning process a clear procedure for implementation and maintenance has been defined.

The E-SHMP addresses each required element of 44 CFR § 201.4 and includes information required in 44 CFR § 201.5 to meet the Federal Emergency Management Agency's (FEMA) "Enhanced" plan criteria. Pending continued approval of the "Enhanced" plan elements, Colorado will remain eligible for increased federal funding for state and local mitigation projects.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

TABLE OF CONTENTS 4

FORMAL STATE ADOPTION 8

ASSURANCES OF CONTINUED COMPLIANCE 9

PLANNING PROCESS 10

Acronyms 10

State Hazard Mitigation Team 12

2023 Plan Update Process 18

Plan Update 23

Plan Organization 24

HAZARD IDENTIFICATION & RISK ASSESSMENT 25

Risk Assessment Overview 25

Hazard Profile Overview 52

Animal Disease Outbreak – Moderate Risk 55

Avalanche – Moderate Risk 68

Dam / Levee Incident – Moderate Risk 88

Drought – Extremely High Risk 117

Earthquake – Moderate Risk 143

Erosion and Deposition – Low Risk 165

Expansive Soils – Low Risk 184

Extreme Heat – High Risk ____ 201

Flood – Extremely High Risk ____ 219

Ground Subsidence – Low Risk ____ 250

Hail – Low Risk ____ 271

Landslide / Debris Flow / Rockfall – Moderate Risk ____ 288

Pandemic – High Risk ____ 319

Pest Infestation – Low Risk ____ 332

Severe Wind – Low Risk ____ 344

Severe Winter Weather – High Risk ____ 361

Thunderstorm / Lightning – Low Risk ____ 382

Tornado – Moderate Risk ____ 399

Wildfire – Extremely High Risk ____ 417

Wildlife-Vehicle Collision – Low Risk ____ 454

HAZARD MITIGATION CAPABILITIES ____ 463

Acronyms ____ 463

Government Mitigation Responsibility ____ 469

Programs, Policies, Regulations, & Practices ____ 479

Land Use / Zoning ____ 541

Building Codes ____ 547

Mitigation Funding ____ 549

Local Mitigation Capabilities 569

FEMA Core Capabilities 592

Obstacles, Challenges, & Solutions 594

HAZARD MITIGATION STRATEGY 600

Acronyms 600

Goals & Objectives 602

2018 Mitigation Actions 605

Mitigation Successes 639

2023 Mitigation Actions 647

LOCAL COORDINATION 676

Hazard Mitigation Plans 677

Technical Assistance 679

E-SHMP IMPLEMENTATION 688

Acronyms 688

Integration 694

Commitment to Comprehensive Mitigation Program 723

Program Utilization 724

Hazard Mitigation Assistance Program Compliance 733

Assessing Effectiveness 741

Monitoring, Evaluating, and Updating 754

ANNEX - DISASTER DECLARATION HISTORY 756

State Emergency Declarations 756

Federal Declarations 767

ANNEX - DROUGHT RESPONSE PLAN 788

Ongoing Monitoring, Mitigation, and Drought Response Efforts 788

ANNEX - COLORADO RURAL ELECTRIC ASSOCIATION HMP 803

Introduction and Background 803

Planning Process 808

Vulnerability Assessment 814

Capability Assessment 823

Mitigation Planning 823

ANNEX - HIGH AND SIGNIFICANT HAZARD DAMS 830

ANNEX - PLANNING ROSTER 878

ANNEX - FEMA APPROVAL PACKET 897

Professional planning services for this plan update provided by:

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FORMAL STATE ADOPTION

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December 13, 2023

Ms. Nancy Dragani
Regional Administrator
Federal Emergency Management Agency, Region 8
P.O. Box 25267
Denver, CO 80225-0267

Dear Ms. Dragani:

Pursuant to the authority vested in the Office of the Governor of the State of Colorado, and pursuant to the relevant portions of the Colorado Disaster Emergency Act of 1992, §24-32-2100 et seq., C.R.S., as amended and made effective on August 8, 2018 by House Bill 18-1394 to address all phases of emergency management, I, Jared Polis, Governor of the State of Colorado, hereby approve the 2023 Colorado Enhanced State Hazard Mitigation Plan (E-SHMP), including all related assurances and supporting documents.

As a result of this approval, the 2023 Colorado Enhanced State Hazard Mitigation Plan (E-SHMP) is hereby adopted and serves as a Supporting Annex to the State of Colorado Emergency Operations Plan (SEOP).

Through this adoption and FEMA approval, Colorado sustained its goal of Enhanced Plan status designed to increase the resiliency of Colorado to future disasters and reflects the efforts and dedication of departments and agencies within the state and local governments to mitigation, preparedness, prevention, response, and recovery activities. I support the goals and actions identified in the enhanced plan and encourage its continued implementation.

Sincerely,

Jared Polis
Governor

ASSURANCES OF CONTINUED COMPLIANCE

The Colorado Enhanced State Hazard Mitigation Plan (E-SHMP) was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (DMA or DMA 2000) (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.4 and§201.5) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.)

While the DMA emphasizes the need for mitigation plans and coordinated mitigation planning and implementation efforts, the regulations established requirements that hazard mitigation plans must meet in order for a state jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288).

The Colorado E-SHMP falls under assurances proclaimed in this Plan. The State of Colorado assures that it will comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding in compliance with 44 CFR Part 13.11(c). The state will amend the E-SHMP whenever necessary to reflect changes in state or federal laws and statutes, as required in 44 CFR Part 13.11(d). The adoption of this SHMP demonstrates the State of Colorado's commitment to fulfilling the mitigation objectives in the SHMP and authorizes the agencies identified in the SHMP to execute their responsibilities.

PLANNING PROCESS

Colorado's 2023 E-SHMP builds on the original Colorado State Hazard Mitigation Plan of 2001 and subsequent updates, most recently the 2018 Enhanced State Hazard Mitigation Plan (E-SHMP). In addition to ensuring that all requirements outlined in 44 CFR § 201.4 are met, sections of the E-SHMP were updated, expanded, newly developed, and consolidated to provide a more concise picture of statewide hazard mitigation. In addition to meeting all required 'Standard' plan elements, the 2023 E-SHMP was developed to continue meeting all required 'Enhanced' plan elements as defined by FEMA.

Acronyms

Table 1 provides a key for the acronyms contained within this chapter of the E-SHMP.

TABLE 1 – ACRONYM KEY

Acronym	Name	Acronym	Name	Acronym	Name
AFN	Access and Functional Needs	CREA	Colorado Rural Electric Association	E-SHMP	Enhanced State Hazard Mitigation Plan
CAIC	Colorado Avalanche Information Center	CRO	Colorado Resiliency Office	FEMA	Federal Emergency Management Agency
CCC	Colorado Climate Center	CSFS	Colorado State Forest Service	HIRA	Hazard Identification & Risk Assessment

Acronym	Name	Acronym	Name	Acronym	Name
CDA	Colorado Department of Agriculture	CWCB	Colorado Water Conservation Board	HHPD	High Hazard Potential Dam
CDE	Colorado Department of Education	CPW	Division of Parks & Wildlife	HMP	Hazard Mitigation Plan
CDHE	Colorado Department of Higher Education	DFPC	Division of Fire Prevention & Control	OEDIT	Office of Economic Development & International Trade
CDPHE	Colorado Department of Public Health & Environment	DHSEM	Department of Homeland Security and Emergency Management	PUC	Colorado Public Utilities Commission
CDOT	Colorado Department of Transportation	DLG	Division of Local Government	SHMT	Colorado State Hazard Mitigation Team
CDPS	Colorado Department of Public Safety	DNR	Colorado Department of Natural Resources	SHPO	State Historic Preservation Office
CEPA	Colorado Emergency	DOLA	Colorado Department of Local Affairs	SME	Subject Matter Expert

Acronym	Name	Acronym	Name	Acronym	Name
	Preparedness Assessment				
CICOmaps	Community Inclusion in Colorado maps	DRA	Department of Regulatory Agencies	TAP	Technical Assistance Partnership
CGS	Colorado Geological Survey	DWR	Division of Water Resources		

State Hazard Mitigation Team

Colorado's SHMT is comprised of a broad group of state agency partners and natural hazard SMEs that encompass a whole-community approach. These state agency partners, summarized in Table 2, contribute to Colorado's mitigation program and the E-SHMP's integrated planning process. These contributions came through a variety of means including defining capabilities, identifying mitigation funding, providing data and information for the risk assessment, participating in the planning process, contributing to the updated mitigation strategy, and through ongoing review and comment on plan drafts throughout the update.

The 2023 SHMT roster was originally based on involvement in the 2018 E-SHMP update and was continually updated and expanded throughout the planning process. Additional members were added based on SHMT member suggestions and interactions over the course of the plan update. The SHMT roster grew from ~100 individuals initially to over 160 at the conclusion of the planning process. Invitations to participate as part of the SHMT and become involved in the 2023 E-SHMP update process originated from DHSEM leadership by e-mail and direct conversations. The full planning roster (including SHMT and stakeholders) is provided in Annex – Planning Roster and documents workshop participation and one-on-one meetings held.

TABLE 2 – PARTICIPATING ORGANIZATIONAL SUMMARY

Department / Entity	Agency / Division / Sub-Entity (when applicable)
CDA	Animal Health Division, Conservation Services Division, State Conservation Board
CDE	-
CDHE	-
CDPHE	Center for Health & Environmental Data, Office of Emergency Preparedness & Response, Office of Health Equity, Water Quality Control Division
CDOT	Chief Engineer's Office, Materials & Geotechnical Services
CDPS	DHSEM, DFPC
CCC	-
CGS	-
CREA	-
CSFS	-
DOLA	DLG, Community Development Office, CRO, Division of Housing, Demography Office
DNR	CAIC, CPW, CWCB, DWR, Office of the State Engineer (Dam Safety)
DRA	Division of Insurance
Governor’s Office	Colorado Energy Office, Office of Climate Preparedness and Disaster Recovery, OEDIT
Local Governments	-
SHPO	History Colorado Center
PUC	-

The SHMT also coordinated with a number of federal and local stakeholders during the E-SHMP update. It is important to highlight the state's inclusion of local government representatives. This marked the first time that local governments were invited to participate directly in the E-SHMP planning process. A total of 15 local government (county-level) representatives, representing 13 counties, were included on the SHMT roster. These collective stakeholders are listed in the following bullets.

- Federal Emergency Management Agency (FEMA)
- National Oceanic and Atmospheric Administration (NOAA)
- US Department of Agriculture (USDA)
    - Natural Resources Conservation Service (NRCS)
- US Economic Development Administration (EDA)
- US Environmental Protection Agency (EPA)
- US Geological Survey (USGS)
- Alamosa County
- Carbon Valley
- City and County of Denver
- Conejos County
- Delta County
- Gunnison County
- Huerfano County
- Jefferson County
- Mesa County
- Mineral County

- Rio Blanco County
- Routt County
- Sedgwick County

Table 3 summarizes the sector-specific expertise that each state organization provided to the SHMT. It should be noted that the Colorado Climate Center (CCC) was directly coordinated with pertaining to all climate change elements of the E-SHMP. Additionally, hazard-specific subject matter experts also informed and contributed to this related analysis.

TABLE 3 – SHMT EXPERTISE BY SECTOR SUMMARY

Department / Entity	Emergency Management	Economic Development	Land Use & Development	Housing	Health & Social Services	Infrastructure	Natural & Cultural Resources
CDA	X	X	X				X
CDE	X	X			X	X	
CDHE	X	X			X	X	
CDPHE	X				X		X
CDPS	X					X	
CDOT	X		X			X	
CCC							X
CGS	X		X				X
DOLA	X	X	X	X	X	X	X
DNR	X		X			X	X
DRA		X		X		X	
CREA						X	

Department / Entity	Emergency Management	Economic Development	Land Use & Development	Housing	Health & Social Services	Infrastructure	Natural & Cultural Resources
CSFS	X		X				X
Governor's Office		X					X
Local Governments	X						
SHPO						X	X
PUC						X	

This E-SHMP update has been completed with the whole-community approach in mind. Centering equity in the mitigation plan reinforces the inclusive planning process, with the goal to reduce risk to populations that face barriers to access and, as such, are disproportionately affected by disasters. The E-SHMP is an opportunity to advance a cohesive strategy to counter those barriers, allowing intentional planning and risk reduction for the communities where it is most needed.

Continuous coordination among state agencies, local governments, or other partners working with or on behalf of underserved communities is the key to achieving mitigation goals and long-term resilience across Colorado. State-level implementation of equitable treatment of underserved communities is undertaken with the goal of eliminating avoidable or remediable barriers regardless of differences in social, economic, demographic, or geographic factors.

In addition to those sectors highlighted in the preceding Table, the SHMT also included representation from individuals that provide assistance and support to the state's underserved communities. A summary of those efforts by DHSEM, CDPHE, and DOLA follows.

In keeping with the state's prioritization of inclusivity, the DHSEM Planning Section has included an Access and Functional Needs (AFN) Coordinator since 2018. The AFN Coordinator continually promotes inclusive planning, maintaining a resource database, supporting state and local emergency management efforts, promoting AFN awareness, offering training and guidance, and establishing partnerships through all levels of government. The Coordinator's office advocates for whole-community and inclusive emergency management before, during, and after disasters. The AFN resources webpage can be accessed at Access and Functional Needs Resources | Division of Homeland Security and Emergency Management.

The Community Inclusion in Colorado maps (CICOmaps) were created by CDPHE and University of Colorado Assistive Technology Partners. CICO maps enhance current emergency preparedness and response planning and resources by making location-based community information easy-to-access. The maps include community demographics and functional characteristics at the census-tract (sub-county) level.

DOLA recently developed its Roadmaps Program that will result in regionally-aligned and actionable strategies that will help Colorado's rural communities recover from COVID and be more resilient to future disruptions. By identifying, including, and serving disproportionately impacted and socially or economically disadvantaged groups through the program, these populations will be less vulnerable and less impacted during future shocks and stressors.

Flood Technical Assistance Partnership

The state has historically organized hazard-specific working groups to address all aspects of disaster preparedness, including mitigation. These working groups are defined as Technical Assistance Partnerships (TAPs), and participation is based on a whole-community concept as appropriate, with evolving membership. Since the 2018 E-SHMP was updated, the Flood TAP continued to be active and contributed to the respective updates in this E-SHMP.

2023 Plan Update Process

DHSEM is the state entity responsible for maintaining and facilitating development of the E-SHMP. The 2023 update process began in June 2022 with the intent to again develop an Enhanced plan. A planning consultant team led by Synergy Disaster Recovery was hired to help facilitate development of the updated E-SHMP.

One major decision made during the update process related to the state sunsetting its separate Drought Mitigation and Response Plan and Flood Mitigation Plan. These separate planning efforts were previously led by CWCB. Relevant content from both plans was integrated into the E-SHMP as appropriate. A second major decision involved the elimination of a number of human-caused and technological hazards profiled in the 2018 E-SHMP.

Planning Workshops

A total of three SHMT workshops were conducted over the course of the sixteen-month planning process, in addition to a number of individual "1-on-1" meetings and calls with SHMT members and individual SMEs. DHSEM led all SHMT communications, utilizing email as the primary communication tool, followed by individual meetings and phone calls with key stakeholders as needed.

SHMT Workshop #1

The first SHMT workshop was held on June 29, 2022, and was facilitated as a hybrid event, with SHMT members attending both in-person and virtually. The agenda followed the following outline:

- Summary of disaster declarations since the last plan update
- Education on the benefits of the state having an Enhanced HMP
- Updates on progress made since the 2018 E-SHMP
- Overview of the planning process
- Updates on other recent or on-going state planning efforts

- Initial HIRA discussions
- Review of the existing mitigation strategy

Major takeaways from, and discussions occurring at, the workshop included:

- Agreement to continue pursuing an Enhanced plan for the state
- SHMT input relating to on-going / recent state planning efforts
- Agreement to eliminate a number of human-caused and technological hazards added to the 2018 E-SHMP, including: cyber attack, explosive attack, power failure, mine accidents, radiological release, infrastructure failure, hazardous materials release, radon/carbon monoxide/methane seeps, and chemical/biological/radiological/nuclear attack
- Discussion of social vulnerability indexes utilized by state agencies
- Updates on SHMT progress made at implementing the state's mitigation strategy
- Discussion of potential new mitigation goals to consider
- Discussion of new state mitigation capabilities
- Discussion relating to integrating the results of the Colorado Emergency Preparedness Assessments (CEPA)

Following the workshop, several action items were assigned to the SHMT, including requests to provide:

- Best available risk assessment data and information
- Feedback on hazard profiles within SHMT member's area of expertise
- Suggested updates to the mitigation strategy
- Status updates on 2018 mitigation actions
- Information relating to inter-agency collaboration / integration initiatives

SHMT Workshop #2

The second SHMT workshop was held on April 5, 2023, and was similarly facilitated as a hybrid event, with SHMT members attending both in-person and virtually. A Google Jamboard was utilized to capture specific input from the SHMT. Prior to the meeting, a two-page "read ahead" document was provided to assist the SHMT in preparing for the workshop. The agenda followed the following outline:

- Education on the benefits of the state having an Enhanced HMP
- Planning process updates
- Plan document updates
- Defining underserved communities
- Continued discussion of social vulnerability indexes utilized by state agencies
- HIRA results summary
- State and local mitigation capability review
- Inter-agency collaboration / integration initiatives
- Continued review of the existing mitigation strategy
- Mitigation funding prioritization

Major takeaways from, and discussions occurring at, the workshop included:

- Agreement to sunset and integrate the Mitigation and Response Plan and Flood Mitigation Plan into the E-SHMP
- Discussion of ways to reduce or eliminate the "credibility gap" between the E-SHMP and local HMPs
- Discussion of any perceived gaps in the HIRA
- Discussion of how best to classify the various hazard risks to the state
- Continued SHMT input on other recent or on-going state planning efforts

- Discussion of mitigation success stories since 2018
- Continued discussion of additions or edits to the state's mitigation strategy
- Agreement to retain the same mitigation action prioritization criteria identified in 2018

Following the workshop, a handful of action items were again assigned to the SHMT, including requests to provide:

- Ideas for new mitigation actions
- Feedback on hazard profiles within SHMT member's area of expertise
- Outstanding past requests

SHMT Workshop #3

The third and final SHMT workshop was held on July 26, 2023, and was again facilitated as a hybrid event. A two-page "read ahead" document was again provided to assist the SHMT in preparing for the workshop. The agenda followed the following outline:

- Planning process updates
- Plan document updates
- Local coordination / survey results review
- HIRA final updates
- Hazard risk classifications
- Continued review of state mitigation capabilities
- Continued review of the existing mitigation strategy
- Plan implementation, monitoring, & integration
- Continued review of mitigation funding prioritization
- Mitigation obstacles and challenges

Major takeaways from, and discussions occurring at, the workshop included:

- Continued discussion of how best to classify the various hazard risks to the state
- Continued SHMT input on other recent or on-going state planning efforts
- Continued discussion of mitigation success stories since 2018
- Continued discussion of additions or edits to the state's mitigation strategy
- Discussion of how to consider expanding the local government SHMT participation beyond the emergency management sector in the next update
- Discussion of federal building code requirements outside of FEMA programs
- Review of new mitigation actions proposed by the SHMT
- Review of nature based solutions
- Discussion of ingress / egress challenges across the state

Remaining action items were assigned to the SHMT following the workshop, including requests to provide:

- Ideas for new mitigation actions
- Feedback on mitigation capabilities and other plan chapters
- Outstanding past requests

1-on-1 Agency Meetings

Outside of the SHMT workshops, over 40 meetings were held with individual agencies and SHMT members over the course of the planning process, encompassing over 30 state entities. This coordination was critical to the development of the E-SHMP. This additional coordination was utilized for a variety of purposes such as input to specific sections of the E-SHMP, follow-up from the SHMT meetings, and agency-specific mitigation actions / capabilities.

Office of the State Engineer (Dam Safety)

To ensure that the updated E-SHMP met all additional high hazard potential dam (HHPD) FEMA planning requirements, close coordination with the State's Dam Safety Program occurred across the planning process. The Office of the State Engineer provided several recent data sets and studies relating to populations at risk from dam failure, dam inundation area mapping (for assessing impacts to state facilities), and an outlet release database of high hazard dams. This last item was the result of a mitigation action identified as part of the 2018 E-SHMP. This information is summarized and presented in the Hazard Identification & Risk Assessment chapter of this E-SHMP.

Local Involvement

The involvement of local emergency managers as stakeholders is important to highlight when documenting the E-SHMP planning process. As mentioned previously, a total of 15 local government representatives were included on the updated SHMT roster and invited to participate in all meetings and communications. Additionally, all county and tribal emergency managers across the state were offered an opportunity during the E-SHMP planning process to provide their input through three separate local surveys. These results are summarized in the Local Coordination chapter of this E-SHMP.

Plan Update

The final culmination of the state's integrated planning process resulted in this updated E-SHMP. Individual sections and sub-sections were sent for review and comment to the SHMT and other applicable SMEs as necessary throughout the update process. The final draft was delivered to FEMA Region VIII for review in November 2023. After resolving initial required revisions, the E-SHMP was resubmitted to FEMA for an additional review in December 2023. Approvable Pending Adoption (APA) status was granted by FEMA on December 8, 2023 and signed by the Governor with required assurances on December 13, 2023. Final FEMA approval was received on December 18, 2023 providing for a five-year eligibility cycle in advance of the next required update.

Plan Organization

As part of the 2023 update process, attention was directed at streamlining the 2018 document. Additionally, this updated E-SHMP complies with the most recent FEMA State Mitigation Planning Policy and leveraged guidance provided within FEMA's Key Topics Bulletins. Listed below are the various chapters and annexes of this updated E-SHMP.

- Executive Summary
- Formal State Adoption
- Assurances of Continued Compliance
- Planning Process
- Hazard Identification & Risk Assessment
- Hazard Mitigation Capabilities
- Hazard Mitigation Strategy
- Local Coordination
- E-SHMP Implementation
- Annexes
    - Disaster Declaration History
    - Drought Response Plan
    - Colorado Rural Electric Association HMP
    - High and Significant Hazard Dams

HAZARD IDENTIFICATION & RISK ASSESSMENT

Risk Assessment Overview

Introduction

The purpose of the Hazard Identification and Risk Assessment (HIRA) is to identify those natural hazards that impact Colorado and to evaluate the risk they pose to people, property, the economy, and the environment. The HIRA is a major input into the state's mitigation strategy and is a shared assessment that factors in local community risk, coupled with a broader statewide risk perspective.

Hazard Identification

Table 4 identifies those natural hazards that can impact the State of Colorado. Determining the hazards profiled in this 2023 E-SHMP update involved an evaluation of existing state plans, input from the State Hazard Mitigation Team (SHMT), an assessment of previous disasters, a review of historical hazard losses, an analysis of expected future events, and information provided by local hazard mitigation plans.

TABLE 4 HAZARDS PROFILED IN THE 2023 COLORADO E-SHMP

2023 Colorado E-SHMP Hazards Profiled	
Animal Disease Outbreak	Landslide / Debris Flow / Rockfall
Avalanche	Pandemic
Dam / Levee Incident	Hail
Drought	Pest Infestation
Earthquake	Severe Wind
Erosion / Deposition	Severe Winter Weather
Expansive Soils	Thunderstorm / Lightning
Extreme Heat	Tornado

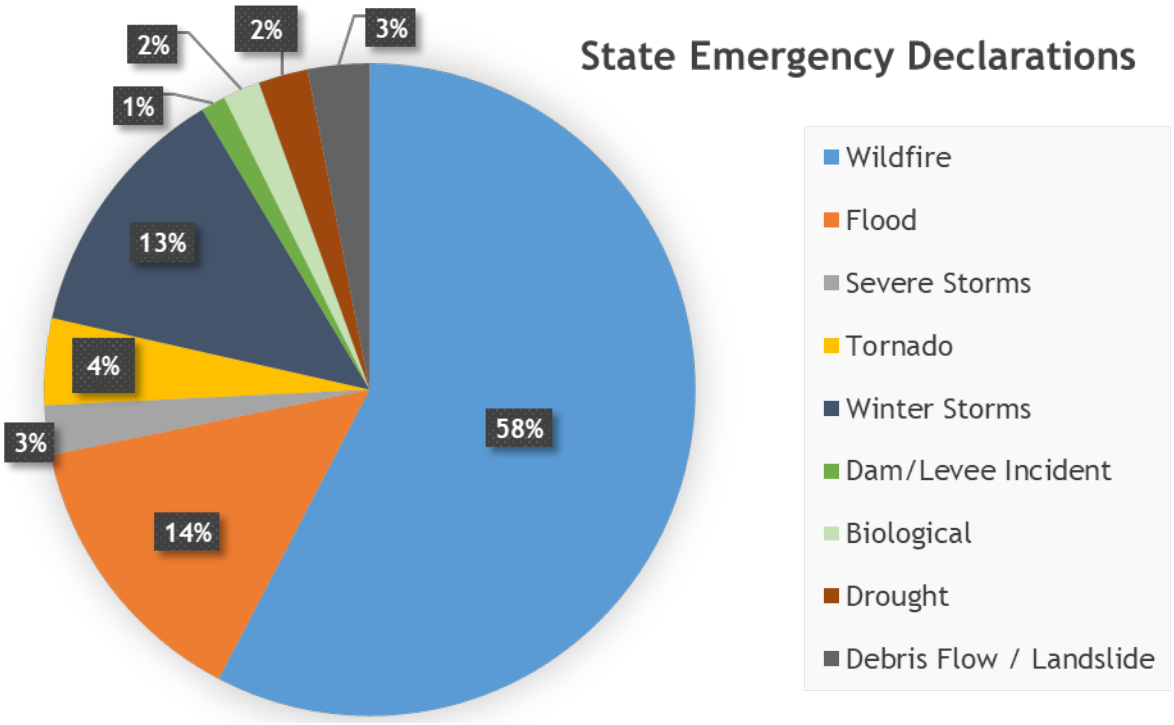
2023 Colorado E-SHMP Hazards Profiled	
Flood	Wildfire
Ground Subsidence	Wildlife Vehicle Collision

Disaster Declaration History

Colorado has an extensive history of natural hazard events. Larger incidents can lead to disaster declarations at the state level by the governor, or at the federal level through entities such as the Federal Emergency Management Agency (FEMA) and the US Department of Agriculture (USDA). The following section provides a summary overview of these disaster declarations across the state. A detailed listing of all past declarations can be found in an accompanying Annex – Disaster Declaration History to the E-SHMP.

There have been over 170 emergency declarations issued by Colorado Governors since 1980, 50 of which (roughly 30%) have occurred since 2017. Figure 1 summarizes these state declarations by hazard type showing that wildfires have contributed to over half of these events. Flooding and winter storms are the next largest causes of state declarations.

FIGURE 1 COLORADO STATE EMERGENCY DECLARATIONS



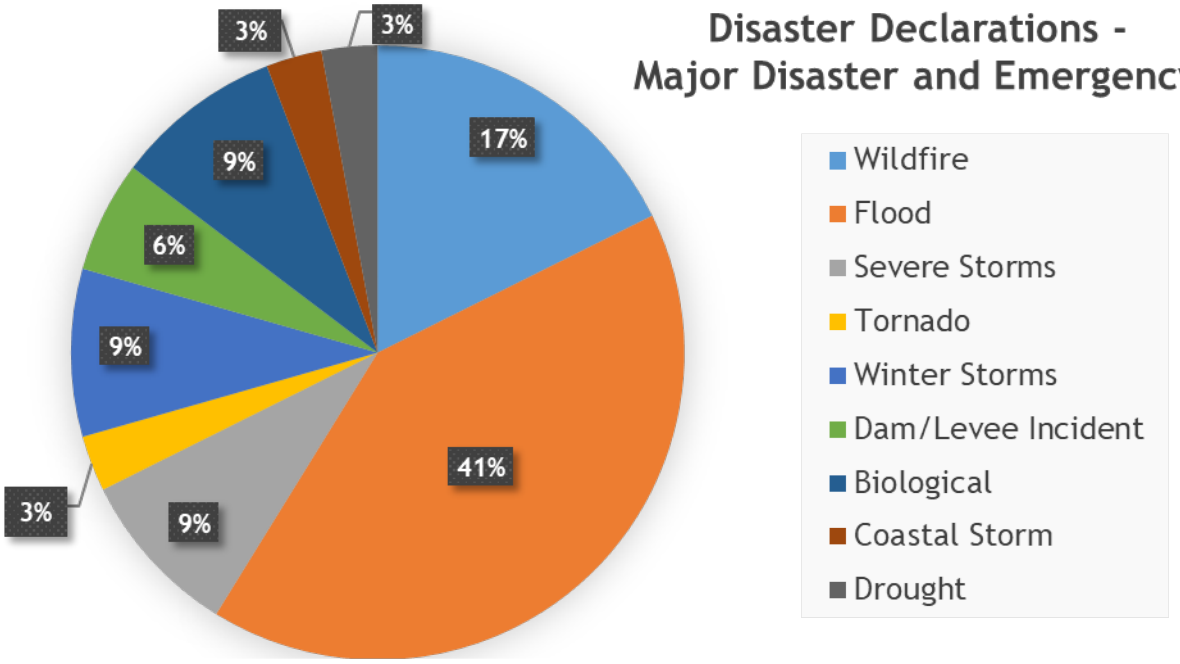
Federal declarations for disasters are issued by the President and include Emergency Declarations and Major Disaster Declarations. Emergency Declarations can be declared for any occasion or instance when the President determines federal assistance is needed to supplement state and local efforts. The total amount of assistance provided for a single emergency may not exceed $5 million.

The President can declare a Major Disaster Declaration for any natural hazard event that causes damage of such severity that it is beyond the combined capabilities of state and local governments. A Major Disaster Declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work.

Since 1955, Colorado has received 25 Presidential Disaster Declarations and seven Emergency Declarations for natural hazard events. Figure 186 presents a summary of these historical federal declarations by hazard type. Flooding events have generated 40% of the state's past federal declarations, while wildfires have been the second

leading cause (17% - including a majority of those declarations made over the last decade).

FIGURE 2 COLORADO DISASTER DECLARATIONS INCLUDING MAJOR DISASTER AND EMERGENCY



Other federal designation types include Fire Mitigation Assistance Grants (FMAG) and Secretarial Disasters. FMAGs are funded through FEMA and are awarded when a state demonstrates that total eligible response costs for a wildfire exceed a certain threshold. This can apply to single wildfire event or can relate to the cumulative fire costs of numerous smaller fires occurring in quick succession. The state has received 70 FMAG awards for suppression and management since 1978.

The USDA issues Secretarial Disaster designations which are related to crop losses. These are commonly the result of drought, but also include other adverse events such as excessive rain, flooding, hail, high winds, insect infestations, and extreme temperatures. Since 2003, Colorado has received a secretarial disaster designation for drought every year, with the exception of 2007 and 2016. All counties in the state have had at least one drought disaster designation.

Historical Insured Losses

Per the Rocky Mountain Insurance Information Association (RMIIA), current insurance industry standards classify a catastrophe as a natural disaster that causes at least $25 million in insured damages. Colorado has experienced at least 29 such catastrophes since 1984. The majority represent significant hailstorm events, as shown in Table 5, however recent years have seen numerous catastrophic wildfires.

Recent notable events include the 2021 Marshall Fire, estimated to have caused insured losses of at least $2 billion. Those losses have only been exceeded by a hail event in 2017, which occurred along the state's Front Range resulting in $2.8 billion of losses.

TABLE 5 INSURED LOSSES DUE TO CATASTROPHIC DISASTERS[1]

Year	Hazard	Losses When Event Occurred ($ Millions)	Losses Adjusted to 2023 Dollars ($ Millions)
1984	Hail	276.7	807
1990	Tornado – Limon	20	47
1990	Hail	625	1.45 billion
1991	Hail	100	225.2
1994	Hail	225	460
1996	Hail	122	238.5
1997	Hail	128	244.6
1998	Hail	87.8	165.2
2002	Wildfires	70.3	119.8
2003	Winter Storm	93.3	155.4

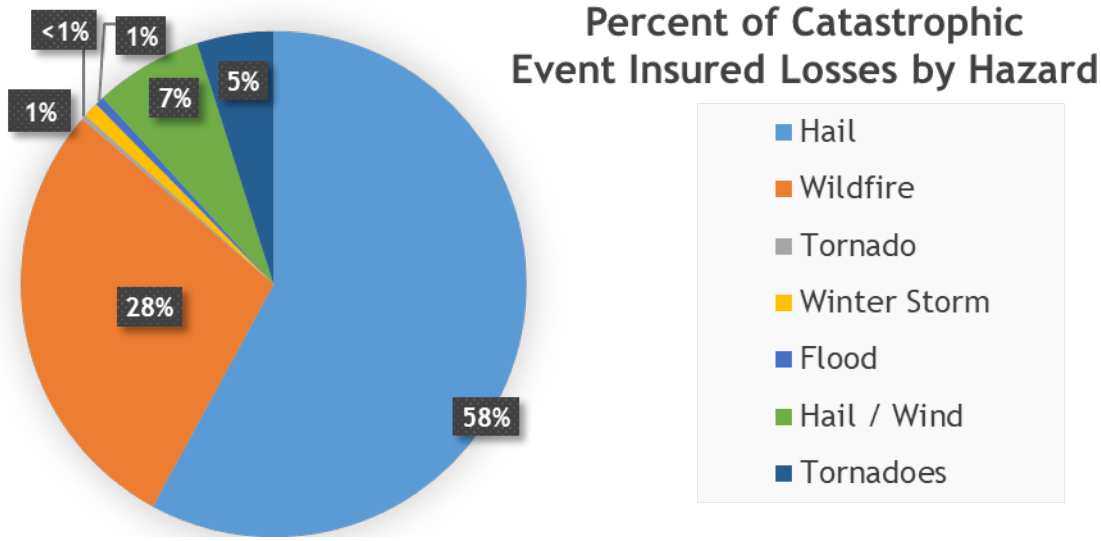
[1] Catastrophe Facts and Statistics - Rocky Mountain Insurance Information Association

Year	Hazard	Losses When Event Occurred ($ Millions)	Losses Adjusted to 2023 Dollars ($ Millions)
2004	Hail	146.5	237.9
2004	Hail	62.2	100.9
2008	Tornadoes/Hail	193.5	272
2009	Tornadoes/Hail - Denver Metro	353.3	499
2009	Hail/Wind - Denver Metro	767.6	1.0 billion
2009	Hail - Pueblo	232.8	329
2010	Wildfire	217	305.2
2011	Hail	164.8	224.7
2012	Hail	321.1	424
2012	Wildfire	113.7	151.8
2012	Wildfire - Colorado Springs	453.7	606.3
2013	Wildfire - Black Forest Fire	420.5	553.8
2013	Flood	71.7	94
2014	Hail	213.3	273
2016	Hail - Colorado Springs	352.8	445
2017	Hail - Denver Metro	2.3 Billion	2.8 billion
2018	Hail	276.4	333
2020	Wildfire - Cameron Peak	71	78
2020	Wildfire - East Troublesome	543	602

Year	Hazard	Losses When Event Occurred ($ Millions)	Losses Adjusted to 2023 Dollars ($ Millions)
2021	Wildfire – Marshall	2 billion	2.1 billion

Figure 3 presents these catastrophic insured losses by hazard type, showing the percentage of each as compared to the state total of $15.9 billion. Hail has caused a majority of these insured losses, while wildfires have caused roughly one-quarter.

FIGURE 3 CATASTROPHIC HAZARD INSURED LOSSES



Hazard Risk Classifications

All of Colorado is at risk of multiple hazards at any one time. Most locations across the state are vulnerable to all of the 20 hazards profiled in this E-SHMP. Table 6 presents the state's overall hazard risk classifications, based upon the expected impacts to property, the economy, the environment, and the health and safety of the state's population.

TABLE 6 COLORADO HAZARD RISK CLASSIFICATIONS

Extremely High	High	Moderate	Low
2023 Colorado E-SHMP Hazard Classifications			
Animal Disease Outbreak		Hail	
Avalanche		Landslide / Debris Flow / Rockfall	
Dam / Levee Incident		Pandemic	
Drought		Pest Infestation	
Earthquake		Severe Wind	
Erosion / Deposition		Severe Winter Weather	
Expansive Soils		Thunderstorm / Lightning	
Extreme Heat		Tornado	
Flood		**Wildfire**	
Ground Subsidence		Wildlife Vehicle Collision	

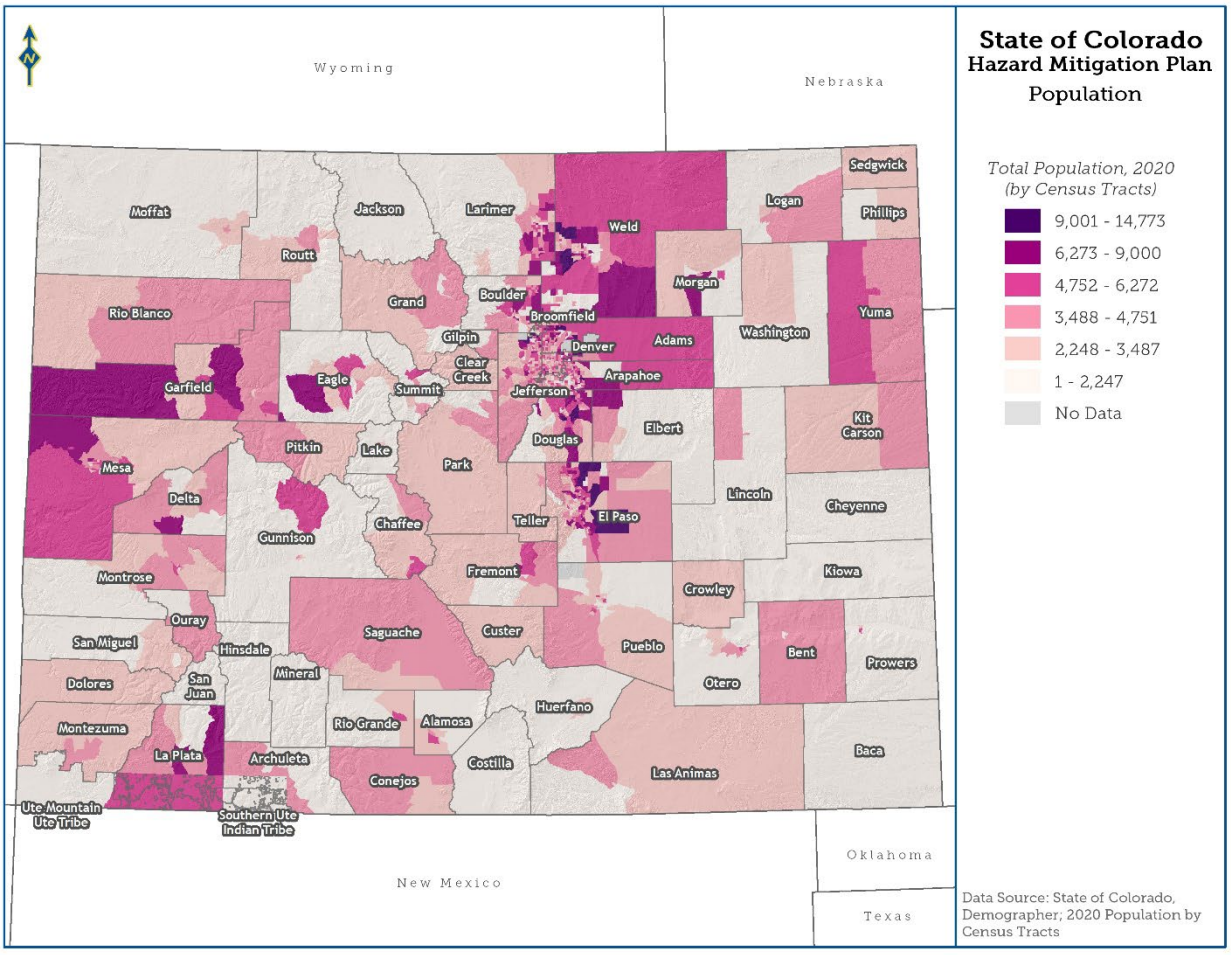
Climate Change

Colorado is in the process of developing its first Climate Preparedness Strategic Plan and Roadmap as directed by SB22-206, due in late 2023, to proactively prepare for the impacts of climate change on Colorado and promote a proactive approach to adapting to anticipated changes. The roadmap is based on data-driven analysis of the expected future changes to Colorado's climate and anticipated resulting impacts to Colorado's people, landscapes, ecosystems, infrastructure, and economy. The Roadmap will identify priorities and state-level actions to promote the long-term health of the state, accounting for projected population growth, and minimize the negative impacts of climate change and natural disasters on Colorado.

Population

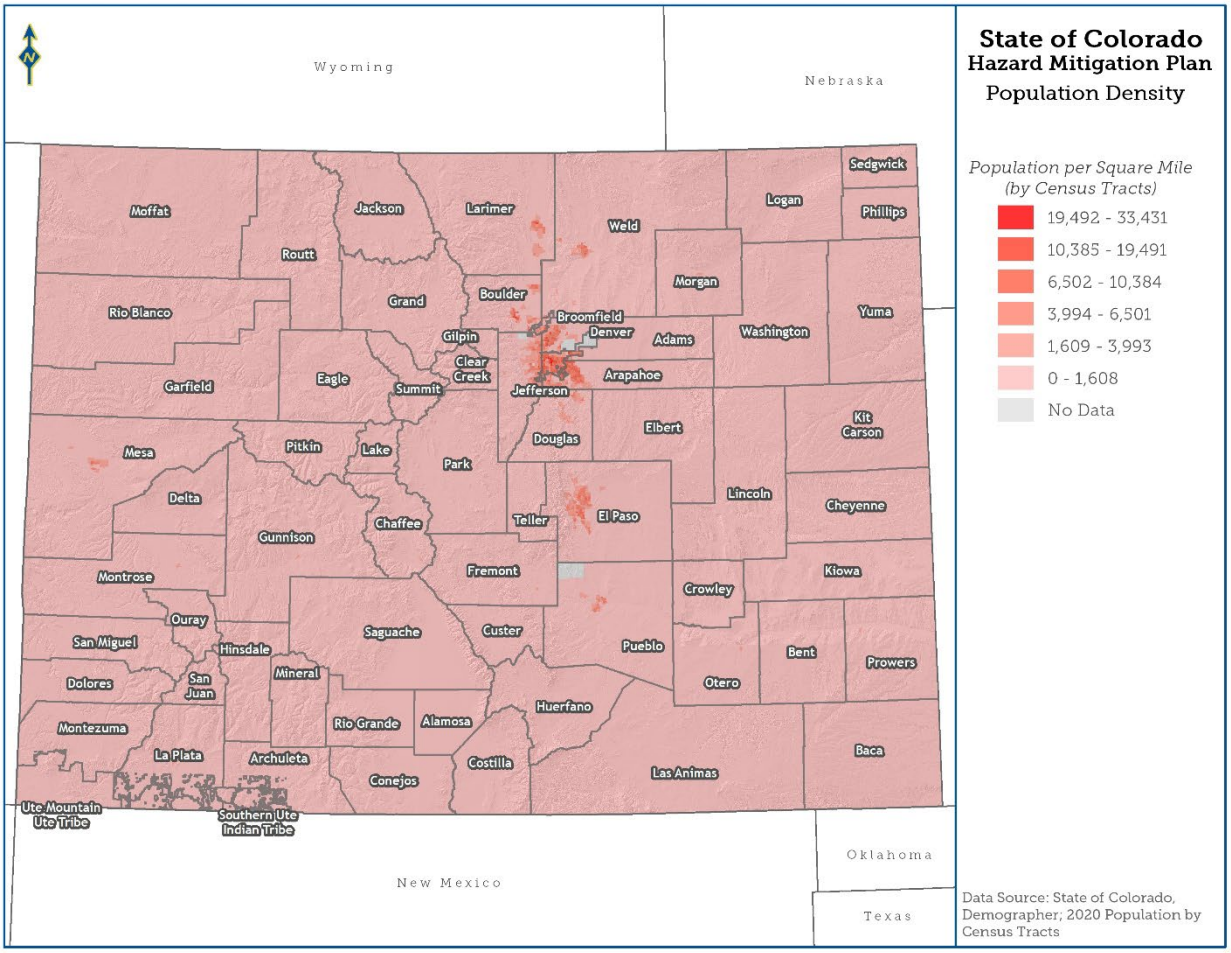
For most all hazards there is a direct connection between a location's population and its vulnerability to hazards. A larger population exposes a larger number of individuals to a potential hazard, thereby increasing risk. Figure 4 presents the state's 2020 population per US Census tract and shows a majority of Coloradoans are located across the state's Front Range.

FIGURE 4 COLORADO POPULATION BY CENSUS TRACT



Reviewing US Census tracts by population density is another way to observe this population information and can be seen in Figure 5. This similarly highlights the Front Range as being the location of a majority of the state's population.

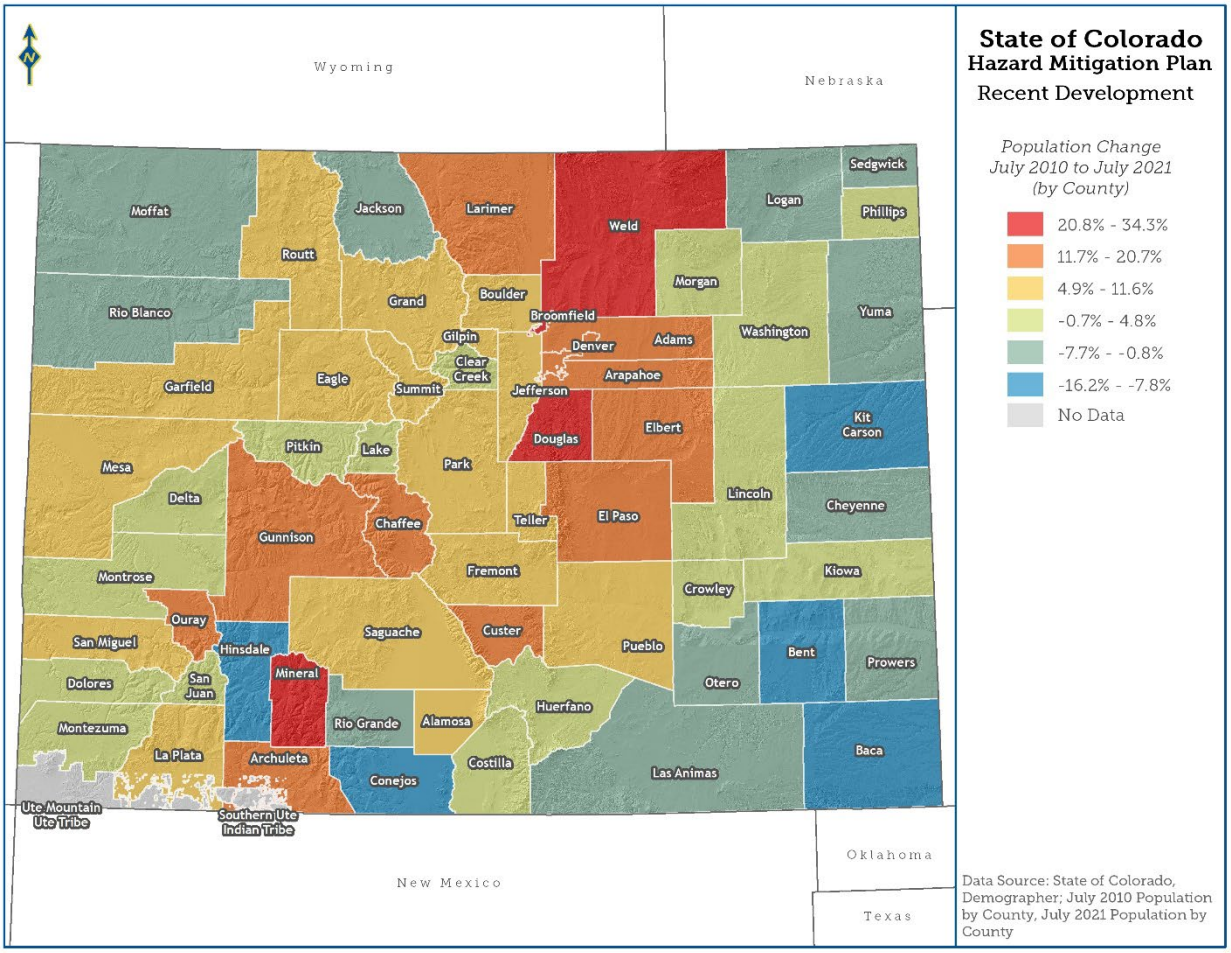
FIGURE 5 COLORADO POPULATION DENSITY BY CENSUS TRACT



Recent Development

Changes in development can most clearly be assessed at a state level through reviewing population change. Figure 6 presents the changes in population at the county level, from 2010-2021. The local HMPs for those counties experiencing the most growth (top two map classes) were reviewed for information relating to development in hazard-prone areas. When available, this information is included in the applicable hazard sections of this E-SHMP.

FIGURE 6 COLORADO POPULATION CHANGE (2000-2021)



Future Development

Future changes in development can most clearly be assessed at a state level through reviewing projected future population change. Figure 7 presents the most current population projections from the State Demography Office for the year 2030.

FIGURE 7 COLORADO 2030 ESTIMATED POPULATION GROWTH

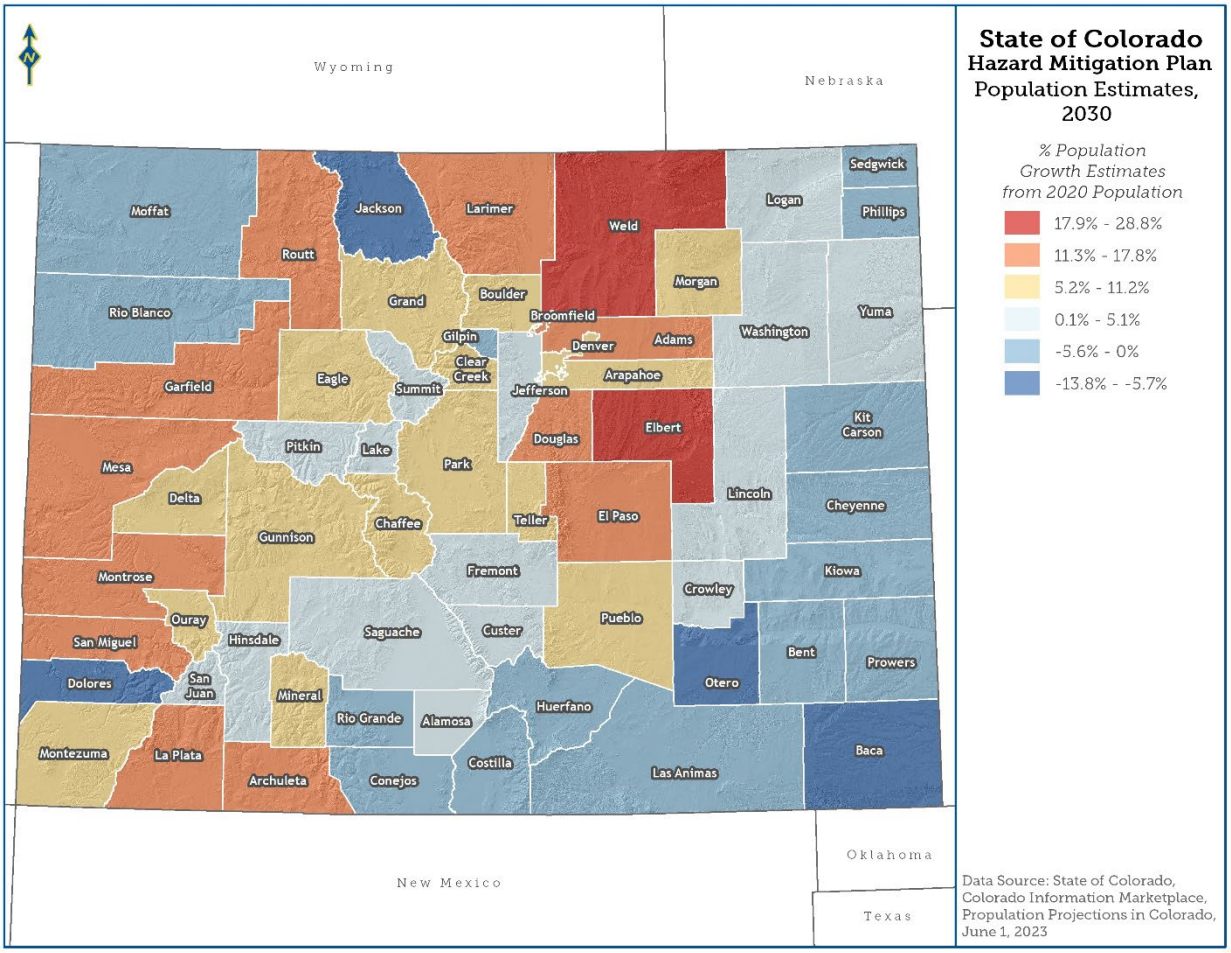
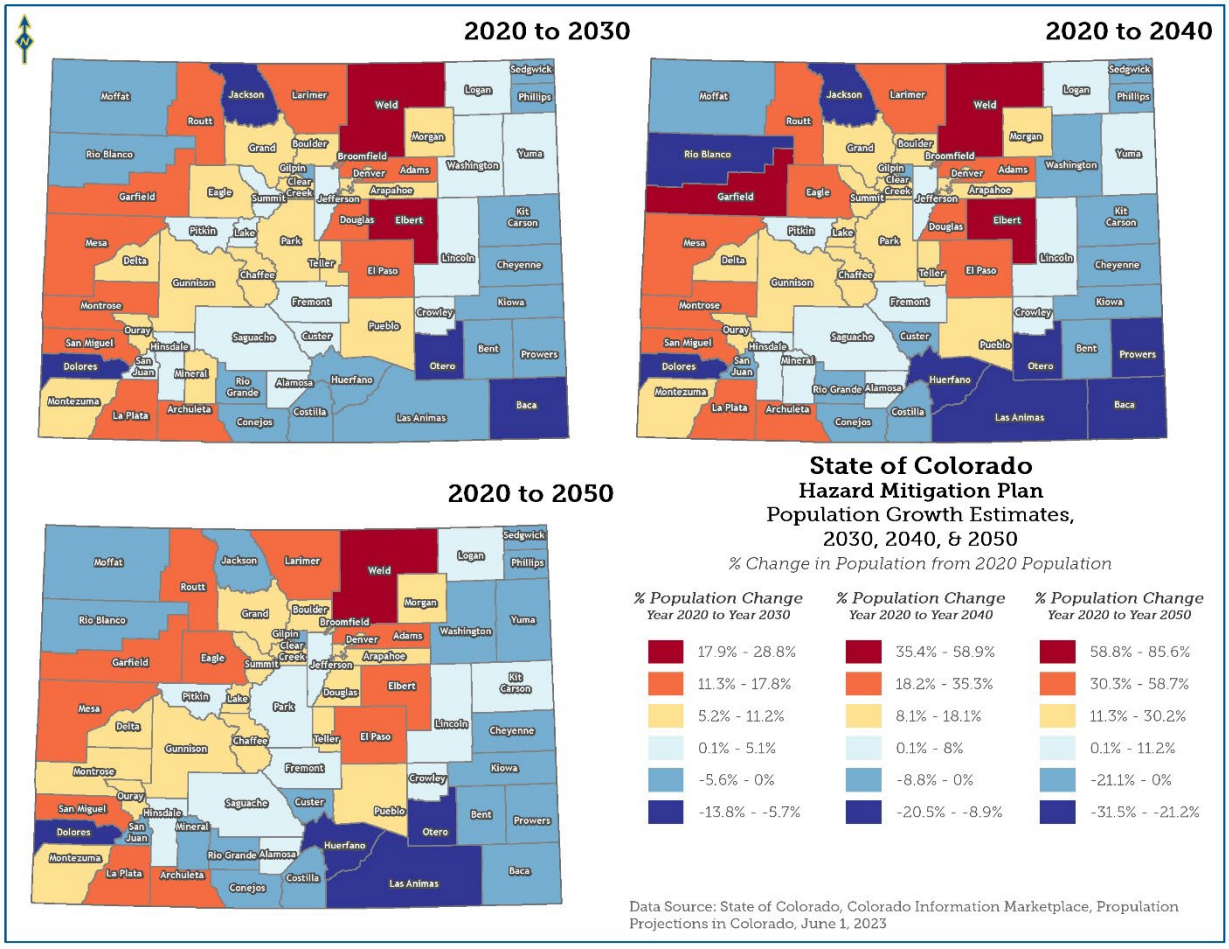


Figure 8 presents additional projections from the Demography Office through 2050. The local HMPs for those counties projected to experience the most growth (2050 - top two map classes) were reviewed for information relating to future development in hazard-prone areas. When available, this information is included in the applicable hazard sections of this E-SHMP.

FIGURE 8 COLORADO FUTURE POPULATION ESTIMATES



Development in Hazard Prone Areas

Colorado's natural and cultural amenities continue to make it an attractive place for people to relocate to. It is estimated, by the State Demography Office, that the state's population will have increased 22% by 2040. This is as compared to the 2020 population of 5.77 million and equates to an estimated 7.07 million persons. Colorado's increasing population is of particular concern when it comes to addressing the threat of natural hazards and associated vulnerability created when people move to hazard areas.

Continual population growth is typically absorbed through urban infill and densification, or new development in previously undisturbed or agricultural lands. In Colorado, these development patterns occur simultaneously, and often result in land

use patterns where people want to live close to urban areas yet in a natural or rural environment. One of the preferred places to find this setting is west of the Interstate 25 corridor and within the Front Range foothills. This desire for people to live within Colorado's natural environment is inherent to development occurring in the following three areas:

- Within or adjacent to the wildland urban interface (WUI)
- Within or near the regulatory floodplain
- On or near geologic hazards

Colorado's foothill and mountain environments are dominated by forests, steep slopes, valleys, canyons, and stream channels located within steep drainages or meandering across valley bottoms. Development within these areas may be at immediate risk to many of the state's more costly hazards, including wildfires, floods, landslides / debris flows / rockfalls, severe winter weather, and avalanches.

Underserved Communities

Since the adoption of the state's last E-SHMP the federal government publicly acknowledged the disparities between race, socioeconomic stability, and access and functional needs through numerous Executive Orders, directives, and mission statements. Each action takes steps to address unmet needs for these "underserved communities." The Justice40 initiative and inclusion of these factors in grant award criteria are all examples of how this change in policy has impacted hazard mitigation programs across the nation.

This E-SHMP update has been completed with the "whole community" approach in mind. By centering equity in the mitigation plan we reinforce the inclusive planning process, with the goal of reducing risk to populations that face barriers to access and, as such, are disproportionately affected by disasters. The E-SHMP is an opportunity to advance a cohesive strategy to counter those barriers, allowing intentional planning and risk reduction for the communities where it is most needed.

In Colorado, the Environmental Justice (EJ) Action Task Force was established by HB21-1266 and was developed to ensure there is a common definition for Disproportionately Impacted Communities (DIC) across state agencies. Per the bill, the following definition was codified.

"DISPROPORTIONATELY IMPACTED COMMUNITY": A COMMUNITY WHERE THE PROPORTION OF HOUSEHOLDS THAT ARE LOW INCOME, THE PROPORTION OF HOUSEHOLDS THAT IDENTIFY AS MINORITY, OR THE PROPORTION OF HOUSEHOLDS THAT ARE HOUSING COST-BURDENED IS GREATER THAN FORTY PERCENT; OR IS ANY OTHER COMMUNITY AS IDENTIFIED OR APPROVED BY A STATE AGENCY.

Continuous coordination among state agencies, local governments, and other partners working with or on behalf of underserved communities is the key to achieving mitigation goals and long-term resilience across Colorado. It is the responsibility of the state that this plan's mitigation strategy complies with all applicable legal requirements related to civil rights to ensure nondiscrimination. Such compliance can help achieve equitable outcomes through the mitigation planning process for all communities, including those underserved and socially vulnerable populations.

State-level implementation of equitable treatment of underserved communities is undertaken with the goal of eliminating avoidable or remediable barriers regardless of differences in social, economic, demographic, or geographic factors. This goal will help to ensure that a person is no more or less likely to experience society's benefits or burdens due to these factors.

Additional information relating to underserved communities' vulnerability to hazards are included in the individual hazard sections of this E-SHMP.

Social Vulnerability Indexes

Multiple national social vulnerability indexes are available to utilize, each leveraging differing data sources and indicators. Use of specific indexes will sometimes be

dictated by a funding program, else local communities are encouraged to utilize the index that best defines their vulnerable populations and underserved communities.

The vast amounts of social vulnerability data available, as well as the innumerable ways to analyze, visualize, and deliver the information, creates an opportunity for multiple indexes to share similar data with different focuses and purposes. The benefit of this is the ability to fill gaps in categories of social vulnerability that may not be covered by a specific index.

Indicators that may be relevant to hazard mitigation could include:

1. Density and ages of populations
    1.1. Age 65 years and older
    1.2. Age 17 years and under
    1.3. Under 5 years of age
2. Minority status and language
    2.1. Minority
    2.2. Limited English (speaks less than well)
3. Access and functional needs (AFN)
    3.1. Disability
    3.2. Use of electricity dependent medical equipment
    3.3. Population with chronic health conditions
4. Household Characteristics
    4.1. Crowding (households with more people than room)
    4.2. Living alone
    4.3. Group quarters (institutionalized housing): college dorms, correctional facilities, long-term care facilities, military barracks
    4.4. Single parent households with children under 18 years old
5. Socioeconomic status
    5.1. Poverty, persons living below poverty level
    5.2. Unemployed, ages 16 years and older

5.3. Income, per capita
5.4. High school diploma status, persons age 25+ without a diploma
5.5. No vehicle available

6. Housing Characteristics
   6.1. Housing units
   6.2. Households
   6.3. Influx (households moving)
   6.4. Multi-unit housing structures with 10 units or more
   6.5. Mobile homes
7. Information and healthcare access
   7.1. Broadband availability
   7.2. Hospitals per capita
   7.3. Population without health insurance
   7.4. Employment by industry type

The SHMT agrees to use the DIC definition, as defined by statute and updated by the Environmental Justice Program, and resulting mapping, as the foundation to incorporate those communities into mitigation project prioritization. Each agency will then incorporate other definitions of underserved and vulnerable populations as required by funding sources.

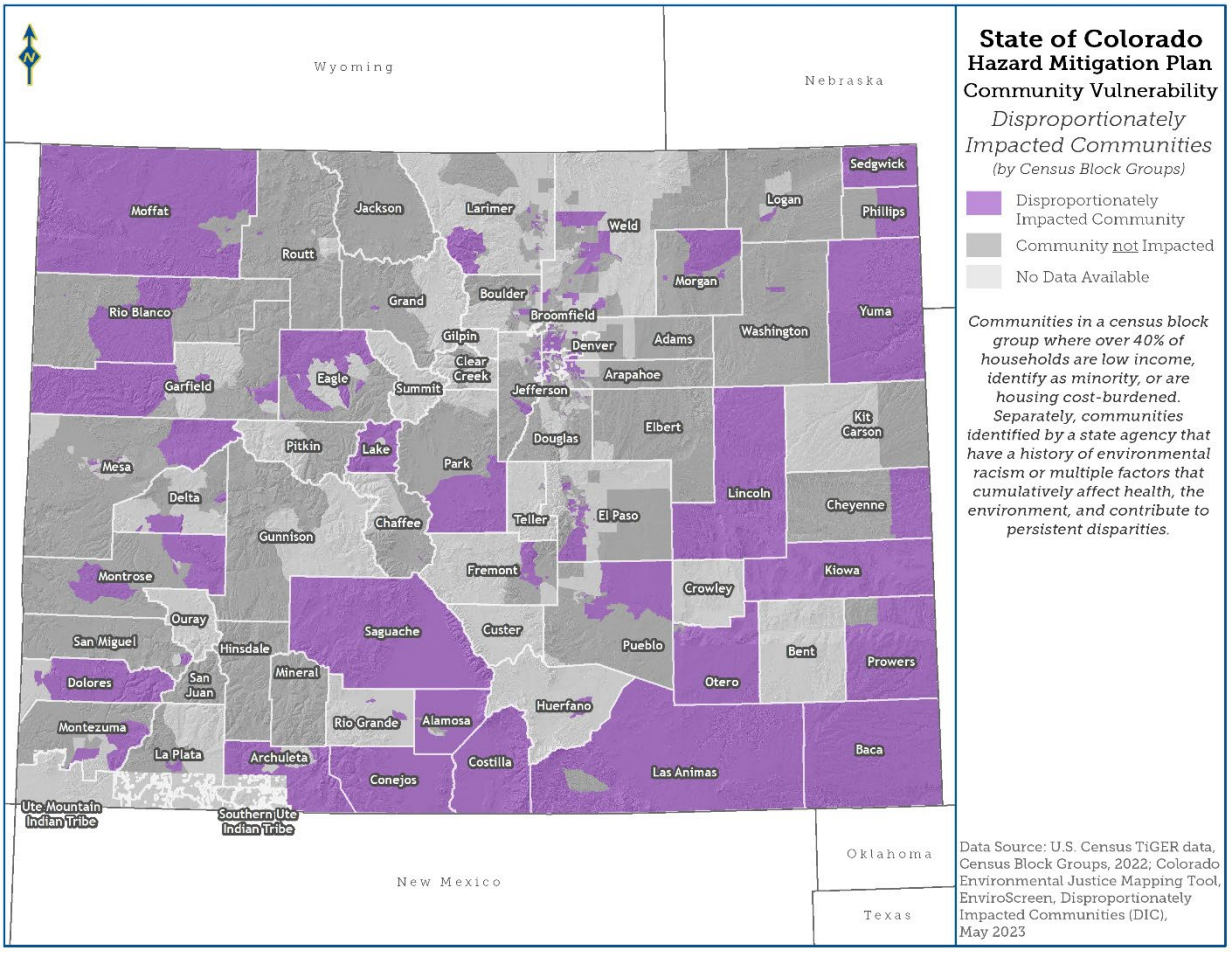
Local governments are encouraged to utilize the index that best aligns with their community needs.

Agencies may consider, but not be limited to, the following indexes:

- Colorado Disproportionately Impacted Communities (see Figure 9)
  - Colorado EnviroScreen
- Climate and Economic Justice Screening Tool (see Figure 10)
  - CEJST Map
- CDC Social Vulnerability Index (see Figure 11)
  - The Social Vulnerability Index (SVI): Interactive Map | CDC
- Headwaters Economics Rural Capacity Index (see Figure 12)
  - Rural Capacity Map

- My Community Explorer – US Census
  - My Community Explorer
- American Community Survey (ACS) US Census Data Tables
  - Data Profiles | American Community Survey | U.S. Census Bureau

FIGURE 9 DISPROPORTIONATELY IMPACTED COMMUNITIES



Additional analysis relating to the DIC can be found in the individual hazard sections.

Figure 10 Disadvantaged Communities

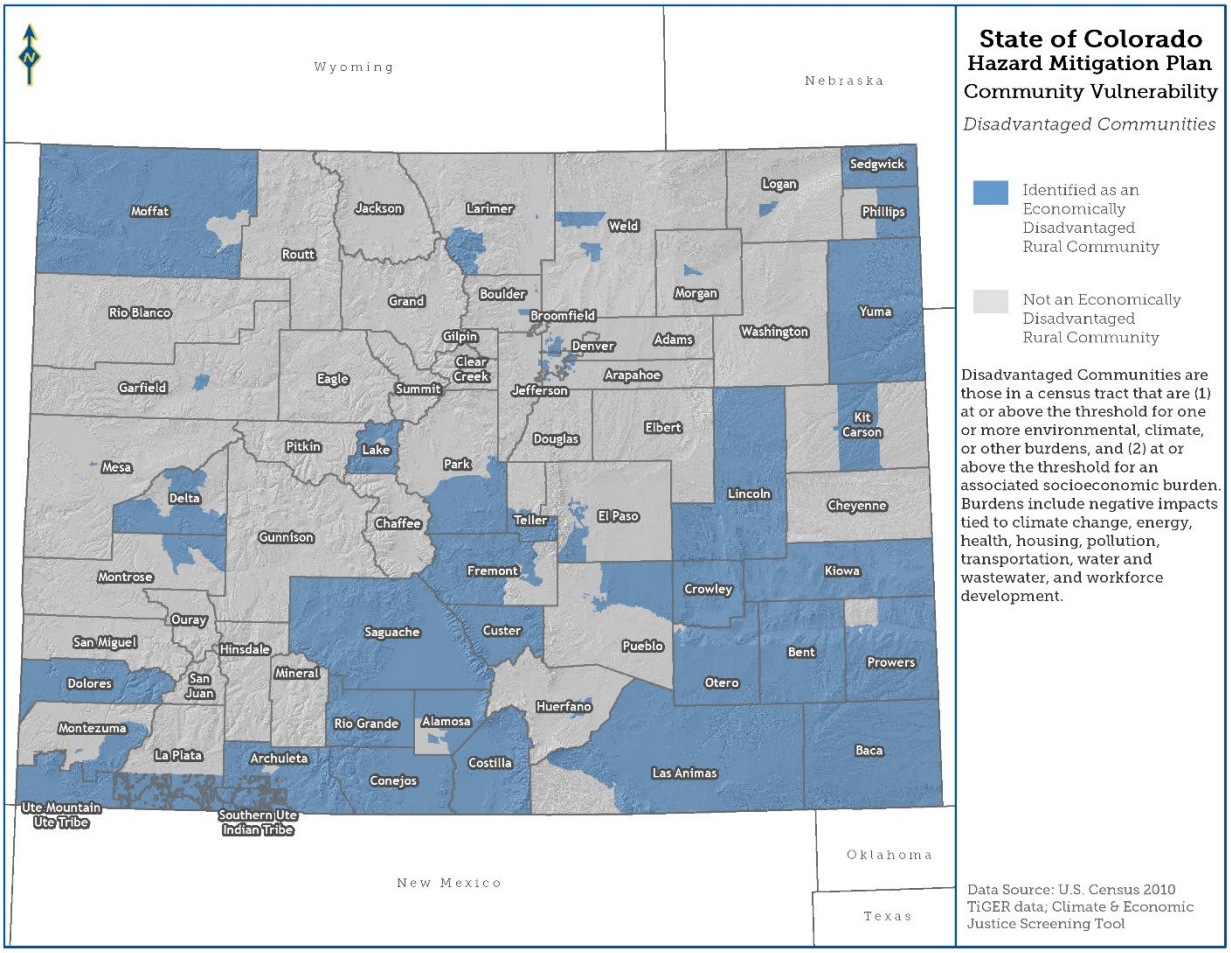
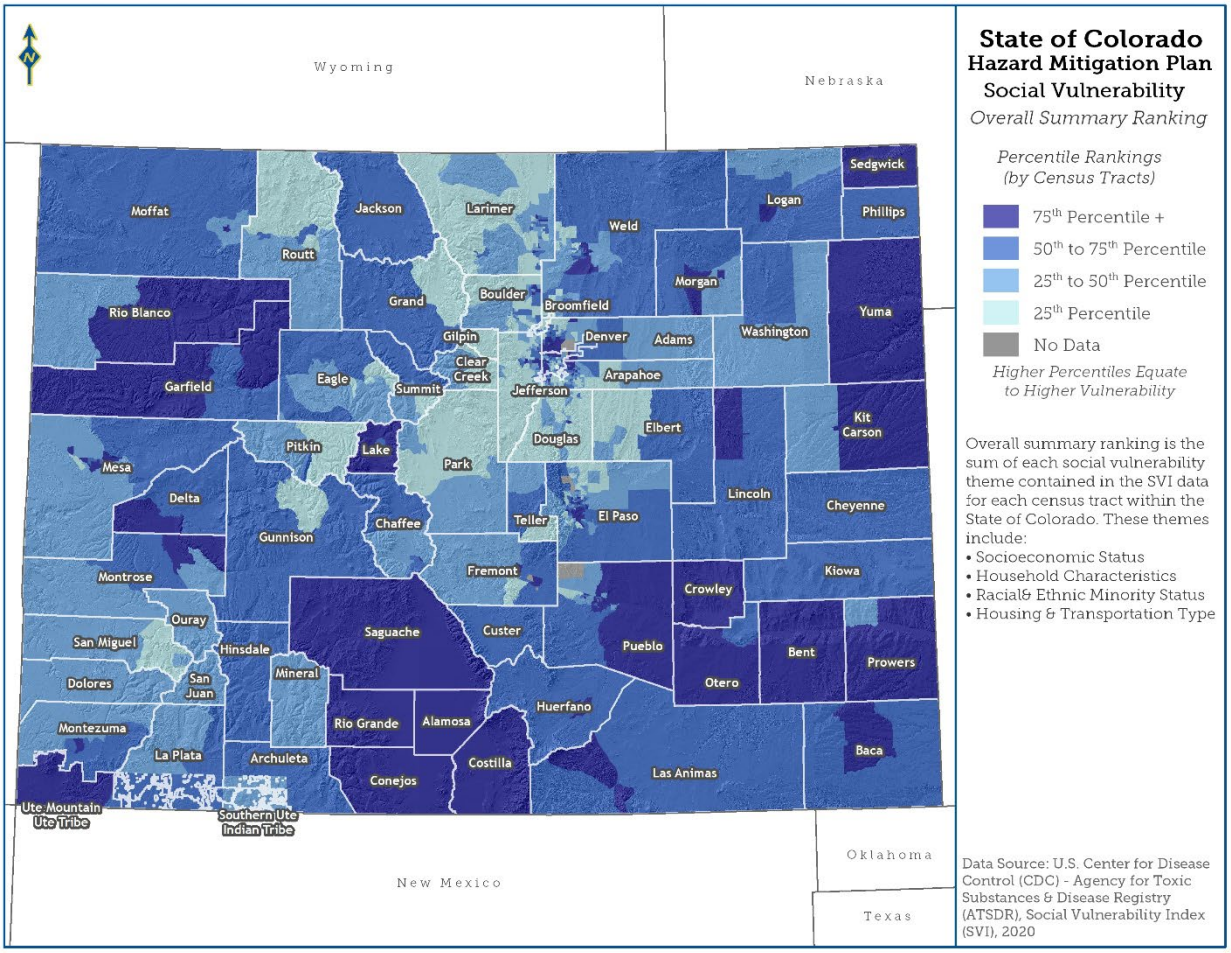
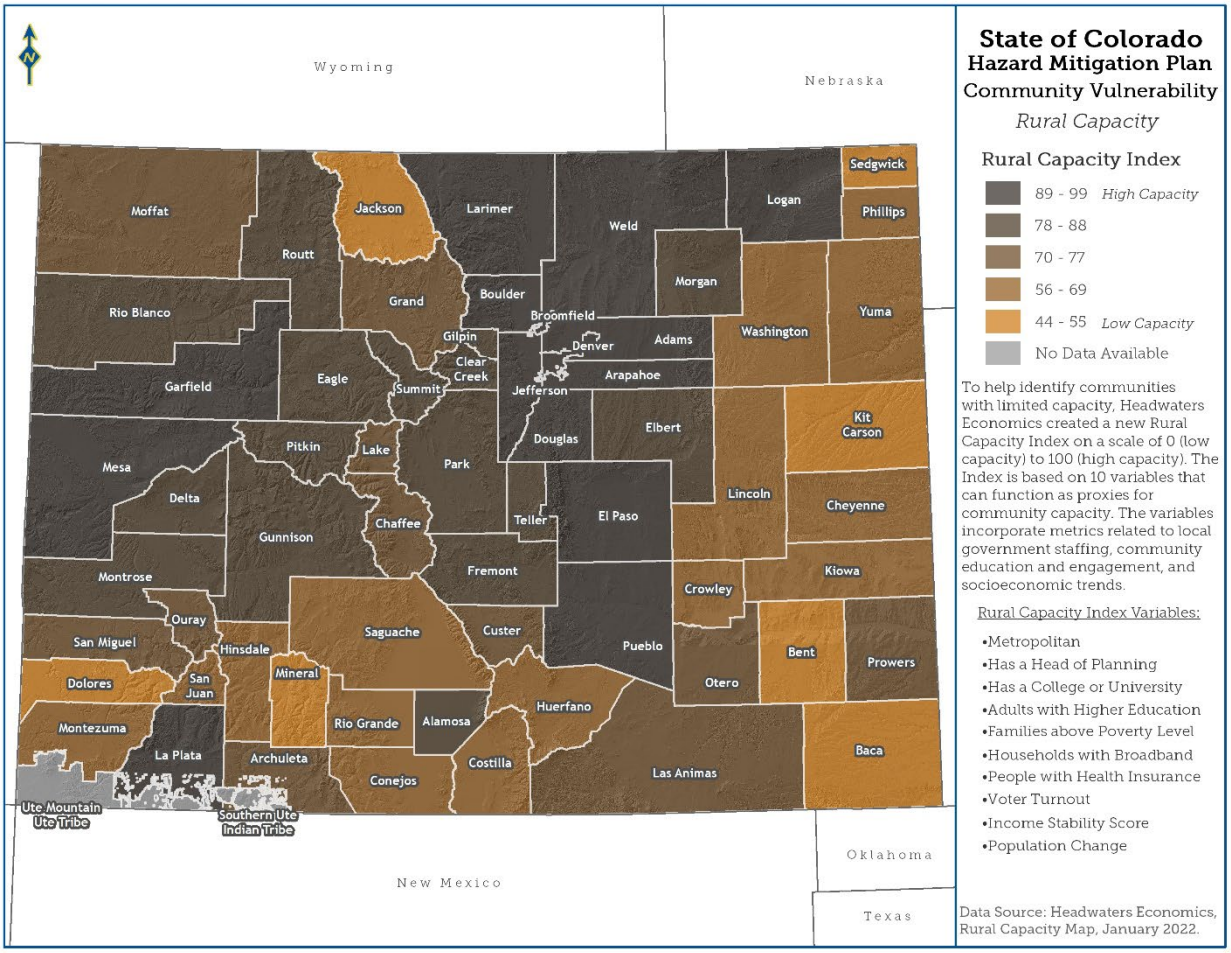


FIGURE 11 SOCIAL VULNERABILITY



Additional related specific narrative is detailed in each hazard section.

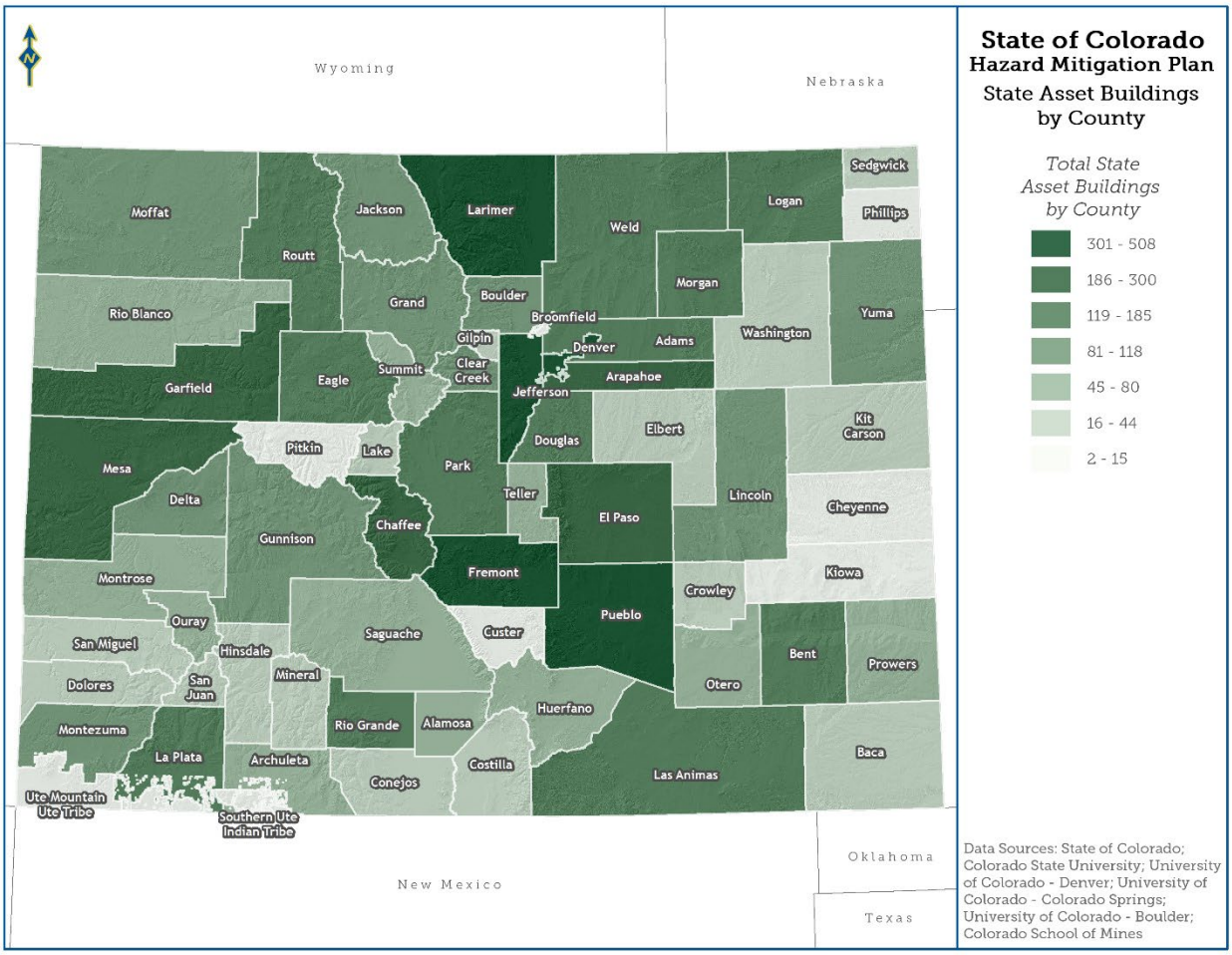
FIGURE 12 RURAL CAPACITY



State Assets

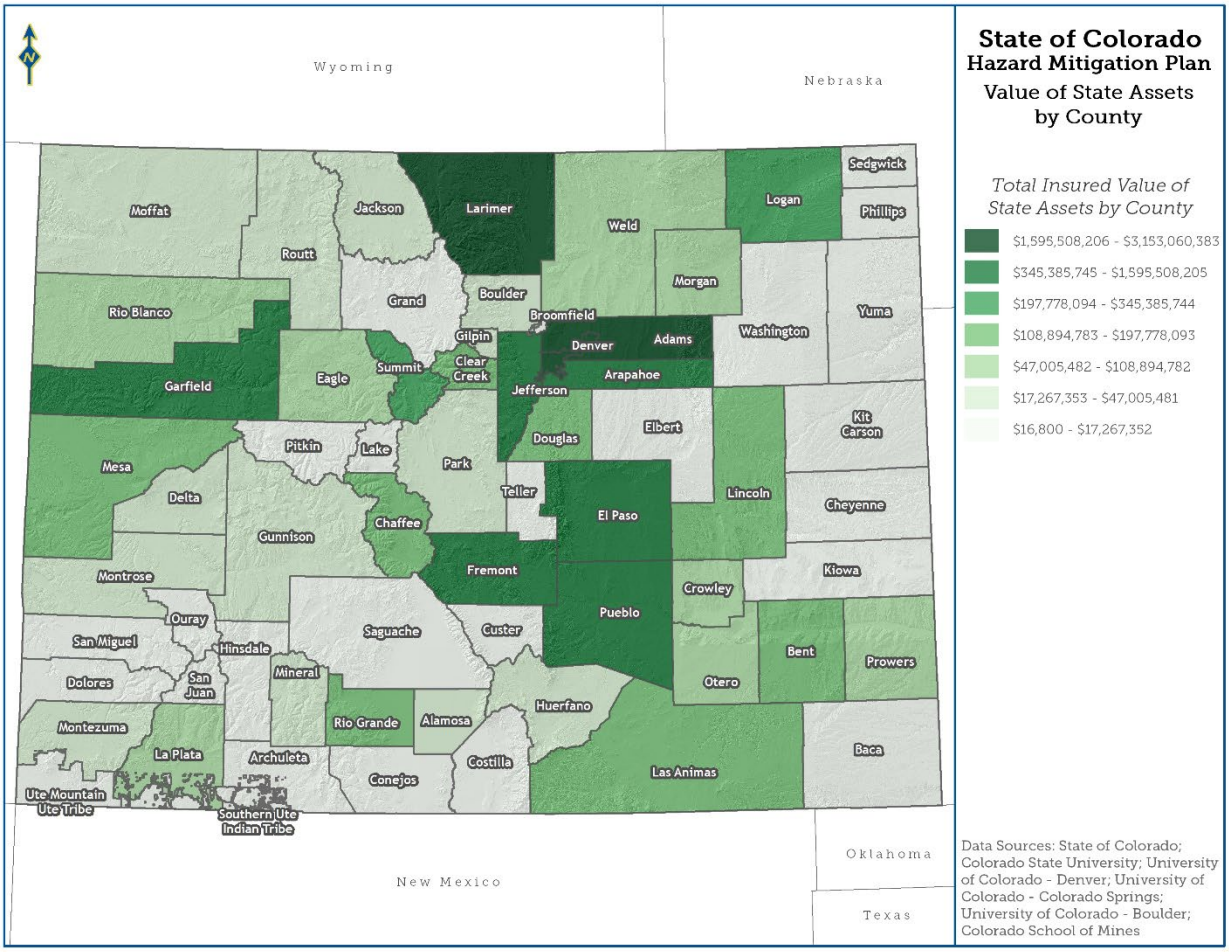
The state-owned building assets were compiled from the Office of Risk Management (ORM), in addition to contributions from the University of Colorado, Colorado State University, and the Colorado School of Mines. Over 7,000 assets were able to be mapped for additional analysis throughout the E-SHMP. Figure 13 presents a summary of these asset counts by county and tribal area.

FIGURE 13 – STATE ASSET BUILDINGS BY COUNTY AND TRIBAL AREA



Utilizing this same data, Figure 14 presents the total value of these state assets by county and tribal area.

FIGURE 14 – STATE ASSET BUILDING VALUE BY COUNTY AND TRIBAL AREA



State Lifelines

Lifelines are the most fundamental services that, when stable, enable all other aspects of society to function. This integrated network of assets, services, and capabilities enable the continuous operation of critical government and business functions and are essential to human health, safety, and economic security. FEMA's Community Lifelines connect to sectors identified in the National Mitigation Framework and the Recovery Support Functions under the National Disaster Recovery Framework.

The State of Colorado understands the vital importance of protecting its community lifelines. As part of the E-SHMP update, the SHMT was specifically tasked with

evaluating mitigation actions that would help to prevent and reduce impacts to these services.

The planning process also provided an opportunity for the SHMT to consider unique post-disaster circumstances that could make currently unfeasible lifeline mitigation projects achievable. Identifying, evaluating, and developing these scenarios prior to a disaster event will allow for improved implementation during large-scale recovery efforts.

Statewide Lifeline Status

The State Emergency Operations Center (SEOC) is established to coordinate and support state and local government actions during an emergency or disaster event. The SEOC is always activated, and the activation level is determined by the severity of an incident and the level of effort required to provide support and coordination. When events exceed, or are expected to exceed, the capabilities of local jurisdictions, the SEOC will change its activation level to provide support. When the state's capacity is expected to be exceeded, the SEOC is responsible for notifying the governor's office to solicit federal aid.

The SEOC maintains continuous communication with local jurisdictions via the Field Operations team and monitors extraordinary problems and challenges that cannot be adequately addressed within the routine operations of local government. This includes local or state-wide events, and those with regional or national implications that may impact the operational status of lifelines within all 64 counties of the state.

Lifeline assessments look across all on-going and anticipated events to determine the effects on the state's capability to respond. This flexibility allows the state to accurately identify situations where external assistance is required. There are no prescribed impacts that will automatically change the condition reporting of a lifeline from green to yellow, or from yellow to red. Each assessment takes the local ability to manage the incident, as well as the state's need to respond and provide support, into consideration.

While an event may have major lifeline impacts to a few counties or a region, other portions of the state may be unaffected, and a lifeline condition change is not necessary. Conversely, a condition change may be indicated for a hazard event impacting only a single county. In addition to direct impacts to the entire state, potential cascading impacts to neighboring states factor into lifeline condition reporting.

Statewide Coordination

The E-SHMP update involved coordination with local governments and other stakeholders, including lifeline owners and operators. These entities provided expertise and insight on the potential risk to vital lifeline components. Improving local coordination during the E-SHMP update was a priority for the state, and this coordination produced numerous mitigation actions for the state to consider. One example involved the Colorado Rural Electric Association (CREA), on behalf of its member cooperatives, whose mitigation plan is now integrated as an Annex in this updated E-SHMP.

However, other local utility providers presented a greater coordination challenge. Although invited to participate in the planning process, no other utilities chose to engage with the state. The state plans to conduct additional outreach efforts with these specific stakeholders over the E-SHMP's next five-year lifecycle, in an attempt to overcome the barriers to collaboration.

State Sector Integration with Lifelines

The following graphic, Figure 15, demonstrates how each of the State of Colorado's Resiliency Framework sectors integrate within FEMA's lifeline construct.

FIGURE 15 – COLORADO RESILIENCY FRAMEWORK LIFELINE INTEGRATION

Commu-nity	Commu-nity	Commu-nity	Commu-nity	Commu-nity	Commu-nity	Commu-nity
		Watershed & Natural Resources	Watershed & Natural Resources	Watershed & Natural Resources	Watershed & Natural Resources	
Economic	Economic	Economic		Economic	Economic	Economic
Infra-structure	Infra-structure	Infra-structure	Infra-structure	Infra-structure	Infra-structure	Infra-structure
Health & Social	Health & Social	Health & Social	Health & Social	Health & Social	Health & Social	Health & Social
	Housing	Housing		Housing	Housing	Housing

These resiliency framework sectors are supported by state departments and entities who often assist in mitigation and recovery efforts. These organizations that support the state's capability to implement and guide mitigation efforts are enumerated below.

Influence on Lifeline Mitigation

Through an evaluation of existing state mitigation capabilities and funding resources, the following departments and entities, shown in Figure 16, have direct or indirect influence on mitigation actions that would impact the state's lifelines. By reducing the chance of hazard impacts on lifelines, either from the hazard event itself or from cascading failures, the state can improve its collective resilience.

FIGURE 16 – STATE ENTITY INFLUENCE ON LIFELINE MITIGATION

CDPS, OIT	DNR, CDPS, CGS, PUC, CEO	CDA, CDHS, DOLA, DNR, CDPS, CGS, CSFS, CDHE, CCC, Higher Education	CDOT, CDPS, CDHPE	DOLA, DNR, CDPHE, CDPS, CSFS, CDHS, HCPF	CDA, DOLA, DNR, CDPS, CGS, CSFS, DMVA	DOLA, CDOT, CDPS

Hazard Impacts on State Lifelines

Each hazard's potential impacts to lifelines are discussed within each hazard profile, based on historical events and a statewide consequence analysis that was conducted. In many cases, a single hazard may potentially impact multiple lifelines.

Hazard Profile Overview

Hazards profiles have been updated for all 20 hazards in this E-SHMP and have been consistently structured to give a comprehensive view of the factors that contribute to the risk posed by a hazard.

Hazard mapping across the E-SHMP is customized and symbolized based on each specific data set being analyzed. Maps are categorized using the Jenks natural breaks classification method. This method clusters data into groups that minimize the within-group variance and maximize the between-group variance. This classification type is useful for mapping data values that are not evenly distributed and allows for more meaningful and specific representations of the data being presented.

The following list highlights each section of the hazard profiles.

- **Definition**: A definition is given to provide a common understanding of the various characteristics of a hazard and the elements that make a hazard a concern for the state.
- **Location**: The location where hazards can occur range from statewide to regional, with some hazards limited to specific localized areas.
- **Contributing Factors**: Contributing factors are those which dictate how dangerous, damaging, or negatively impactful a hazard may become.
- **Past Occurrences**: Past occurrences provide details on historical events, previous losses, and notable events.
- **Probability**: Probability is the likelihood of a hazard occurring again, based on past event frequency. Future environmental conditions may also influence probability and are separately discussed in the climate change impacts section of each hazard.
- **Climate Change Impacts**: Through coordination with the State Climatologist and other subject matter experts, climate change's impacts to each hazard are summarized as changes to a hazard's location, extent/intensity, frequency, and duration.

- **Risk and Vulnerability**: Best available information and data was utilized to summarize the potential risk and vulnerability presented by a hazard. This was assessed for the state's population, state assets, and local governments.
    - **Underserved Communities**:
        - The State of Colorado's recently defined "disproportionately impacted communities" (DIC) were evaluated for all natural hazards. Communities assessed include:
            - Low income: Census block groups where more than 40% of households are at, or below, 200% of the federal poverty line. This generally limits the community's financial ability to mitigate personal risk, evacuate from a disaster, or to recover from a disaster.
            - Housing burdened: More than 40% of households in the census block groups spend more than 30% of their income on housing costs. This generally limits the community's financial ability to mitigate personal risk or to recover from a disaster.
            - People of color: 40% of the population are people of color (including all people who do not identify as non-Hispanic white).
            - Linguistically isolated: Census block groups where more than 20% of the population live in households where all adults speak a language other than English and speak English less than very well. This generally limits the community's ability to receive information relating to hazard alerts, opportunities, information, and resources.
            - EnviroScreen score: Colorado EnviroScreen maps the overlap of environmental exposures and effects, climate vulnerability, sensitive populations, and demographics to understand environmental injustice and environmental health risks in Colorado. The EnviroScreen Score combines population characteristics and environmental burdens. The

score goes from 0 to 100, with the highest score representing the highest burden.

- Climate and Economic Justice Screening Tool (CEJST): The tool uses datasets as indicators of burdens. The burdens are organized into categories. A community is highlighted as disadvantaged on the CEJST map if it is in a census tract that is: (1) at or above the threshold for one or more environmental, climate, or other burdens, and (2) at or above the threshold for an associated socioeconomic burden. In addition, a census tract that is completely surrounded by disadvantaged communities and is at or above the 50% percentile for low income is also considered disadvantaged.

  - The U.S. Department of Health and Human Services' current Social Vulnerability Index (SVI) vulnerability ratings are also included in this E-SHMP, to identify additional factors to assess for evaluating socially vulnerable communities. The SVI is one of the major inputs into FEMA's National Risk Index (NRI). Additionally, FEMA's Community Disaster Resilience Zones (CDRZ) are also included to further identify the state's most vulnerable communities.

- **Interconnected Hazards**: Interconnected hazards relate to the hazards that are caused or worsened by the profiled hazard, as well as the hazards that cause or impact the profiled hazard.
- **Recent and Future Development**: The impact to future populations highlights how future development may increase vulnerabilities to a hazard.
- **Consequence Analysis**: The consequence analysis provides an impact analysis across different sectors of government and the community, relating to the Emergency Management Accreditation Program (EMAP).

Animal Disease Outbreak – Moderate Risk

Definition

The Colorado Department of Agriculture's (CDA) Animal Health Division prioritizes combatting and responding to outbreaks involving foreign animal diseases (FAD). The United States Department of Agriculture (USDA) defines a FAD as an important transmissible livestock or poultry disease believed to be absent from the United States and its territories that has a potential significant health or economic impact. Preparedness and response planning for FAD incidents is crucial to protect public health, animal health, animal agriculture, the environment, the food supply, and the economy.

Another kind of animal disease outbreak that is a concern in Colorado is a disease that moves between animals and humans, or zoonotic diseases. There are common reportable zoonotic diseases that are of concern to CDA and Colorado Department of Public Health and Environment (CDPHE), but do not often require a response from CDA.

A zoonotic disease is one that is passed to humans through a vector, which includes mammals, birds, or insects. Zoonotic pathogens may be bacterial, viral, or parasitic, or may involve unconventional agents and can spread to humans through direct contact or through food, water, or the environment. These animal-related diseases are reported to CDPHE and are listed below in order of confirmed human case prevalence between 2017 and 2022[2].

- West Nile virus (WNV)
- Malaria
- Dengue

[2] Colorado Dept. of Health and Environment Zoonotic Disease in Colorado 2017-2022

- Q-Fever, Acute
- Spotted Fever Group Rickettsioses, including Rocky Mountain Spotted Fever (RMSF)
- Tularemia
- Hantavirus
- Lyme Disease

It should be noted that approximately 900 cases of rabies, in animals, were reported to CDPHE during this time, but there were no reported cases in humans[1].

Multiple organizations track these various diseases including the Animal and Plant Health Inspection Service (APHIS) which is overseen by the USDA, the Centers for Disease Control and Prevention (CDC), CDA, CDPHE, and local public health agencies (LPHA). Per the Colorado Revised Statutes (CRS) 35-50-105, "(1) The CDA commissioner is responsible for regulation related to livestock disease or other livestock emergencies among or affecting livestock in the state." If a response is needed for livestock related emergencies, CDA serves as the state's lead agency during an outbreak.

The National Animal Health Surveillance System is comprised of data from multiple sources including the USDA, APHIS, Veterinary Services (VS), and the National Animal Health Reporting System (NAHRS). The NAHRS oversees information on reported diseases, infections, and infestations through monthly data reports from participating state animal health officials. These reports give a summary of the presence of disease on the National List of Reportable Animal Diseases[3].

Animal diseases are also reported through APHIS and tracked to identify potential and active outbreaks in animals. APHIS keeps detailed records of the type of disease, type

[3] National List of Reportable Animal Diseases - USDA

of animal impacted, and any losses from the illness. In addition to livestock, wild animals, domestic animals, and backyard flocks with reported exposure and infections are tracked.

Through state surveillance programs and collaboration with producers, CDA has identified the following animal disease threats to the state:

- Foot and Mouth Disease (FMD)
- Highly Pathogenic Avian Influenza (HPAI)
- African Swine Fever (ASF) and Classical Swine Fever (CSF)
- Other Reportable Diseases in Colorado

APHIS has several surveillance programs for each type of animal and disease. The details of the diseases regularly monitored by these programs are below.

Cattle Health Surveillance

- Tuberculosis
- Brucellosis
- Bovine Spongiform Encephalopathy (BSE)
- Cattle Fever Tick
- FMD
- Foreign Animal Disease (FAD)

Other diseases can impact the health of cattle and may cause economic losses including Bluetongue, Bovine Leukemia, Johne's Disease, New World Screwworm, Trichomoniasis, and Vesicular Stomatitis.

FMD is identified by CDA as an animal disease threat to the state and is a high priority concern for the CDA, USDA, and APHIS due to severe economic impact concerns and international trade restrictions. FMD is a highly contagious viral disease that primarily

affects cloven-hoofed livestock (cattle, swine, sheep, goats) and some wildlife (deer, bison, pronghorn antelope, feral swine). Adult animals generally recover, but the morbidity rate can be very high. It is considered the most contagious disease of livestock.

Swine Health Surveillance

- Influenza A Virus in Swine (IAV-S)
- Classical Swine Fever (CSF) and African Swine Fever (ASF)
- Swine Brucellosis
- Pseudorabies Virus (PRV)
- Swine Vesicular Disease

Identified as an animal disease threat to the state by CDA, CSF and ASF are highly contagious viral diseases that affect swine only. ASF is a hemorrhagic disease of wild and domestic pigs that is often characterized by high morbidity and mortality rates. There is no effective treatment for ASF-infected swine, nor is there a vaccine. Both CSF and ASF are considered a high priority concern for the CDA, USDA, and APHIS due to severe economic impact concerns and international trade restrictions.

Sheep and Goat Surveillance

There are numerous monitored sheep and goat diseases that can be transmitted to humans. The majority of these diseases are carried by multiple animal species, but one disease, chlamydiosis, is specific to sheep and goats. Two diseases carried by sheep and goats can be severe and, in some cases fatal, including the Crimean-Congo Hemorrhagic Fever and Rabies.

Poultry Health Surveillance

- Virulent Newcastle disease

- Avian Influenza (AI) – Low Pathogenicity and High Pathogenicity

Identified as an animal disease threat to the state by CDA, AI is a viral infection of birds caused by type A influenza viruses. AI viruses are classified as either highly pathogenic AI (HPAI) or low pathogenic AI (LPAI), based on the genetic features of the virus and the severity of disease in poultry. Of particular concern are the H5 and H7 subtype viruses. While most AI viruses are LPAI and usually result in mild or asymptomatic infections, HPAI viruses are associated with very high morbidity and mortality rates in poultry. Some LPAI virus strains are capable of mutating under field conditions into HPAI viruses.

AI viruses are often found in migratory waterfowl, serving as a natural reservoir for the influenza A viruses, and often do not show any clinical signs, unlike their domestic poultry counterparts. The reservoir of AI virus in wild birds is a major source of infection for domestic birds, particularly free and open range poultry.

Location

The State of Colorado is home to approximately 39,000 farms, with over 31.8 million acres zoned as farmland. Outdoor recreation occurs in every county in the state, creating exposure to wildlife acting as disease vectors.

Contributing Factors

According to the USDA 2022 Colorado Agriculture Statistics, over half of the approximately 39,000 farms in the state produce livestock and poultry. These products make up $5.7 billion dollars in the total state agriculture revenue of over $8 billion and contribute to even greater economic impacts including employment throughout the supply chain.

Animal disease outbreaks can have localized effects, impacting the livestock or poultry at a single facility or can be detrimental to the industry and overall production. Limiting the scope of an outbreak is dependent on the early detection and rapid response to eradicate the disease.

HPAI is an example of an outbreak with dramatic consequences. Across the state, producers can lose inventory in large numbers and the result is felt in employment loss, increased consumer cost, and a ripple effect on the supply chain industry.

Wild birds can also be impacted, which can alter the typically expected number of hunters seeking fowl in Colorado. HPAI has been documented in a number of raptors, waterfowl, and vultures in numerous locations throughout the state.

Not all zoonotic diseases are highly infectious to humans, or highly transmittable to other humans once a person is infected. An infection may be localized to the person exposed, such as hantavirus or rabies. The disease may have a low transmission rate to other humans and is unlikely to impact large groups. As a virus mutates, the potential for a disease to transfer to humans and increase the ease of transmission between humans can occur. An example of this is COVID-19, which mutated to be highly transmissible between humans.

Past Occurrences

Historical Events

Animal disease outbreaks occur often at small scales, such as plague among prairie dogs, however large-scale events of zoonotic disease or those that require extensive culling of livestock are sporadic. COVID-19 was the largest scale zoonotic animal disease outbreak in the last 100 years and the recent 2022 HPAI outbreak caused mass culling across the globe.

In Colorado multiple animals have been reported as infected with HPAI including mountain lions, skunks, and a black bear. The first human infection of avian flu in the United States was of HPAI H5N1 in Colorado, in April 2022. This is one of 11 cases reported globally since December 2021.

Previous Losses

Determining costs for animal disease outbreak losses can be difficult due to the cascading effects on the economy, supply chain, and employment. It is challenging to

gather comprehensive data for specific inventory loss, effects on recreation, or the other impacts downstream.

To illustrate the extent of the 2022 HPAI outbreak, CDA calculated the total amount spent in Colorado on HPAI response efforts. This total of $35.2 million in response funds includes funding from the USDA and CDA. The state paid more than $91,000 of this total.

Notable Events

In July 2014, four people and a dog were confirmed to be infected with the plague. The people survived the illness, surviving what was referred to as the largest outbreak since 1924.[4]

Between 2004 and 2020, there were multiple years with livestock presenting with Vesicular Stomatitis, both equine and bovine. Most notable recently was in 2019 when 38 counties in the state reported cases, primarily in horses.[5]

The ongoing event of the H5N1 HPAI which appeared in the state in early 2022, has been detected in 14 counties. Approximately 12,000 gamebirds and over 6 million commercial poultry were impacted.[6] After mass culling the virus has slowed. However, as wild birds pass through there is potential for a rapid increase in cases.

Probability

Animal disease outbreaks will occur in Colorado, potentially each year. This is dependent on the type, zoonotic or animal only, and the definition of an outbreak which differs between the disease and type. There is a 100% chance that a future outbreak will occur.

[4] CDC: Plague Outbreak - Dog-to-Human & Possible Human-to-Human Transmission — Colorado 2014
[5] APHIS: 2019 Vesicular Stomatitis Virus Situation Report
[6] CDA: Response to HPAI Situation Report 6/16/2023

According to the CDC, when two or more people get the same illness from contact with the same animal or animal environment, the event is called a zoonotic outbreak. CDPHE states that outbreaks are instances in which more than one person is ill. The CDC has recorded 71 zoonotic outbreaks of Salmonella in Colorado between 2009 and 2021, which creates a 17% probability of this type of outbreak occurring in a given year[7].

Data from CDPHE shows there have been 69 confirmed cases of plague since 2005, which creates a 23% probability of a case of plague any given year[8].

Animal-only disease outbreaks can be more difficult to quantify as long-term data is not always available. These outbreaks may be sporadic but are likely to occur again when one considers the variety of diseases under surveillance for multiple animal types. The high concentration of farms located throughout Colorado makes the state susceptible to livestock outbreaks. When an animal disease outbreak occurs in the future it has the potential for large scale impacts.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future animal disease outbreaks. Table 7 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 7 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Warmer stream temperatures could have direct and indirect effects on aquatic ecosystems, including the spread of non-native species and diseases to higher elevations.

[7] CDC: National Outbreak Reporting System (NORS) Dashboard
[8] CDPHE Plague Data 2005-2021

Extent/Intensity	The extent is projected to increase with climate change. Climate change may increase the prevalence of parasites and diseases that affect livestock (i.e., the earlier onset of spring and warmer winters could allow some parasites and pathogens to survive more easily).
Frequency	Under warmer winter temperatures, new pests and diseases may become established.
Duration	Under warmer winter temperatures, some existing agricultural pests can persist year-round.

Risk & Vulnerability

Populations at Risk

All populations are at risk of being infected with a zoonotic disease, although those who handle animals, especially livestock and poultry, are more vulnerable. People with chronic health issues may have more negative impacts from an infection, as well as children and the elderly.

State Assets

Previous Losses

Since 2008, there have been no state asset property losses reported due to animal disease outbreaks.

Exposure

There is no direct risk to state assets from animal disease.

Lifelines

The food, hydration, and shelter and health and medical lifelines are most vulnerable to the impacts from an animal disease outbreak. A large-scale event has the potential to strain resources and impact supply chains, potentially having long-term effects on recovery and resilience.

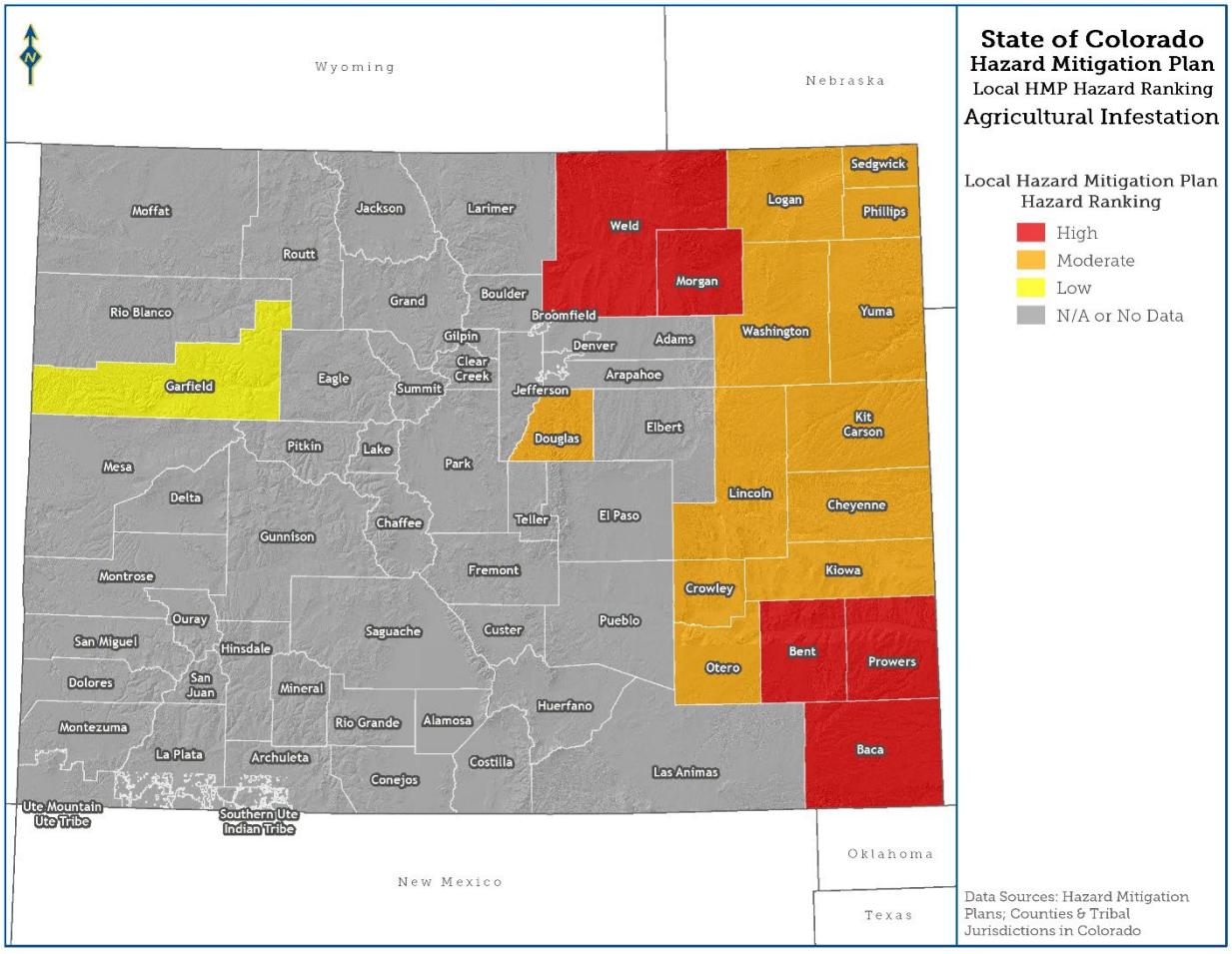
Animal Dis-ease			Food, Hydration, Shelter		Health and Medical		

Local County / Tribe

Hazard Rankings

Figure 17 presents the local risk rankings provided by local and tribal hazard mitigation plans. With the exception of Garfield County, all counties that ranked the animal disease outbreak hazard fall on the eastern half of the state. This hazard is considered a high risk for Baca, Bent, Morgan, Prowers, and Weld Counties and moderate risk for the others in the east.

FIGURE 17 LOCAL HAZARD RISK RANKING – ANIMAL DISEASE OUTBREAK



Exposure

All animals are vulnerable to animal disease outbreaks. Exposure varies depending upon proximity to other animals, rate and method of infection, and how likely an animal is to come into contact with new animals.

Humans are vulnerable to all zoonotic diseases, although some diseases are more infectious than others. Exposure varies depending on contact with animals, whether the animal is domestic or wildlife, and the method of infection. Those who recreate outdoors often are at greater exposure to disease carrying vectors and are more likely to encounter infected wildlife.

Due to privacy concerns, and compliance with the Livestock Information Security Act (LISA), best available data was used for a high-level approach to illustrate the risk of animal disease outbreaks. The LISA act is a state law which regulates the release of information on specific operational details of livestock operations. This includes ownership, head counts, and locations, among other information. Based on the LISA act, most data is not public.

All facilities are strictly regulated and follow guidelines set forth by the CDA, USDA, CDPHE, the Food and Drug Administration (FDA), and the Occupational Safety and Health Administration (OSHA). These include processes to reduce the risk of disease outbreak and facility inspections to identify and mitigate any potential issues.

Counties with multiple facilities and large numbers of animals are at the highest risk of a disease outbreak. At locations where new animals are brought in daily, the chance of an infection being introduced and spreading quickly is significantly higher. While still at risk, small operations can stop the spread of a disease more effectively due to smaller numbers of animals exposed.

Cattle operations, including calves, dairy, and beef, are prevalent across the state. Based on CDA data, there are 193 facilities handling cattle in roughly one-third of the

counties in the state. The capacity of these facilities ranges significantly from approximately 1,000 to over 125,000.

Based on CDA data, there are 39 commercial egg and poultry facilities operating in the state. Reported numbers of animals at each facility can vary greatly, which has significant impacts on the risk of animal disease outbreaks. Due to privacy and security concerns most companies do not report headcounts of animals publicly, which interferes with an overall awareness of risk to animal disease.

Northeast Colorado faces the highest risk of swine related animal disease outbreaks with six counties in the region accounting for 84 of 109 swine facilities in the state. The remainder of these facilities are located in three counties in Southeast Colorado.

Headcounts for facility capacity are based on the best available data, due to privacy and security concerns. Only 6 facilities, located in two counties in the northeast, reported maximum capacity. For each facility, this was approximately 3,800 swine.

Interconnected Hazards

Flood may exacerbate the spread of animal disease, as vectors such as mosquitos are likely to increase. Drought may impact the quality and safety of available water, potentially increasing exposure to diseases.

Recent and Future Development

As the population grows throughout the state the potential for people to come into closer contact with animals is likely. Increased demand for livestock products may increase farms in size or quantity and exposure to new development can be a health issue for animals and humans. If unable to expand farmland, the potential for overcrowding livestock increases, also posing health risks.

Population growth and development into areas with wildlife can impact natural habitats and create more opportunities for animal interaction, increasing disease exposure.

Consequence Analysis

Disease outbreaks have many adverse impacts and consequences. Table 8 summarizes some of the adverse impacts and consequences that can come from animal disease outbreaks.

TABLE 8 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Public health is at risk. If an outbreak occurs, measures to protect the public from exposure should be taken.
Responders	Higher risk of exposure to the disease through treating infected individuals or facilities.
Continuity of Operations (Govt. & Services)	No impact.
Property, Facilities, & Infrastructure	No impact.
Environment	Entire species are at risk. Environmental factors can also be influential in spreading the disease.
Economic	Colorado's livestock industry, as well as related industries are at risk during an outbreak.
Public Confidence in Govt.	An occurrence could lead to lack of confidence in global trade initiatives.

Avalanche – Moderate Risk

Definition

A mass of snow sliding, flowing, or tumbling down a slope. Avalanches are also referred to as snow slides. There are three main factors that contribute to an avalanche: a slope steep enough to slide (usually between 30˚and 50˚), snow cover, and a trigger. Snow avalanches are defined in Colorado state statutes as a geologic hazard.

Location

Avalanche hazards occur predominantly in the mountainous regions of Colorado above 8,000 feet. About 98 percent of all avalanches occur on slopes of 30-50 degrees. Avalanches release most often on slopes above timberline that face away from prevailing winds, as leeward slopes collect snow blowing from the windward sides of ridges. However, avalanches can run on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees.

The Colorado Geological Survey (CGS) and the Colorado Avalanche Information Center (CAIC) have mapped some areas of the state susceptible to avalanche activity. The CAIC provides avalanche information to the public, as well as promoting education and research of avalanches. Forecasts are provided for backcountry avalanche and mountain weather conditions across all mountainous areas of Colorado. The CAIC recently updated its website[9], which features a plethora of information relating to avalanche forecasts, observations, accidents, and education.

As part of this recent E-SHMP update, the state is able for the first time to provide mapped areas of the most likely avalanche risk areas across the state. Currently, the best available topographic data still leaves some gaps in the location assessment, but this is a new data set to assist in improving statewide and local risk assessments.

[9] Home | Colorado Avalanche Information Center (state.co.us)

Figure 18 presents the best available data relating to areas of highest avalanche hazard across the state. Identified areas were based off of a statewide assessment that included identifying all slope areas between 30°- 50° (based off of 1-meter digital elevation models) that intersect with historical snowfall areas where the average snowfall (November – April) is greater than ~40 cm (~16”). This snowfall data was based on the average 30-year snowfall and is available at an 800-meter grid resolution, so improved local risk assessments are still the preferred best available data.

FIGURE 18 AVALANCHE HAZARD AREAS

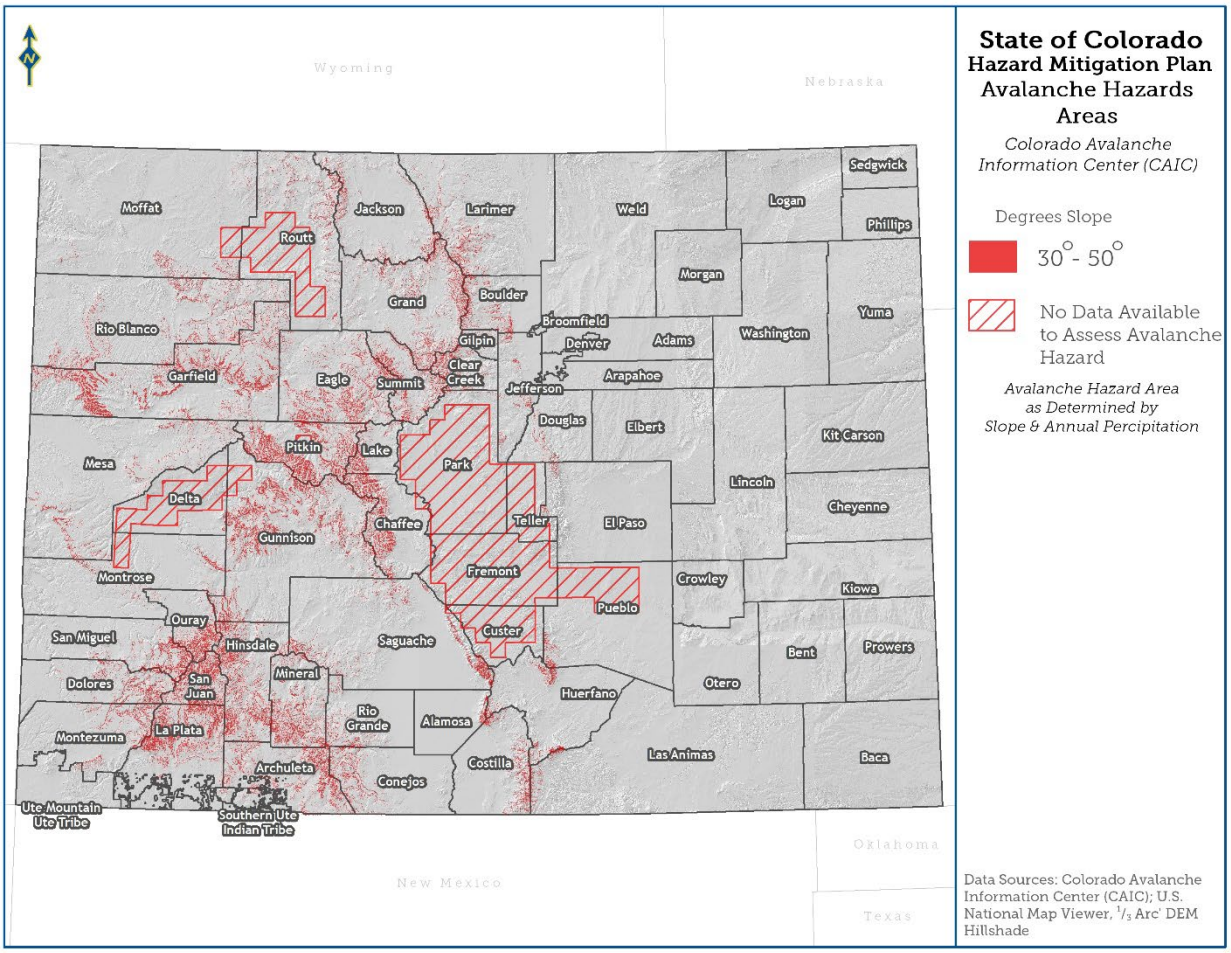
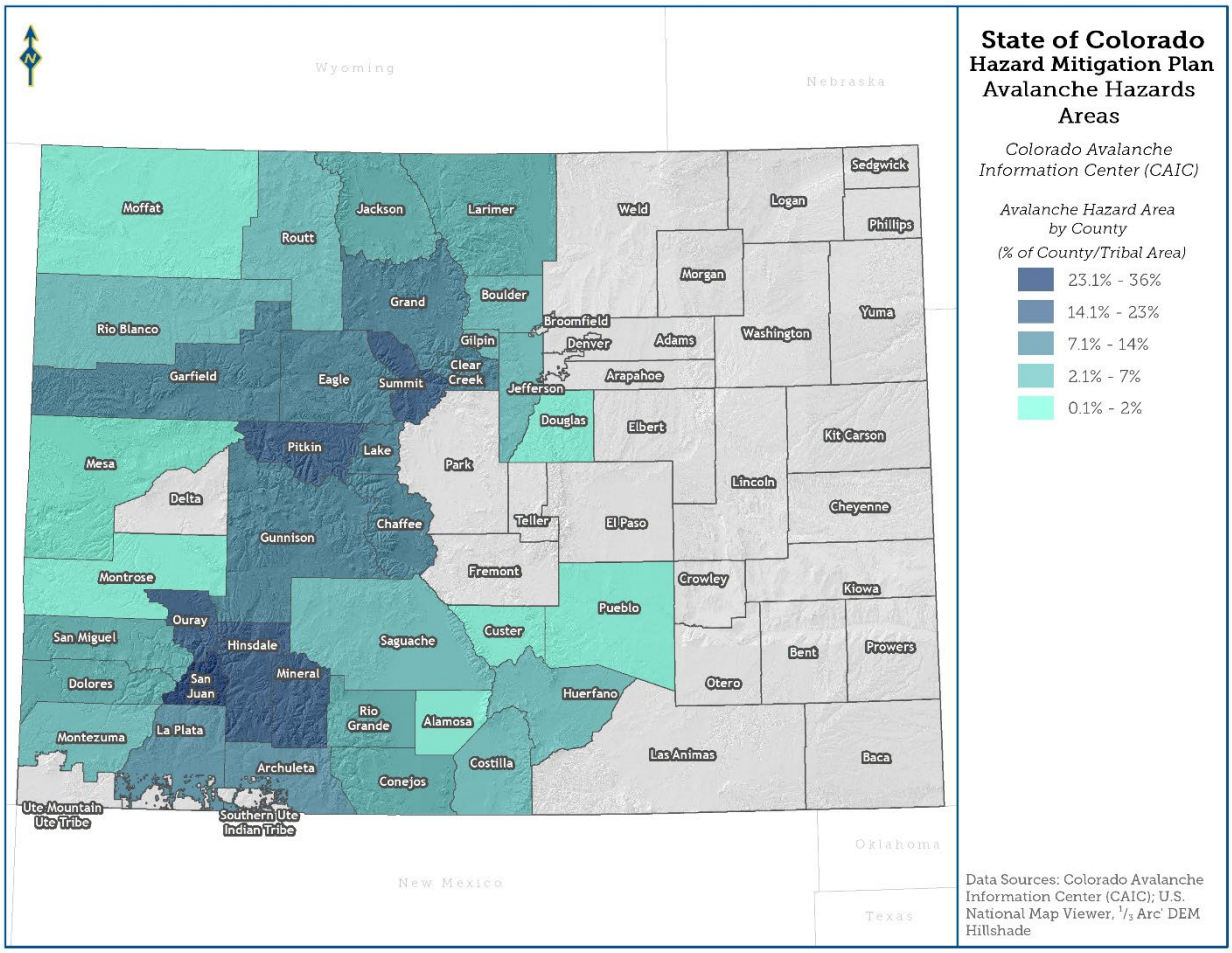


Figure 19 illustrates this data (areas where there is more than 40 cm of average annual snowfall and slopes are between 30°- 50°) summarized at the county level. This shows that San Juan County has the state’s largest percentage of avalanche

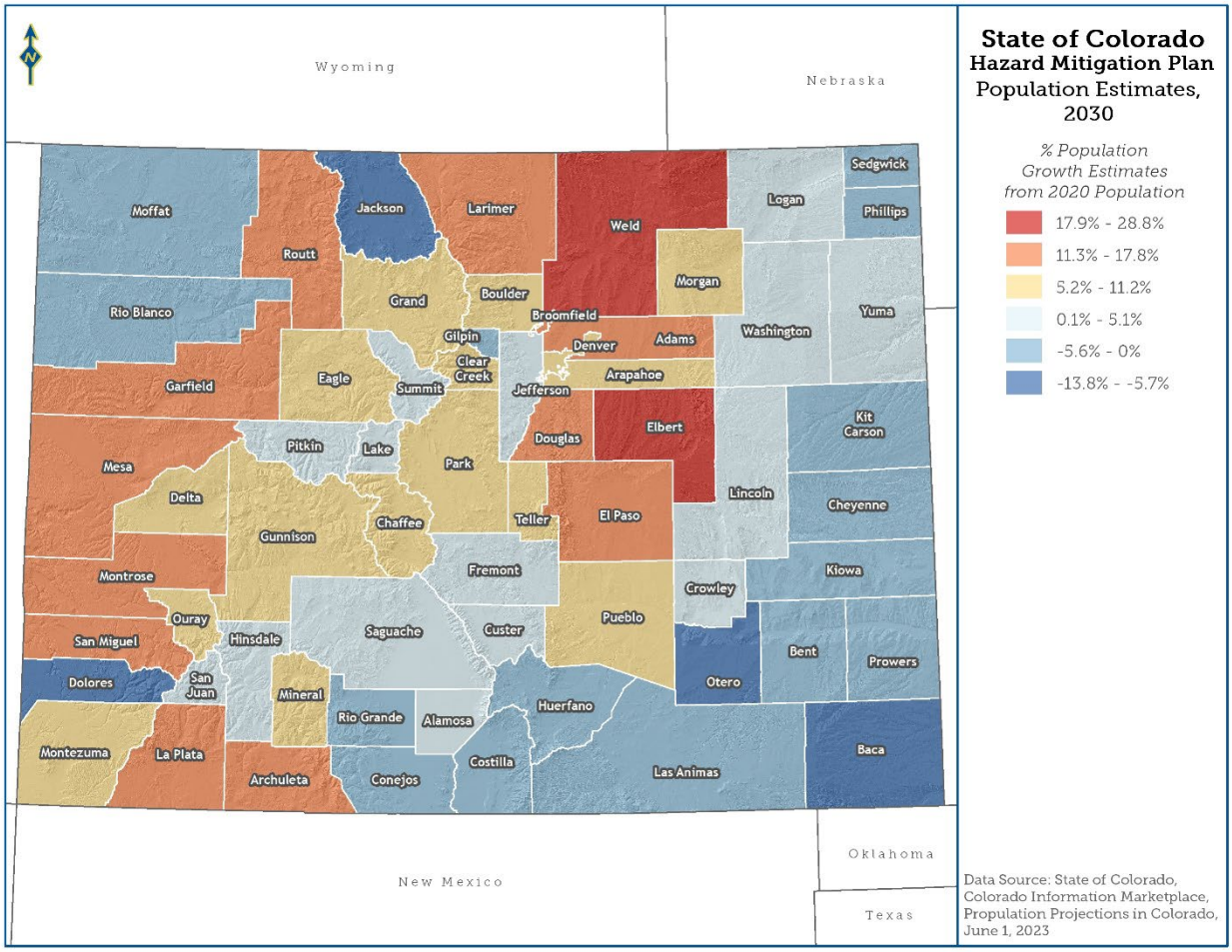
hazard areas as compared to county size. Readers should note that some counties on the western half of the state could not be assessed due to data restrictions.

FIGURE 19 AVALANCHE HAZARD AREAS BY COUNTY



For comparison, Figure 20 presents the estimated population growth across the state through 2030.

FIGURE 20 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

Avalanches occur regularly in the backcountry and are not typically a problem until human activities and land uses are adversely affected. Avalanches are extremely destructive due to the great impact forces of the rapidly moving snow and debris and the burial of areas in the runout zone. Air blasts from powder avalanches commonly exert a pressure capable of knocking out most windows and doors.

Per Avalanche.org: The destructive potential of avalanches is a function of the mass, speed, and density of avalanche debris paired with the length and cross-section of the avalanche path. Observers rate the size of an avalanche based on its destructive potential. An avalanche of a given destructive size has a wide range of potential runout lengths, depending on the width and thickness of the avalanche and the

characteristics of the terrain. Table 9 presents the destructive potential scale for avalanche events.

TABLE 9 AVALANCHE DESTRUCTIVE POTENTIAL SCALE[10]

Size	Destructive Potential	Typical Length	Typical Deposit Volume
D1	Relatively harmless to people	Bus	Average apartment size, ≤ 1 meter deep
D2	Injure, bury, or kill a person	Football field	Flood size of a large home, ~2 meters deep
D3	Bury / destroy a car or structure	1 km	Hockey rink, 2-3 meters deep
D4	Destroy a large truck or 4 hectare forest	2 km	4 hockey rinks, 4 meters deep
D5	Destroy a village or 40 hectare forest	3 km	5+ football fields, 8 meters deep

Property damage can occur throughout the entire avalanche path and can impact structures as well as transportation or communication infrastructure. Roads, highways, and railroads have been blocked for hours, sometimes days, every year due to avalanches. It is costly to clear the transportation routes. Power line corridors in have also been known to be affected by avalanches, resulting in power outages. In areas where efforts are underway to mitigate avalanches, the maintenance of avalanche control structures and /or explosive control is costly.

The complex interaction of weather and terrain factors contributes to the location, size, and timing of avalanches. In the absence of detailed scientific observation, any accumulation of snow on a slope steeper than about 30 degrees should be considered

[10] https://avalanche.org/avalanche-encyclopedia/avalanche/avalanche-problems/avalanche-size/destructive-force-d-scale/

a potential avalanche hazard. Usually when one slope is hazardous, many of the nearby slopes are also hazardous.

Avalanche-prone areas may pass many winters or even decades without a serious avalanche, with many running only once every five to 15 years, and others even less frequently. When avalanches do occur, they are most common between November and April. The most avalanche-prone months are, in order, February, January, March, December, April, and November. Depending on the amount and condition of the snow in the path, avalanches may not run the full length of their paths and may stop in the starting zone, track, or run-out zone.

Past Occurrences

Historical Events

Avalanche fatalities increased dramatically in the past but have remained in the same range since the 1980s. CAIC explains that Colorado accounts for one-third of all avalanche deaths in the country and since 1950, avalanches have killed more people in Colorado than any other natural hazard. Table 10 shows the avalanche fatalities per decade beginning in 1951. There have been avalanche fatalities and accidents in Colorado every month of the year. Most avalanche related deaths occur from winter sports and recreation activities.

TABLE 10 AVALANCHE FATALITIES BY DECADE IN COLORADO[11]

Decade	Avalanche Fatalities
1951-1959	13
1960-1969	21
1970-1979	27

[11] Value of statistical life estimates were assigned by decedent age: 0–17 years, $16.9 million (4); 18–65 years, $10.7 million (3); values descending from $6 million (aged 66 years) to $410,000 (aged ≥100 years), reflecting the estimate for persons aged 18–65 years adjusted for older adults' decreasing general life

Decade	Avalanche Fatalities
1980-1989	51
1990-1999	62
2000-2009	52
2010-2019	61
2020-2023	36
Total through 2022-2023 Season	**323**

Every winter, the Colorado Department of Transportation (CDOT) regularly monitors and/or controls over 278 of the more than 564 total mapped avalanche slide paths in Colorado, to help prevent avalanches from impacting Colorado highways. During the 2013-2024 winter season, CDOT triggered 553 avalanches with explosives and handled 214 natural occurrences, all of which impacted Colorado highways. That year, CDOT experienced 816 hours of road closures due to avalanche control, resulting in a total of 19,590 feet of snow covering the centerline of the roadway. Although protecting highway infrastructure is one benefit from implementing avalanche control mitigation activities, CAIC and CDOT programs are equally, if not more focused, on reducing the economic and human impacts of avalanches on recreation, tourism, commerce, industry, citizens, and visitors.

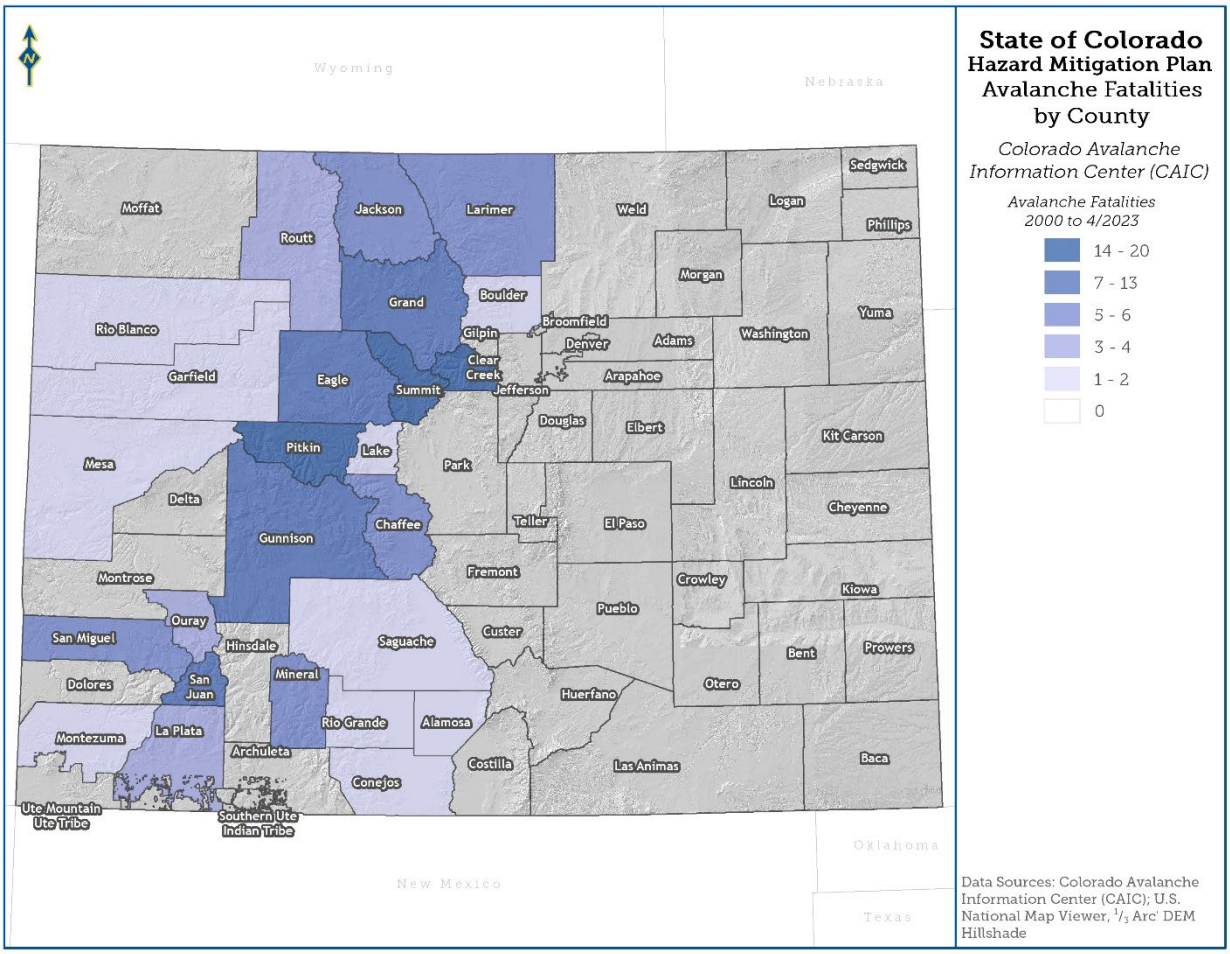
Previous Losses

Based on data from the National Centers for Environmental Information (NCEI) Storm Events Database, between January 1998 and February 2023, $525,050 was reported in property damage in Colorado. Loss of life estimates from 1990-2023 are 2.25 billion.[12]

[12] Value of statistical life estimates were assigned by decedent age: 0–17 years, $16.9 million (4); 18–65 years, $10.7 million (3); values descending from $6 million (aged 66 years) to $410,000 (aged ≥100 years), reflecting the estimate for persons aged 18–65 years adjusted for older adults' decreasing general life

Avalanche fatalities between 2000 and April 2023 are shown by county in Figure 21. These values coincide with the larger tourism numbers for counties with more popular ski resorts and backcountry areas.

FIGURE 21 AVALANCHE FATALITIES BY COUNTY



Notable Events

Mount Elbert, Twin Lakes, Lake County – January 21, 1962[13]: The deadliest Colorado avalanche reported in the last 60 years came down Mount Elbert, from approximately 13,000 feet, toward the town of Twin Lakes. The avalanche destroyed four homes. Nine people were trapped and seven died.

[13] Cary, H. (2023 May 2). Tragedy Slides into Twin Lakes in 1962, *Herald Democrat*. www.leadvilleherald.com

Northwestern San Juan Mountains, Red Mountain Pass – January 6, 2005[14]: Many avalanche paths ran full track, taking out mature timber, and several slides affected area roads for the first time in years. There were closures of Red Mountain, Molas, and Coal Bank Passes among others. Red Mountain Pass was closed for nearly a week. One slide struck a Front Range Wireless/Verizon Cell building on the top of Coal Bank Pass. The building was destroyed and buried by at least 6 feet of debris. Reported property damages were $200,000.

Animas Mountain, Durango, La Plata County – January 24, 2010[15]: Within Durango city limits, an avalanche roared into a house resulting in severe structural damage. Snow blasted through an exterior wall and completely filled one room with snow. The avalanche ran about 600 vertical feet with a 150 foot wide path. Reported property damages were $200,000.

Loveland Pass, Clear Creek County – April 20, 2013: The state's second deadliest recorded avalanche in the past 60 years resulted in the death of 5 people. Six experienced backcountry skiers and snowboarders triggered the slide in the Sheep Creek drainage of Loveland Pass in Clear Creek County. All six group members were buried, and only one survived. The slope where the avalanche occurred was not extremely steep, but heavy, wet snows and high winds created unstable conditions.

In March of 2019 Colorado experienced a widespread 100-year avalanche event. Infrastructure damages included: power lines in Peru Creek, gas line near Copper Mountain, house destroyed in Hinsdale County, many streams dammed with debris, cars buried on State Highways 91 and 550, and a state emergency declaration for Hinsdale County.

Red Mountain Pass, Highway 550 between Silverton and Ouray, was closed due to avalanche debris piles as high as 30 feet covering the roadway. The avalanche was

[14] NCEI Storm Events Database
[15] NCEI Storm Events Database

triggered by mitigation measures implemented by CDOT. The road was closed for more than a week when further mitigation efforts caused more than 60 feet of new snow, trees, and debris to cover the roadway. The 19 day long closure broke the previous record for the longest road closure since CDOT began recording in 2004[16].

Probability

It is difficult to accurately capture the number of avalanches occurring in any given year because some are not witnessed or recorded in data. However, CAIC keeps records of best available data including human-caused avalanche numbers. In the 2022-2023 Annual Report[1], CAIC shared the documentation of 3,283 avalanches, which is not uncommon. Notably they recorded that approximately 900 of these were human caused.

Avalanches will continue to occur and human caused avalanches will also continue to occur (100% chance), though it cannot be stated whether or not these numbers are expected to increase or decrease. This unpredictability is due to how much can change from one avalanche season to the next, including impacts from climate change on season timing, number of people recreating in the backcountry, and the day-to-day weather.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future avalanche events. There is high confidence that temperatures are warming across the mountain-west, but there is much lower confidence projecting changes in precipitation at any specific location.

These warmer temperatures lead to more precipitation falling as rain, as compared to snow. As compared to historical records, the rain-snow lines will move to higher elevations over time and rain is expected to occur at higher elevations in the winter

[16] Red Mountain Pass reopens after historic avalanche closure, The Gazette, 2019

and earlier in the season. There will be more rain-on-snow events, even in cold interior climates like Colorado.

Wet avalanche activity will start earlier in the spring season, with some wet activity occurring mid-winter. This pattern will be more pronounced in lower-elevation and warmer climates. This means that the state will likely have to deal with, and forecast for, more wet avalanche activity at different times of the season than done so historically.

An increase in crusts due to rain or melt will cause more crust-weak layer issues earlier in the season. It is also expected that inter-annual variability will increase, with consecutive seasons experiencing very different conditions. The idea of an "average" year is becoming less useful since the chances of seeing a season that looks like "average" will decrease over time.

Each year will be different, like now, but the differences between years are likely to be more dramatic with the expected influence of climate change. This means that using historical analog years may become less useful, especially as we experience seasons and weather events without historical analogs.

It is consistent with current climate science that storm intensity, or the frequency of intense storms, will increase with a warming climate. But this pattern is not yet evident in Colorado SNOTEL records for winter storms. More intense storms and unusual/unprecedented weather events will lead to avalanche cycles that may be outside historical norms. There is also some evidence suggesting that drier periods are becoming more prolonged.

Table 11 summarizes these projected changes.

TABLE 11 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Avalanches are only a hazard in mountainous regions of the state. The area affected by avalanches is projected to shrink as warmer temperatures cause more precipitation to fall as rain.
Extent / Intensity	In areas affected by avalanches, it is unknown if or how the intensity of avalanches will change. Extent is not projected to change.
Frequency	Additional research is needed to determine the effects of climate change on avalanche frequency.
Duration	Additional research is needed to determine the effects of climate change on avalanche duration. However, some research suggests that there will be earlier wet snow avalanches, by as much as six weeks by the end of the century under a higher emissions scenario (SWCARR, 450).

Avalanche officials in several western states have noticed a pattern associated with increased avalanche risk (Freedman, 2012). Snow occurs early in the winter and is then followed by a long period without snow. This creates a thin snowpack that becomes structurally weaker as winter goes on. New layers of snow may not bond well to the weak base layer, creating prime conditions for avalanches. As Colorado experiences winters with higher average temperatures and lower average precipitation, these conditions that increase avalanche risk become more common.

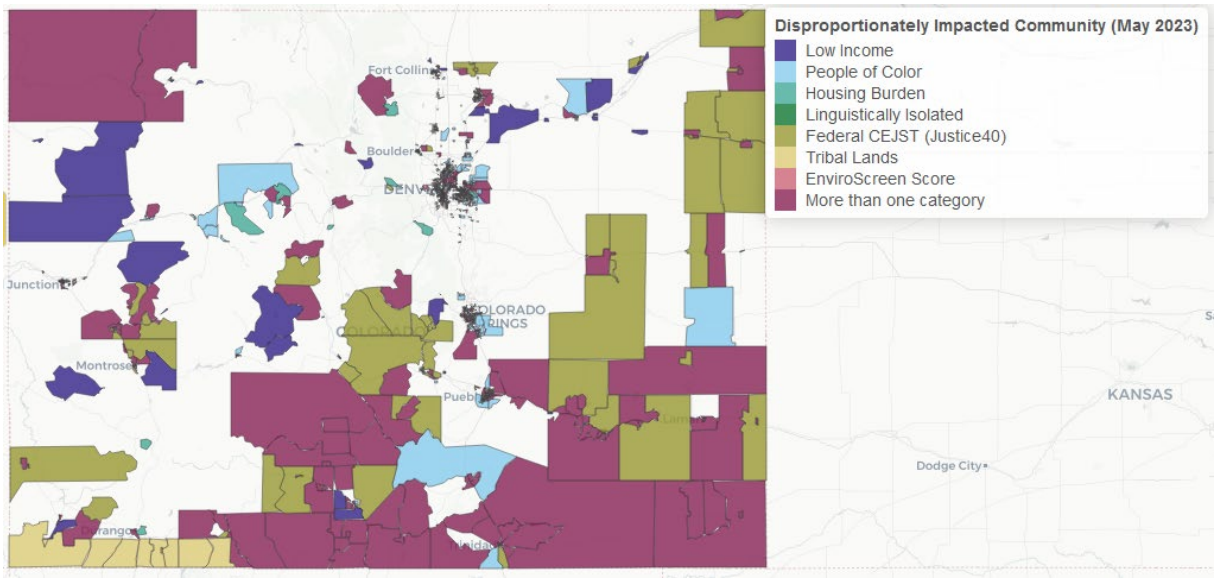
Risk & Vulnerability

Populations at Risk

Those who choose to spend time in areas with warnings for avalanches, whether hiking, skiing, or snowmobiling, and are uneducated about the factors and dangers of the hazard are especially vulnerable to being caught in an avalanche.

The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 22. When comparing these communities to those counties with the highest avalanche risk (Figure 19), Summit County contains Census Block Groups that are the most vulnerable in Colorado.

FIGURE 22 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in Summit County at a higher risk to avalanche include: low income, housing burdened, and people of color. The county has a statewide cumulative SVI score indicating a “Low-Medium” level of vulnerability.

State Assets

Previous Losses

No state asset structures have been reported as damaged by avalanches, but losses have been incurred to infrastructure. The cost of snow removal from transportation routes in avalanche prone areas can be significant depending on necessary equipment

and man-power costs. In addition, economic losses due to impassable transportation routes can be extensive. In some places, closures can cause millions of dollars in economic losses per hour.

Exposure

There are state owned buildings, primarily storage facilities, that lie in avalanche areas. In addition, miles of federal, state, and locally managed transportation routes fall within areas of state mapped avalanche potential.

Highways are the most vulnerable state asset type exposed to avalanche hazard. The largest risk is to those state highways located in known avalanche paths. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

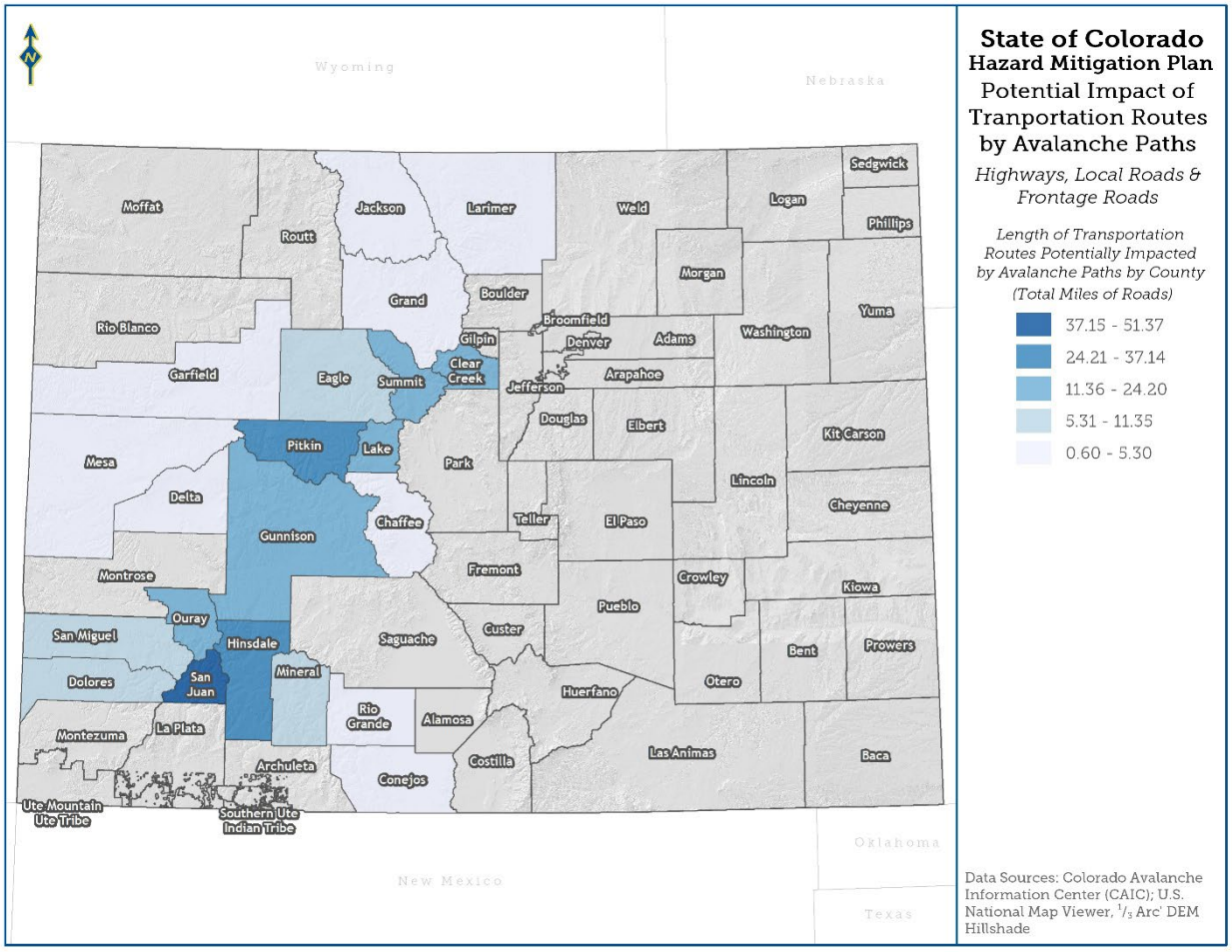
The greatest avalanche impact would involve an event affecting I-70 in the mountains. This event could affect local and regional economies and cause supply chain disruptions at the state and national levels.

Of those counties at the highest risk from avalanches (Figure 19), Summit County has the most state assets and valuations exposed (as shown in Figure 13 and Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Figure 23 presents a summary of the miles of roads potentially impacted by mapped avalanche paths.

FIGURE 23 POTENTIAL IMPACTS (CURRENTLY MAPPED) ON TRANSPORTATION ROUTES



Lifelines

Communications, energy, and transportation are the community lifelines vulnerable to the impacts from an avalanche event. Infrastructure for each of these lifelines could have cascading impacts should they be disrupted. It is unlikely that an avalanche event would strain resources or have long-term effects on recovery and resilience.

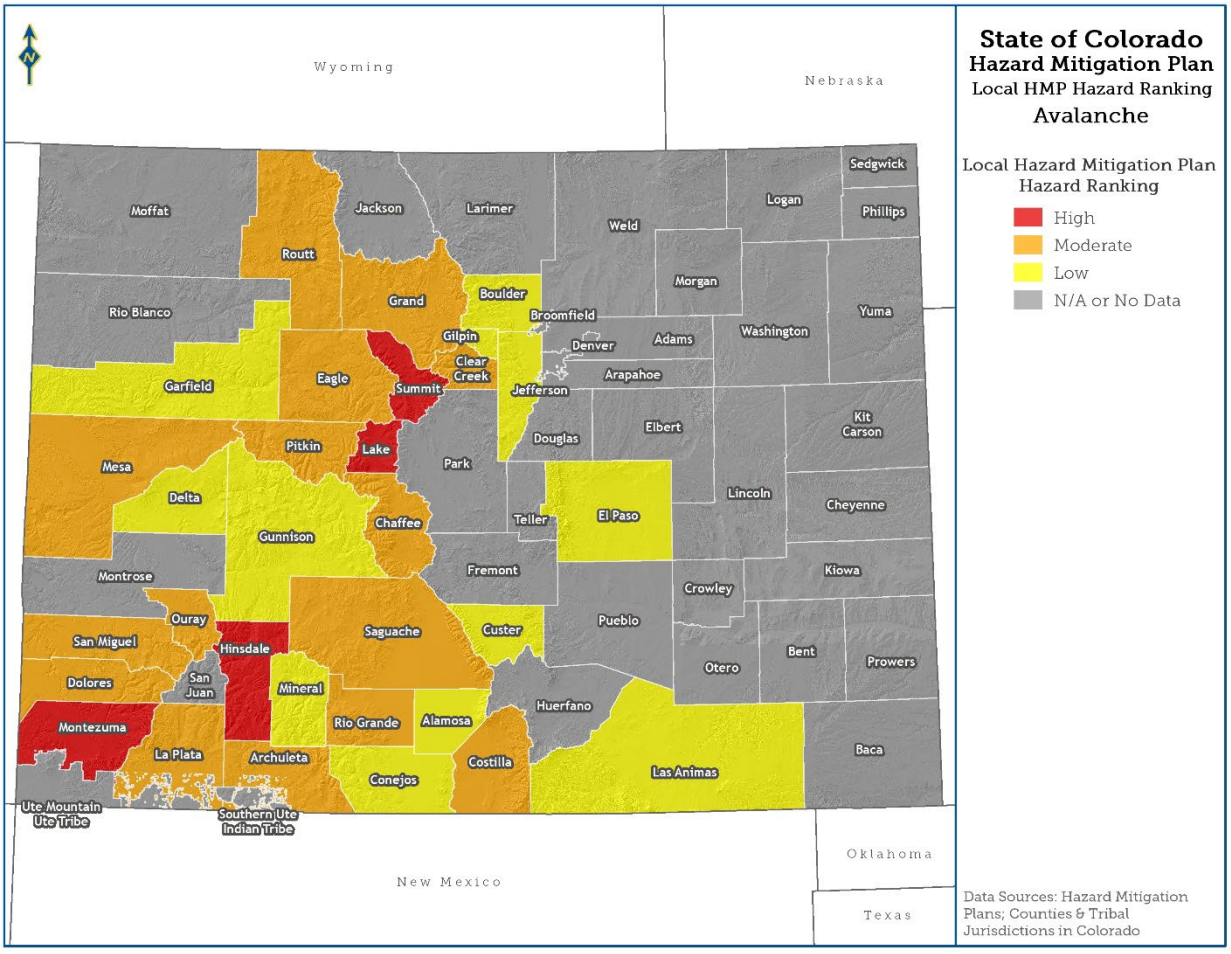
Ava-lanche	Communications	Energy (Power & Fuel)					Transportation

Local County / Tribe

Hazard Rankings

Figure 24 details the hazard risk rankings reported for avalanche in local hazard mitigation plans. As expected, only those counties located in the mountains consider this hazard to be a risk. Outside of four counties with a high risk ranking, most others are split between moderate to low risk. It should be noted that some mountain communities consider avalanche to be an individual hazard, not necessarily impacting their local government or community. Therefore, not all local plans with mountainous terrain currently profile this hazard which could have local impacts.

FIGURE 24 LOCAL HAZARD RISK RANKINGS



Exposure

Anyone recreating in the back country within areas of avalanche exposure are at risk. Where communities have built or developments have encroached into steep mountainous terrain, the vulnerability to avalanches exists.

Local-level analysis of avalanche risk to structures is not provided in any of the state's HMPs. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Avalanche events can cause erosion / deposition and landslide / debris flow / rockfall. Avalanche events can be induced or made worse by earthquake, erosion / deposition, extreme heat, landslide / debris flow / rockfall, and severe winter weather.

Recent and Future Development

Overall population growth in the state equates to more people recreating in the backcountry, increasing exposure to potential avalanche accidents. As tourism continues to grow for winter recreation, visitors may be unaware of avalanche risk. Additionally, with limited land available for future development in mountain communities, new development is being observed occurring in known hazardous avalanche areas. New residents of those communities may be unaware of the avalanche risk to themselves and their homes.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- Ouray County's vulnerability to this hazard has fluctuated with development trends in the county, specifically as they relate to the mining industry. When the mining activity subsided considerably, so did the deaths and damage from avalanches. A renewed interest in mining is occurring in the Camp Bird Road

area, and the county has been pressured to keep the road plowed year-round to allow access to the high-country area. This has the potential to put county road crews, and miners and mining infrastructure, at risk.

- Avalanches are a very significant threat as development and recreation increase in mountain areas across Eagle County.
- Areas of Garfield County where development has encroached into steep mountainous terrain have increased vulnerability to avalanches.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- None of the counties with the highest future development projections provided any specific content about future development.

Consequence Analysis

TABLE 12 – EMAP IMPACT SUMMARY

Consideration	Description
Public	There are six to seven annual deaths along with multiple injuries, with most deaths and injuries impacting winter sport and backcountry recreationists such as skiers and snowboarders, hikers, and snowmobilers. Highway maintenance crews and motorists are also at risk of avalanche near or on roadways.
Responders	Some exposure exists to personnel performing routine duties on roadways and other areas that may be prone to events. Some responders may face risk of avalanches during response if entering avalanche prone areas, however most avalanche-

Consideration	Description
	related duties are post-event where risk of occurrence has subsided.
Continuity of Government (Govt. & Services)	Loss of facilities or infrastructure for the provision of government services is expected to be non-existent or negligible. Possible short-term accessibility issues for first responders performing routine duties or personnel reporting to work locations.
Property, Facilities, & Infrastructure	Instances of personal property losses are infrequent yet occur on occasion. Known avalanche runs are sometimes void of development due to local land use regulations. Some events will impact private vehicles. Buildings and equipment are typically not located within avalanche runs due to their known locations. Roadways are blocked by avalanches but typically do not sustain significant damage. Communication and power infrastructure occasionally experiences short-term or minor impacts.
Environment	Localized impact related to tree damage may be found in or around avalanche chutes. Removal or displacement of trees and rocks may cause secondary impacts such as landslides or rock falls as slope stability is impacted. There is potential for the short-term damming and sudden release of water if the event intersects a waterway.
Economic	Possible short-term blockage of roadways that prevent travel and access to local businesses by residents, recreationists, and tourists. Due to limited exposure of property to this hazard, economic losses resulting from damage to buildings and personal property or associated downtime are anticipated to be limited.

Consideration	Description
Public Confidence in Govt.	Characteristics of avalanches result in limited response and recovery functions for government beyond first responders. Monitoring programs typically mitigate potential large-scale events and road crews are typically swift in restoring service to blocked roadways.

Dam / Levee Incident – Moderate Risk

Definition

Dams are human-designed structures built for a variety of uses including: flood protection, power generation, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. In general, there are three types of dams: concrete arch or hydraulic fill, earth-rockfill, and concrete gravity.

Levees are embankments constructed along the banks of rivers, canals, and coastlines to protect adjacent lands from flooding by reinforcing the banks. Levees can be natural or man-made. A natural levee is formed when sediment settles on the riverbank, raising the level of the land around the river. To construct a man-made levee, workers pile dirt or concrete along the riverbanks, creating an embankment that is flat at the top, and slopes at an angle down to the water. Levees provide strong flood protection, but they are not failsafe. Levees only reduce the risk to individuals and structures behind them; they do not eliminate risk. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events.

Hydrologic failures of dams and levees can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which can result in overtopping
- Seismic activity
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, piping, or rodent activity
- Improper design
- Improper maintenance

- Negligent operation
- Failure of upstream dams on the same waterway
- Levee opening/breaching (similar to overtopping)
- Physical damage from debris, ice, or trees toppling leaving holes in the structure

Location

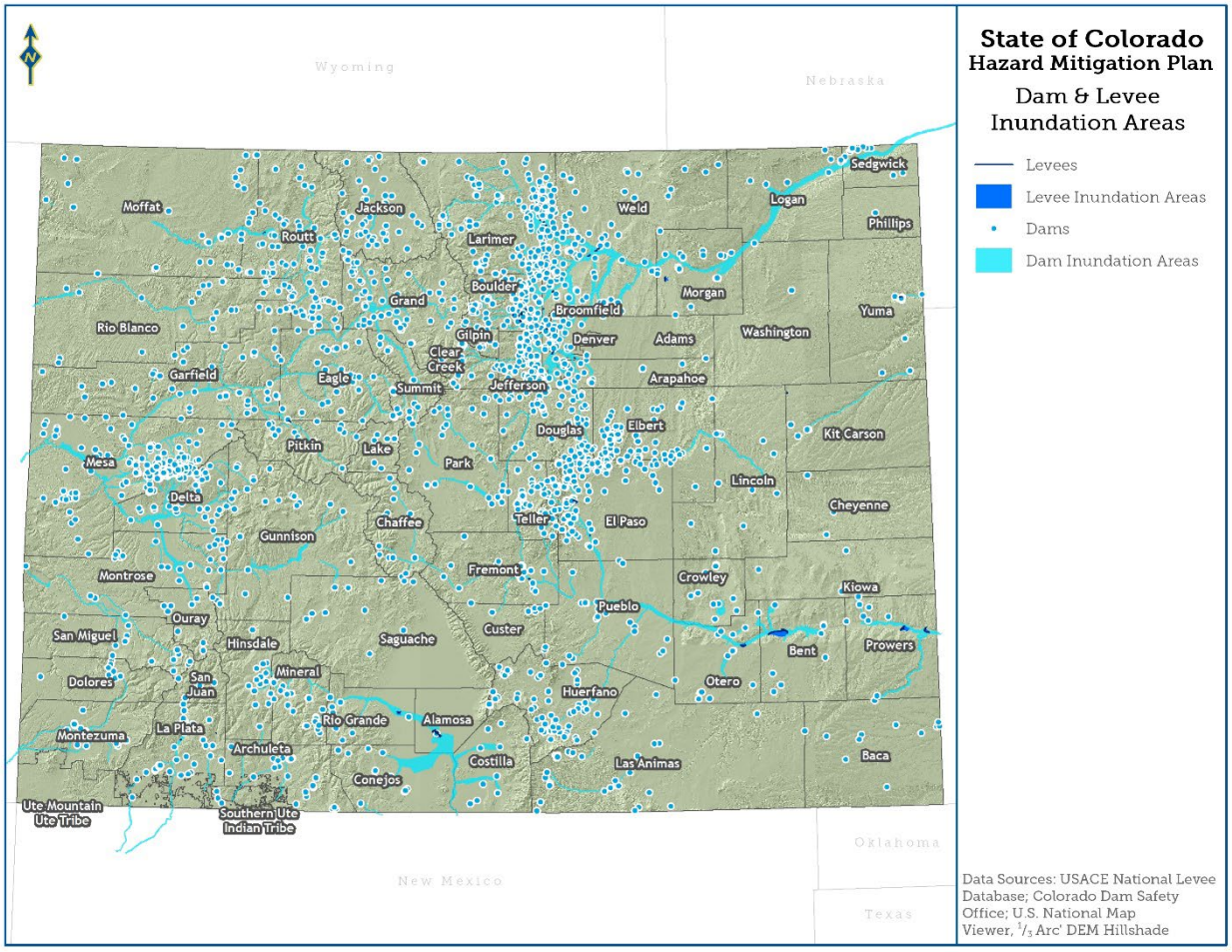
There are dams in every county across the State of Colorado. As of August 2023, the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID)[17] reports on 1,983 structures. Of these, fifty-six counties report having "high" hazard dams and 46 contain "significant" hazard dams (for a total count of 471 and 295 dams, respectively). A list of all high and significant hazard dams can be found in the Annex – High and Significant Hazard Dams. The state also has its own web mapping application of dams that can be accessed here.

Levee systems are present in 22 counties throughout the state, according to the USACE National Levee Database (NLD)[18]. There are 61 levee systems, which are a total of 73 miles long when combined. Most of these systems are operated by the public, 48 of them were locally constructed, while another 15 were built by USACE and turned over to the public for maintenance.

Figure 25 shows a statewide view of the locations of these dams and levees throughout the state. Also shown are the best available inundation areas, which are those areas at risk of flooding if there were to be an incident with either a dam or levee.

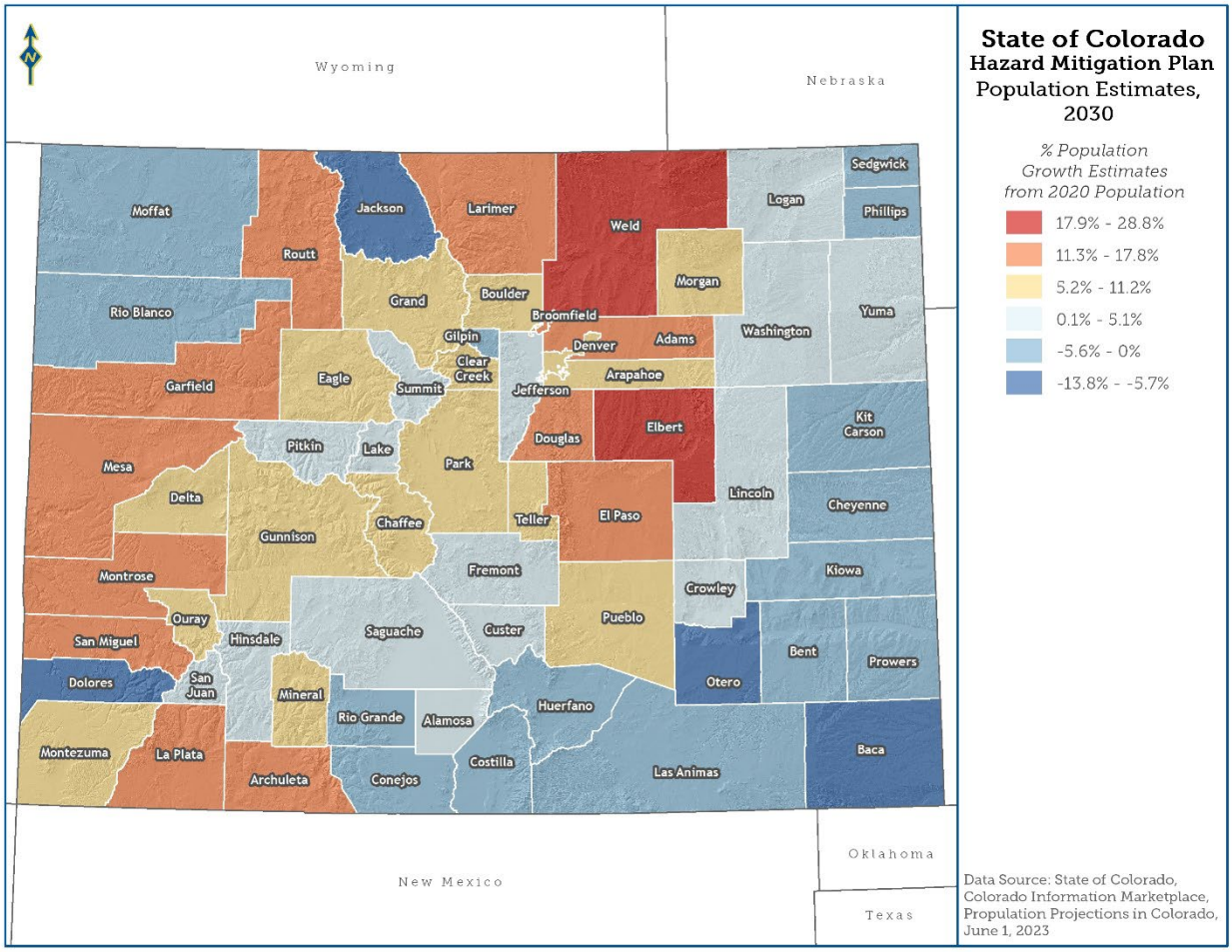
[17] https://nid.sec.usace.army.mil/#/
[18] https://levees.sec.usace.army.mil/#/

FIGURE 25 DAM AND LEVEE LOCATIONS AND INUNDATION AREAS



For comparison, Figure 26 presents the estimated population growth across the state through 2030.

FIGURE 26 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

FEMA Federal Guidelines for Dam Safety details the classification determinations for low, significant, and high hazard dams. The system is based on a dam failure's potential for probable loss of human life, and the impacts on economic, environmental, and lifeline interests.

Dam failures may be categorized into two types:

1. component failure of a structure that does not result in a significant reservoir release
2. controlled breach failure that leads to a significant release

For levees, breaches and overtoppings are the most common types of failure that occur. With an uncontrolled breach failure of a levee or dam, there is a sudden release of the water, sometimes with little warning.

Another consequence of hydrologic containment structure failures is the potential for flooding as a result of designed discharge from dam outlet structures or spillways during excessive rain or snowmelt events.

Low hazard dams are classified based on the improbability of loss of human life and/or economic/environmental losses. Significant hazard dams may result in some economic/environmental losses; however, there is no probable loss of human life, while the failure of a high hazard dam almost inevitably leads to fatalities. These hazard categories do not correlate with the probability that an event will occur. Table 13 shows the details for these hazard categories.

TABLE 13 DAM HAZARD CLASSES

Hazard Category	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

When assessing the magnitude of a dam incident, it is important to consider the severity of an event, the location of the dam, and its proximity to urban centers. Some events lead to shallow flooding or a slow release while others may completely overwhelm the spillway, resulting in a rush of large volumes of water. Damages range considerably depending on the knowledge of possible structure function issues and if plans are in place to address any consequences that may arise. Complete failure of dams and levees has the potential to severely damage property, shutdown facilities

and services for more than 30 days, and result in fatalities or leave residents stranded.

Potential for loss of life is determined by the capacity and number of evacuation routes available for residents in the inundation zone, as well as the ability to provide timely warning. Flood waters may cut off evacuation routes, limit emergency access, and create isolation issues. Any building, property, state-owned facility, and critical infrastructure located within or close to the dam inundation zone has the greatest likelihood of being impacted by the surge of water. Communications and energy infrastructure are also at risk of damage. Populations without adequate warning, either from lack of availability, technological or language barriers, or minimal time to receive them, are likely the most negatively impacted groups.

Beyond impacts for people and infrastructure, a dam incident exposes the environment to many risks. The inundation may introduce foreign elements and debris into local waterways and destroy downstream habitat, having significant effects on many species of both plants and animals.

Some water releases from dams are intentional, to preserve safety and operations. When a reservoir behind a dam fills to certain levels it may be necessary to open a spillway to execute a controlled release of water from the reservoir. The resulting water travels to outlet release areas. Outlet release areas are not mapped in typical floodplain mapping, although they have the potential to be significantly impacted by the release.

Although all high-hazard dams in Colorado have dam failure inundation maps to outline flooding limits for dam failures, no statewide mapping exists for the range of outlet releases that might be anticipated to occur during flooding events. As a first step toward addressing this need, Colorado Dam Safety recently produced the Colorado High Hazard Dam Release - Downstream Floodplain Impacts Database and Ranking Tool. The results of the tool are summarized in the Vulnerability section.

Past Occurrences

Historical Events

There have been 184 recorded dam incidents in the State of Colorado according to the National Performance of Dams Program (NPDP)[19], through Stanford University. NPDP collects dam incident data from the U.S. Committee on Large Dams, Association of State Dam Safety Officials, and contributions from state dam safety programs. The records for Colorado date back to 1890 with the most recent incident occurring in 2021.

The data is differentiated between an uncontrolled release of the reservoir (URR), which is considered a dam failure, and an incident which may involve damage to the dam, inadequate spillway capacity, or dam operations issues but retains control of the reservoir. Of the reports in Colorado, 74 were confirmed as URR or dam failures, while 99 incidents were reported with no loss of reservoir control. The final 11 incidents are reported unknown for the status of URR or not.

A database for levee incidents is not currently available. Some incidents are highlighted in the Notable Events section.

Previous Losses

Comprehensive incident losses can be difficult to quantify due to data availability. There is no single location to record these numbers and figures may be withheld for a variety of reasons. Private dam or levee owners may choose not to disclose information and insurance claims are not often reported due to confidentiality concerns. If the incident impacts multiple jurisdictions there may be different reporting standards or no reporting at all. This is similar to federal agencies which may not report out totals to outside agencies.

[19] NPDP Dam Incident Database | National Performance of Dams Program (stanford.edu)

Notable Events

The section below details major dam and levee failure flood events occurring in the state between 1950 and 2023.

Larimer County, Lilly Lake Dam, 1951: The earliest recorded dam failure flood in the Estes Park region occurred on May 25, 1951, when Lilly Lake Dam failed, sending flood waters down Fish Creek and into Lake Estes.

Prowers County, Clay Creek, 1965: In June 1965, a flood occurred on Clay Creek in Prowers County, which overtopped an earthen dam being constructed by the Colorado Game, Fish, and Parks Commission. Although the dam did not fail, it did divert floodwater into an adjacent drainage. The subsequent damage and death from this flood resulted in an important legal controversy known as the Barr Case. This case was finally decided in 1972 by the Colorado Supreme Court, which recognized the concept of probable maximum flood as a predictable and foreseeable standard for spillway design purposes.

Weld County, Lower Latham Reservoir Dam, 1973: The failure of the Lower Latham Reservoir Dam in 1973 and subsequent flooding in the Town of Kersey, resulted in a Presidential Major Disaster Declaration.

San Juan County, Lake Emma, 1979: The San Juan Mountains above Silverton experienced a dam failure flood when Lake Emma, a natural lake, was completely drained on June 4, 1979 by a series of abandoned mine tunnels beneath the lake. On June 4, 1979, floodwater flowed through a network of abandoned mine tunnels that extended beneath the lake.

Larimer County, Lawn Lake Dam, 1982: The Lawn Lake Disaster of 1982 caused four deaths and over $31 million in property damage when a privately-owned dam failed in Rocky Mountain National Park above the Town of Estes Park in Larimer County. Gradual deterioration of the earthen dam led to a breech that released 220 million

gallons of water. A lawsuit awarded $480,000 to the family of one of the four persons killed in the disaster.

Delta County, Carl Smith Reservoir, 1998: The Carl Smith Reservoir failed on the evening of May 2, 1998. Carl Smith Dam is an 850-acre foot, Class 1 off-channel reservoir in Leroux Creek Basin north of Hotchkiss, Colorado. The failure was a result of a large slide on the downstream slope that extended across the crest and into the upstream slope. The releasing water swiftly eroded down through the top half of the remaining embankment and quickly released about 500 acre-feet of storage. The peak discharge just below the dam was determined to be around 3,300 cfs. Several residences were evacuated. The only loss of life was livestock. The high water washed out numerous bridges, and diversion structures were quickly rebuilt to restore water to irrigators.

Dikes North of La Junta, Otero County, 1999: A three-day rainfall event occurred on April 29 to May 1, 1999. Heavy rain and saturated soil caused flooding in two major areas along the Front Range, specifically in Northeastern Colorado along the South Platte River and some of its tributaries, and Southeastern Colorado along the Arkansas River and some of its tributaries. Rainfall totals of up to 13 inches were recorded in the Cheyenne Mountain region of Colorado Springs. The La Junta region recorded approximately 8 inches over the same three-day period. The Arkansas River broke the dikes near North La Junta, flooding approximately 200 residences and businesses. The stormwater runoff from the three-day rain resulted in large flood inundation and erosion in the Arkansas River and Fountain Creek watersheds.

La Plata County Levees and Dikes, 2006: In 2006, La Plata County experienced prolonged and heavy rainfall over October 5 and 6. Vallecito Creek overflowed, resulting in flash flooding. Levees and dikes built in the 1970s along the Creek breached on the night of October 6.

Embankment North of Pueblo, Pueblo County, 2007: The area north of Pueblo was inundated by heavy rainfall in early May 2007. On the morning of May 7, an earthen

embankment along Fountain Creek failed and 15 structures were flooded. The flooding was not a result of overtopping, but rather structural failure. This embankment was not a certified levee and was not identified on the effective Flood Insurance Rate Map.

Riverside Park Levee, Evans, Weld County, 2013: The Riverside Park levee failed in Evans during the September 2013 flooding. The floodwaters created a 70-foot gap in the levee. The flood put the sewage treatment plant out of operation, leaving residents unable to shower or flush their toilets for over a week.

Morgan and Washington Counties Levee Breach, 2015: On June 15, 2015, a levee breach, about 100 yards wide along the South Platte River, produced farmland flooding over northeast Morgan and northwest Washington Counties. Floodwaters, three to four feet deep, washed out the Union Pacific railroad tracks southwest of Messex. Up to ten inches of water covered several miles of track. Approximately 30 trains per day had to be diverted until the tracks could be repaired and inspected. Washington County Road 58.3 was also washed out.

Probability

Based on NPDP data there have been 184 known dam failures and incidents since 1890. This number reflects all incidents associated with a dam, ranging from small leakages to catastrophic failure. While structural malfunctions or overtopping caused by excessive rainfall may be an annual occurrence, dam and levee failure events that cause damage to people and property are much less common. Since 1950, there have been six major dam failure events in the state. Using this information, a destructive dam failure occurs once every fourteen years.

Climate Change Impacts

With a potential for increases in extreme precipitation events, climate change may result in large floods that could stress dams and levees, and thus potentially increase the risk of failure of these structures. Dams and other hydrologic containment structures are designed based on calculations of a river's flow behavior, and any

changes in weather patterns can have significant effects on the hydrologic information used for the design of a dam or levee.

To address some of these impacts, the State Engineer Dam Safety Rules and Regulations for Dam Safety and Dam Construction was recently updated, adding content regarding the atmospheric moisture factor. This involves the calculation of runoff from precipitation to be calculated based on expected increases in temperature and increased atmospheric moisture availability over the 50-year period, 2020-2070.

Climate change may alter the dam/levee profile and affect the designed margin of safety. If freeboard is reduced, dam operators may be forced to release increased volumes of water to maintain the required safety parameters. Such early releases can increase flood potential downstream and possibly involve the spillway.

Additionally, the structural integrity of earthfill dams may be compromised by climate change impacts such as drought and severe storms. Changes in vegetation and prolonged drying due to drought, embankment erosion due to severe storms, and more extreme fluctuations in water levels due to severe storms and increased frequency of drought all make earthfill dams vulnerable to climate change. The structural integrity of non-erodible dams or levees, such as concrete, are less vulnerable to climate change, but extreme temperatures may lead to cracking or joint movement.

Risk & Vulnerability

When assessing the risk posed by dams across the state, it should be noted that the Office of Dam Safety does designate certain structures that have currently reported restrictions. By first looking at high hazard dams only, and then further filtering by those with current restrictions, it is possible to identify those dams presenting the most risk. Table 14 presents a summary of these specific dams across the state. Note that the state's dams are constantly being inspected and maintained, so this list is subject to change.

TABLE 14 - RESTRICTED HIGH HAZARD DAMS[20]

NID ID	Name	County	Downstream Town	Year Constructed
CO00148	SPRING CREEK	GUNNISON	GUNNISON	1961
CO00162	MIRAMONTE	SAN MIGUEL	NORWOOD	1978
CO00219	ERIE	BOULDER	ERIE	1935
CO00307	SMITH	JEFFERSON	LAKEWOOD	1908
CO00336	POLLY A. DEANE	JEFFERSON	LITTLETON	1908
CO00342	TARRYALL	PARK	DECKERS	1929
CO00377	FLAGLER	KIT CARSON	ST. FRANCIS, KANSAS	1965
CO00438	PENROSE	EL PASO	COLORADO SPRINGS	1917
CO00489	BECKWITH	PUEBLO	COLORADO CITY	1911
CO00497	DAIGRE	HUERFANO	LA VETA	1907
CO00663	GOOSE PASTURE TARN	SUMMIT	BRECKENRIDGE	1965
CO00693	GRASS VALLEY	GARFIELD	SILT	1892
CO00712	LITTLE KING RANCH	GRAND	HOT SULPHUR SPRINGS	1968
CO00778	RITO HONDO	HINSDALE	SOUTH FORK	1956
CO00790	SANCHEZ	COSTILLA	SAN LUIS	1911
CO00807	LEON LAKE	MESA	COLLBRAN	1898
CO00861	VALLEY NO. 1	EL PASO	COLORADO SPRINGS	1901

[20] https://dwr.state.co.us/Tools/DamSafety/Dams

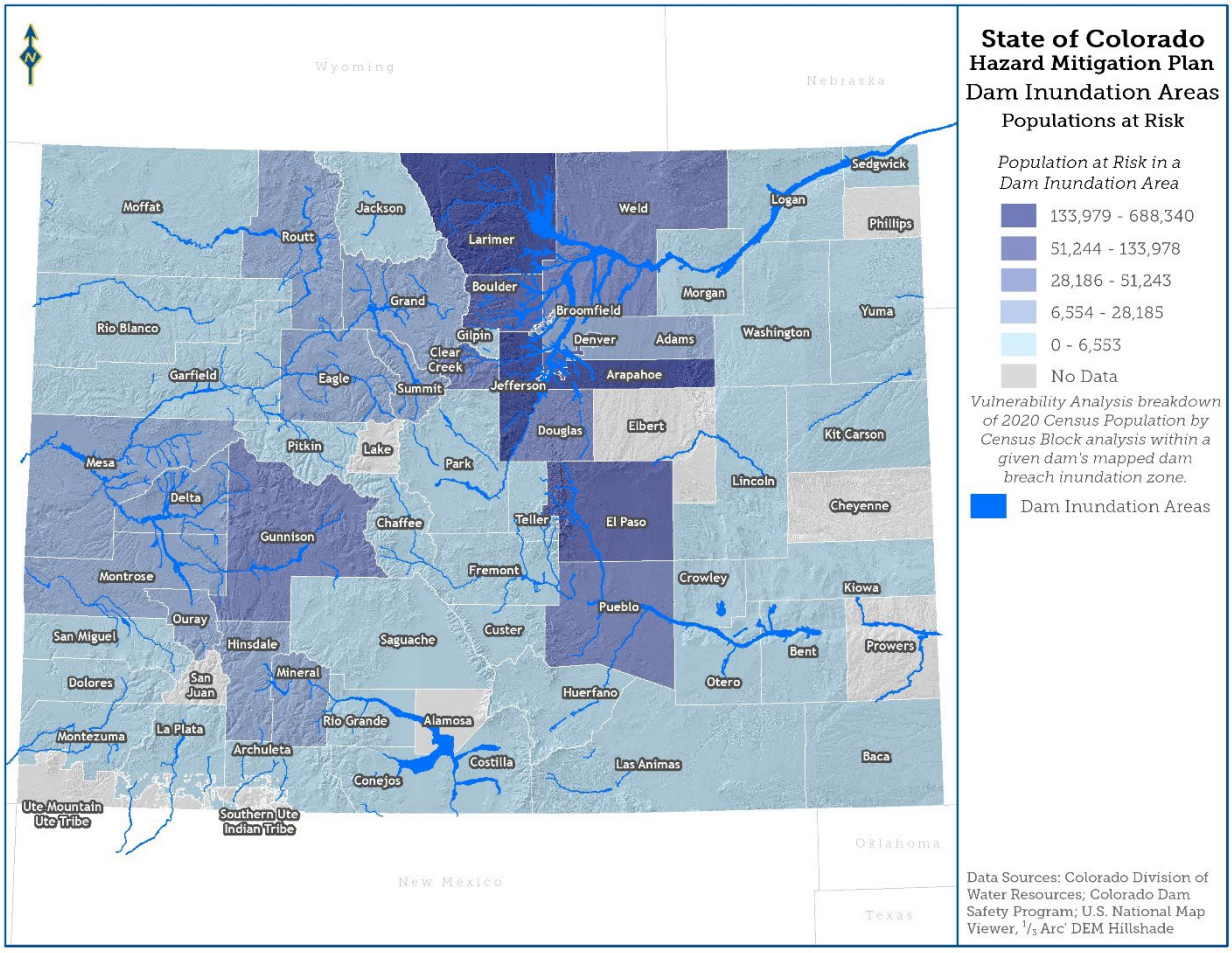
NID ID	Name	County	Downstream Town	Year Constructed
CO01015	SHERIFF	RIO BLANCO	MILNER	1955
CO01030	STILLWATER #1	GARFIELD	YAMPA	1939
CO01050	Y T RANCH	MESA	COLLBRAN	1911
CO01089	NARRAGUINNEP - MAIN DAM	MONTEZUMA	BLUFF, UT	1908
CO01091	SUMMIT - MAIN DAM	MONTEZUMA	DOLORES	1905
CO01147	WINDSOR	DENVER	DENVER	1892
CO01250	HYATT	JEFFERSON	ARVADA	1863
CO01304	SKEEL	DENVER	DENVER	1900
CO01783	UPPER LONG LAKE	JEFFERSON	ARVADA	1939
CO01784	LOWER LONG LAKE	JEFFERSON	ARVADA	1939
CO01797	JULESBURG #4	SEDGWICK	SEDGWICK	1910
CO01886	OFFIELD	MOFFAT	Pot Creek Campground	1914
CO02259	APISHAPA	LAS ANIMAS	AGUILAR	1892
CO02289	VALLEY NO. 2	EL PASO	COLORADO SPRINGS	1906
CO02779	JULESBURG #1	LOGAN	DORSEY	1910
CO02780	JULESBURG #1A	LOGAN	DORSEY	1910
CO02781	JULESBURG #2	SEDGWICK	DORSEY	1910
CO02782	JULESBURG #3	SEDGWICK	DORSEY	1910

Populations at Risk

There are dam inundation areas across the state and some cover areas with larger populations, shown in Figure 27. This explains the largest populations at risk residing primarily along the central corridor of the state. Larimer, Jefferson, and Arapahoe counties have the largest number of people within inundation areas compared to other counties, between almost 134,000 and 688,000 people.

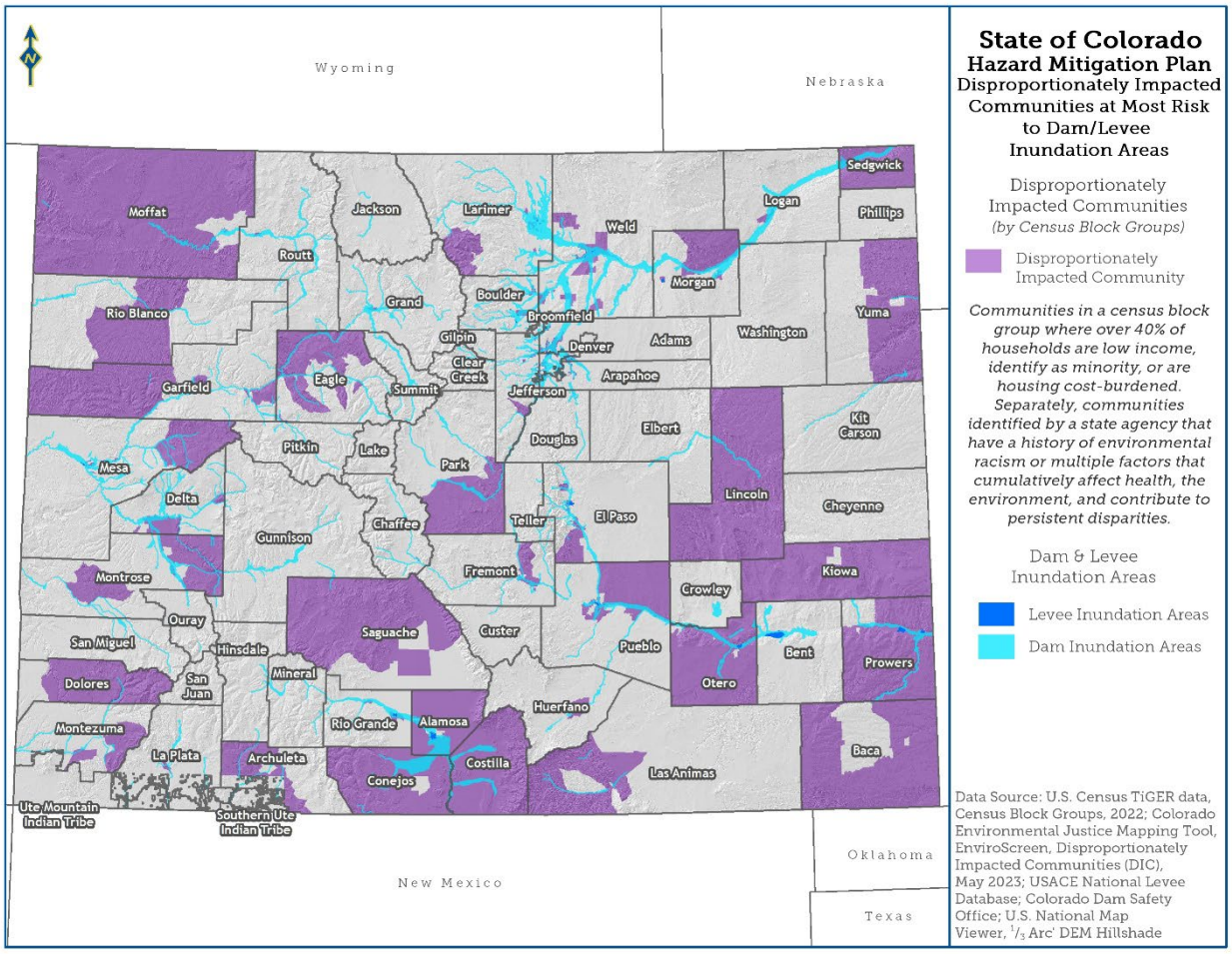
These counties are followed by Boulder and El Paso counties, with the population centers exposing between 51,000 and slightly less than 134,000 residents. The majority of rural counties have less than 6,500 residents exposed to inundation areas, especially the east region. However, in the west there are some outliers, most of these exposing over 6,500 to 28,000 people.

FIGURE 27 DAM INUNDATION AREAS POPULATIONS AT RISK



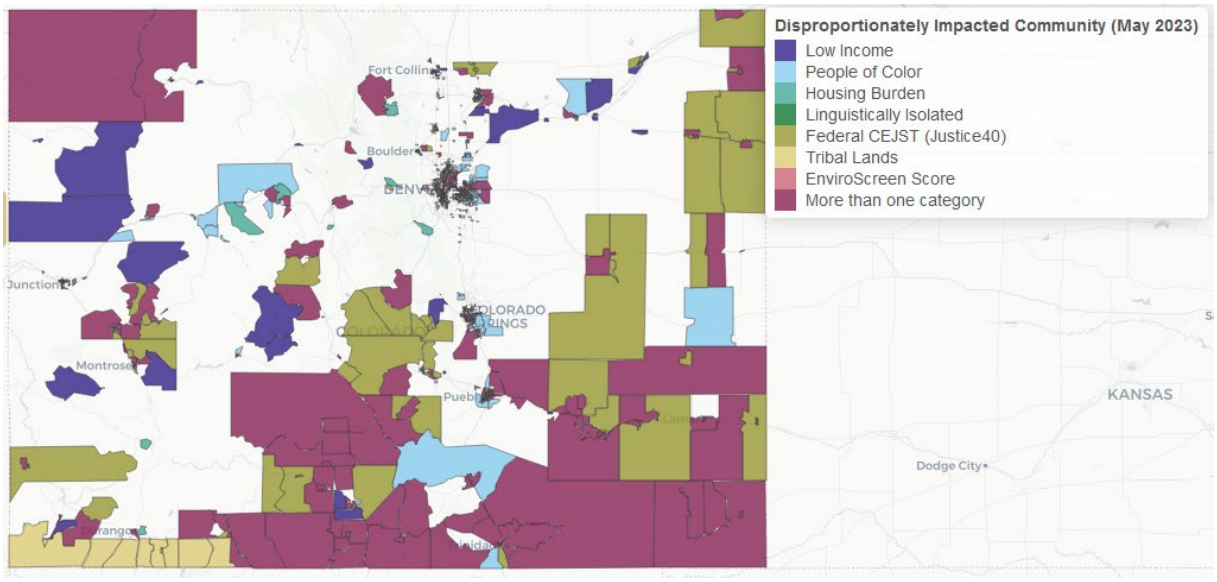
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 28 identifies those DIC communities, at a Census Block Group level, that have mapped dam / levee inundation areas.

FIGURE 28 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



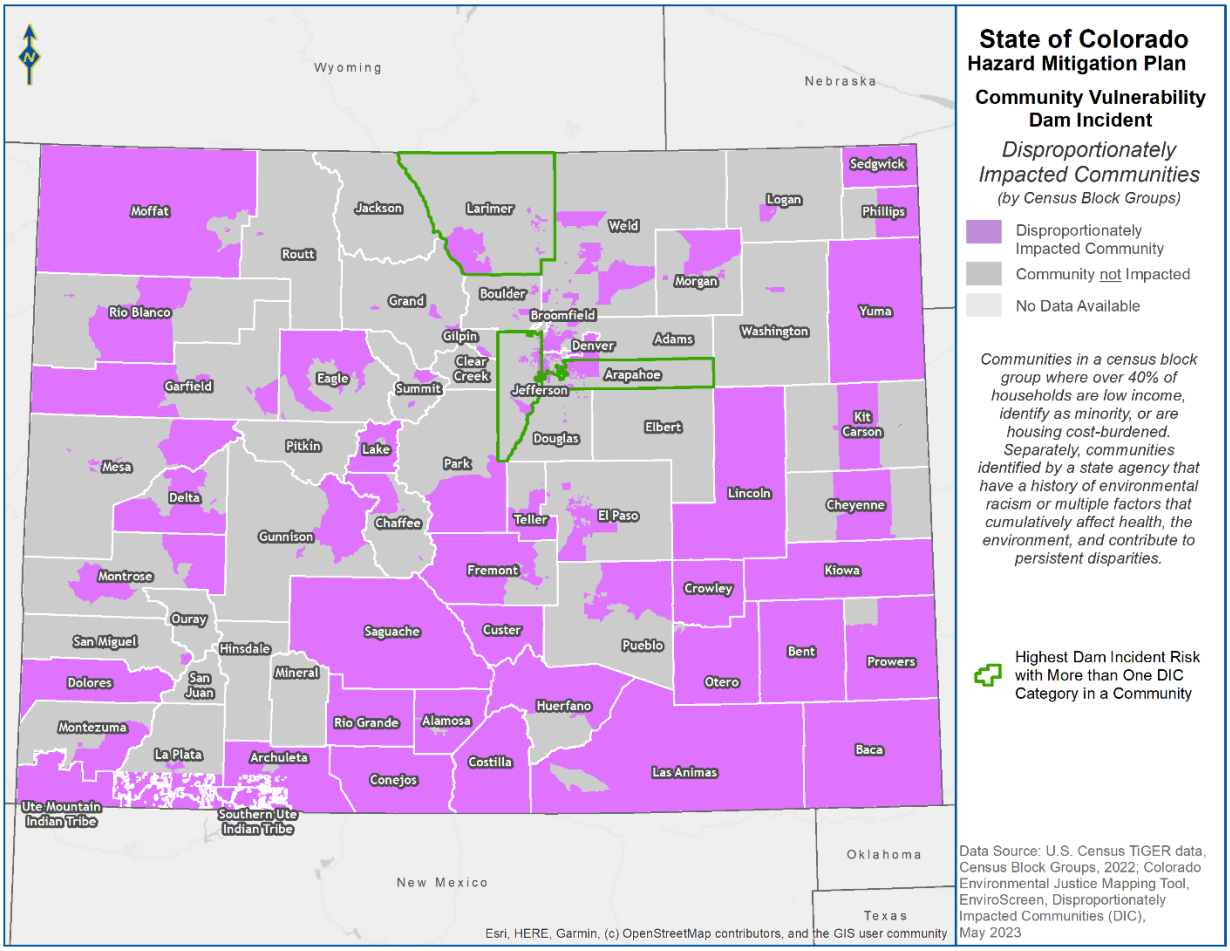
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 29. When comparing these communities to those counties with the highest populations at risk (Figure 27), Arapahoe, Jefferson, and Larimer Counties all contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 29 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to dam incidents include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 30 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Low-Medium” (Arapahoe and Larimer) and “Low” (Jefferson). Additionally, there are three Community Disaster Resilience Zones (CDRZ) located in DIC identified communities in Larimer County.

FIGURE 30 COMMUNITY VULNERABILITY



State Assets

Previous Losses

There are no reports of state asset losses due to a dam or levee incident.

Exposure

State assets are exposed to potential dam and levee inundation areas across the state, as seen in Figure 31. The highest exposure in both count and dollar values are along the Front Range, in Denver and Larimer counties. The distribution in structure counts across the rest of the state varies widely. Approximately one-quarter of the counties in the state have less than 10 state structures within their borders.

FIGURE 31 STATE ASSET BUILDINGS EXPOSED TO DAM AND/OR LEVEE INUNDATION AREAS

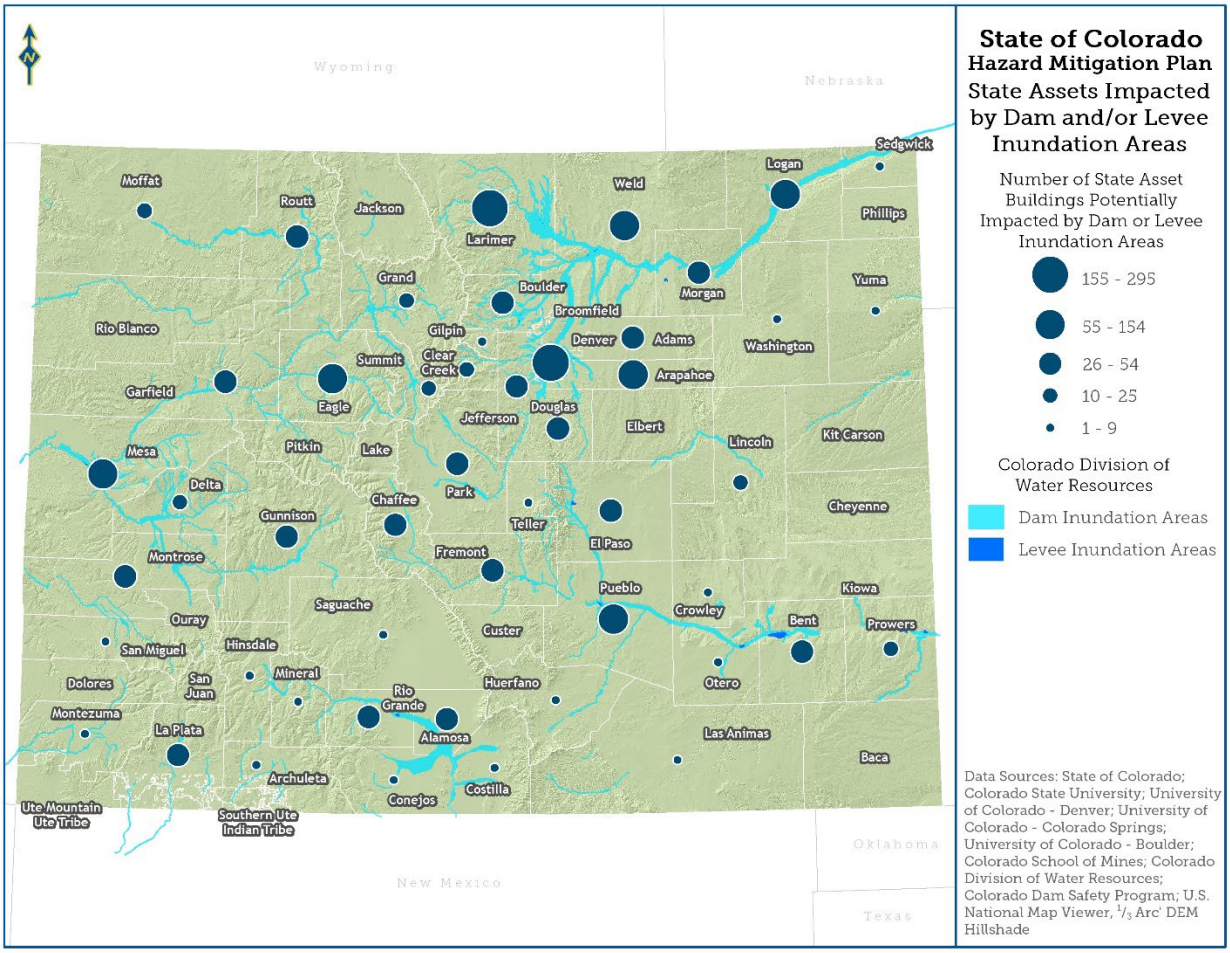
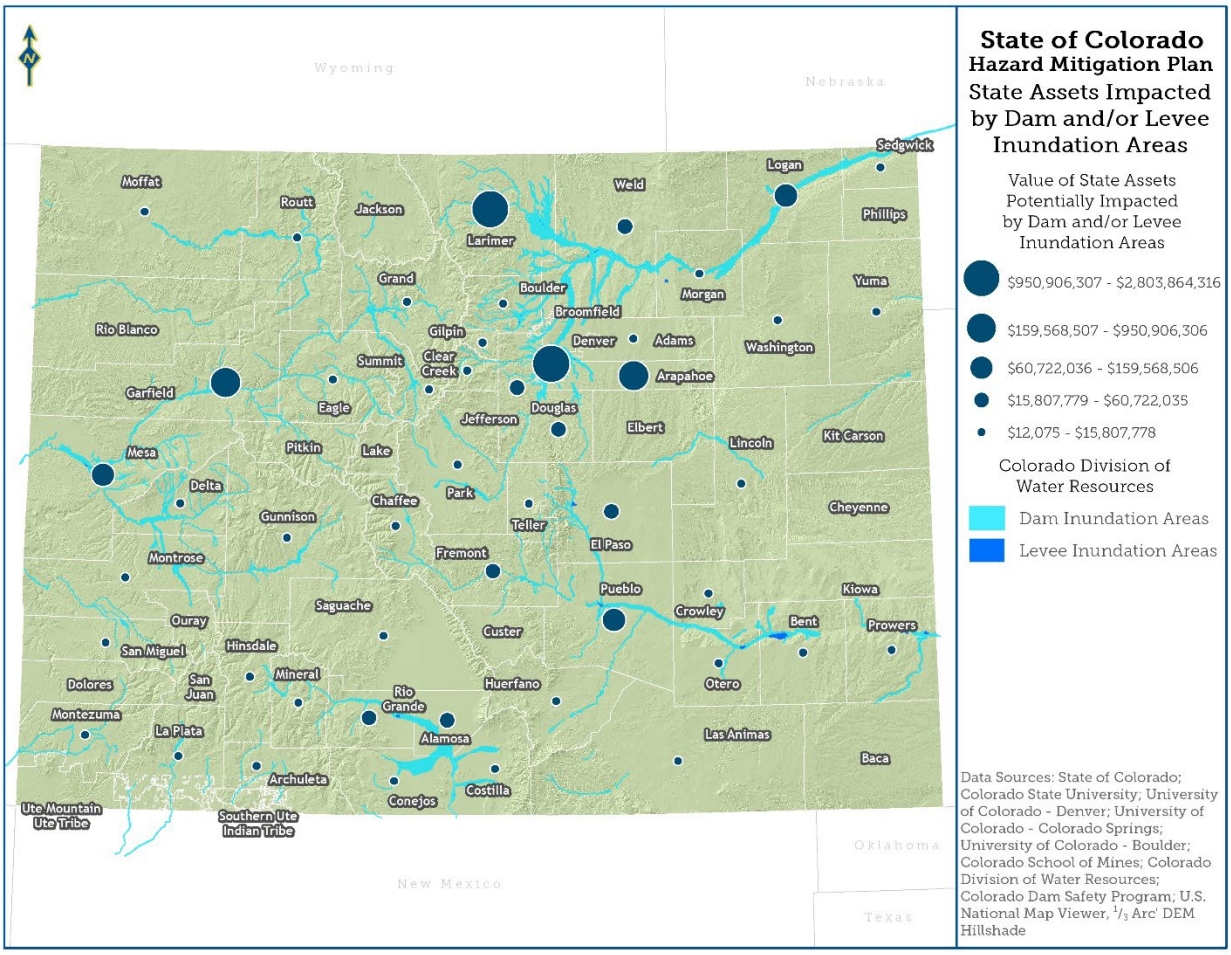


Figure 32 illustrates that while the structure counts are distributed across the counties, the dollar values are concentrated. Following Larimer and Denver counties, Arapahoe and Garfield hold the highest values in state assets exposed to dam inundation areas.

FIGURE 32 VALUES OF STATE ASSET BUILDINGS EXPOSED TO DAM AND/OR LEVEE INUNDATION AREAS



From a statewide perspective, those specific state assets most vulnerable to an incident are the dam structures themselves. Table 15 summarizes the top 10 state-owned dams that could most severely impact the state, through impacts to water storage, recreation, fisheries, the environment, and downstream populations at risk. All of these dams are owned by Colorado Parks and Wildlife.

TABLE 15 – STATE ASSETS MOST VULNERABLE TO A DAM INCIDENT

Name	NID ID	County	Downstream Town	Year Constructed	Hazard Class	Population at Risk
WILLOW CREEK	CO00103 6	ROUTT	MILNER	1966	High	5147

Name	NID ID	County	Downstream Town	Year Constructed	Hazard Class	Population at Risk
BEAVER PARK	CO00763	RIO GRANDE	SOUTH FORK	1912	High	3461
GARNET MESA	CO00747	DELTA	DELTA	1954	High	1466
BIG BEAVER	CO00962	RIO BLANCO	MEEKER	1964	High	697
SYLVAN LAKE	CO00670	EAGLE	EAGLE	1947	High	624
LESTER CREEK	CO01022	ROUTT	MILNER	1962	High	401
HAVILAND LAKE	CO01062	LA PLATA	DURANGO	1927	High	246
MEADOW CREEK	CO00695	GARFIELD	NEW CASTLE	1958	High	126
HEART LAKE	CO00925	GARFIELD	DOTSERO	1953	High	111
HORSESHOE LAKE	CO00498	HUERFANO	WALSENBURG	1961	High	65

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a dam or levee incident. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

Dam / Levee Incident							

Local County / Tribe

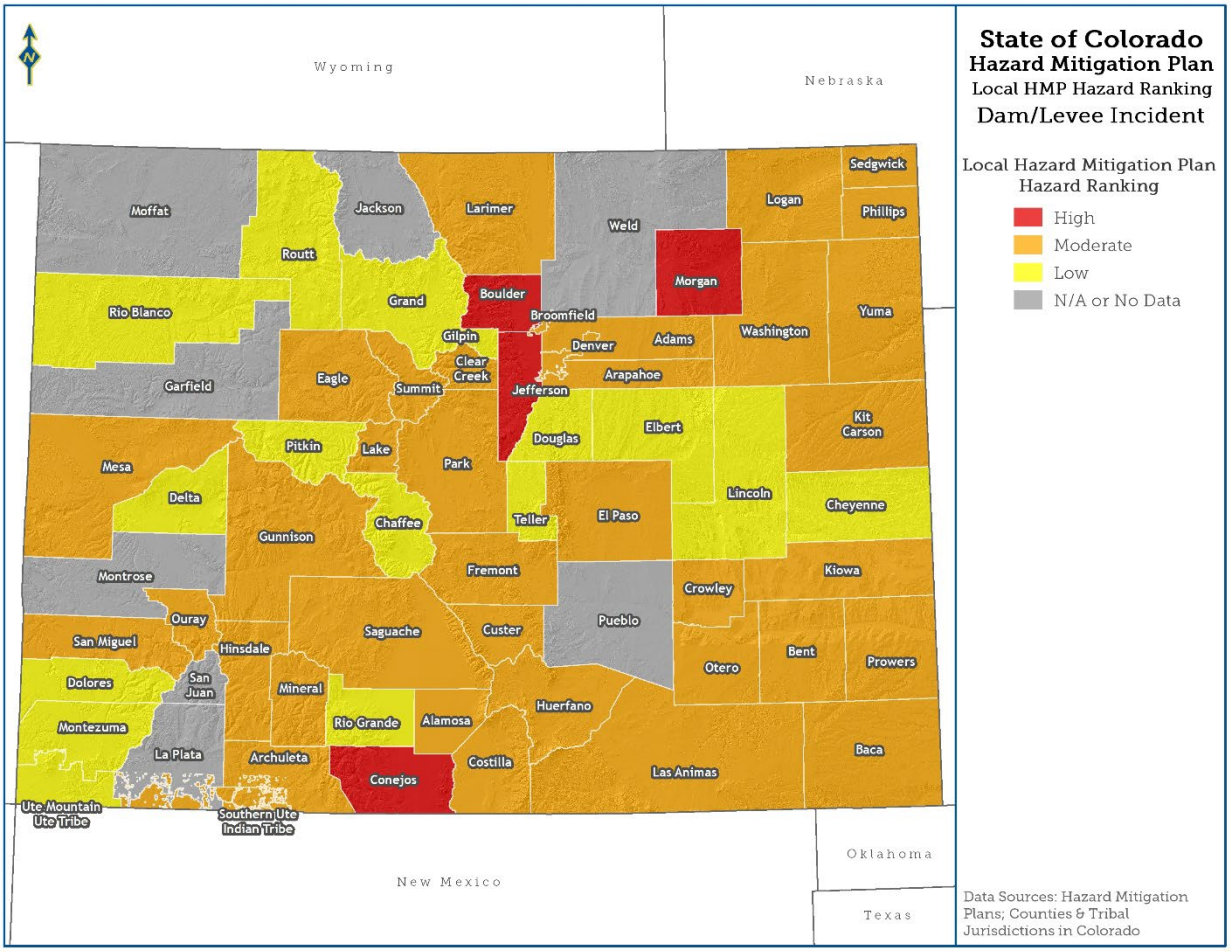
Hazard Rankings

Figure 17 presents the local risk rankings provided by local and tribal hazard mitigation plans. In addition to impacts, probability, and extent, local hazard rankings are based on the local's perceived risk, subject matter knowledge, and data sources. This can lead to rankings that may seem contrary to the best-available data utilized for the statewide risk assessment.

For example, some counties have less than 7,000 people and less than 160 buildings exposed to inundation areas, with a number in the lowest range for building value. However, one may assess a high risk ranking while another assesses a moderate risk. As another example, a county with mid-range numbers of exposed population and building count at risk, with a mid-range value for exposed structures as well, assesses a low risk ranking. Both of these cases illustrate how specific the context behind these local rankings is and how they may not align with state level perspectives. It is important to also note that the statewide risk assessment is focused on state assets and populations, not local assets.

Approximately half of the state ranked dam / levee incident as a moderate risk. Only four counties ranked the risk as high.

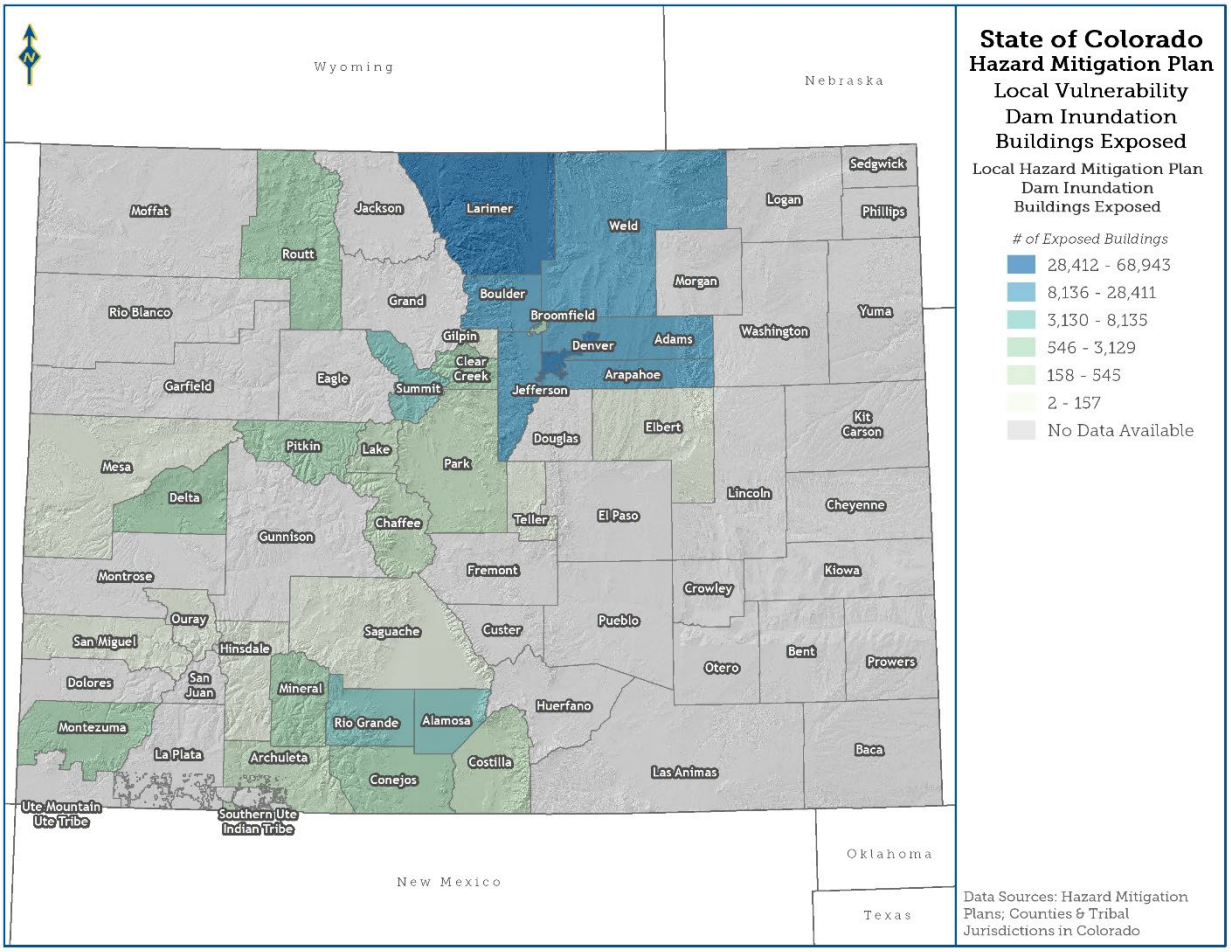
FIGURE 33 LOCAL HAZARD RISK RANKING – DAM / LEVEE INCIDENT



Exposure

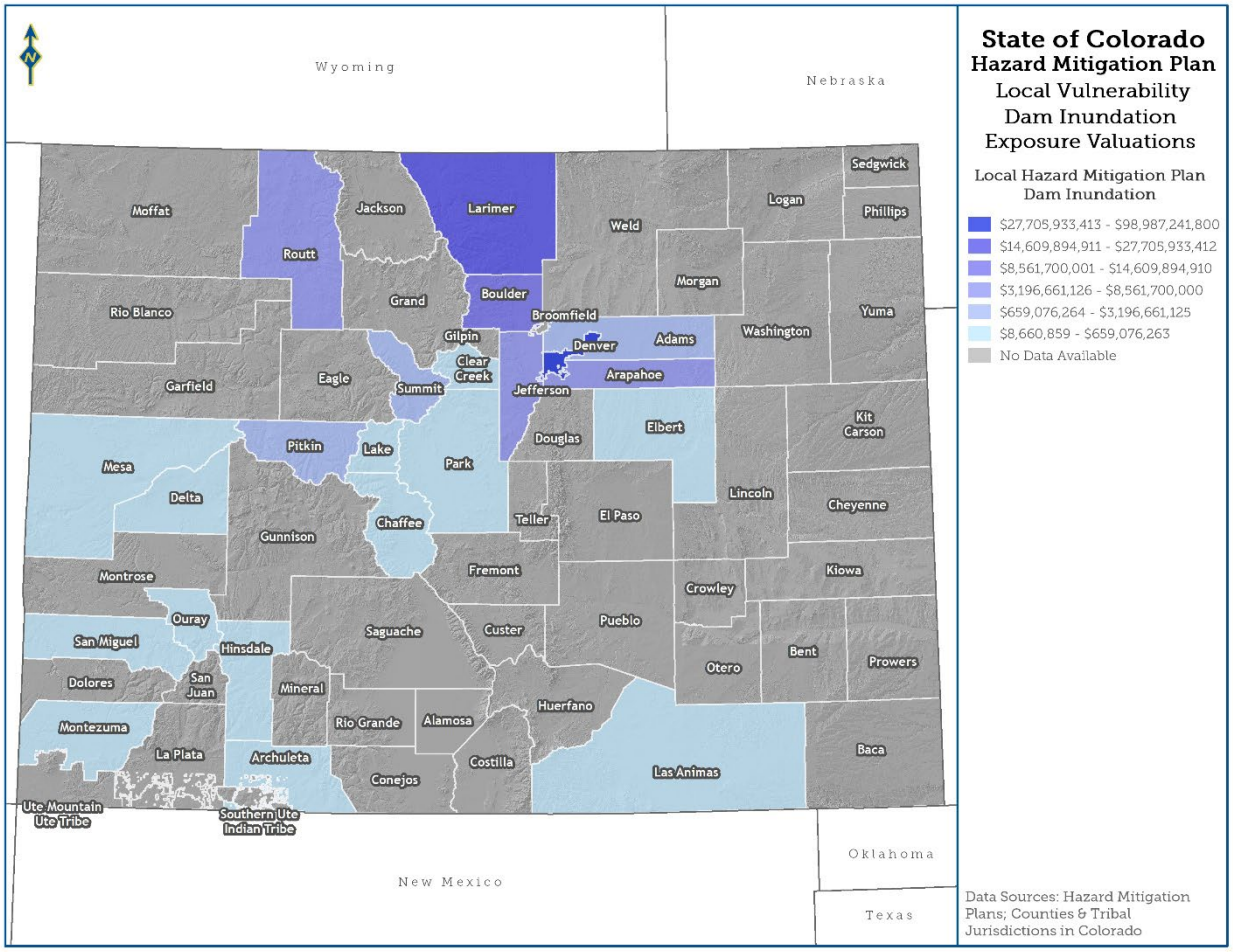
Building exposure to dam and levee inundation areas, as reported in local hazard mitigation plans, is presented in Figure 34 as a total count of structures. While noting that local assessment methodologies may vary, it is still important to consider the exposure being assessed by the local governments. Counties may not report these numbers due to lack of data or privacy concerns. Dam owners oftentimes do not provide inundation mapping or allow for the data's public use.

FIGURE 34 LOCAL BUILDING COUNT EXPOSED TO DAM/LEVEE INUNDATION AREAS



Exposure to dam and levee inundation areas, as reported in local hazard mitigation plans, is presented in Figure 35 as a total sum valuation of those structures. This information presents a similar summary to the previous Figure.

FIGURE 35 LOCAL VALUE OF BUILDINGS EXPOSED TO DAM/LEVEE INUNDATION AREAS



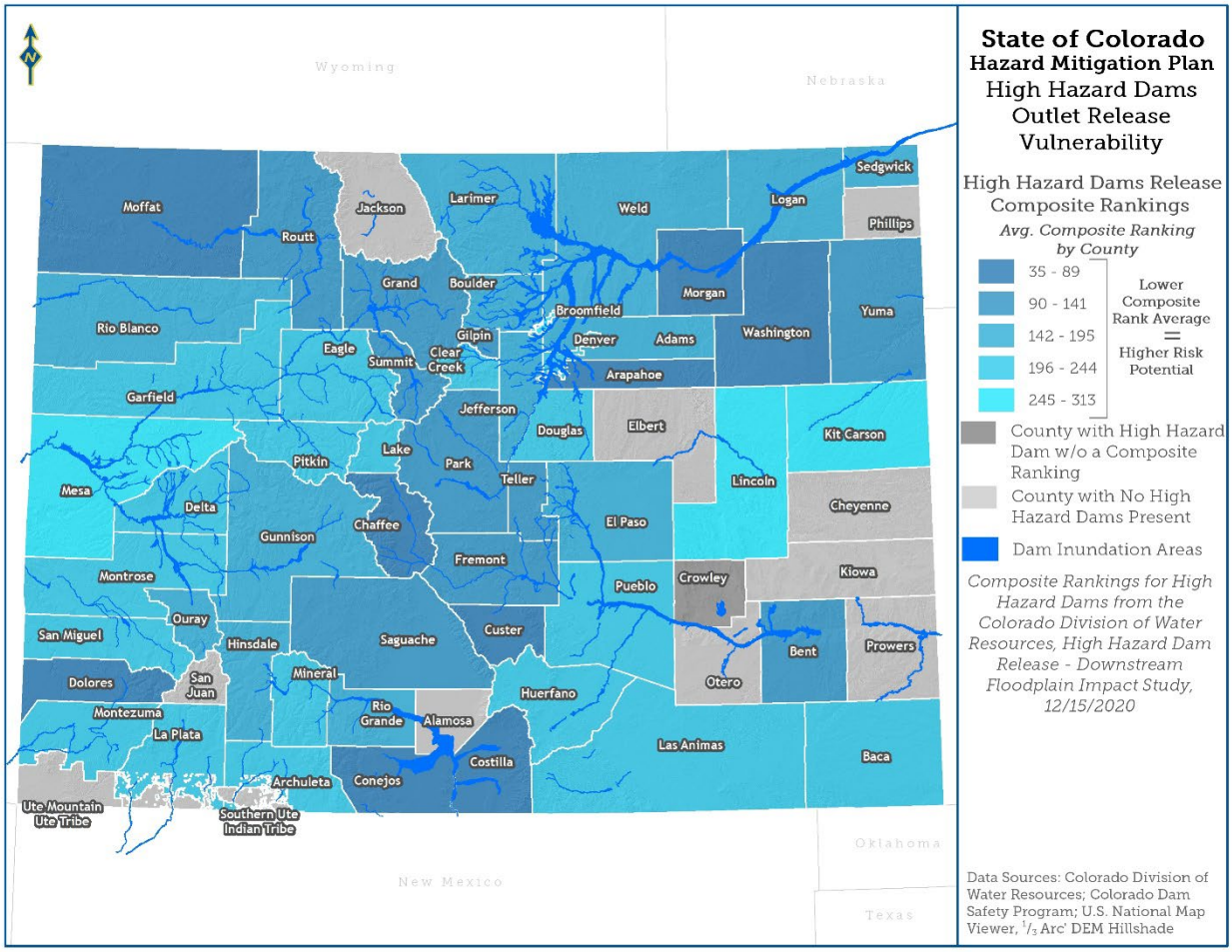
In addition to the exposure to inundation areas, the vulnerability to dam outlet release areas was also assessed. These areas may be inundated if the controlled release of water is deemed necessary for safety and the integrity of the structure.

This assessment was led by Colorado Dam Safety during the recent development of the Colorado High Hazard Dam Release – Downstream Floodplain Impacts Database and Ranking Tool. The tool can be used to support public awareness, planning, and emergency preparedness activities, as well as during emergency response situations involving high hazard dams throughout Colorado. Colorado Dam Safety is the first state dam safety program in the nation to systematically evaluate their portfolio of over 400 high-hazards dams related to operational and flood release capabilities.

The Downstream Floodplain Impacts Database and Ranking Tool contains information for both private and publicly owned high hazard dams across the state. The ranking of the dams identifies the dams with the highest threat of downstream flooding associated with releases of excess water during high runoff or heavy rain. Dam Safety screened the state's dam database using information from USGS (Streamstats), FEMA Flood Insurance Studies (FIS), and the National Flood Hazard Layer (NFHL). The data was used to compare natural flows versus natural flows in combination with dam release flows. The resulting ranks were developed based on the severity of the conditions, estimated safe channel capacity of the downstream channel, and maximum controlled discharge. The report assesses 415 dams in the State of Colorado and provides a ranking for 366 dams.

Figure 36 shows a summary of this assessment. The average risk ranking of all assessed dams located within each county is symbolized across the state. Counties with the highest average potential risk are present across the state. A lower composite rank average equates to a higher risk potential.

FIGURE 36 OUTLET RELEASE VULNERABILITY



Interconnected Hazards

Multiple hazards can cause or exacerbate a dam / levee incident including erosion / deposition, flood, ground subsidence, and landslide / debris flow / rockfall. A dam / levee event may cause the following: earthquake, erosion / deposition, flood, ground subsidence, and landslide / debris flow / rockfall.

Recent and Future Development

As Colorado's population increases, infrastructure and structures will continue to be constructed across the state. This has the potential to increase future exposure that counties may face from dam and levee incidents. Downstream development below low or significant hazard dams may also cause them to be re-classified as high hazard.

Conscientious planning is crucial to limiting increased exposure to inundation and outlet release areas.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- The Broomfield HMPC noted that in the past five years residential development has increased downstream of the Great Western Dam.
- Any areas of recent or future growth across Douglas County could be potentially impacted by the dam failure hazard because the entire county is exposed and vulnerable.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- Larimer County has the highest number of high hazard dams in the state. City of Fort Collins and the Unincorporated County areas contain the largest population at risk to a dam failure as well as the highest number of parcels and total values exposed. Loveland and Wellington also have substantial property and people in inundation zones. The majority of exposed parcels in dam inundation zones are residential. Additional development near those parcels would increase the exposure and risk.
- Brighton, Westminster, and the Unincorporated Adams County areas contain the largest population at risk to a dam failure as well as the highest number of parcels and total values exposed. Over 15,000 parcels are found in dam inundation extents, with over $1.43 billion of exposed values, and almost 37,000 people potentially at risk. Future development in those areas would increase the risk.

- Vulnerability to dam failure is greatest on the Grand Mesa where most of the dams are located and specifically the Town of Collbran which is downstream from many of the dams. Mesa County and towns should consider the dam failure hazard when permitting development downstream of the Class I and Class II dams.
- There are an estimated 409 residents and 292 buildings with an estimated $86,277,485 in property value exposed to dam inundation risk throughout Archuleta County. Future development near these sites would increase exposure to the hazard.

Consequence Analysis

TABLE 16 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Dam and levee incidents rarely result in fatalities, however, localized impact expected to be severe for inundated areas and moderate to light for other adversely affected areas. Contamination due to flooding of hazardous waste results in public health issues, as well as damage to sanitation services. Depending on the severity of the event, many people may be displaced or left homeless.
Responders	Localized impact damages to personnel in flooded areas at the time of incident. Impacts to transportation corridors and communications lines affect first responders' ability to effectively respond.
Continuity of Operations (Govt. & Services)	Loss of facilities or infrastructure for the provision of government services is expected to be non-existent or negligible. Possible short-term accessibility issues for first responders performing routine duties or personnel reporting to work locations. Damage to facilities/personnel in the

Consideration	Description
	incident area may require temporary relocation of some operations.
Property, Facilities, & Infrastructure	Some severe damage is possible. Private property losses are at increased risk to those who do not have insurance. Localized impact to facilities and infrastructure in the incident area. Critical facilities impacted by dam / levee incident flooding include communications services, hospitals, schools, nursing homes, utilities, waste-water treatment plants, and roadways.
Environment	Wetland impacts due to dam or levee failure flooding can result in water quality impacts and wildlife habitat impacts. Dam/levee failure flooding may alter stream flow patterns, increase erosion, and lead to release of hazardous materials, sediment, or waste into streams, rivers, drinking water supply, ground water, and air.
Economic	Local economy and finances adversely affected, possibly for an extended period depending on damage.
Public Confidence in Govt.	Ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective. Localized impact expected to adversely affect confidence in local, state, and federal government, regardless of the dam owner.

Drought – Extremely High Risk

Definition

Drought is a natural part of the Colorado climate, yet warming temperatures have increased the severity of 21st century droughts in Colorado. Most simply defined, drought is insufficient water to meet demands. Drought is most commonly assessed as a deficit of precipitation, snowpack, soils moisture, and/or streamflow. It can be measured across a range of timescales, from months to years. Natural variations across Colorado, in climate and precipitation, make it rare for all of the state to be deficient in moisture at the same time. However, single season droughts over portions of the state are quite common.

Drought is a complex and gradual phenomenon in Colorado. Although often characterized as emergencies, droughts typically occur slowly with impacts compounding over time, making it difficult to quantify when a drought begins and ends. Drought can often be defined regionally based on its effects:

- 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 the state's crops and other agricultural operations such as livestock.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere. Similarly, water users with different types and locations of water supplies may feel the effects of drought in vastly different ways. Individual water providers may use different criteria, such as

rainfall/runoff, amount/percent of water in storage, or expected supply from a water wholesaler, to define their water supply conditions. The complexity of drought can be further compounded by the ways that water rights are managed in Colorado. Water rights are subject to a variety of legal doctrines.

Location

All portions of the state have experienced and will continue to experience drought conditions.

Contributing Factors

Droughts are subject to global climate and precipitation trends, and wet and dry periods can persist for years. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Drought is monitored by the National Oceanic and Atmospheric Administration's (NOAA) National Integrated Drought Information System (NIDIS). A major component of this portal is the U.S. Drought Monitor (USDM) which was produced jointly by the National Drought Mitigation Center (NDMC), NOAA, and the U.S. Department of Agriculture (USDA). The purpose is to synthesize multiple indices, outlooks, and local impacts into an assessment that best represents current drought conditions. The outcome of each Drought Monitor is a consensus of federal, state, and academic scientists familiar with the conditions in their regions.

The USDM differentiates between short-term drought (less than 6 months) and long-term drought (greater than 6 months). Short-term drought can have impacts on agriculture and grasslands, and the drought classification can rapidly change. Long-term drought, in contrast, has deeper impacts on hydrology and ecology and can persist even with short-term gains in precipitation.

The USDM measures drought anotherntensity in five categories, from "abnormally dry" to "exceptional drought." These categories are defined in Table 17. All counties

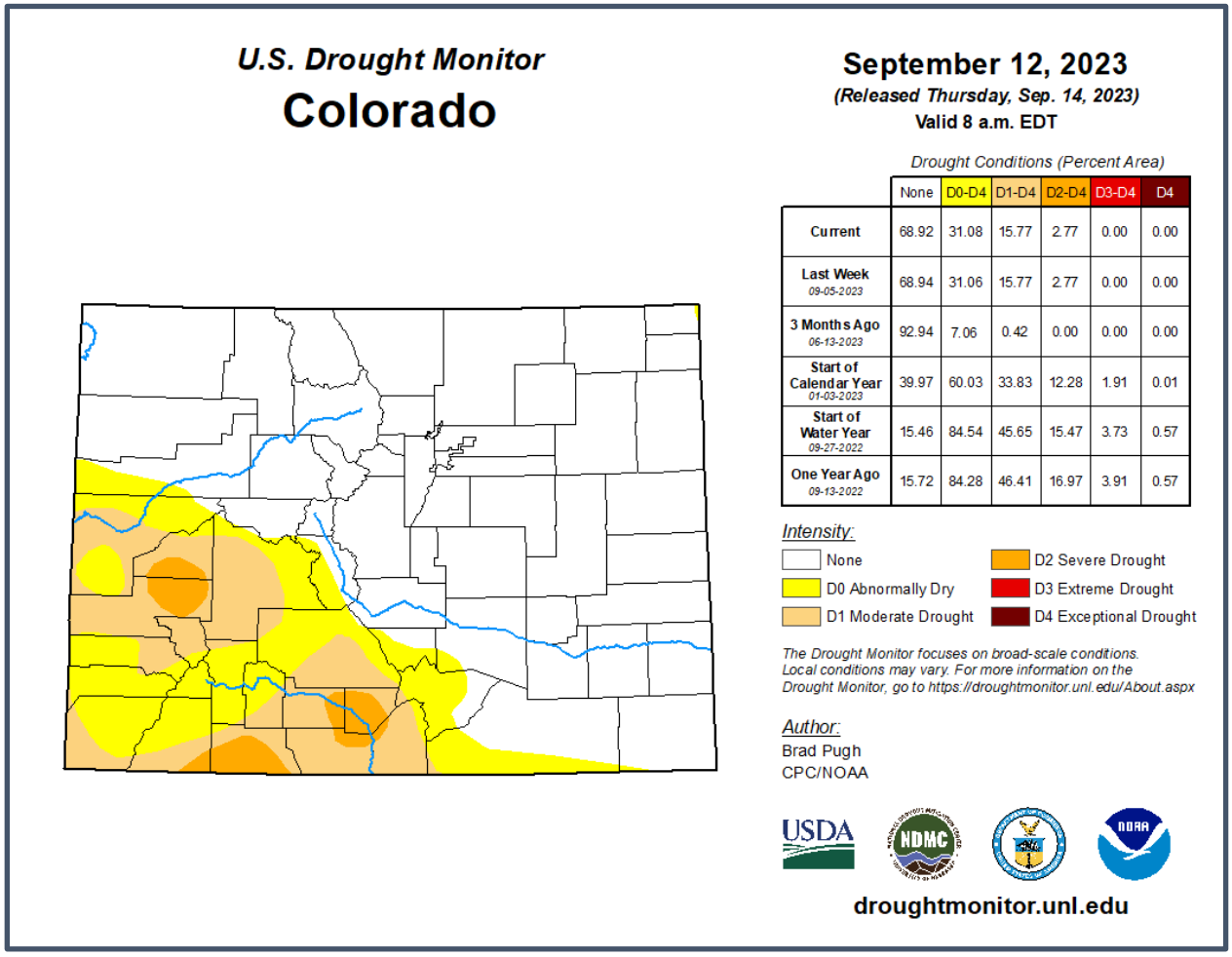
across the state are vulnerable to all levels of drought, including exceptional drought. A sample snap-shot Drought Monitor for the state can be found in Figure 37.

TABLE 17 US DROUGHT MONITOR DROUGHT CATEGORIES

Category	Description	Possible Impacts
D0	Abnormally Dry	▪ Short-term dryness slowing planting, growth of crops, or pastures ▪ Some lingering water deficits
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low ▪ Some water shortages developing or imminent ▪ Voluntary water-use restrictions requested
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses

		▪ Shortages of water in reservoirs, streams, and wells creating water emergencies

FIGURE 37 U.S. DROUGHT MONITOR MAP OF COLORADO



The updated Colorado Drought Response Plan has been included in the Annex – Drought Response Plan. This provides details pertaining to the state's Drought Monitoring Framework.

Past Occurrences

Historical Events

The state has experienced severe drought several times since the late 1800s. The most dramatic prolonged events occurred in the 1930s, 1950s, and early 2000s when many states, Colorado included, were affected for several years at a time.

Figure 38 shows the historical precipitation for Colorado since records began in 1895. Outside of the prolonged events mentioned, it is important to acknowledge that there have been many more short duration droughts through the years. These types of drought were most recently experienced in 2012 and 2020.

FIGURE 38 HISTORICAL PRECIPITATION FOR COLORADO[21]

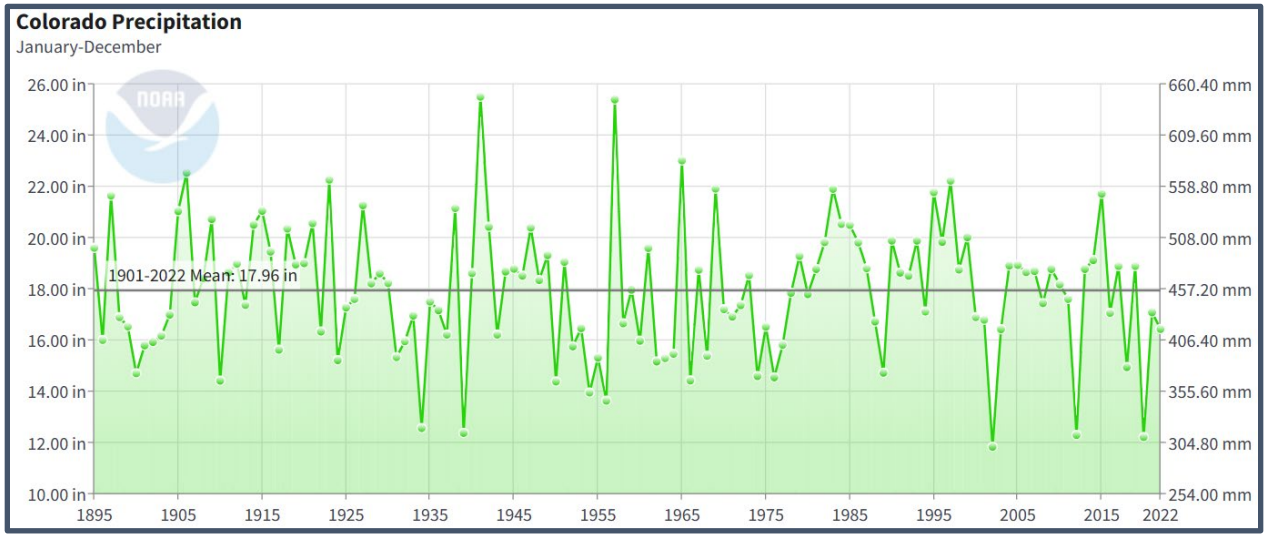


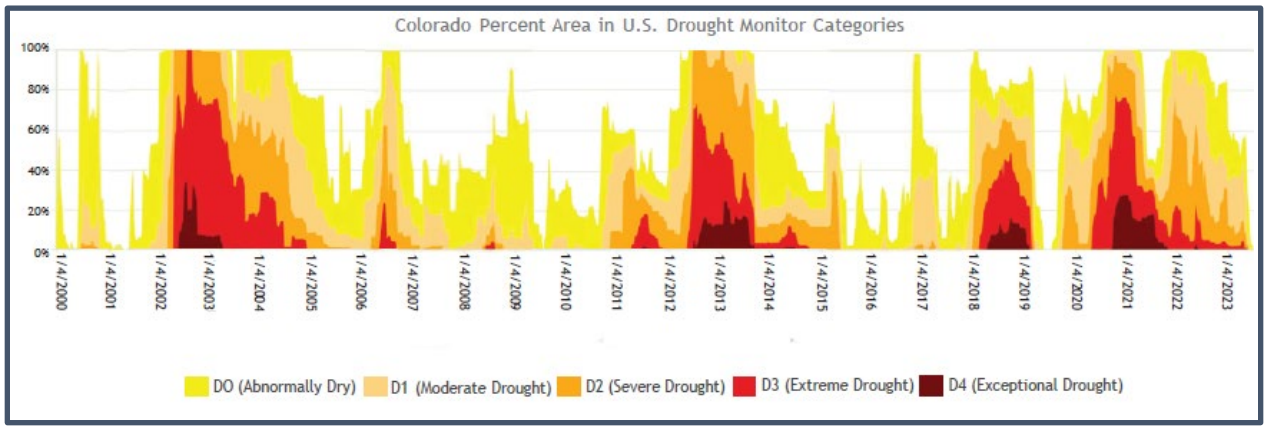
Figure 39 presents a historical timeline[22] from the USDM, showing the duration and percentage of the state affected by drought of all levels (readers are encouraged to follow the link in the footnote, as this graphic is difficult to read at this scale). The timeline begins in 2000 and throughout there are four events of "exceptional" drought for extended periods, all of which lasted approximately one year. At its peak, one of these events affected 30% of the state. There are also multiple notable durations of

[21] Statewide Time Series | Climate at a Glance | National Centers for Environmental Information (NCEI) (noaa.gov)

[22] https://droughtmonitor.unl.edu/dmData/Timeseries.aspx

"extreme" drought, which affected 70 to 80% of the state at the highest point. In one instance in 2002, 100% of Colorado was in "extreme" or "exceptional" drought for a few months.

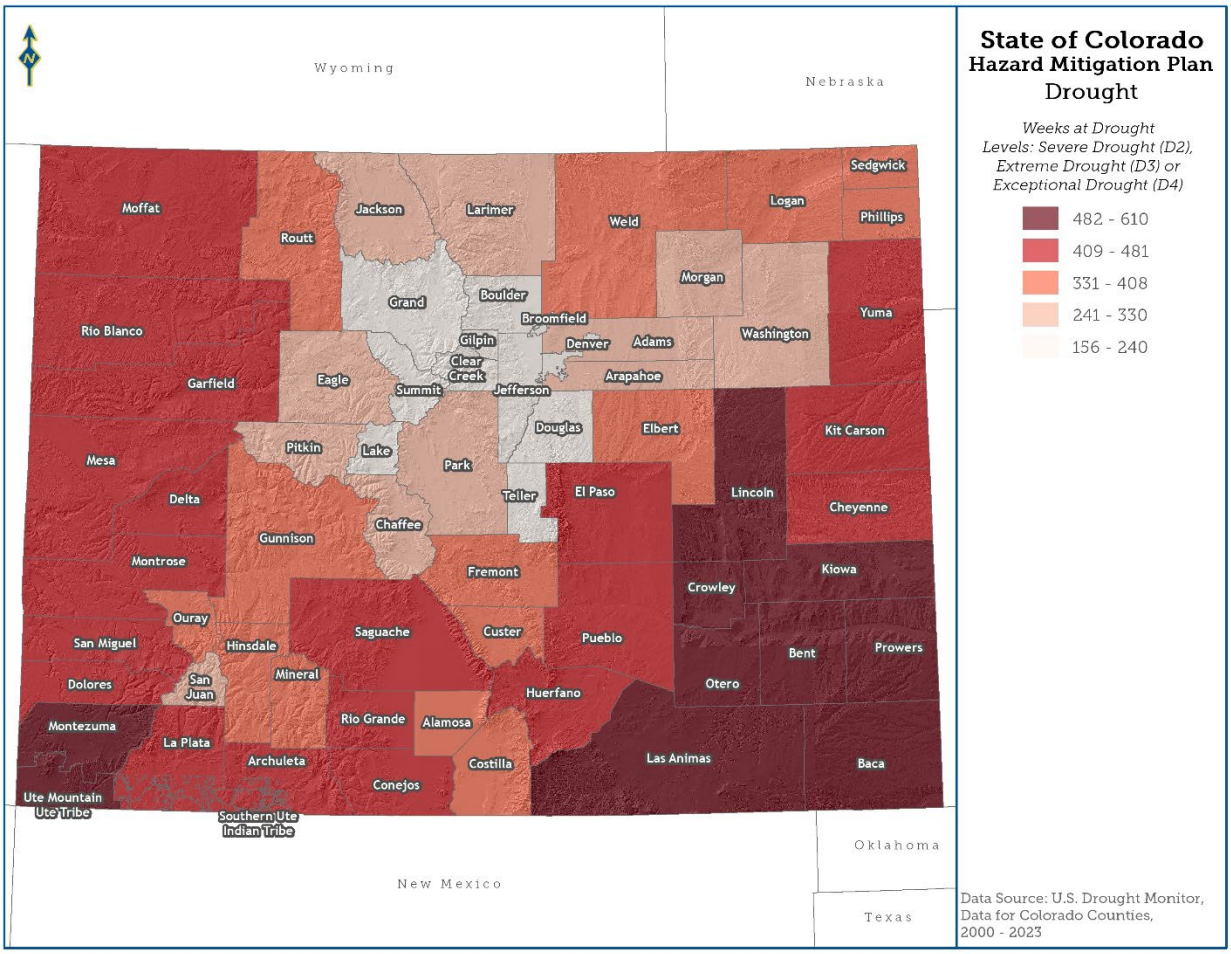
FIGURE 39 TIME SERIES USDM PERCENT AREA OF COLORADO IN DROUGHT BY TYPE



In Figure 40, the tally of weeks each county experienced drought conditions (not consecutive), whether "severe", "extreme", or "exceptional", is shown (data used was from January 2000 – April 2023). These drought conditions are combined to depict how often considerable drought was experienced in a county, not the level of the drought itself.

The southeast region of the state, and a smaller area in the southwest (Ute Mountain Ute Tribal area and Montezuma County), have by far seen the greatest number of weeks in drought since 2000. For these areas, this equates to having experienced considerable drought for almost half of the reported time period.

FIGURE 40 NUMBER OF WEEKS IN SEVERE- EXCEPTIONAL DROUGHT PER COUNTY AND TRIBAL AREA



Previous Losses

Overall total losses due to drought are unlikely to ever be fully quantifiable. This results from the complex impacts of drought on many sectors of society and the environment. Currently, the best available data comes from the EWG Farm Subsidy Database[23], which is compiled from USDA data. This database reports that producers in Colorado received approximately $332 million between 1995 and 2021 for the Crop Disaster Assistance Program.

[23] EWG - Farm Subsidy Database: Crop Disaster Assistance Program

It should be noted that this program assists with all agricultural hazard types, so these losses cannot solely be attributed to drought. However, the two years with the highest payments, 2003 and 2005, correspond to years of especially bad drought conditions across the state. The assistance payments for 2003 totaled $93.9 million and the 2005 figure was $95 million. Another bad drought year was experienced across portions of the state in 2008, which reported $55.6 million in assistance payments.

The USDA's Livestock Forage Disaster (LFD) Program is another potential future source for identifying future grazing losses related to drought. It provides compensation to livestock producers who have suffered grazing losses for livestock and who are also producers of grazed forage crop acreage. Data from this program was unavailable at present time.

Notable Events

The following is a summary of major droughts that have affected Colorado.

The 1930's Drought – The Dust Bowl drought severely affected much of the United States during the 1930s. The drought came in three waves, 1934, 1936, and 1939-1940, but some regions of the High Plains experienced drought conditions for as many as eight consecutive years. The soil, depleted of moisture, was lifted by the wind into great clouds of dust and sand so thick they concealed the sun for several days at a time (referred to as "black blizzards"). The Dust Bowl drought worsened the already severe economic crises that Great Plains farmers faced and many were forced off their land. The severe impacts of this drought were due to many factors. In its aftermath a better understanding of the interactions between the natural elements (e.g., climate, plants, and soil) and human-related elements (e.g., agricultural practices, economics, and social conditions) of the Great Plains developed. As a result, farmers adopted new cultivation methods to help control soil erosion in dry land ecosystems; consequently, later droughts in the region have not been as impactful.

The 1950s Drought – The drought was characterized by decreased rainfall and excessively high temperatures. The Texas panhandle to central and eastern Colorado, western Kansas, and central Nebraska areas experienced severe drought conditions, reaching a peak in 1956. The drought devastated the region's agriculture, with crop yields in some areas decreased as much as 50%. By the time the drought subsided in 1957, many counties across the region were declared federal drought disaster areas.

The 1977 Drought – During 1976 and 1977, the state experienced record-low streamflows at two-thirds of the major stream gages, records that held until the 2002 drought. The Colorado ski industry estimated revenue losses at $78.6 million (~$400M in today's dollars) and agriculture producers incurred higher crop production costs due to short water supplies. Numerous municipalities had to impose water use restrictions. The drought resulted in the state's agriculture producers and municipalities receiving over $110 million in federal drought aid.

1980-1981 Drought – Although short-lived, beginning in the fall of 1980 and lasting until the summer of 1981, this drought generated costly impacts to the ski industry and initiated a huge investment in snow making equipment. It motivated the writing of the Colorado Drought Response Plan, one of the first plans of its type in the nation, and the formation of the Water Availability Task Force.

1994 Drought – On August 1, in response to extremely arid conditions, the Governor activated, by memorandum, several Drought Impact Task Forces to assess impacts: Agriculture (blowing soils), Wildlife, Wildfire, Commerce/Tourism, and Review and Reporting. Significant impacts reported included an increase in wildfires statewide, losses to winter wheat crops, difficulties with livestock feeding, and impacts to the state's fisheries.

1996 Drought – On July 29, the Governor issued an Executive Order proclaiming a Drought Disaster Emergency Declaration. Fifteen counties were included in a request for USDA assistance. The directive activated the Water Availability, Agriculture, Wildfire, Tourism, Municipal Water, and Review and Reporting Task Forces to monitor

the situation and evaluate impacts to potable water supplies in the southwest and northwest portions of the state.

2002 Drought – On a statewide basis, 2002 was the most intense single year of drought in Colorado's recorded history, according to studies of tree rings and archaeological evidence from aboriginal cultures (Pielke and Doesken, 2003). This was an extraordinarily dry year embedded in a longer dry period (2000-2006), similar to the extremely dry year of 1934 within a period of longer drought (1931-1939). The conditions were rated "exceptional" by the U.S. Drought Monitor and were the most severe drought experienced in the region since the Dust Bowl (Tronstad and Feuz, 2002).

Many municipalities implemented strict water conservation restrictions. Winter wheat crops experienced rapid deterioration. Ranchers quickly sold or relocated their herds in response to the poor range conditions and high cost of feed. Numerous forest fires ignited and spread swiftly. The most severe fires of the season erupted in June, including the Hayman Fire southwest of Denver which quickly grew to be the largest documented forest fire on record (at the time) in Colorado (138,000 acres).

2011-2013 Drought – In 2011 it was very wet across northern Colorado, but the extreme drought in Texas, New Mexico, and Oklahoma was still felt in the Rio Grande and Arkansas Basins. Based on the U.S. Drought Monitor, approximately 50% of Colorado was under drought conditions at the beginning of 2012 and the entire state was under drought conditions by the end of May 2012. This included regions where 80% of the state's water supply originates. Streamflows measured only slightly better compared to the extreme drought years of 1934, 1954, 1977, and 2002 (Ryan and Doesken, 2013).

Agriculture was highly impacted as there was less water availability for summer irrigation diversions due to low snowpack and runoff. Soil moisture was low and temperatures were high on the plains during the planting season, giving crops little chance to establish and survive the summer. This multi-year drought deteriorated

vegetative cover across the state's Eastern Plains. The exposed soil, combined with heavy winds, created dust storms similar to those of the 1930's Dust Bowl. Some farmers lost entire crops with one storm.

Drought conditions and extremely hot temperatures in June 2012 contributed to very dry forests, leading to wildfires such as the High Park and Waldo Canyon fires in 2012 and the Royal Gorge and Black Forest fires in 2013.

Other impacts during the 2011-2013 drought were decreased rafting numbers in 2012 due to low streamflows and wildfire conditions making some areas inaccessible. The ski industry experienced an 11.9% decrease in visits for the 2011-2012 season compared to the five-year average. Both of these industries have developed marketing and operations strategies to mitigate economic impacts due to drought. In the agriculture sector, the Arkansas Basin lost approximately 1,300 jobs and $105 million in economic activity (Gunter et al., 2012).

2020-2023 Drought – Water Year 2020 was the third driest water year on record and 2020 was the first time since 2012 that 100% of the state concurrently experienced drought. This drought came on the heels of an intense short-term 2018 drought and in the midst of the COVID-19 pandemic, 2020's drought disaster hit agricultural producers hardest. Major drivers of the severe drought in 2020 included absent monsoon seasons, accruing soil moisture deficits, record high temperatures, and extreme evaporative demands from winds, low humidities, and high temperatures. In response, the Municipal and Agricultural Impacts Tasks Forces were activated by the Governor.

Probability

Historical analysis of precipitation shows that drought is a frequent occurrence in Colorado, and short duration droughts occur somewhere in Colorado nine out of ten years (90% chance) (McKee et al., 1999). Short duration drought is defined by the three-month Standardized Precipitation Index (SPI).

However, severe, widespread multi-year droughts are much less common. Up until the publishing of the 2004 Drought Water Supply Assessment (DWSA), there had been six recorded multi-year drought incidents which impacted the State of Colorado since 1893, during a span of 111 years (from 1893 to 2004).

With the addition of the 2011-2013 and 2020-2023 droughts, Colorado has been exposed to a total of eight major multi-year droughts in its recorded history. Based on this historical data, a severe drought should be expected to occur roughly every ~14 years. But as the state is experiencing, historical drought patterns do not take into account the impacts of climate change and future events are expected to occur more frequently.

NOAA projects the short-term future probability of drought by releasing the U.S. Seasonal Drought Outlook maps, which forecast anticipated drought conditions three months out.

Climate Change Impacts

Colorado's hydrology and water resources, and hence its economy, are extremely sensitive to climate. Climate change researchers around the world have recognized mountain systems as sensitive bellwethers of regional change. The interannual variability of the snow resource, the impacts of rapidly emerging factors such as dust-on-snow, and the possibility that climate change could cause substantial long-term reductions to Colorado's seasonal snow cover highlight the vulnerability 'f the state's mountain snowpack.

Climate change's impacts on the Colorado River Basin alone is a large risk to much of the country, as 40 million people rely on it for agricultural and municipal water. A recent study by researchers at UCLA has concluded that higher temperatures in the

West have resulted in a roughly 10% decrease in the river's flow over the last two decades.[24]

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future drought events. The following Table 18 presents a breakdown of these projected changes in terms of the hazard's location, extent/intensity, frequency, and duration.

TABLE 18 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Mountains and plains both experience drought. Drought changes geographically from year to year and decade to decade. Location is not projected to change.
Extent / Intensity	Property damage that does not threaten structural integrity is common. Little or no impact to critical services or facilities is expected. Economic and water resource impacts are foreseen. Extent is not projected to change. Intensity of droughts is projected to increase, as a result of increased evaporative demand associated with higher temperatures.
Frequency	Droughts are projected to increase in frequency due largely to increased evaporative demand associated with higher temperatures, and to changes in the amount and timing of mountain snowpack.
Duration	Droughts are projected to have a longer duration due to a changing climate, including shifts in seasonal precipitation patterns and increased evaporative demand associated with higher temperatures. Mountain snowpack is expected to melt earlier in the spring, which will alter the timing of water availability in rivers (e.g., less streamflow available during the hottest part of summer).

[24] https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022WR033454

Future Costs

The Future Avoided Cost Explorer (FACE) tool was developed by the state to understand the economic impacts of flood, drought, and wildfire looking forward to 2050. It estimates the expected cost impacts of these three hazards on a selection of economic sectors, under future climate and population scenarios. These costs are expressed in expected annual damages, which are a function of the hazard magnitude, probability, and exposed assets.

Drought damages were modeled by analyzing four economic sectors: crops, cattle, skiing, and rafting. For the crops sector, the model analyzed irrigated acres for each population scenario to estimate future production. For the cattle sector, the total pasture and grassland per county was analyzed. For the two recreation sectors, changes in population were used to increase the total baseline and annual user days based on historic rates of Colorado residents participating in rafting and skiing.

Figure 41 presents the state's estimated expected annual damages from drought, based on climate and population change scenarios. These scenarios show that high population growth (with current climate conditions) would more than double the expected annual damages. Conversely, severe climate change (with the state's current population) almost triples the expected damages.

FIGURE 41 DROUGHT EXPECTED ANNUAL DAMAGES BY POPULATION AND CLIMATE CHANGE SCENARIO

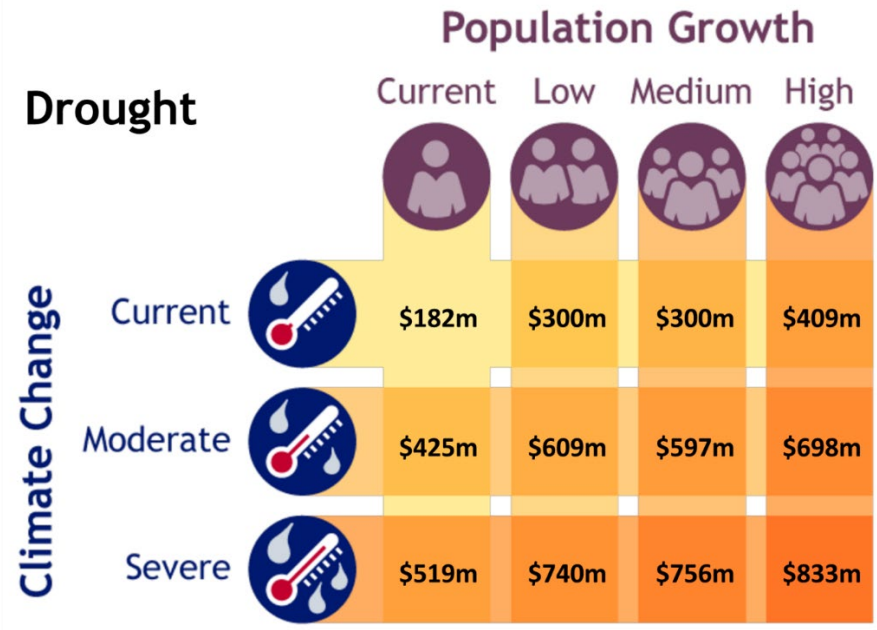


Figure 42 and Figure 43 present this same information, broken down for the agricultural sectors (crops and cattle) and recreation sectors (skiing and rafting), respectively.

FIGURE 42 DROUGHT EXPECTED ANNUAL AGRICULTURE DAMAGES

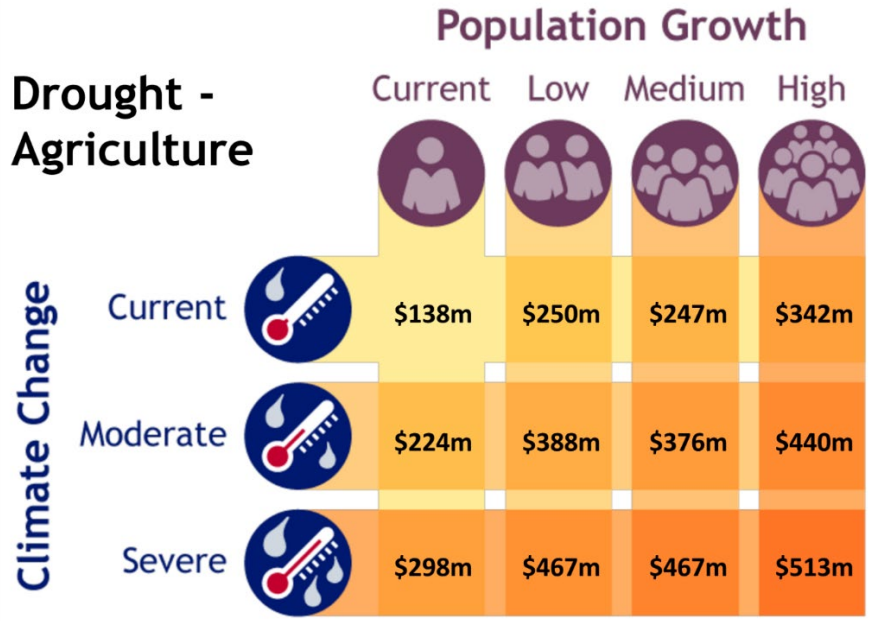
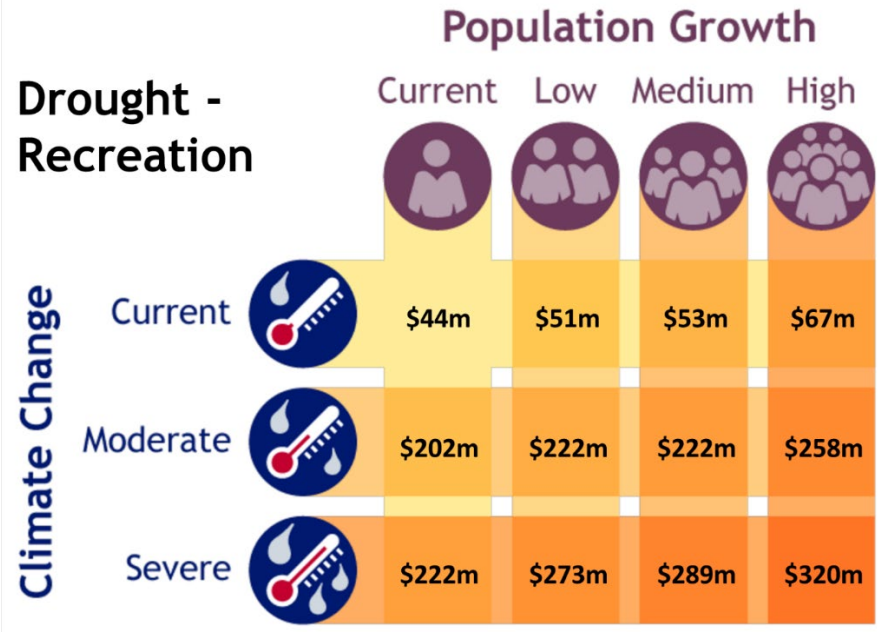


FIGURE 43 DROUGHT EXPECTED ANNUAL RECREATION DAMAGES



Risk & Vulnerability

Populations at Risk

Drought can impact the entire state, however it typically has minimal impacts on public health. Municipalities may put water restrictions into effect, but even in long

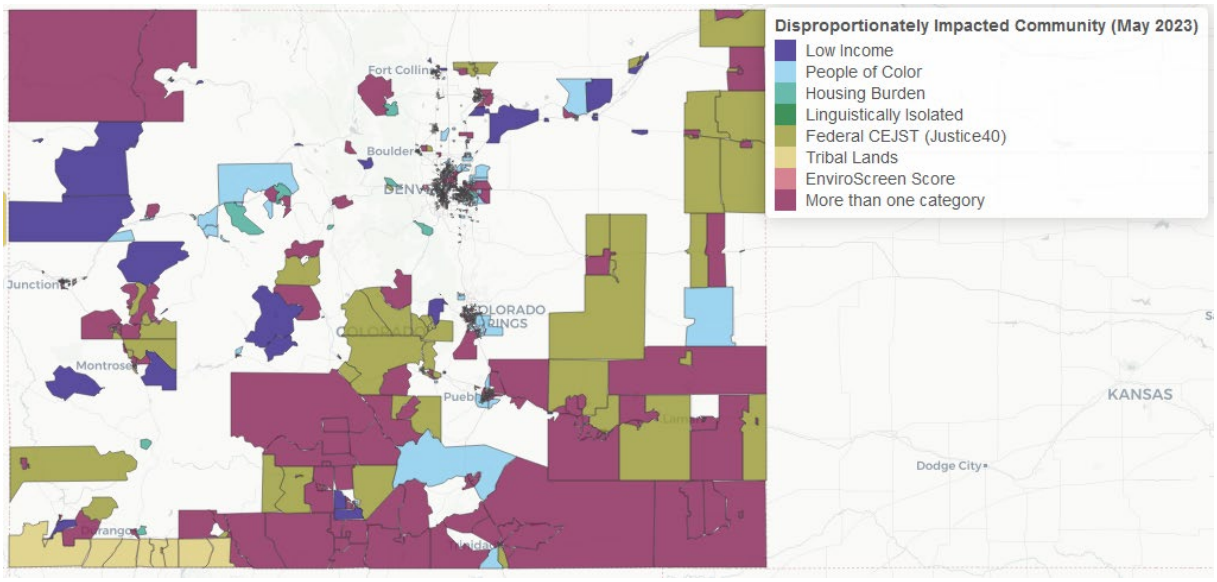
droughts this does not typically interfere with normal drinking water availability. It should be noted, however, that there are communities in Colorado with more limited water supplies and/or water conveyance and distribution infrastructure for whom drought impacts could have disproportionately negative health and financial impacts.

Some populations may be impacted financially, such as those in agriculture, landscaping, or water recreation jobs and loss of income may be difficult to recover from. Small communities that rely on groundwater are the most vulnerable to drought.

It is important to think of heat impacts separately from drought impacts, as drought can occur throughout the year and does not always correlate with heat events.

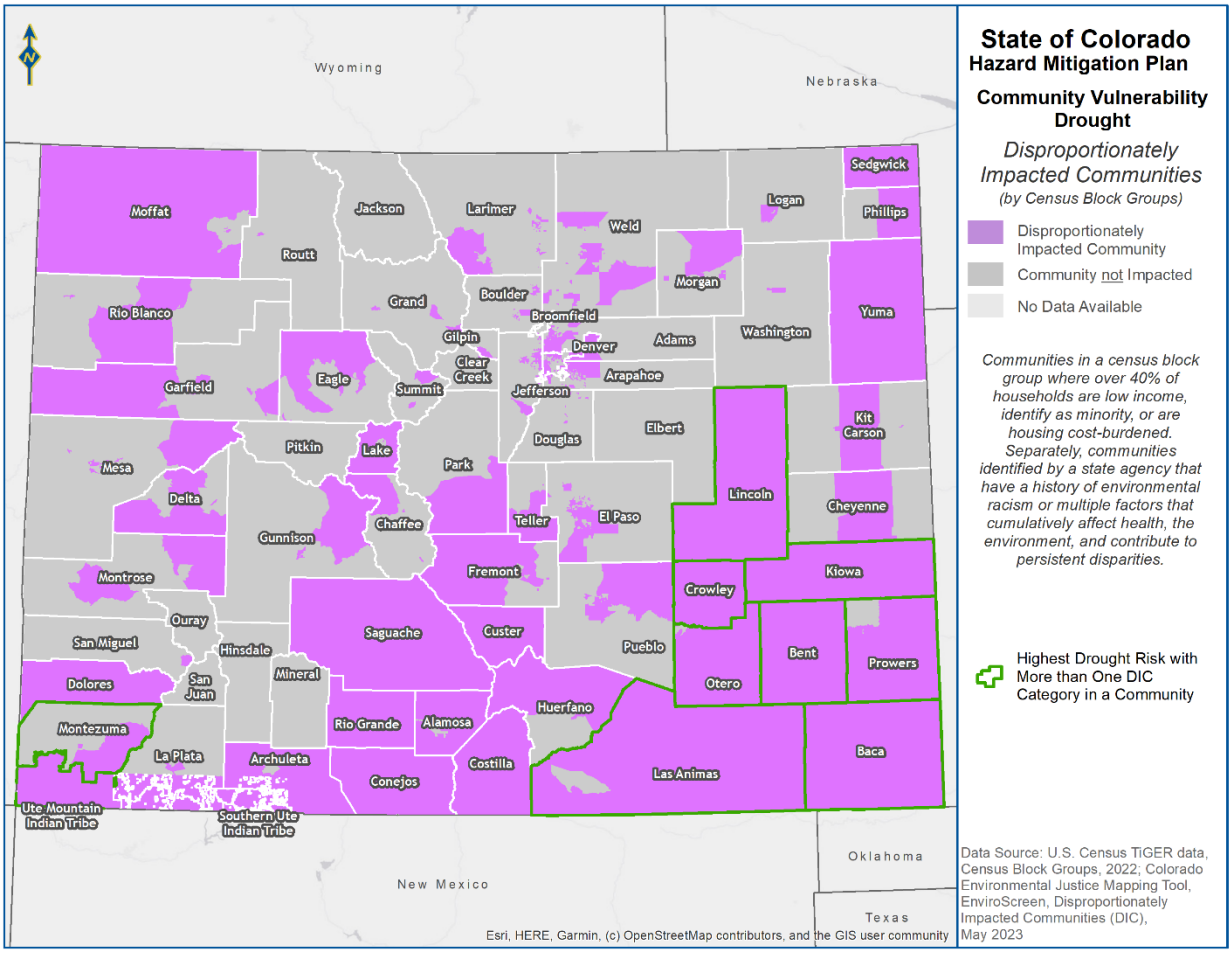
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 44. When comparing these communities to those counties with the highest drought risk (Figure 40), Baca, Bent, Crowley, Kiowa, Las Animas, Lincoln, Montezuma, Otero, and Prowers County and the Ute Mountain Ute Tribe all contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 44 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to drought include: low income, people of color, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 45 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Bent, Crowley, Las Animas, Otero, and Prowers), “Medium-High” (Baca, Lincoln, and Montezuma), and “Low” (Kiowa).

FIGURE 45 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Drought losses are not easily quantifiable and there is no record of state asset losses due to drought. There are, however, a number of potential impacts to consider when assessing state asset risk, as presented in Table 19.

TABLE 19 DROUGHT IMPACTS TO STATE ASSETS

State Assets at Risk	Key Impacts
State-owned or operated buildings	Increased exposure to wildfires, increased wear and tear on building exterior and HVAC systems due to degraded air

State Assets at Risk	Key Impacts
	quality, and water shortages due to out-of-priority rights or restrictions imposed by municipality, landscaping loss.
Critical infrastructure	Decreased water levels in dams can cause structural damage, dry ditches can be damaged by animal holes and general exposure, and increased vegetative growth and high sediment loading resulting from low reservoir levels or wildfire debris can damage structures. Drought causes extensive damages to state rights of way through accumulation of dust and dirt on right of way fences and stormwater diversion utilities.
State Land Board	Decreased forage and crop yields on leased lands, negative impacts to lands if lessees do not appropriately adjust grazing allowances, and decreased mining activity if water is not available for production.
State Parks and CPW	Low reservoir and stream levels can deter visitors and prevent water-based recreation, park closures and campfire restrictions can result from severe wildfires, negative media portrayal is possible, and visitation decline results in a lower operating budget. Revenue from licenses, water activities, tourism, park visitation, biological loss – State Forest and park land trees – dead trees, beetle activity, wildfires, impacts to tourism and recreation sectors.
Aquatic habitat	Impacts to flow levels, water quality, habitats, and fish populations, including increased management requirements and protection programs.
Instream flow rights	Junior water rights associated with most instream flows leave them vulnerable to over appropriation during severe drought, possibly leading to economic and biological losses.

Exposure

Many state assets are conservation areas or protected wildlife that cannot be adequately evaluated based on the revenue they generate. Colorado is renowned for its wilderness areas and outdoor recreation activities. These areas and the outdoor tourism that occurs there bring in significant revenue for the state. Economic considerations are important as the revenues generated by state assets help to maintain protected areas.

Drought-vulnerable infrastructure includes all dams, trans-mountain ditches, and irrigation ditches. Dams are the most vulnerable state asset type exposed to drought. The largest potential impacts resulting from an event could include structural damages caused by decreased water levels. Other impacts could include reduced revenue from water-based recreation and fishery health, impacting the tourism and recreation sectors.

Lifelines

Food, hydration, and shelter is the lifeline most vulnerable to the impacts from a drought. These impacts are most immediate in the agriculture sector. A drought is unlikely to strain resources, other than the potential impact on water availability, and long-term effects on recovery and resilience are minimal as drought fluctuates often.

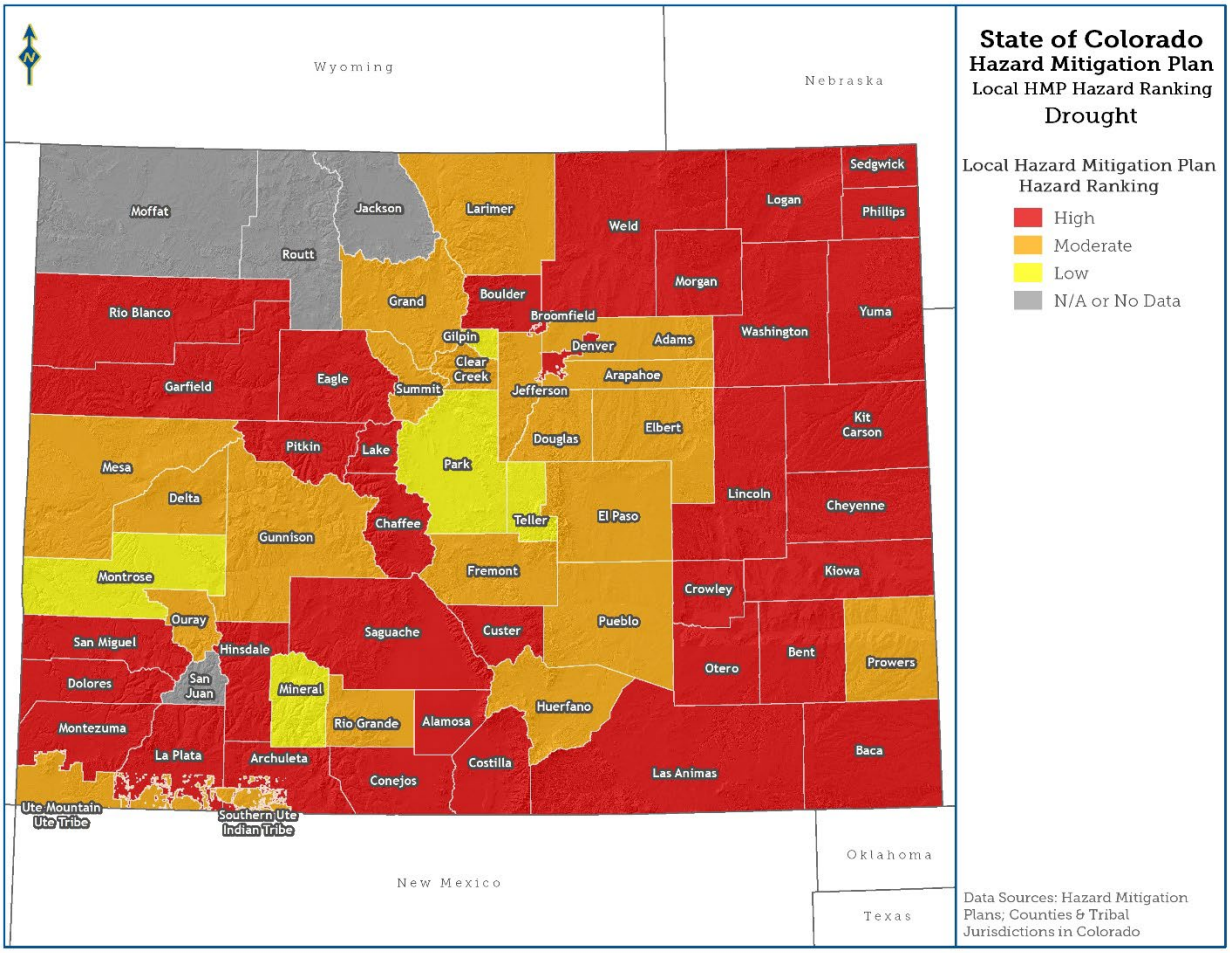
Drought							

Local County / Tribe

Hazard Rankings

A majority of the local hazard mitigation plans ranked the drought hazard as high risk. Much of the Front Range and some western counties ranked it moderate, while only a handful of counties ranked drought as being a low risk. These rankings are illustrated in Figure 46.

FIGURE 46 LOCAL HAZARD RISK RANKING



Exposure

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. Other potential effects include a reduction of electric power generation and water quality deterioration.

A drought in the plains of the state can greatly affect agricultural crops and does not need to be long-term to impact agricultural yields. Droughts of just a few weeks during critical periods of plant development can have disastrous effects on production. During winter months, droughts in the mountainous regions may affect the ski and tourism industry.

Drought in one area of the state may impact other regions. Lack of winter snowfall in the mountains can eventually lead to agricultural impacts downstream due to changes in the timing of runoff and decreased streamflows. Reduced reservoir storage from decreased runoff in the mountains can lead to municipal and industrial water shortages on the Front Range.

Local-level analysis of drought risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Drought conditions can cause or worsen erosion / deposition, expansive soils, extreme heat, flooding, and wildfire. Drought causes soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may increase the speed at which dead and fallen trees and grasses dry out and become more potent fuel sources for wildfires.

Drought can be made worse by extreme heat.

Recent and Future Development

Drought vulnerability will generally increase with future development as there will be increased demands for limited water resources. As Colorado's population continues to grow and the need for water increases, more people and property may be affected by drought conditions.

With that said, growth and development do have the ability to potentially decrease acreage used by agriculture, through purchase or temporary transfers of agricultural water rights for use in municipal supply. This could potentially lessen the economic impacts of drought if there are fewer agricultural producers suffering major crop losses.

Of those counties experiencing the state's largest percentage of growth (Figure 7), none have been identified as being one of the state's highest risk counties to drought (Figure 40).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of drought.

Consequence Analysis

TABLE 20 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Water supply disruptions may adversely affect people. Reduced water quantity and quality could impact delivery of potable water, particularly in rural areas. Reduced air quality associated with blowing dust could have detrimental impacts. Mental health issues may be associated with loss of farm income and heavily impacted lifestyles in agricultural areas.
Responders	Nature of hazard is expected to have minor impacts to properly equipped and trained personnel, though dust storms may require special equipment.
Continuity of Operations (Govt. & Services)	Slow onset and nature of drought makes it unlikely to have an impact on continuity of operations. Nature of hazard not expected to impact delivery of government services, except for moderate impact on water utilities. In extreme cases, municipal water delivery may be interrupted. Ability to

Consideration	Description
	deliver recreational services may be impacted at the local level. Food supply and delivery could be disrupted, with an associated increase in food prices.
Property, Facilities, & Infrastructure	Buildings: Nature of hazard expected to have minimal impact. Landscaping can be damaged or lost in events of severe municipal water restrictions or water rights out of priority. Increased risk of wildfire can threaten catastrophic loss of buildings. Critical infrastructure (e.g., dams, transmountain ditches, irrigation ditches): Infrastructure can be damaged by excessively dry expansive soil as it contracts. Dams and ditches can experience structural damage due to decreased pore water pressure, damage caused by high sediment loads when pulling water from the bottom of reservoirs, and damage caused by debris flows and flooding following wildfires. State lands: Environmental quality of land can be impacted by overgrazing during drought conditions.
Environment	May cause disruptions in wildlife habitat, resulting in an increasing interface with people, and reduction in numbers of animals. Land quality can be negatively impacted by overgrazing during drought. Water quality can become degraded to the point of causing localized fish kills. Low streamflows will have negative impacts on riparian habitats and aquatic species.
Economic	Local economies and finances dependent on abundant water supply or precipitation (e.g., snow at ski areas, water for crops) adversely affected for the duration of drought.

Consideration	Description
	Agricultural economies adversely affected if drought results in widespread loss of crops or yield reductions.
Public Confidence in Govt.	Ability to respond and recover may be questioned and challenged if planning, response, and recovery efforts are not timely and effective. State must balance *over* and *under* responses to the drought hazard.

Earthquake – Moderate Risk

Definition

An earthquake is the vibration of the earth's surface following a release of energy when large plates of Earth's crust move with respect to one another. The intersection of plates is referred to as a fault. This energy can be generated by a sudden dislocation of the crust or by volcanic activity.

Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

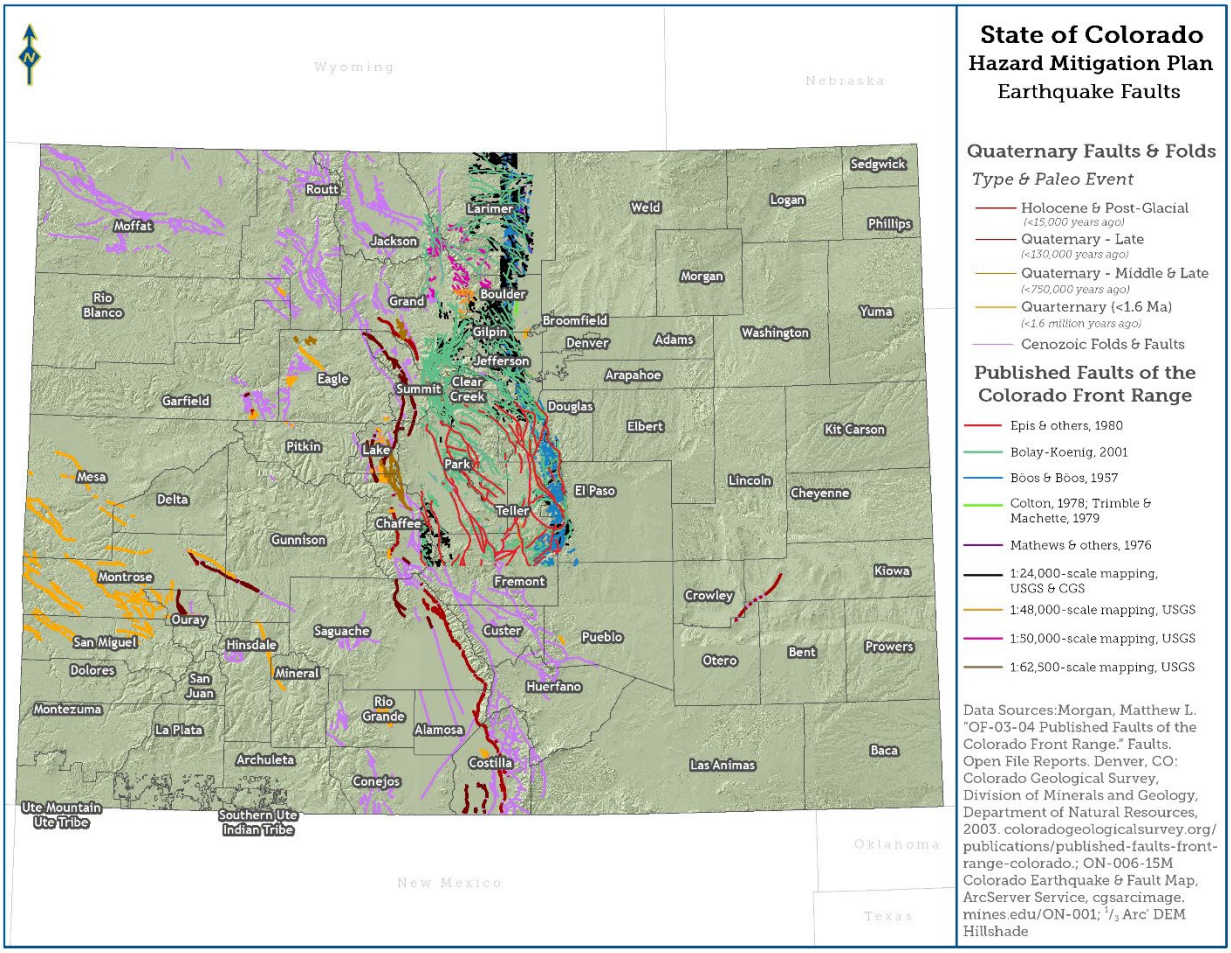
Many earthquakes in Colorado occur naturally, but others are caused by human actions. Humans may induce earthquakes through different types of activities including oil and gas extraction, reservoir impoundment, fluid injection, mining, or carbon sequestration.

Location

Earthquakes in Colorado can occur anywhere across the state. Thousands of faults have been mapped, but scientists think only about 90 of these were active in the past 1.6 million years.

Figure 47 shows the quaternary faults that have slipped in the last 1.8 million years, in addition to those faults published by the Colorado Geologic Survey (CGS). It is believed that these faults are the most likely source of future earthquakes. While a majority are located running north to south down the center of the state, there are a number that have been identified across the western half of Colorado.

FIGURE 47 EARTHQUAKE FAULTS



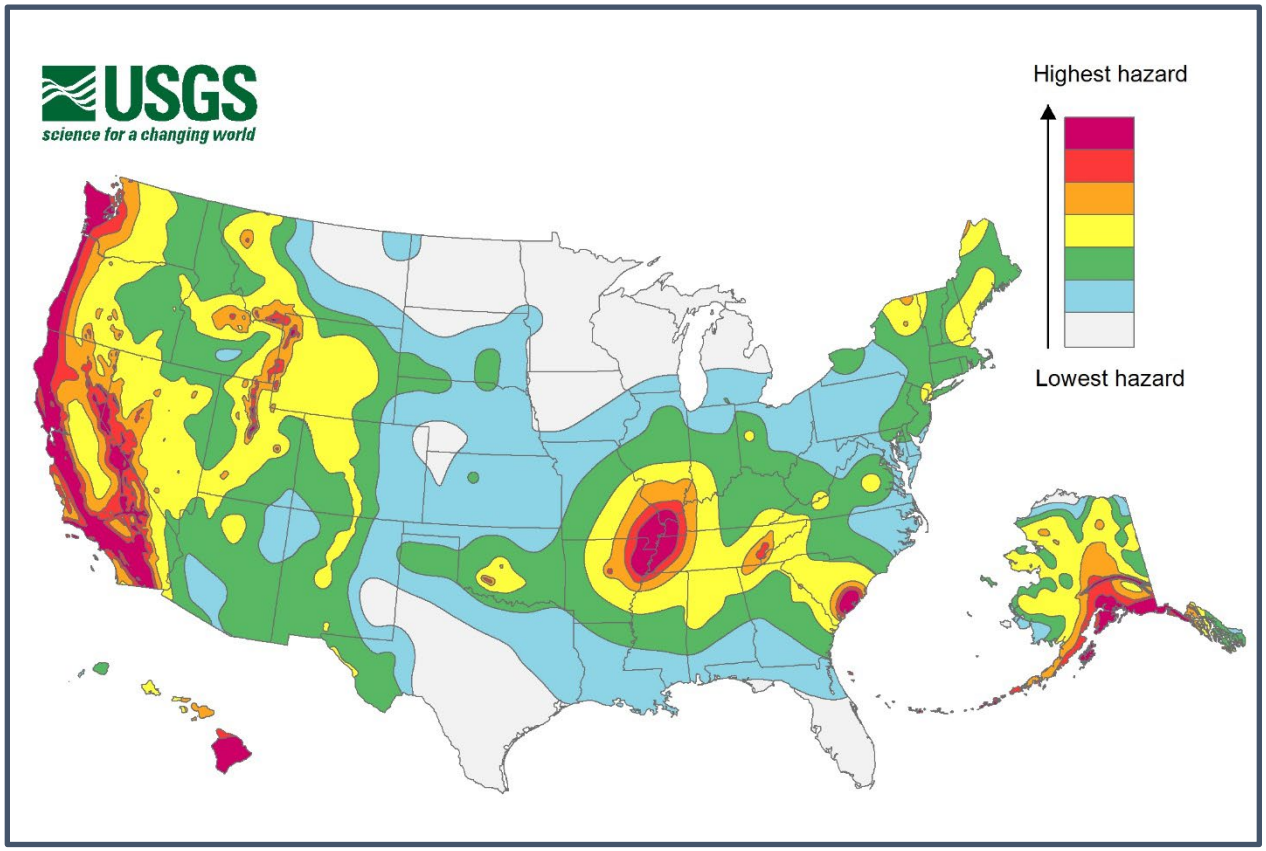
Contributing Factors

The most intense shaking experienced during earthquakes generally occurs near the rupturing fault and decreases with distance away from the fault. In a single earthquake, however, the shaking at one site can easily be 10 times stronger than at another site, even when their distance from the ruptured fault is the same. Seismic events may lead to landslides, uneven ground settling, flooding, and damage to homes, dams, levees, buildings, power and utility lines, roads, tunnels, and railways. Broken natural gas lines may cause fires.

The US Geological Survey (USGS) National Seismic Hazard Map, Figure 48, is based on the level of expected ground shaking that has a 2% chance of being exceeded in a 50-year period. This correlates with a return period of 2,500 years, which is equivalent to

an annual probability of exceedance of 0.0004%. Areas that are expected to have a higher amount of ground shaking are considered to be higher hazard. From a national perspective, Colorado has a moderate to low seismic risk.

FIGURE 48 NATIONAL SEISMIC HAZARD MAP 2018



Magnitude and intensity are used to describe seismic activity. Magnitude (M) is a measure of the total energy released. Earthquake magnitude describes the size of the earthquake itself, so it isn't dependent on any location relative to the earthquake. Intensity (I) measures the impacts of an event on people and structures. Intensity differs throughout an area because it describes the ground shaking at a specific location. Often, but not always, intensity decreases the farther away you are from the earthquake.

A scale commonly used to measure magnitude is the Richter Scale whereas the Modified Mercalli Scale (MMI) is used for intensity. Table 21 presents the Modified

Mercalli Intensity Scale aligned with the Richter Scale Magnitude to show how these classifications approximately align.

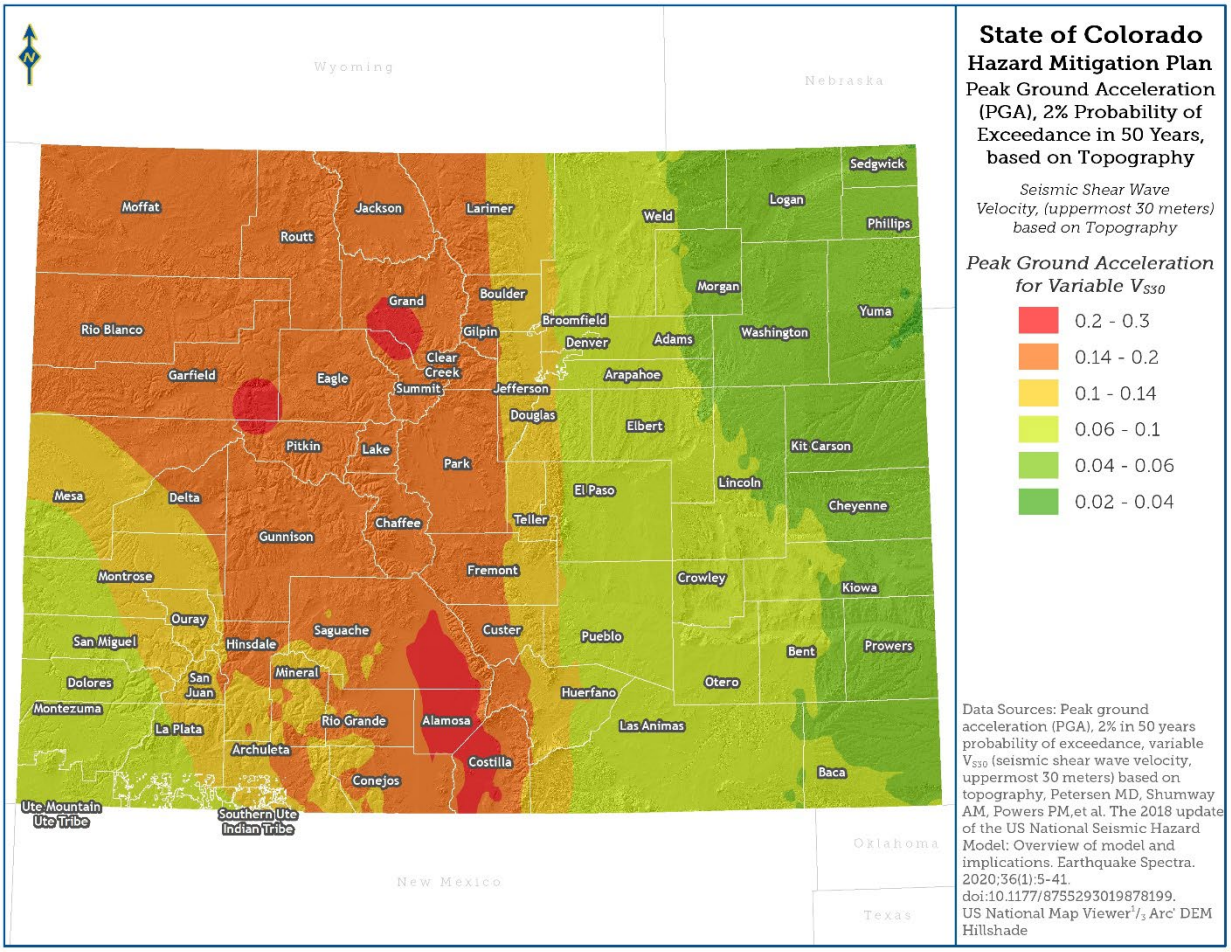
TABLE 21 - MODIFIED MERCALLI INTENSITY SCALE

Scale	Intensity	Description of Effects	PGA (g)	Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	< 0.0017	< 4.2
II	Feeble	Some people feel it	0.0018 - 0.014	
III	Slight	Felt by people resting, like a truck rumbling by		
IV	Moderate	Felt by people walking	0.015 - 0.039	
V	Slightly Strong	Sleepers awake, church bells ring	0.040 - 0.092	< 4.8
VI	Strong	Trees sway, suspended objects swing, objects fall off shelves	0.093 - 0.18	< 5.4
VII	Very Strong	Mild alarm, walls crack, plaster falls	0.19 - 0.34	< 6.1
VIII	Destructive	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged	0.34 - 0.65	< 6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	0.65 - 1.24	
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	> 1.24	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	> 1.24	< 8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	> 1.24	> 8.1

Peak ground acceleration (PGA) is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake. Figure 49 shows the USGS's modeled PGA based on velocity calculations for the top 30 meters of soil/bedrock. This data is being utilized because it takes into account the state's topographic variability. These V_{S30} (variable sub 30) values are estimated using topographic slope as a proxy.

The areas across the state expected to experience maximum PGA are located along the western side of the Sangre de Cristo Mountains and two areas near the counties of Garfield/Pitkin and Grand/Summit. The southwest corner and entire east side of Colorado are expected to experience the lowest PGA. It should be noted however, that Colorado's earthquake hazard risk has historically been rated lower than most knowledgeable scientists in the state consider justified.

FIGURE 49 PEAK GROUND ACCELERATION - 2% PROBABILITY OF EXCEEDANCE IN 50 YEARS



Past Occurrences

Historical Events

More than 500 earthquake tremors of magnitude 2.5 or higher have been recorded in Colorado since 1867. It is likely that more earthquakes of magnitude 2.5 to 3 occurred during that time but were not recorded due to the sparse population distribution and limited instrumental coverage in much of the state. Figure 50 illustrates these historic earthquake events in Colorado.

FIGURE 50 HISTORIC EARTHQUAKE EVENTS

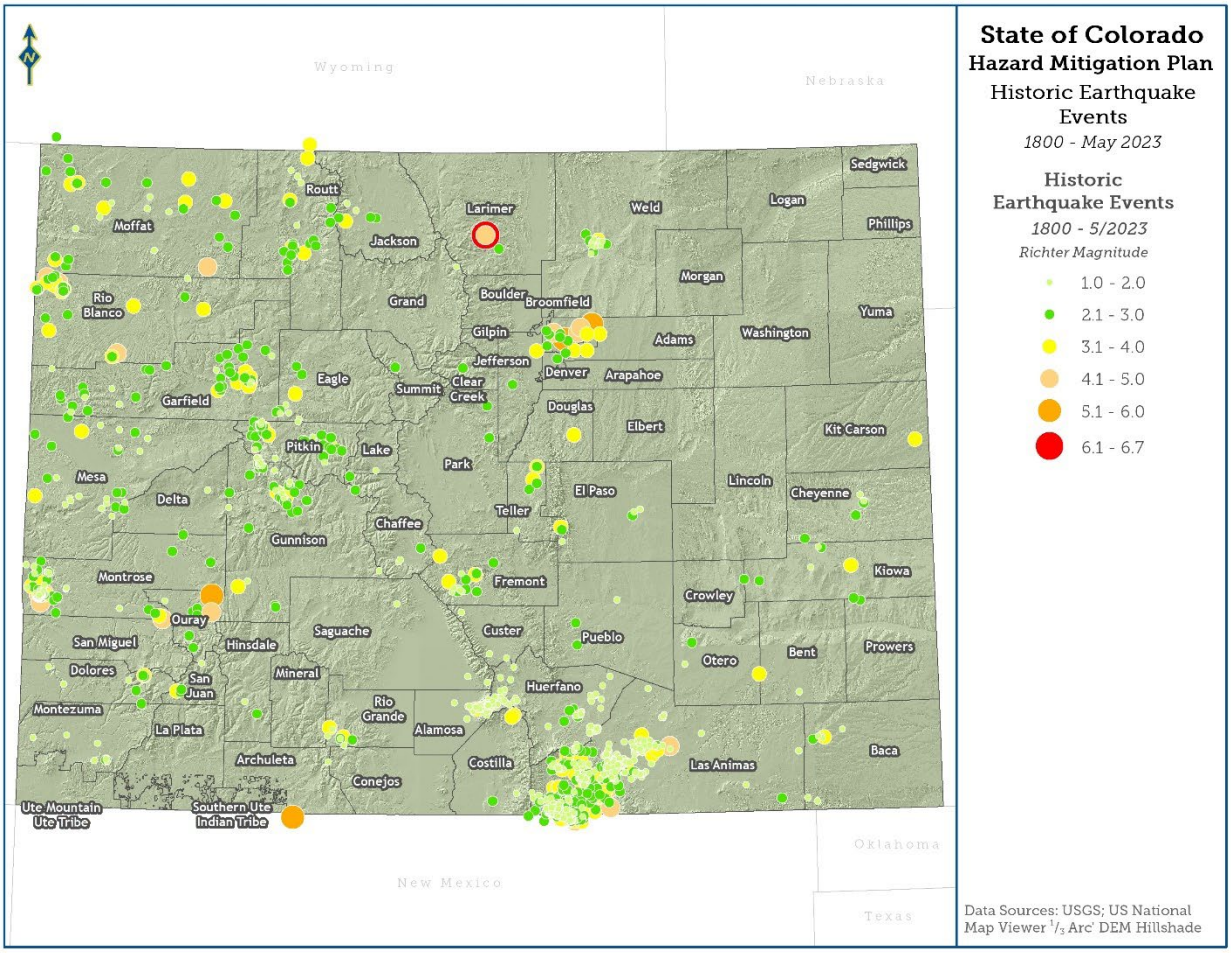


Table 22 provides a summary of the larger earthquakes to have occurred across the state since 1870.

TABLE 22 – LARGE HISTORICAL EARTHQUAKES

Date	Location	Magnitude	Intensity
1870	Pueblo/Ft. Reynolds	Unknown	Unknown
1871	Lily Park, Moffat County	Unknown	Unknown
1880	Aspen	Unknown	VI

Date	Location	Magnitude	Intensity
1882	North central Colorado	6.6	VII
1891	Axial Basin (Maybell)	Unknown	VI
1901	Buena Vista	Unknown	VI
1913	Ridgway Area	Unknown	VI
1944	Montrose/Basalt	Unknown	VI
1955	Lake City	Unknown	VI
1960	Montrose/Ridgway	5.5	V
1966	NE of Denver	5.0	V
1966	CO-NM border, near Dulce, NM	5.5	VII
1967	NE Denver	5.3	VII
1967	NE Denver	5.2	VI
2011	Southwest of Trinidad	5.3	VIII

Previous Losses

Past loss totals for earthquakes in the state are not readily available due to a lack of a singular reporting database. Losses may have been reported to insurance companies, however that data is not typically released due to privacy concerns.

While there are no historical losses available, CGS recently completed loss estimation modeling utilizing FEMA's Hazus software. The losses that are modeled by this tool allow for an understanding of the potential damages that a large earthquake event could cause across the state.

Table 23 and Table 24 present summary results of this analysis for six different earthquake scenarios across Colorado. The 1882 Event was modeled on historical data, while all others are credible hypothetical events on known faults. Following is a listing of these scenarios:

- Cheraw (7.2M)
- 1882 Event (6.6M)
- Gore Range (7.0M)
- Southern Swatch (6.9M)
- North Sangre (7.5M)
- Williams Fork (6.5M)

TABLE 23 - HAZUS EARTHQUAKE LOSS ESTIMATES - SUMMARY 1

Scenario	Expected Building Damage (count)		Expected Essential Facility Damage (count)	
	Extensive	Complete	Moderate	Complete
Cheraw	3,917	719	21	0
1882 Event	14,350	2,965	11	0
Gore Range	7,115	1,007	13	0
S. Swatch	1,828	78	0	0
N. Sangree	8,798	2,042	27	0
Williams Fork	1,828	78	0	0

TABLE 24 - HAZUS EARTHQUAKE LOSS ESTIMATES - SUMMARY 2

Scenario	Households Without Service (Day 1)		Displaced Households	Direct Building Losses ($ Millions)
	Potable Water	Electric Power		
Cheraw	1,543	8,379	1,566	$1,044

1882 Event	17,310	4,562	7,507	$4,255
Gore Range	2,019	20,152	3,681	$2,035
S. Swatch	0	3,371	655	$628
N. Sangree	2,057	1,496	1,501	$793
Williams Fork	0	3,371	655	$628

Notable Events

There have been 15 notable earthquakes recorded in the state since 1870. The recorded magnitudes have ranged from 5.0 to 6.6, with maximum intensities ranging from V to VIII.

The largest known earthquake in Colorado occurred on November 7, 1882 and had an estimated magnitude of 6.6. The location of this earthquake, which has been the subject of much debate and controversy over the years, appears to be in the northern Front Range west of Fort Collins.

On August 22, 2011, a magnitude 5.3 earthquake was recorded at about 11:46 p.m. nine miles west-southwest of Trinidad and 180 miles south of Denver, according to the National Earthquake Information Center in Golden. The quake followed two smaller ones that hit the area earlier in the day. The epicenter of the earthquake was very shallow at a depth of 2.5 miles.

Probability

The occurrence of large magnitude earthquakes is relatively infrequent in Colorado and the historical earthquake record is short (only about 140 years). Based on historical data, roughly three recorded earthquakes should be expected in any given year. It is challenging if not impossible to accurately estimate the timing or location of future dangerous earthquakes in Colorado. Although limited, available seismic hazard information can provide a basis for a reasoned and prudent approach to seismic safety.

Based on the historical earthquake record and geologic studies in Colorado, an event of magnitude 6.5 to 7.5 could occur somewhere in the state. One study suggests an earthquake of magnitude 6.3 or larger has a one percent probability of occurring each year somewhere in Colorado[25].

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are not expected to influence future earthquake events. However, climate change may exacerbate the impacts of earthquakes by contributing to increased damages related to earthquake induced landslides, wildfires, and dam failures.

Risk & Vulnerability

Populations at Risk

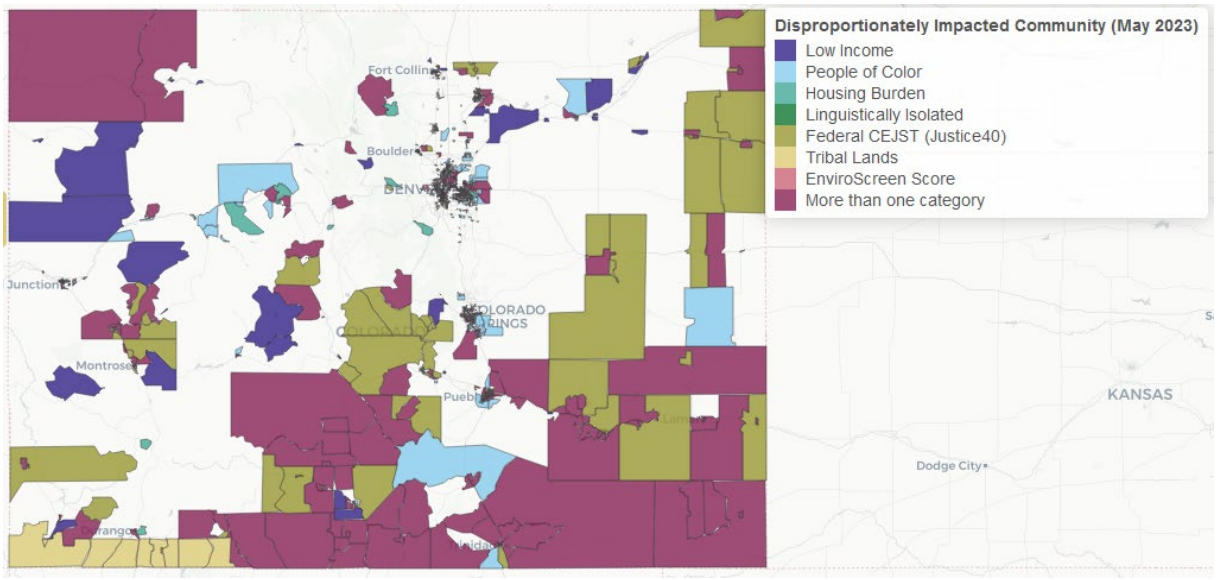
All populations in the state are at risk of an earthquake. Underserved communities may experience issues with recovery depending on the impacts an earthquake may have, including issues with housing, the local economic stability, and potential delays in recovery work. Vulnerable populations, especially those who are isolated, have chronic conditions, or those with access and functional needs are at risk of poor health outcomes and a lack of resilience in recovery.

The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 51. When comparing these communities to those counties with the highest potential peak ground

[25] Charlie, Doehring, Oaks Colorado Earthquake Hazard Reduction Program Report 93-01, 1993

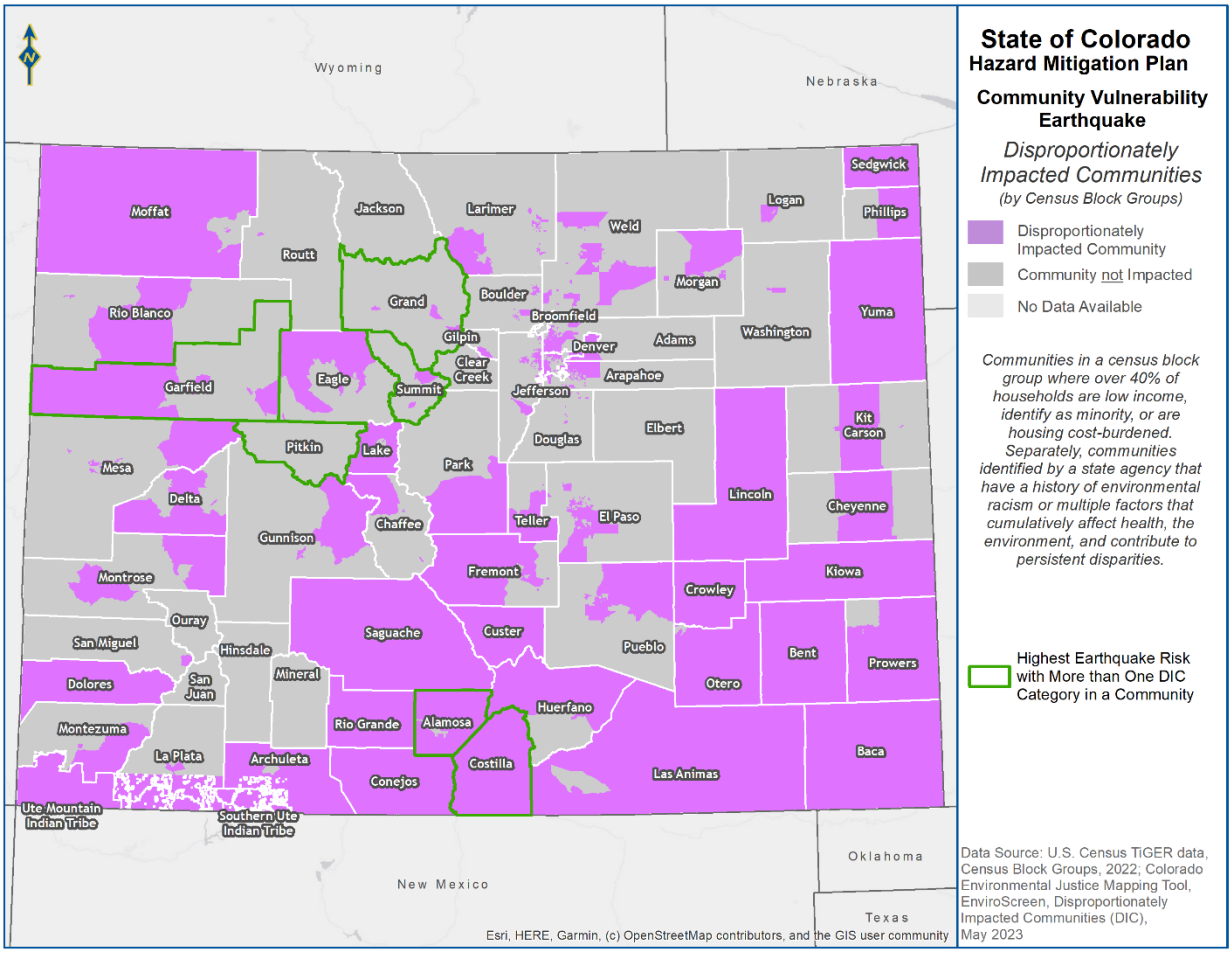
acceleration (Figure 49), Alamosa, Costilla, Garfield, Grand, Pitkin, and Summit County all contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 51 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to earthquake include: low income, housing burdened, people of color, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 52 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Alamosa, Costilla), “Medium-High” (Garfield), “Low-Medium” (Grand and Summit), and “Low” (Pitkin).

FIGURE 52 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Dating back to 2000, the Office of Risk Management reports two events impacting state assets. Although Colorado experienced the strongest earthquake in over 40 years in 2011, there were no reports of losses to state assets due to that event.

Exposure

State facilities are the most vulnerable state asset type exposed to earthquake hazard. The largest risk is to un-reinforced and older structures that may not have been constructed to modern seismic building codes. The largest potential impacts resulting from an event could include structural collapse and damage to building inventories.

Communication towers are another highly vulnerable state asset type. Specific towers include the La Veta Pass tower site (Costilla and Huerfano Counties), Denver DTB transmitter site (Denver, Jefferson, Arapahoe, Douglas, and Boulder Counties), and the Grand Junction SOB (Mesa, Garfield, Pitkin, Eagle, Rio Blanco, and Routt Counties). The largest potential impacts resulting from an event includes limited, or no first responder communications in the coverage area.

Bridges and tunnels are another notable vulnerable state asset. Specific structures include the Eisenhower-Johnson Memorial Tunnels and the Hanging Lake Tunnels. Impacts would be widespread and similar in nature to those recently experienced in the Glenwood Canyon, as post-fire debris flows and the risk of these events have caused numerous closures of I-70. These affected local and regional economies and caused supply chain disruptions at the state and national levels.

Of those counties at the highest risk from the highest potential peak ground acceleration (Figure 49), Garfield County has the most state assets and valuations exposed (as shown in Figure 13 and Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from an earthquake event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

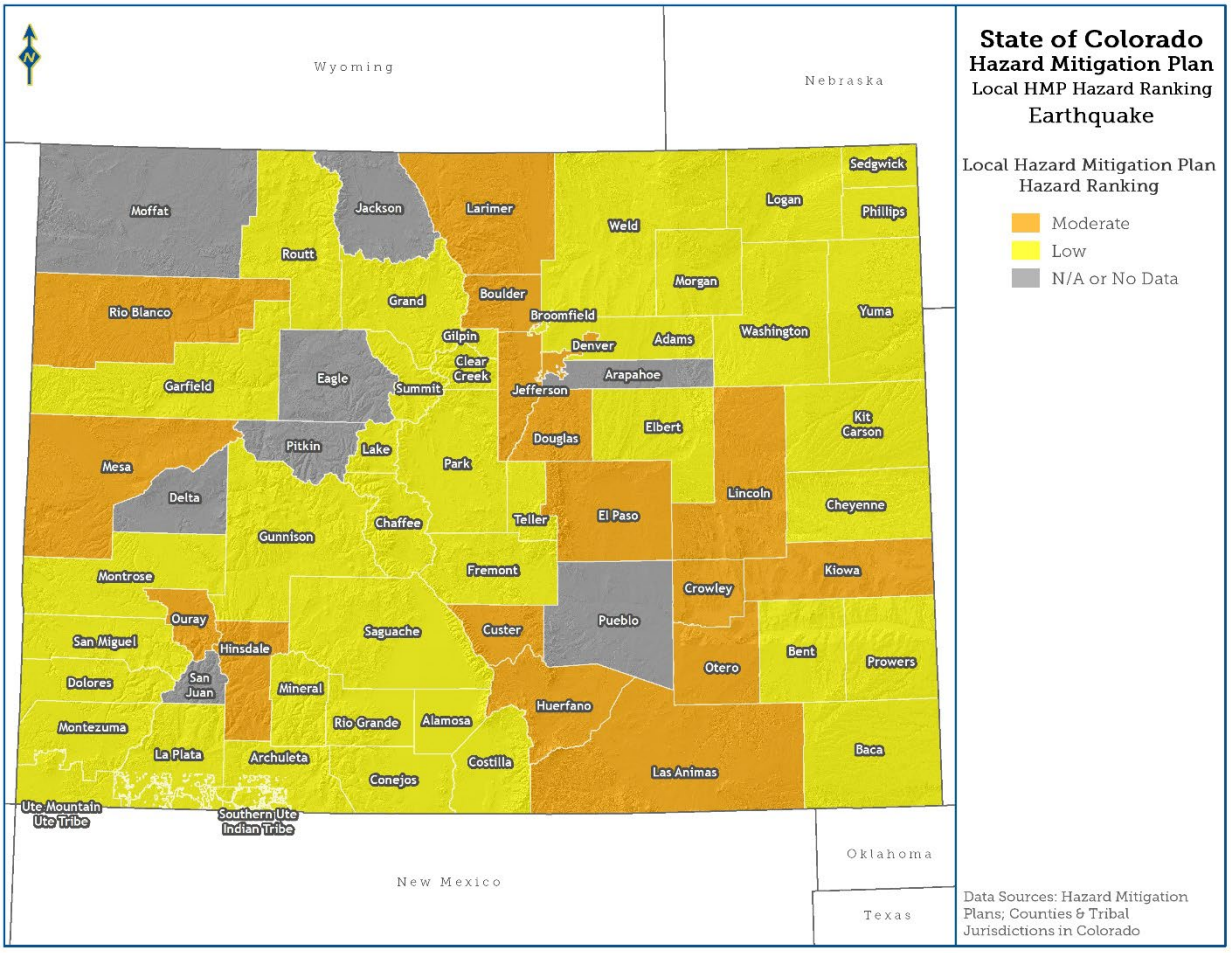
Earth-quake							

Local County / Tribe

Hazard Rankings

The local hazard risk rankings for an earthquake are shown in Figure 53. The majority of local hazard mitigation plans ranked earthquake as a low risk hazard.

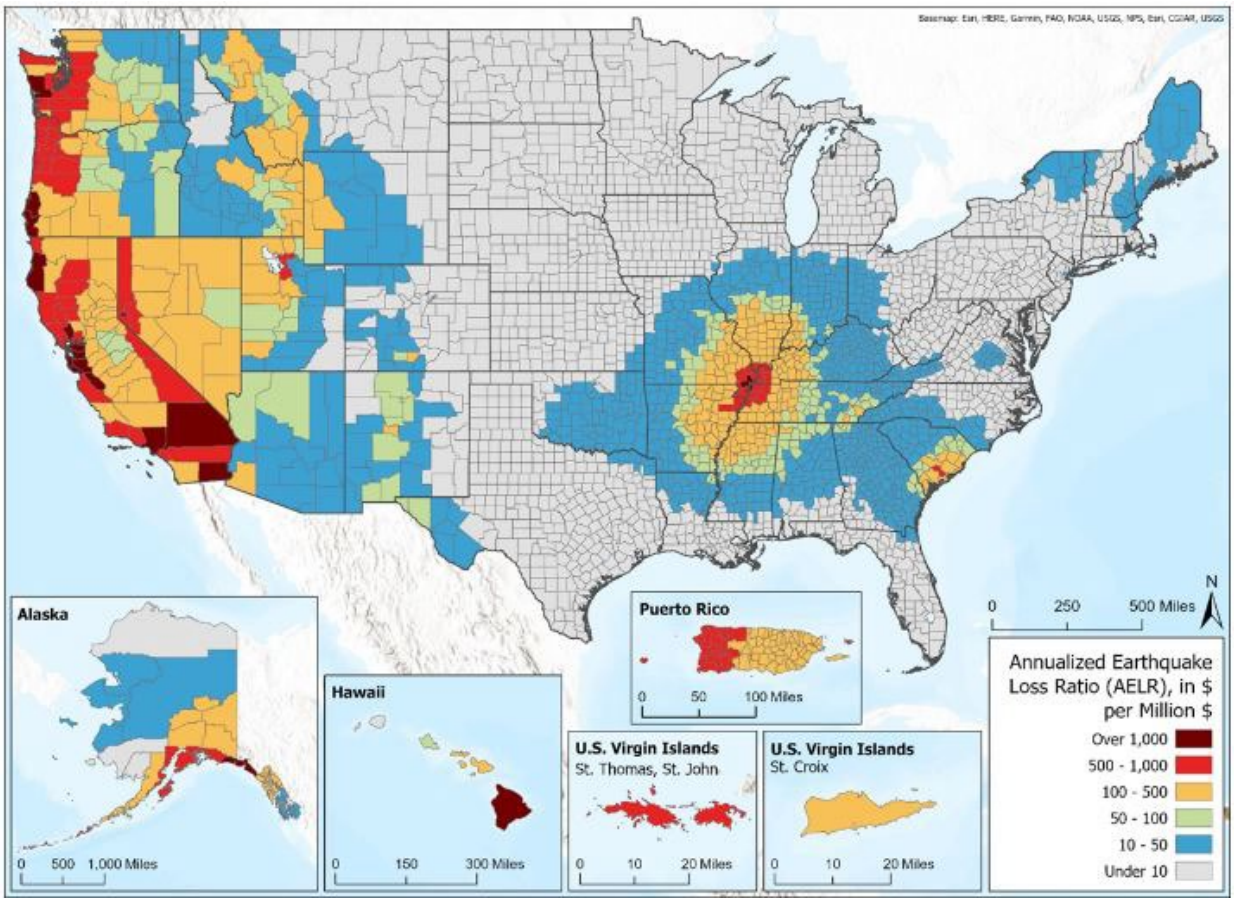
FIGURE 53 LOCAL HAZARD RISK RANKING



Exposure

FEMA and USGS recently published the Annualized Earthquake Losses study, which expresses the estimated annualized loss as a fraction of the building-inventory replacement value (Figure 54). The study shows that approximately three-quarters of the state should expect losses less than $10 million. Of the two counties with the highest annualized losses, Rio Grande would experience between $50 million and $100 million, while Alamosa would see losses of $100 million to $500 million.

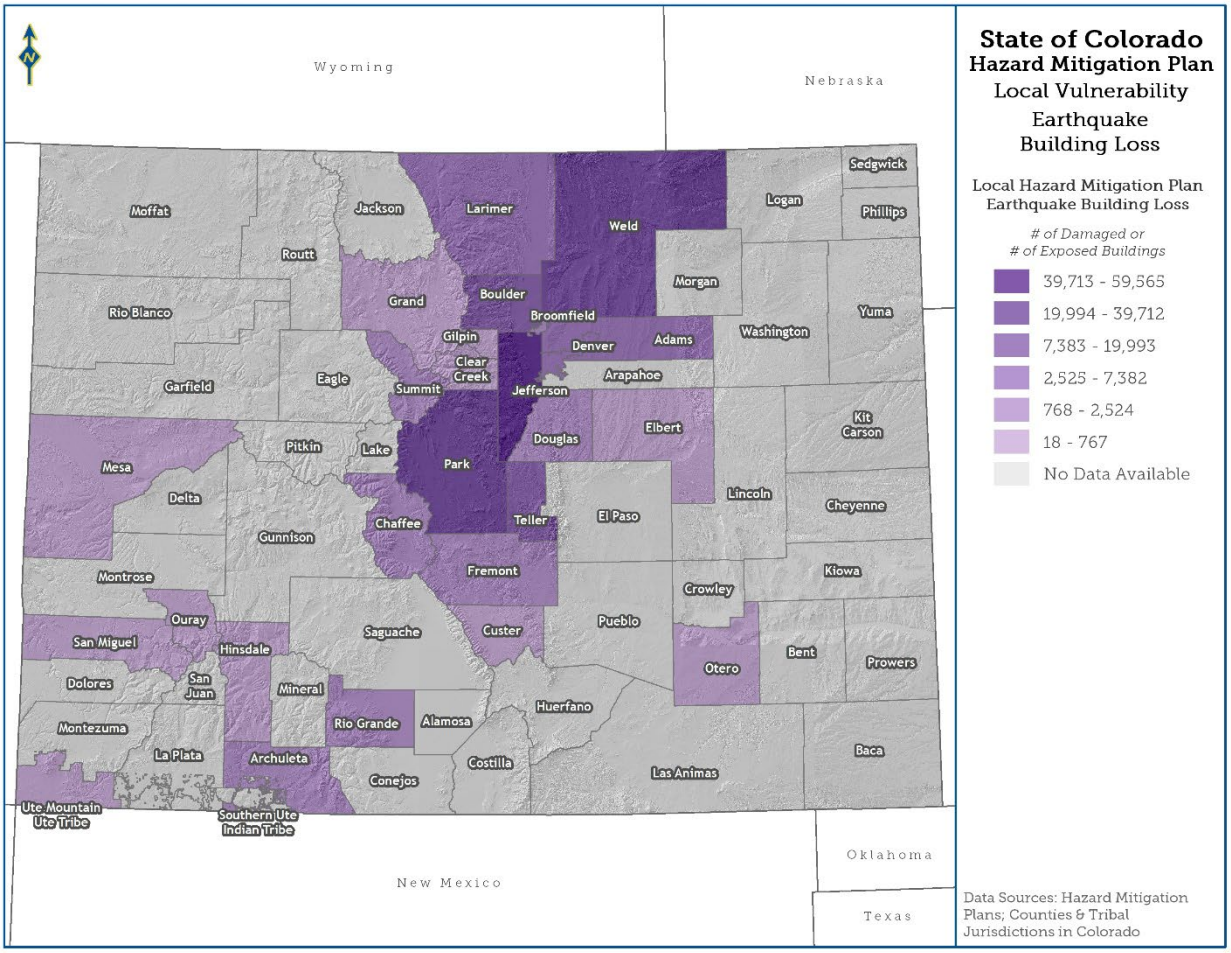
FIGURE 54 ANNUALIZED EARTHQUAKE LOSS RATIO



Within a majority of the local hazard mitigation plans, FEMA's Hazus loss estimation software is used for scenario modeling to assess risk from seismic hazards. A number of variables are included in the Hazus analyses in order to arrive at the estimated levels of damage to property. These expected building damages are presented in Figure 55 and include buildings modeled as moderately, extensively, and completely damaged.

Jefferson County has the highest modeled number of building damages with over 59,000 structures exposed (modeling a 6.5 magnitude, 2,500 year probabilistic event). Park and Weld counties have the next highest with approximately 20,000 to 40,000 buildings estimated to be damaged by an earthquake.

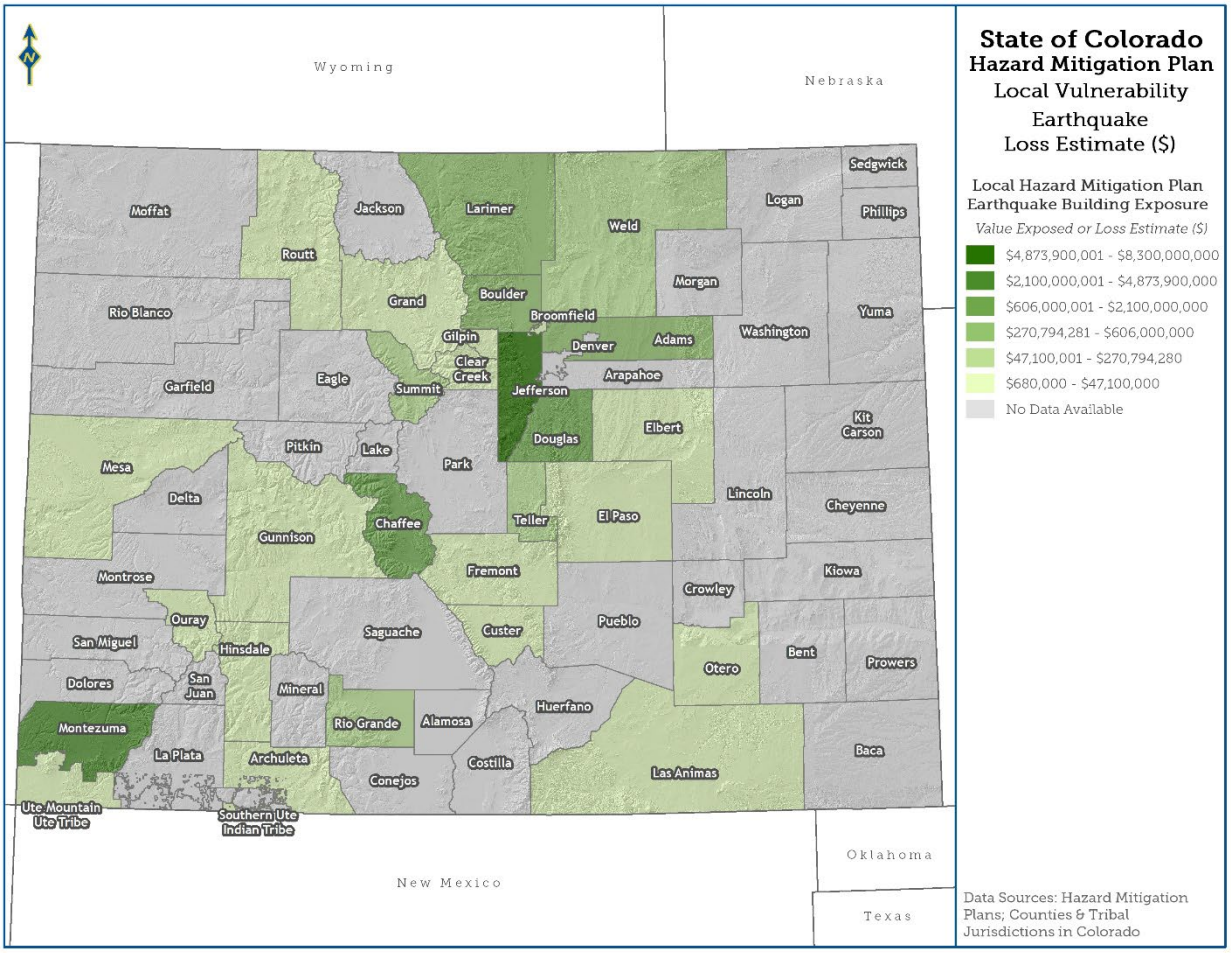
FIGURE 55 LOCAL BUILDING COUNT WITH EXPECTED HIGH DAMAGES TO EARTHQUAKES



Hazus also models building-related economic losses, which factors in direct building losses and business interruption losses. Direct building losses relate to costs to repair or replace the damage caused to structures and their contents. Business interruption losses are those caused by the inability to operate a business because of the damage sustained by an earthquake, in addition to temporary living expenses for those displaced from their homes.

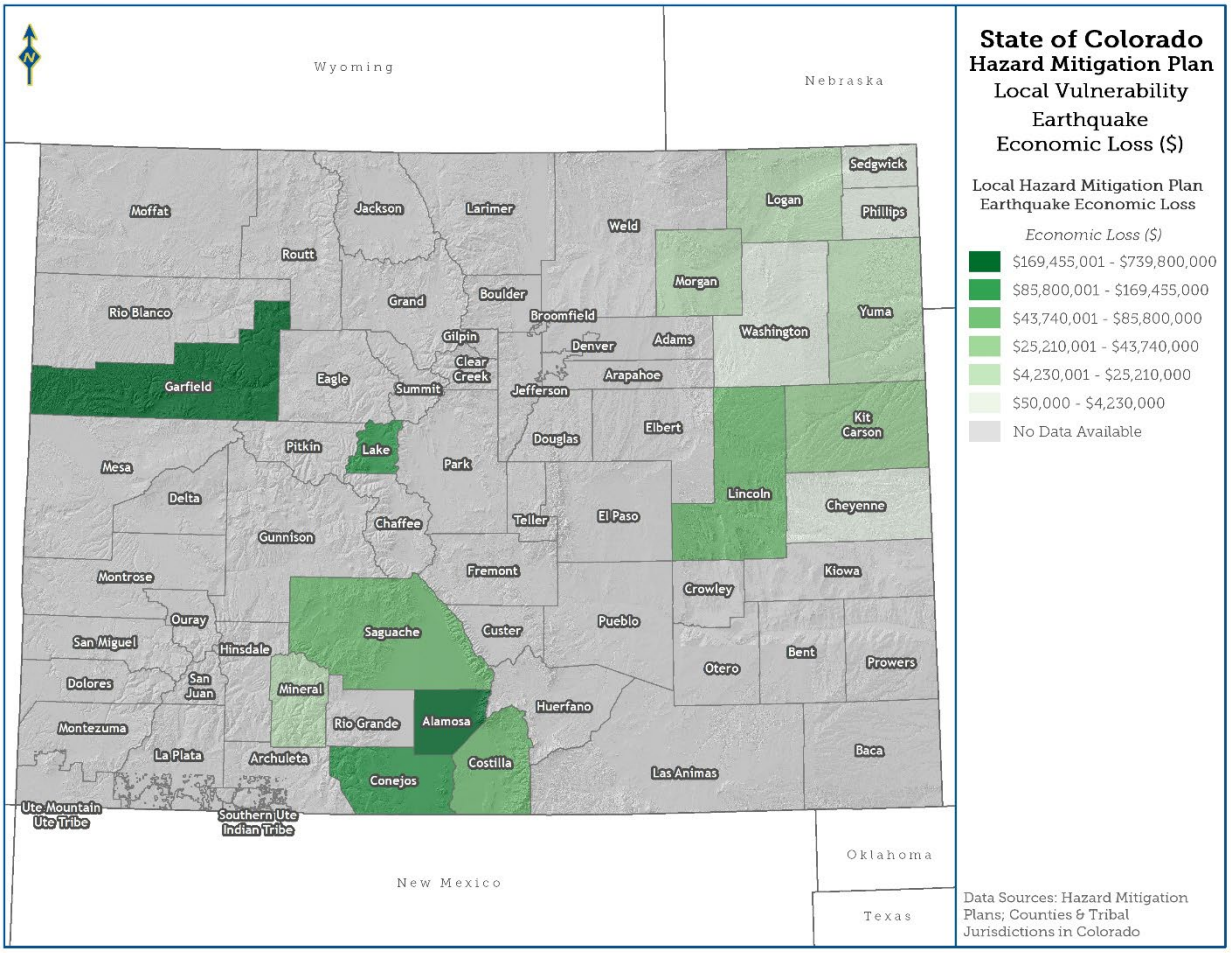
These building-related economic losses are shown in Figure 56. Jefferson and Montezuma County have the highest loss estimations related to earthquake, with between $4.8 and $8.3 billion reported. The majority of counties report building losses that fall within the lowest range of $680,000 and $47 million.

FIGURE 56 EARTHQUAKE STRUCTURAL LOSS ESTIMATES



Total economic losses are also estimated by Hazus and include both building and lifeline related losses. These figures are not always reported in local plans. The estimations that were provided are presented in Figure 57. This shows the highest estimated total economic losses were reported between $169.4 million and $739.8 million in Garfield and Alamosa County. The northeast counties reported most of the lowest loss estimations across the state.

FIGURE 57 EARTHQUAKE ECONOMIC LOSS ESTIMATES



Interconnected Hazards

Earthquakes can cause numerous hazards including avalanche, dam / levee incidents, flood, ground subsidence, landslide / debris flow / rockfall, sinkholes, and wildfire.

Recent and Future Development

Any new construction built to the latest building codes should protect life safety in that location. International Building Code design standards are developed utilizing the 2,500-year return period ground motion data. The potential for non-structural damage will increase with new development. Continued population growth will expose more people to earthquakes and their related hazards.

Of those counties experiencing the state's largest percentage of growth (Figure 7), Garfield County has been identified as being at risk from the highest potential peak ground acceleration (Figure 49).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of earthquake.

Consequence Analysis

TABLE 25 – EMAP IMPACT SUMMARY

Consideration	Description
Public	In a significant event (6-7 magnitude), there is a high expectation of mass casualties and/or fatalities. Anyone caught in a vulnerable structure during an event is at risk. There is limited earthquake preparedness activity in Colorado.
Responders	Exposure exists to personnel performing routine duties when an event occurs, although event related duties are primarily post-event. Unsafe structural or environmental conditions may persist during the response period putting search and rescue personnel and other responders at risk. Scale of event will likely overwhelm local resources and require mutual aid assistance from outside the area of impact.

Consideration	Description
Continuity of Operations (Govt. & Services)	Loss of facilities or infrastructure function, accessibility, or ability to provide services. Power interruption is likely if not adequately equipped with backup generation. Large scale events will typically overwhelm emergency response and coordination services and may require mutual aid assistance from outside the impacted area.
Property, Facilities, & Infrastructure	Buildings, vehicles, signage, and/or any unsecured property may be damaged or destroyed during a significant event. In Colorado, buildings, equipment, and utility infrastructure are typically not constructed to withstand a 6-7 magnitude quake. Potential for high impact of destruction or usability. Communications would be negatively impacted.
Environment	Difficult to assess environmental damage due to variability in location and magnitude. Possible cascading water quality issues from damaged water treatment facilities or impacts to ground and air quality from hazardous material leaks.
Economic	Potential loss of facilities or infrastructure function or accessibility and uninsured damages.
Public Confidence in Govt.	Public holds high expectations of government capabilities for public information and response and recovery activities related to large scale disaster events such as earthquakes. High expectations for rapid restoration of critical lifelines.

Erosion and Deposition – Low Risk

Definition

Erosion is the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice. Deposition is the placing of the eroded material in a new location. All material that is eroded is later deposited in another location. Erosion is usually initiated by water or wind and may be initiated or exacerbated by wildfires and human activity.

Fluvial (i.e. - riverine) erosion is the detachment of sediments from the river or stream bed and the banks of the waterway. Water erosion can occur after intense rainfall, avalanche, wildfire, etc. and can generate mass wasting of hillsides. Wind deposits are small particles of silt and clay, called loess, and can be carried over great distances before being deposited.

Erosion is generally the result of ongoing natural geologic and atmospheric processes that occur slowly over time. Damaging erosion and deposition is usually the result of more extreme events associated with severe winds, thunderstorms, floods, landslides, and debris flows. Separate hazard profiles for these more extreme erosion and deposition events are included in this E-SHMP.

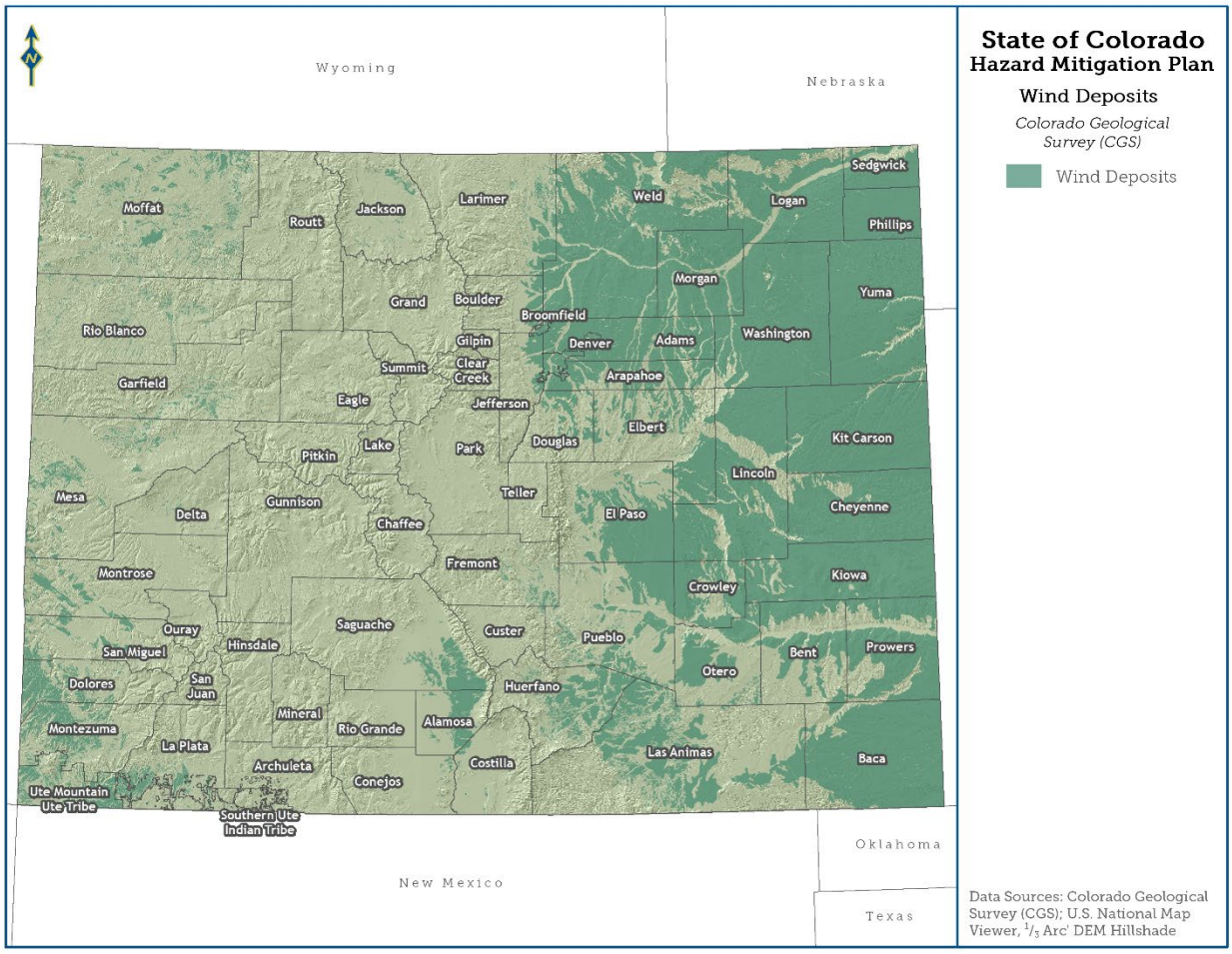
Location

Erosion and deposition are occurring continually at varying rates all over Colorado. “Non-Point” sources of erosion are common to construction sites or other areas where human interaction with the earth results in exposed soil or removal of vegetation. Natural waterways perpetually remove and carry soil from the earth to locations downstream. The Colorado River appears red during times of high runoff due to the amount of soil being carried. Erosion and deposition issues are exacerbated in wildfire burn areas.

Figure 58 shows that CGS identified wind deposit areas are concentrated in the eastern portion of the state, from the New Mexico border to the Nebraska border and

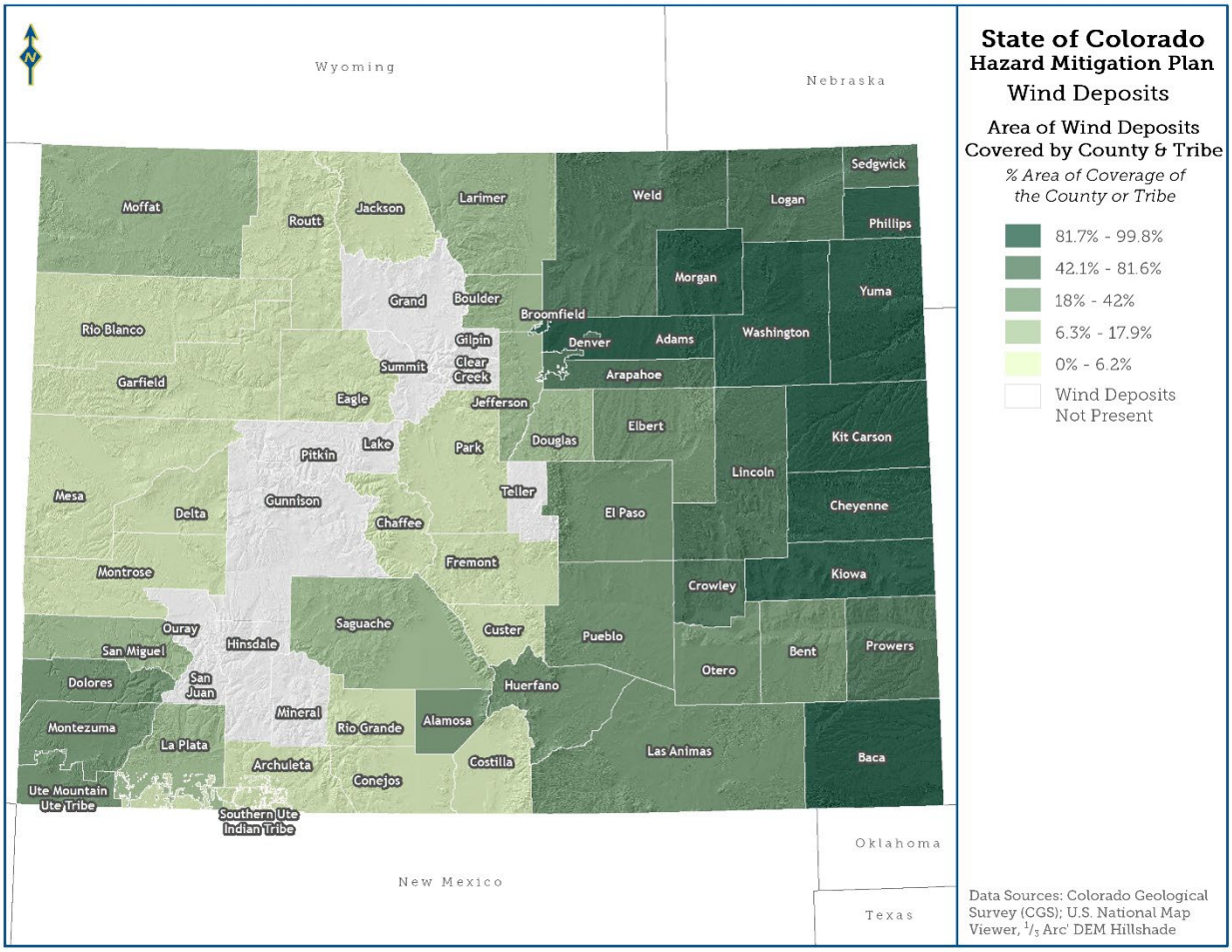
stretch west, diminishing as elevation rises giving way to the mountain ranges. As wind carries deposits over these areas it slows and drops the material, creating large deposits from a continual process. NRCS wind erodibility data is another potential future source of data, as it considers the surface characteristics of loess deposits, and will be evaluated as part of the next E-SHMP update.

FIGURE 58 WIND DEPOSITS HAZARD AREAS



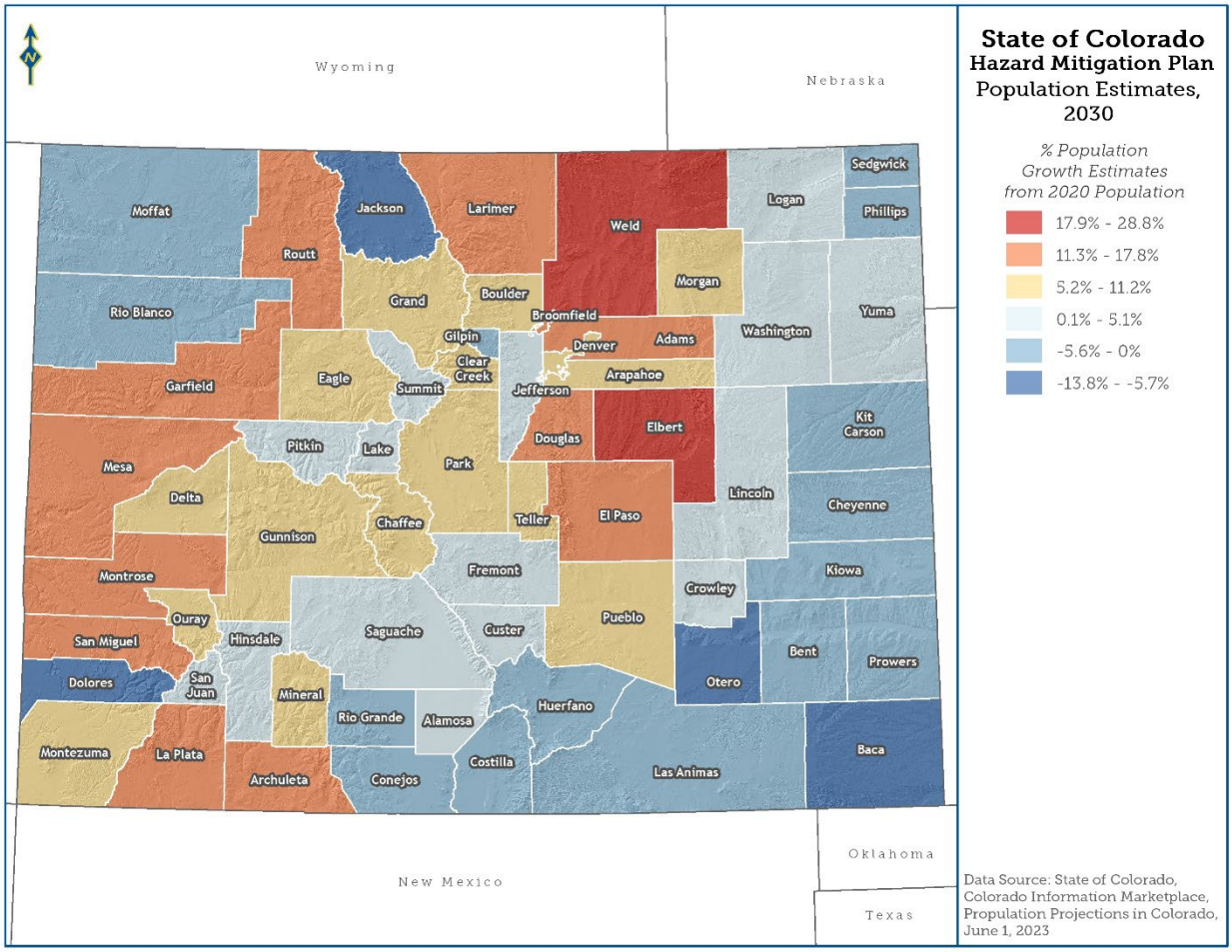
The data shown in the previous Figure has been summarized at the county and tribal area level and is shown in Figure 59. The eastern portion of the state clearly has the highest number of square miles covered by wind deposits. Wind deposits have not been identified in many of the more mountainous counties with high elevations.

FIGURE 59 WIND DEPOSITS AREAS BY COUNTY AND TRIBAL AREA



For comparison, Figure 60 presents the estimated population growth across the state through 2030.

FIGURE 60 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

Fluvial erosion has many consequences including land and development loss. It can affect river sedimentation and degrade channel navigation. Other problems include water quality reduction due to high sediment loads, native aquatic habitat losses, damage to public utilities, and increased infrastructure maintenance, prevention, and control costs. Erosion and deposition can increase pollution risk of surface waters, as nutrients and pesticides from agricultural and residential uses are transported.

Severe fluvial erosion can remove the earth from beneath bridges, roads, and foundations of structures adjacent to streams. This undercutting can lead to increased rockfall and landslide hazard. Deposition of eroded material from flooding events has resulted in injuries and loss of life.

The deposition of material from rockfalls and landslide can destroy structures, block culverts, aggravate flooding, destroy crops and lawns, reduce the capacity of water reservoirs as the deposited materials displace water, and cause overall degradation of the water supply.

Human activities greatly influence the rate and extent of erosion and deposition. These activities can include stripping the land surface of vegetation, altering natural drainages for water control projects, rearranging the earth through construction and development, and improperly managed agricultural lands.

Natural causes, such as wildfire, are an additional precursor to soil erosion and deposition. Runoff dynamics and soil infiltration are changed by removal of vegetation and alteration of the physical condition of the ground. This leads to a greater likelihood of precipitation carrying extensive debris through the burn scar and into a water source.

Wind erosion hinders agricultural production by stripping away the fertile top layers of the soil and organic matter. Erosion can contribute to dust storms as wind-blown dust reduces visibility, causing automobile accidents, and hindering machinery. Wind erosion can have a negative effect on air quality, creating animal and human respiratory health concerns.

Dust storms in the southwest portion of the state, and regular wind events across the mountainous areas have resulted in the deposition of particles on high mountain snow. Being less reflective than snow, the dust particles absorb heat with the result of an earlier snowmelt in some areas of the state. Early snowmelt may result in water supply and recreational use issues on waterways.

Past Occurrences

Historical Events

Deposition is a process that has continually occurred, and deposits have grown, shifted, and in some cases altered the landscape drastically over time. Figure 58 presents the identified historical wind deposit areas across Colorado.

Previous Losses

Losses due to erosion and deposition are not easily quantifiable. Property owners may go through insurance and the figures are not released. Overall, there is no single database collecting this information.

Drainage infrastructure is commonly damaged by erosion, especially due to extreme flooding and debris flow events. Many counties and municipalities have experienced losses to culverts and drainage structures, which in turn caused further damages due to lack of water control.

Notable Events

The following section documents information on previous occurrences of damage caused by erosion and deposition.

Near the Town of Larkspur in Douglas County, an access road and shallow borrow ditch were cut to serve an airport runway, uphill from the access road. During construction of the road and borrow pit a large area was stripped of vegetation. Heavy water runoff from above the runway and the runway itself was channeled down the borrow ditch. There were no control features to slow the velocity of the water or mitigate erosion. Within five years the borrow ditch was eight feet deep. Properly designed and installed water control structures, re-vegetation of the graded area, detention ponds, drop structures, and other measures would have paid for themselves in later maintenance and repair costs.

Erosion and deposition problems have been noted in the Fountain Creek watershed near Colorado Springs and downstream as far as La Junta. There were historic erosion problems through Woodland Park with associated sedimentation, which were exacerbated by the Waldo Canyon Fire of 2012. Erosion is also evident in the stream banks upstream of the Old Crystola Road. Sedimentation and flooding occur downstream in many reaches causing issues during periods of high streamflow. Flooding and erosion in this watershed have accelerated the loss of aquatic and wetland habitats, contributed to the loss of hundreds of acres of productive farmland, and caused the foundations of roads and homes to crumble.

Two months after the May 1996 Buffalo Creek Fire in Pike National Forest, flooding and erosion transported 30 times the annual rate of coarse sediment into the Strontia Springs Reservoir. At the time, the Strontia Springs Reservoir supplied the City of Denver with 75 percent of its drinking water. The Denver Water Department spent years cleaning up the reservoir after water quality tests proved that the burned materials and sediment were degrading water quality. In 2010, the Waterton Canyon Recreation Area was closed and the Strontia Reservoir was dredged to remove the remaining sediment. A nine-mile-long pipeline was installed to carry the hundreds of thousands of tons of sediment down to the mouth of Waterton Canyon. Denver Water partnered with the U.S. Forest Service to drain the reservoir and improve water quality, which cost $33 million. In April 2012, nearly 16 years after the Buffalo Creek Fire and a decade after the Hayman Fire, the 75-ton dredge was removed and the project was completed.

In 1998, Pikes Peak Highway was at the center of a lawsuit between the Sierra Club and the City of Colorado Springs and the US Forest Service. The unpaved highway was built without proper water control structures. Stormwater eroded the road and carried thousands of tons of gravel and sediment down to natural watersheds every year. Over time, hundreds of gullies formed and increased the rate of erosion. The lawsuit was settled when the City of Colorado Springs and the US Forest Service agreed to pave the road. Paving began in 2001 and was completed in October 2011.

Though riverine erosion is an ongoing process, major flood events can dramatically increase erosion rates. The 2013 floods on Colorado's Front Range caused extreme levels of erosion. A 2015 study from researchers at the University of Colorado Boulder found that the 2013 floods resulted in as much as 1,000 years' worth of erosion in the foothills west of Boulder, when compared to the average annual rate of erosion. The researchers also concluded that most erosion occurs as a result of extreme weather events.

Probability

Erosion and deposition, both fluvial and wind driven, will continue to occur annually (100% chance). These processes can be aggravated by natural events such as heavy rain, high wind, wildfires, or human activities that disturb the land. These natural events and human activities are expected to continue, furthering and possibly exacerbating erosion and deposition.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future erosion and deposition events.

TABLE 26 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	The area at risk to erosion and deposition is not expected to change.
Extent/Intensity	The extent of erosion and deposition are expected to increase as frequency of wildfires and drought increases across the state. Intensity may change as more intense and frequent fires exacerbate water runoff.
Frequency	Fire erosion is expected to increase as the frequency of wildfires increase across the state. Additionally, increases in the frequency

Impact	Projected Change
	and duration of droughts will exacerbate the conditions for wind-driven erosion, particularly along the Eastern Plains.
Duration	The duration of erosion and deposition events is not expected to change.

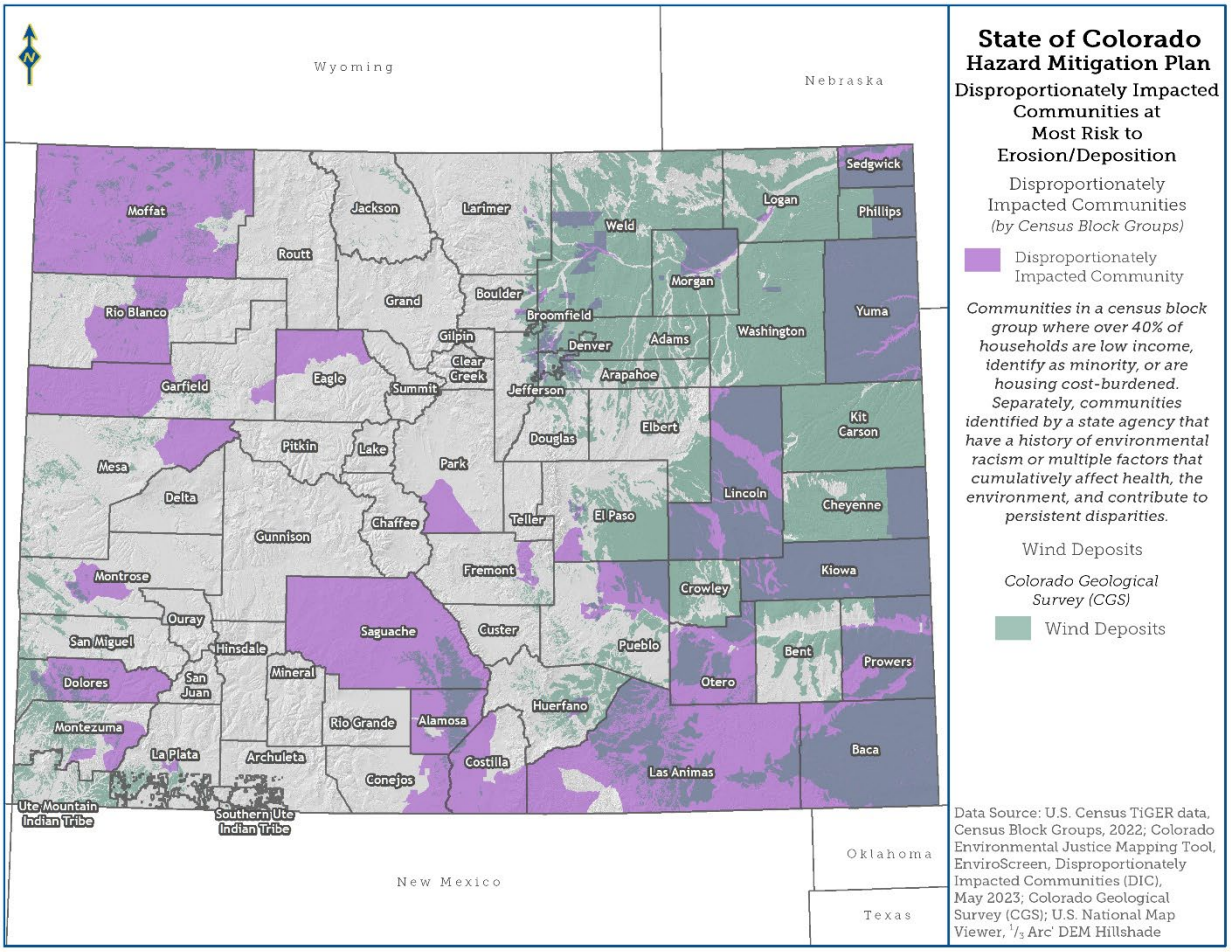
Risk & Vulnerability

Populations at Risk

Erosion and deposition are not an immediate threat to the population. Although those with properties along waterways may potentially see damage to homes and loss of land as riverbanks erode away. Water quality may be an issue if excessive sedimentation affects a water source. This could impact those unable to obtain bottled water, hospitals, and other populations requiring clean water for medical care. Air quality impacts can be experienced due to wind-caused erosion.

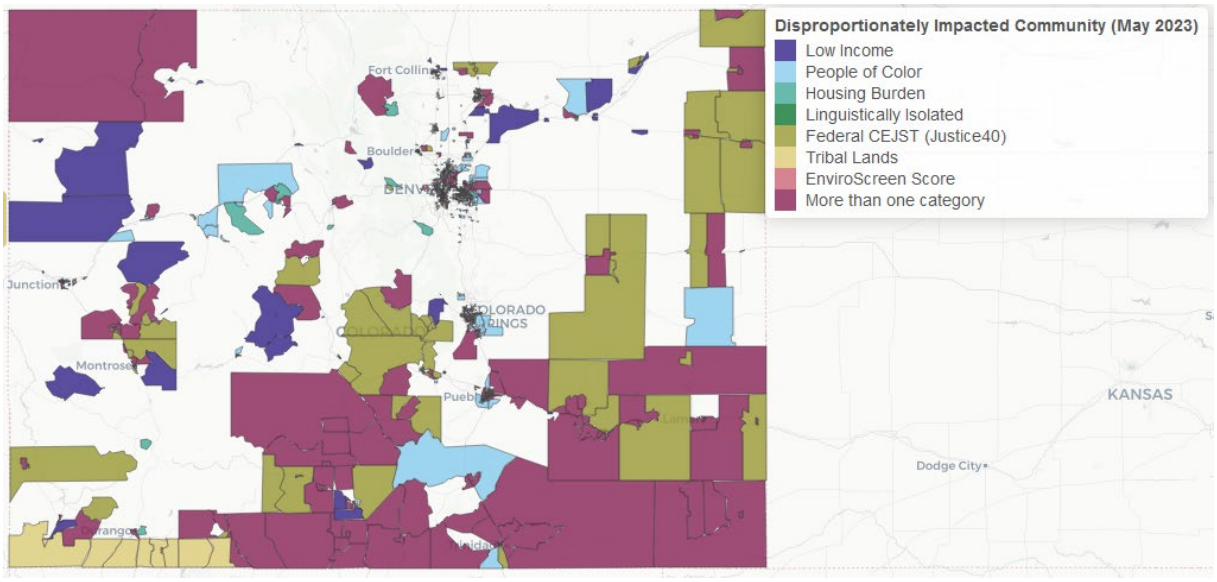
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 61 identifies those DIC communities, at a Census Block Group level, that have mapped wind deposits.

FIGURE 61 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



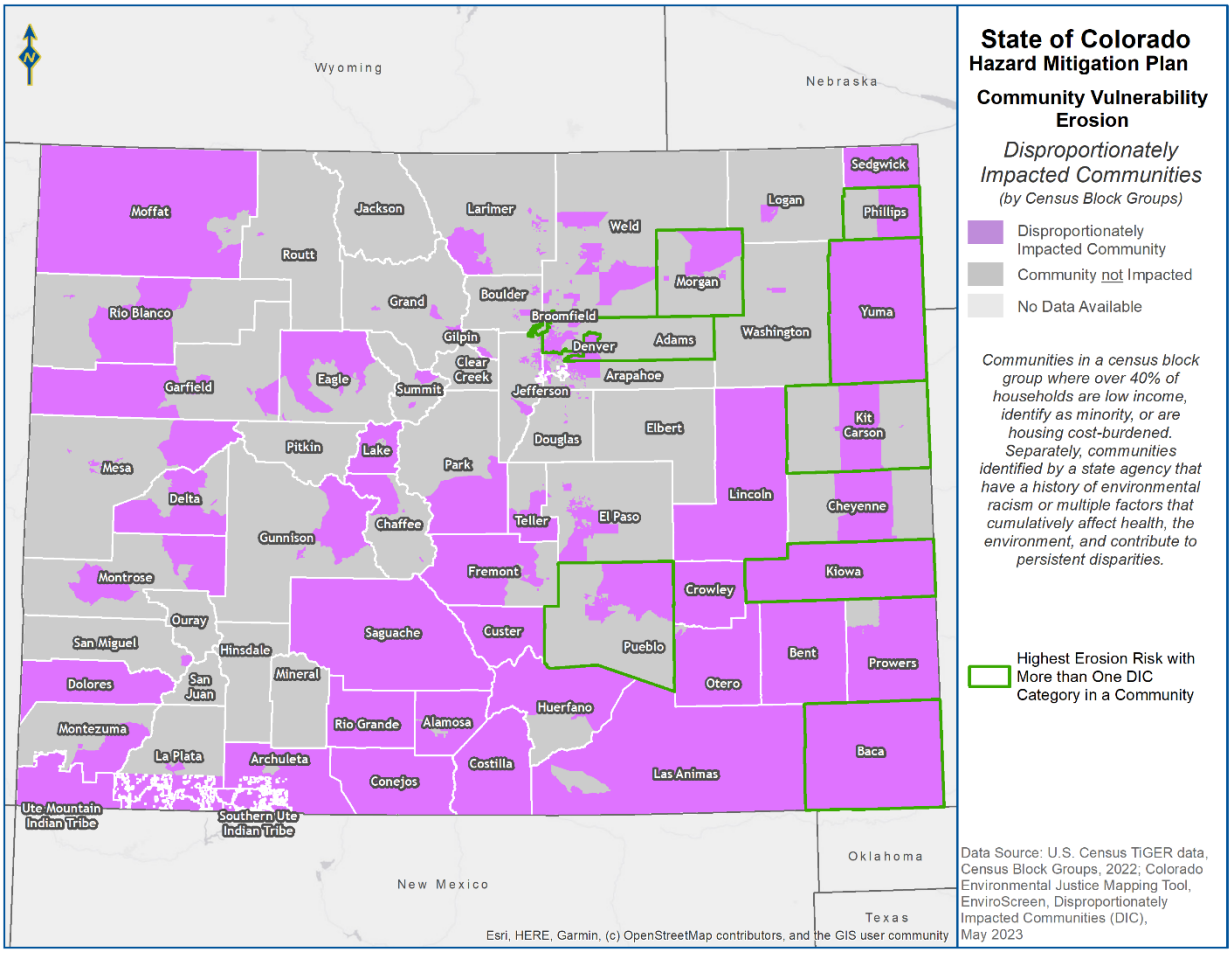
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 62. When comparing these communities to those counties with the highest percentage of wind deposit hazard areas (Figure 59), Adams, Broomfield, Baca, Kit Carson, Kiowa, Morgan, Phillips, and Yuma Counties each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 62 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to erosion / deposition include: low income, housing burdened, people of color, linguistically isolated, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 63 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: "High" (Adams, Morgan, and Pueblo), "Medium-High" (Baca, Kit Carson, Phillips, and Yuma), and "Low" (Broomfield, Kiowa). Additionally, there is a Community Disaster Resilience Zone (CDRZ) located in DIC identified communities in Kit Carson County and two in Yuma County.

FIGURE 63 COMMUNITY VULNERABILITY



State Assets

Previous Losses

The Office of Risk Management (ORM) reports a loss to state assets due to erosion in June 2011, in Glenwood Canyon, west of Hanging Lake Tunnel. High water erosion caused over $897,000 in damage to a biking and walking path.

The only other ORM losses reported were from a wall collapse in 2019 that caused $18,950 in damages.

The catastrophic flood on the Front Range, in 2013, primarily affected the northernmost counties. This event provides a benchmark for road and bridge infrastructure losses associated with a large-scale flood event and the associated

erosion. As of August 2020, CDOT reported the costs for highway systems repair work alone as $750 million[26]. Overall damage figures are not readily available. Damaged infrastructure included 486 miles of state roads and 120 bridges managed by the state across multiple counties.

Exposure

Erosion poses more risk than deposition and can result in substantial losses to state assets. Erosion in the "natural" sense poses little harm to state assets. However, when these assets are placed in proximity to erosion-prone environments the vulnerability increases significantly. This could relate to both state buildings and infrastructure. Scour is the erosion or removal of streambed or bank material from bridge or roadway foundations (and other types of infrastructure) due to flowing water.

Highways are the most vulnerable state asset type exposed to erosion and deposition hazard. The largest risk is to those state highways located alongside the state's rivers and streams. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

State-owned dams are another highly vulnerable state asset type. One, the Flagler Dam, is identified as being located in areas of windblown deposits.

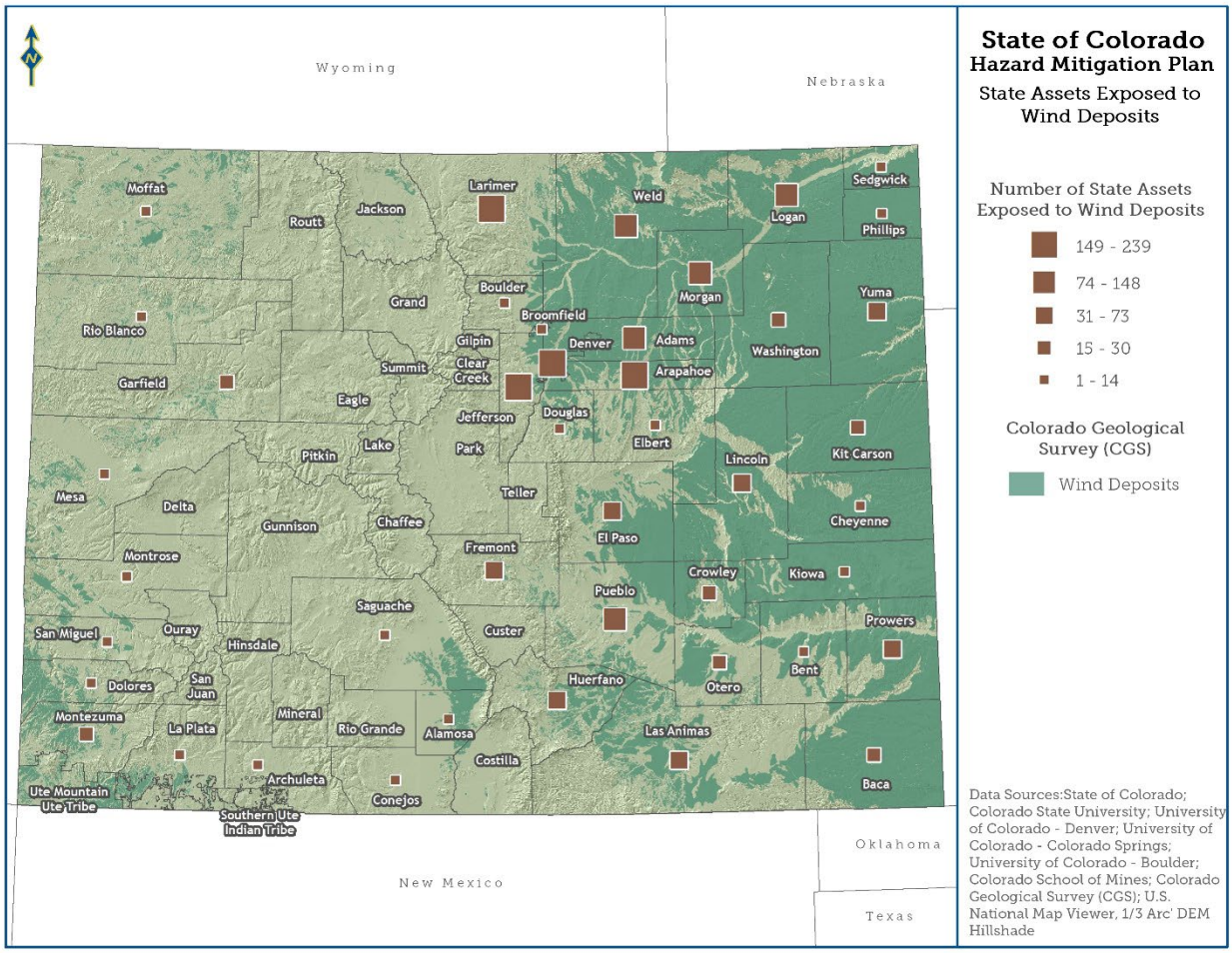
Bridges that were determined to be at risk from scour during flooding events are estimated by the Federal Highway Administration's National Bridge Inventory. Statewide, 251 bridges were determined to be scour critical as of 2023.

Figure 64 presents state assets that could be impacted by wind deposits across the state. These deposits are often not considered damaging until there is enough buildup of materials to impact equipment or structures. While deposits are concentrated on

[26] CDOT Risk and Resilience Analysis Procedure, p. 1

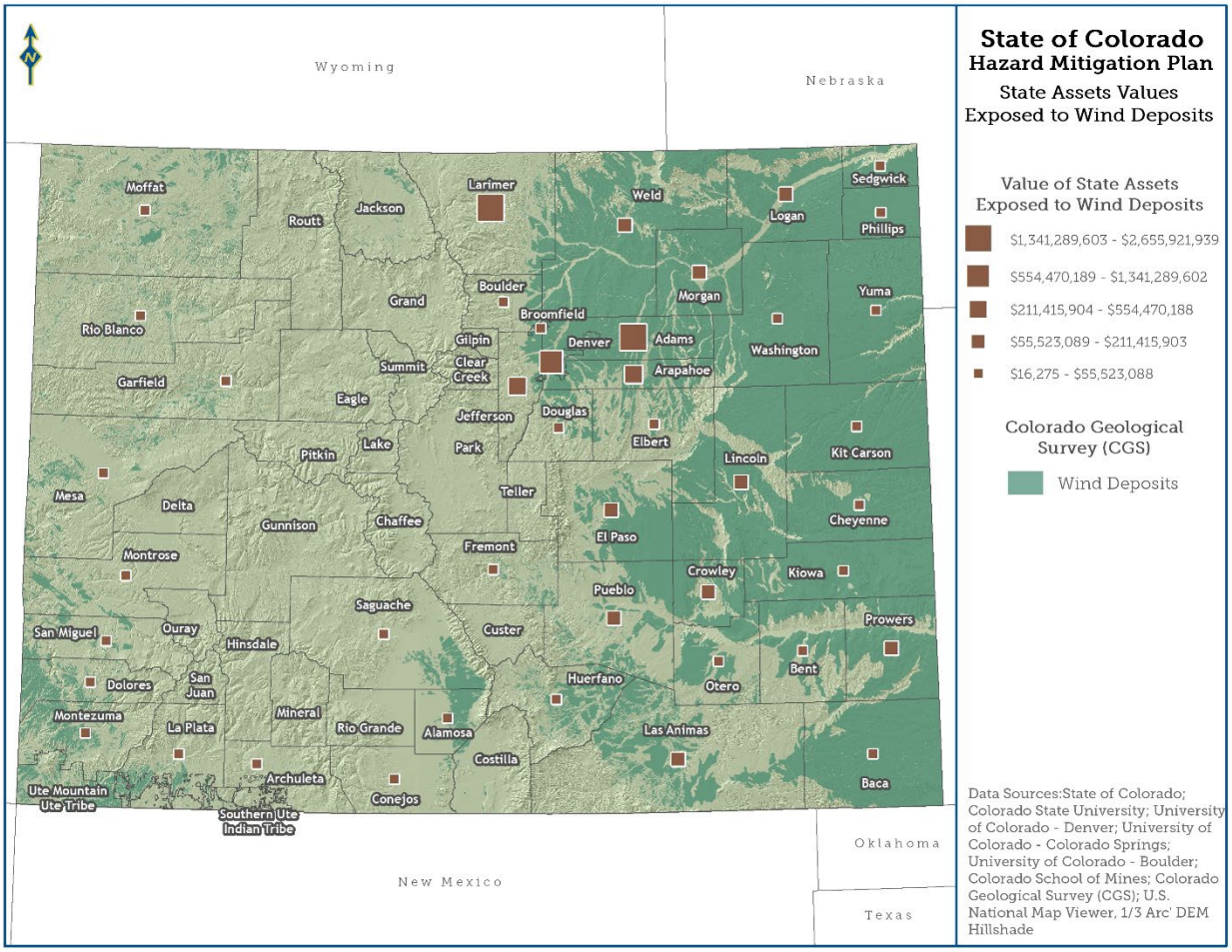
the eastern half of the state, higher exposed building counts occur in the more densely populated counties.

FIGURE 64 STATE ASSETS EXPOSED TO WIND DEPOSITS



Shown in Figure 65, a majority of the exposed state asset values is along the front range. Higher value exposure is found on the east half of the state, where a majority of wind deposits have been mapped.

FIGURE 65 STATE ASSET VALUES EXPOSED TO WIND DEPOSITS



Lifelines

Energy, food, hydration, and shelter, hazardous materials, and transportation are the community lifelines most vulnerable to the impacts from erosion and deposition. It is unlikely that all sectors could be affected, or resources strained due to the relatively small footprint of hazard events. There are likely no long-term effects on recovery and resilience.

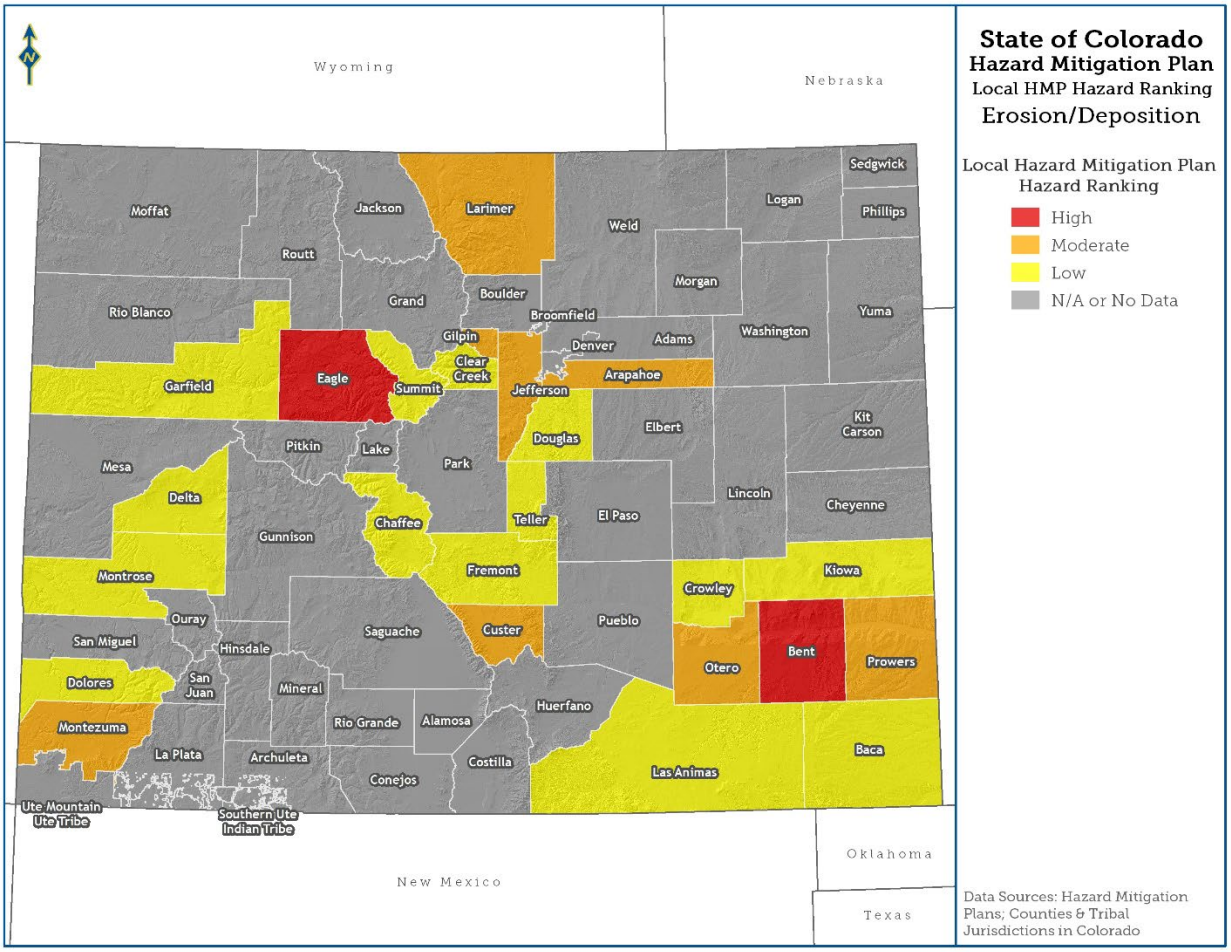
Erosion Depo-sition		Energy (Power & Fuel)	Food, Hydration, Shelter	Hazardous Materials			Transportation

Local County / Tribe

Hazard Rankings

Figure 66 shows that approximately one-third of the counties in the state profiled erosion and deposition in their local hazard mitigation plan. Of those a majority ranked the hazard as low risk, with two counties selecting high risk.

FIGURE 66 LOCAL HAZARD RANKING - EROSION AND DEPOSITION



Exposure

Exposure varies greatly across the state and can rapidly change following other hazard events. While all counties and tribes are at some risk, those on the eastern half of the state are most vulnerable.

Local-level analysis of erosion and deposition risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Erosion and deposition can cause or worsen avalanche, dam / levee incidents, flood, and landslide / debris flow / rockfall. Likewise, erosion / deposition can be the result of avalanche, dam / levee incidents, flood (including post-fire), and landslide / debris flow / rockfall events.

Recent and Future Development

Development can exacerbate issues of erosion and deposition if soil and stormwater impacts are not properly managed. By stripping ground vegetation, altering natural drainage, increasing impervious surface, and/or reducing stormwater infiltration, development can increase the likelihood of erosion and deposition. Erosion best management practices can help minimize impacts associated with future development.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- There are six new development sites across Douglas County located within the erosion hazard area; five within the low erosion risk area. The increase in population will expose more people to the erosion hazard area as residents move into these areas.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- While communities in the Roaring Fork Valley have enacted strict development standards for development on slopes and hillsides, the potential for extreme precipitation events fueled by climate warming may present increased risks to people and property in Eagle County.
- Areas of known geologic risk across La Plata County are not mapped. Development in these geo-hazard areas may occur in Hermosa.

Consequence Analysis

TABLE 27 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Property owners, farmers, and construction workers may be directly impacted by typically limited and localized events.
Responders	Little if any exposure exists to personnel performing routine duties when an event occurs. First responders will not directly report to erosion and deposition events, rather to cascading or unintended consequences resulting from these.
Continuity of Operations (Govt. & Services)	None or limited loss of facilities or infrastructure function or accessibility or ability to provide services.
Property, Facilities, & Infrastructure	Instances of property loss may occur if streamside property is undercut, construction activities induce an event, or buildings are placed in event prone geology. Physical loss of land may occur as erosion carries land from one property and deposits it on another. Severe erosion may remove the earth from beneath bridges, roads, and foundations of structures adjacent to streams.
Environment	This event innately impacts land and water. Earth materials are physically moved from one place to another and under certain circumstances, may be significant. Water quality may be impacted from siltation.

Consideration	Description
Economic	None or limited loss of facilities or infrastructure function or accessibility and limited uninsured damages.
Public Confidence in Govt.	Event characteristics such as duration and speed of onset result in limited response and recovery functions for government beyond first responders. If infrastructure damage occurs, such as a road washout, quick and cost-effective repair is expected.

Expansive Soils – Low Risk

Definition

Expansive, or swelling, soils or rock are defined as soils or soft bedrock that increase in volume as they get wet and shrink as they dry out. They are also commonly known as bentonite or montmorillinitic soils. The Colorado Geological Survey (CGS) is the primary source for the information related to expansive soils described below.

Swelling soils contain a high percentage of certain kinds of clay particles that are capable of absorbing large quantities of water. Soil volume may expand 20 percent or more as the clay becomes wet. The powerful force of expansion is capable of exerting pressures of 30,000 pounds per-square-foot or greater on buildings, roads, and other infrastructure.

In many instances, soils do not regain their original dryness after construction, remaining moist and expanded due to the changed environment. However, drought cycles can dramatically increase the amount of damages, as the contraction of the dry soils creates a “push and pull” effect on structures and infrastructure.

The more water swelling soils absorb the more and their volume increases. Irrigation of landscaping increases soil moisture as does covering soil with concrete and asphalt. Swelling soils also shrink when they dry out. This can remove support from building foundations, roads, utility lines, etc. Damages to buildings worsen over time due to repeated cycles of swelling and shrinkage.

Heaving/dipping bedrock is a geological hazard that is related to expansive soils, but it is more complex in terms of its uplift morphologies, deformation mechanisms, and regional distribution. It is capable of causing exceptional damages to buildings and other infrastructure.

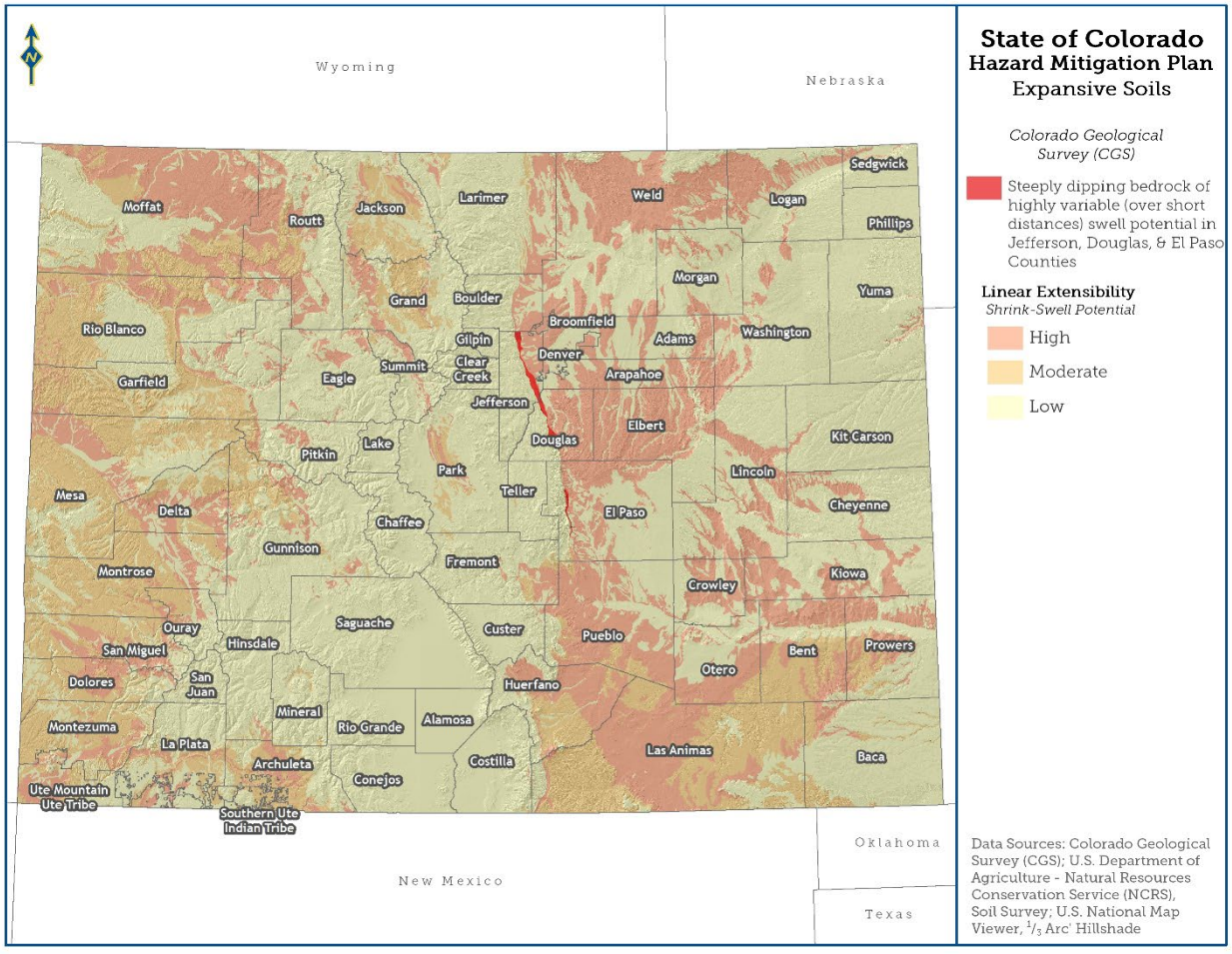
Location

Expansive soils occur throughout Colorado, as presented in Figure 67, although the shrink-swell potential varies by area. Rocks containing swelling clay are generally

softer and less resistant to weathering and erosion than other rocks and therefore, more often occur along the sides of mountain valleys and on the plains than in the mountains.

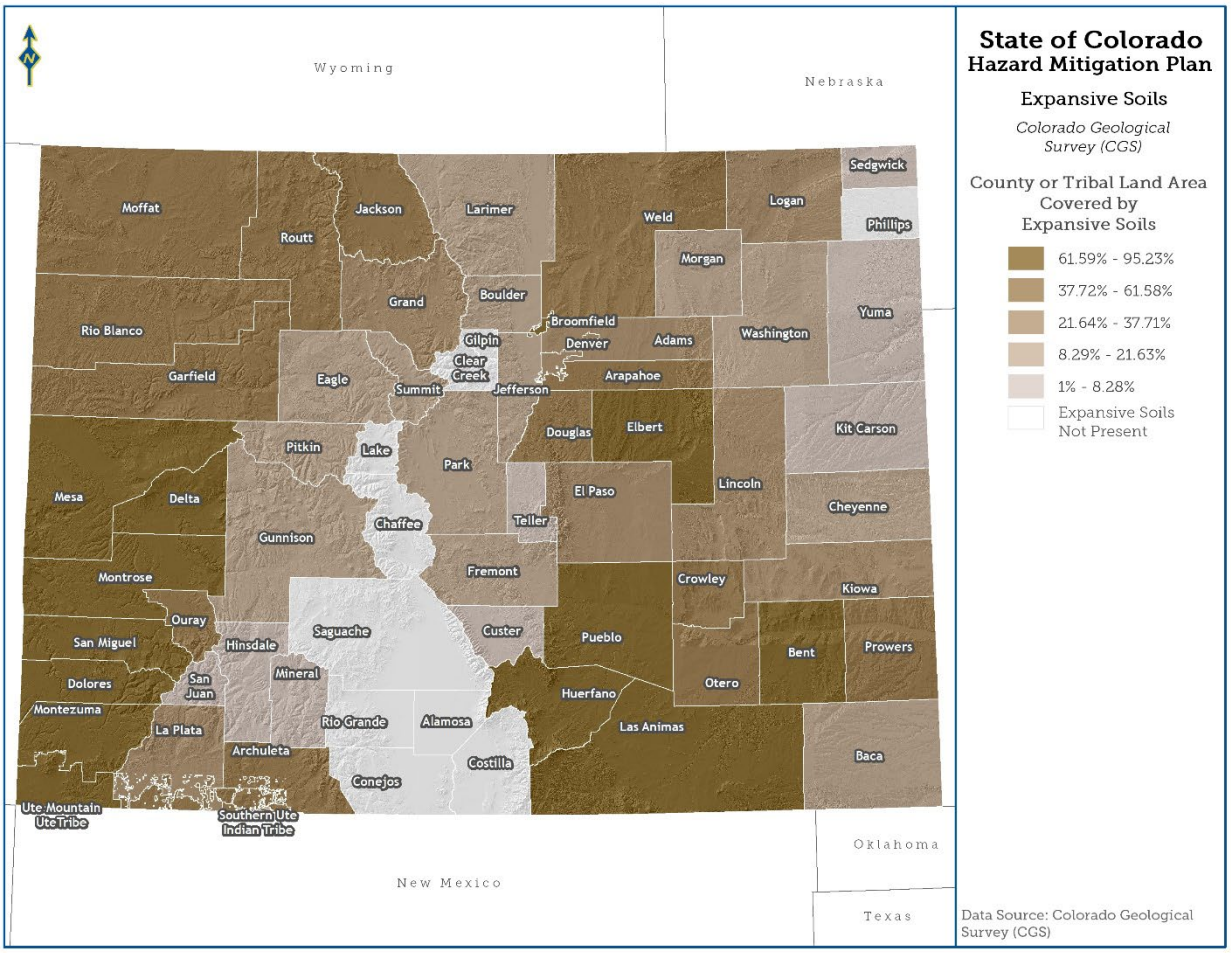
Heaving/dipping bedrock is common along Colorado's Front Range piedmont where steeply dipping sedimentary bedrock containing zones of expansive claystone is encountered near the ground surface.

FIGURE 67 EXPANSIVE SOILS HAZARD AREAS



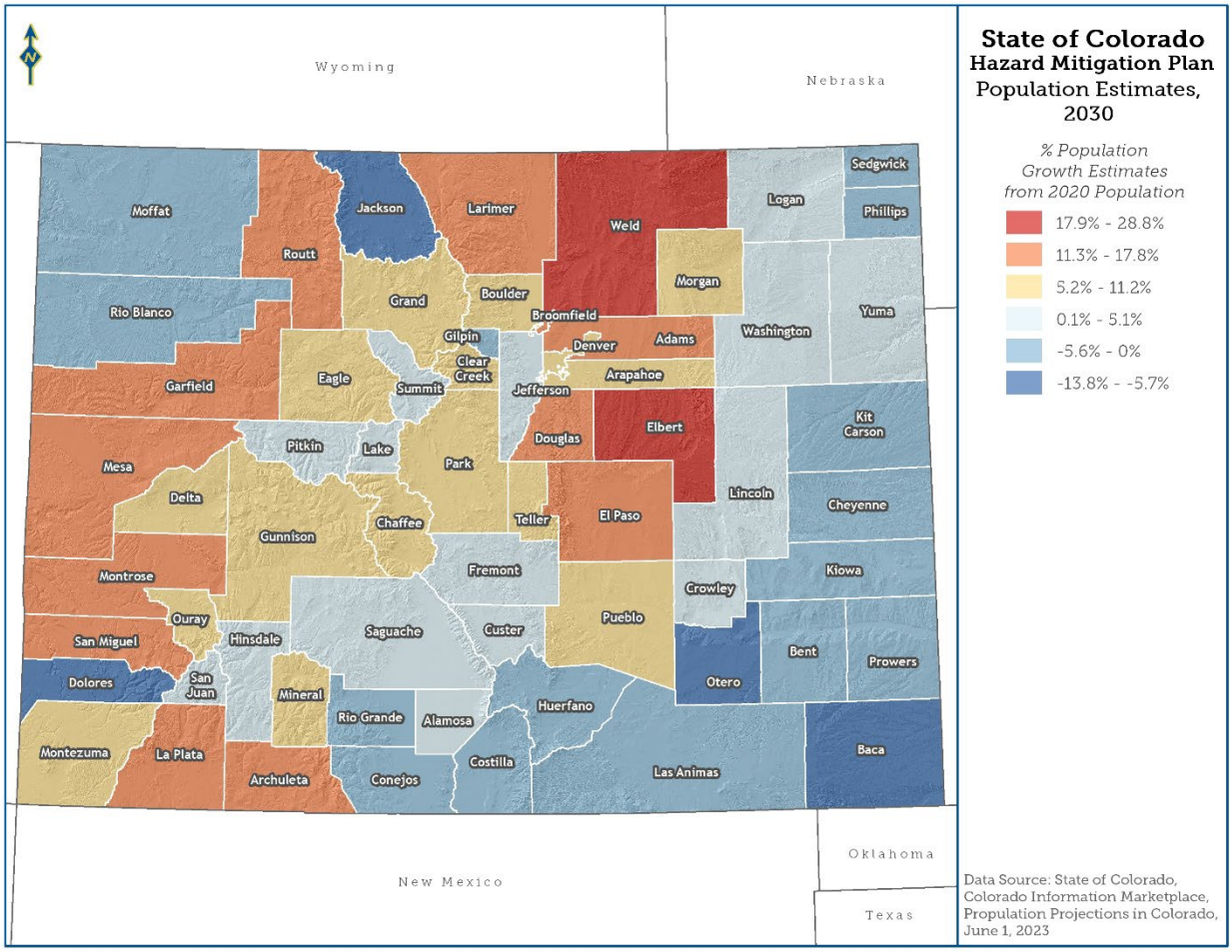
These hazard areas were collectively assessed to identify the percent of each county and tribal area at risk. Figure 68 shows those areas with the highest combined risk are located in the southwest portion of the state and also some of the southeast central counties.

FIGURE 68 EXPANSIVE SOIL AREAS BY COUNTY AND TRIBAL AREA



For comparison, Figure 69 presents the estimated population growth across the state through 2030.

FIGURE 69 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

Expansive soils vary by the potential for linear extensibility, or shrink-swell potential. Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. The volume change is reported as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the potential is moderate or higher, shrinking and swelling can cause

damage to buildings, roads, other structures, and to plant roots. Special considerations for structural design are common to mitigate against expansive soils.

The heave features associated with heaving bedrock are distinctly linear and are caused by differential swelling and/or rebound movements within the bedrock. Heaving bedrock has caused exceptional damage to structures, roads, and utilities along the base of the Front Range since suburban-type development began in the early 1970s. Much of this damage may be attributed to the longstanding tendency to assume that the bedrock may be treated, for site-exploration and design purposes, as an expansive soil having essentially uniform properties. This approach ignores the disparate nature of some bedrock.

Past Occurrences

Historical Events

Expansive soils have damaged structures across the state and this process takes place over many years.

Previous Losses

Expansive or swelling soils are one of the nation's most prevalent causes of damage to buildings and construction. The American Society of Civil Engineers states annual losses are regularly estimated to be greater than those of tornadoes, floods, earthquakes, and hurricanes combined. These losses are estimated in the range of $2.3 billion annually.

Notable Events

The following information on previous occurrences of damage caused by expansive soils is reported on the Colorado Geological Survey (CGS) website:

In 1970, the state of Colorado spent nearly $500,000 to repair cracked walls, floors, ceilings, and windows caused by swelling-clay damage at a state institution near Denver. A college building in western Colorado and a National Guard armory near Denver are among the other state buildings severely damaged by swelling clays.

In 1972, the library at Southern Colorado State College, now Colorado State University Pueblo Campus (CSU-Pueblo) required $170,000 to repair swelling-clay damage. A $2 million, six-year old building on the same campus was closed pending repairs to structural components pulled apart by swelling clay. Structures on the CSU-Pueblo campus were damaged because swelling soils were not recognized or compensated for adequately in design, construction and maintenance of buildings, sidewalks, driveways, and water lines. Water percolating into dry soils exposed by construction excavation caused the clays to expand, exerting tremendous upward pressures. Floors, walls, ceilings, sidewalks, water lines, driveways, and other improvements have sustained an estimated $1.5 million in damages.

In 1976 at the site of the new maximum-security facility for the Colorado State Prison in Fremont County, swelling soils and bedrock were shown on geologic maps. Field investigations and soils tests resulted in a remediation plan by the geologic and soils engineers, architect, builder, and others on foundation design, drainage, and landscaping. Millions of dollars in potential damages were avoided.

In 1996 Jeffco R1 schools closed and rebuilt Shaffer Elementary. The cost was estimated to be $8 to $10 million. The previous school was located in ground zero for heaving bedrock. Windows and doors became so damaged that they would no longer open and close, creating safety hazards. Differential movement of concrete floors posed significant tripping and fall hazards for disabled children and staff.

No figures are available for the total damage to homes in Colorado from swelling clays. Although, in 1995 Jefferson County reported that heaving bedrock is responsible for tens of millions of dollars in excess maintenance costs to county taxpayers. CGS notes that several examples are known where the cost of repairs exceeded the value of the structure.

Highways in some areas of Colorado have required frequent and very expensive reconstruction or maintenance due to damage from swelling clay. As much as one foot of uplift from swelling clay forced the repair of two concrete lanes of an interstate

highway in eastern Colorado only six months after completion of paving. In the same area, additional right-of-way had to be purchased, and the highway design had to be revised to eliminate cuts and fills to prevent similar problems with the two remaining lanes.

Probability

Expansion of soils is a naturally occurring process that has occurred historically and will continue to do so (100% chance). Conditions related to natural causes of expansive soils, such as precipitation and drought cycles, in addition to development and land use prevalent in the past, are expected to continue.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are not expected to directly influence future hazard events. However, the projected increase in frequency and duration of droughts due to climate change may cause an increase in the frequency of expansive soil events.

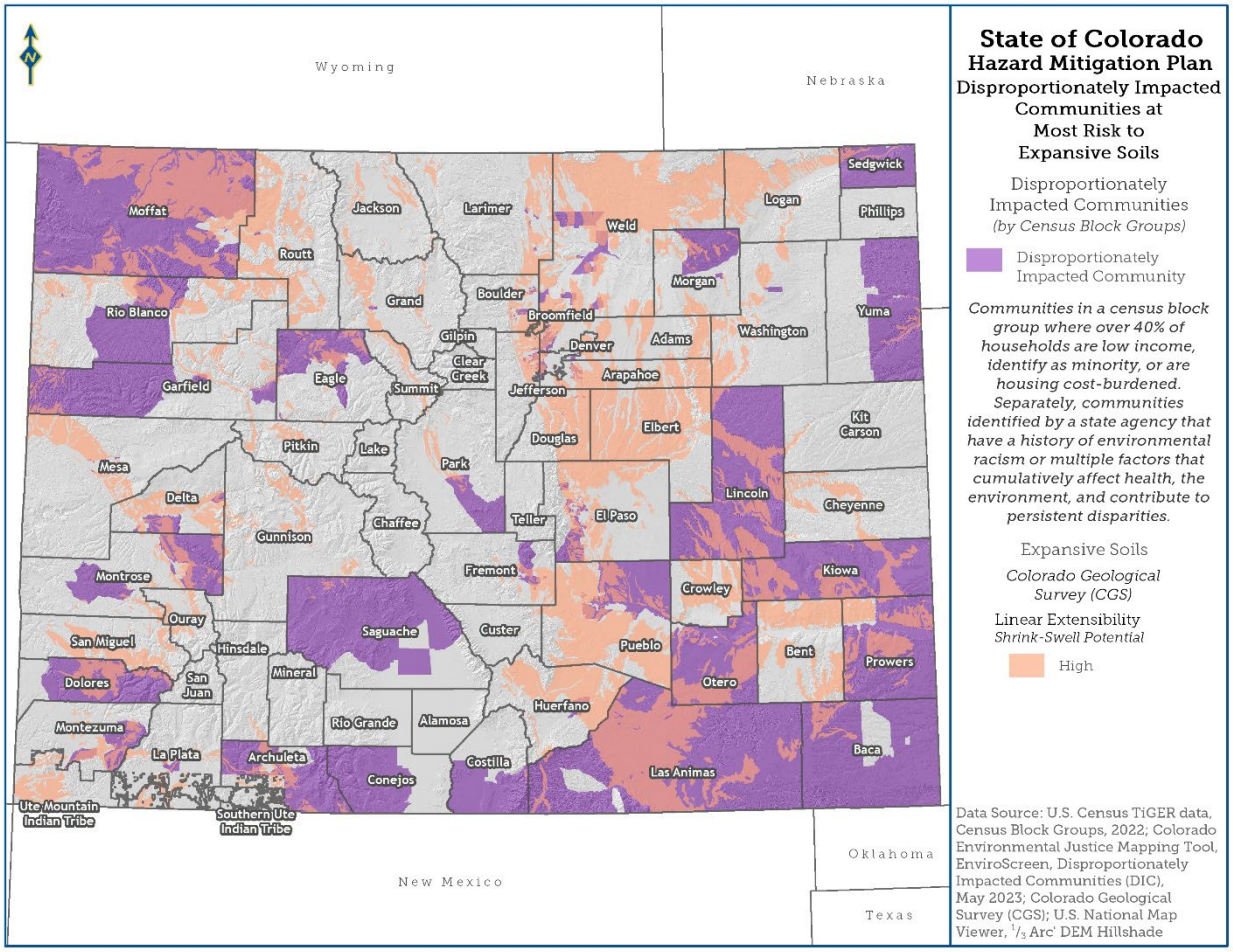
Risk & Vulnerability

Populations at Risk

Those with structures or homes built on expansive soils are at risk of damages from this hazard. Financial recovery from these soils impacting the integrity of a structure can be very difficult as insurance does not cover the hazard. Repairs can be more than the structure is worth and without proper mitigation, such as the use of piers, soils replacement, or chemical soil stabilization, owners could find themselves in the same situation in the future.

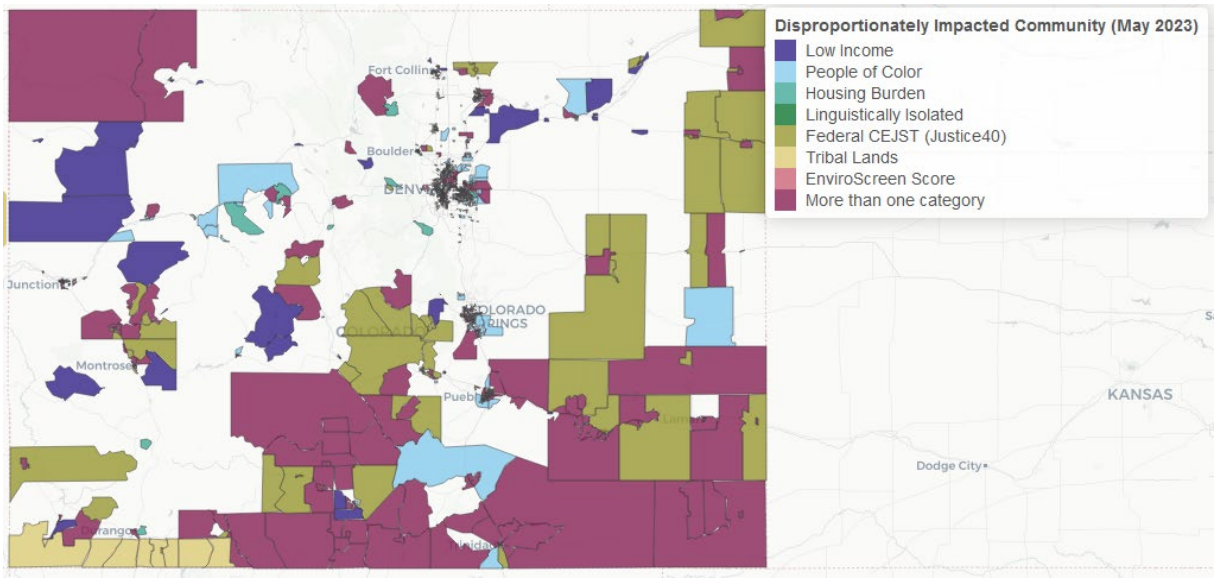
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 70 identifies those DIC communities, at a Census Block Group level, that have mapped high risk expansive soils areas.

FIGURE 70 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



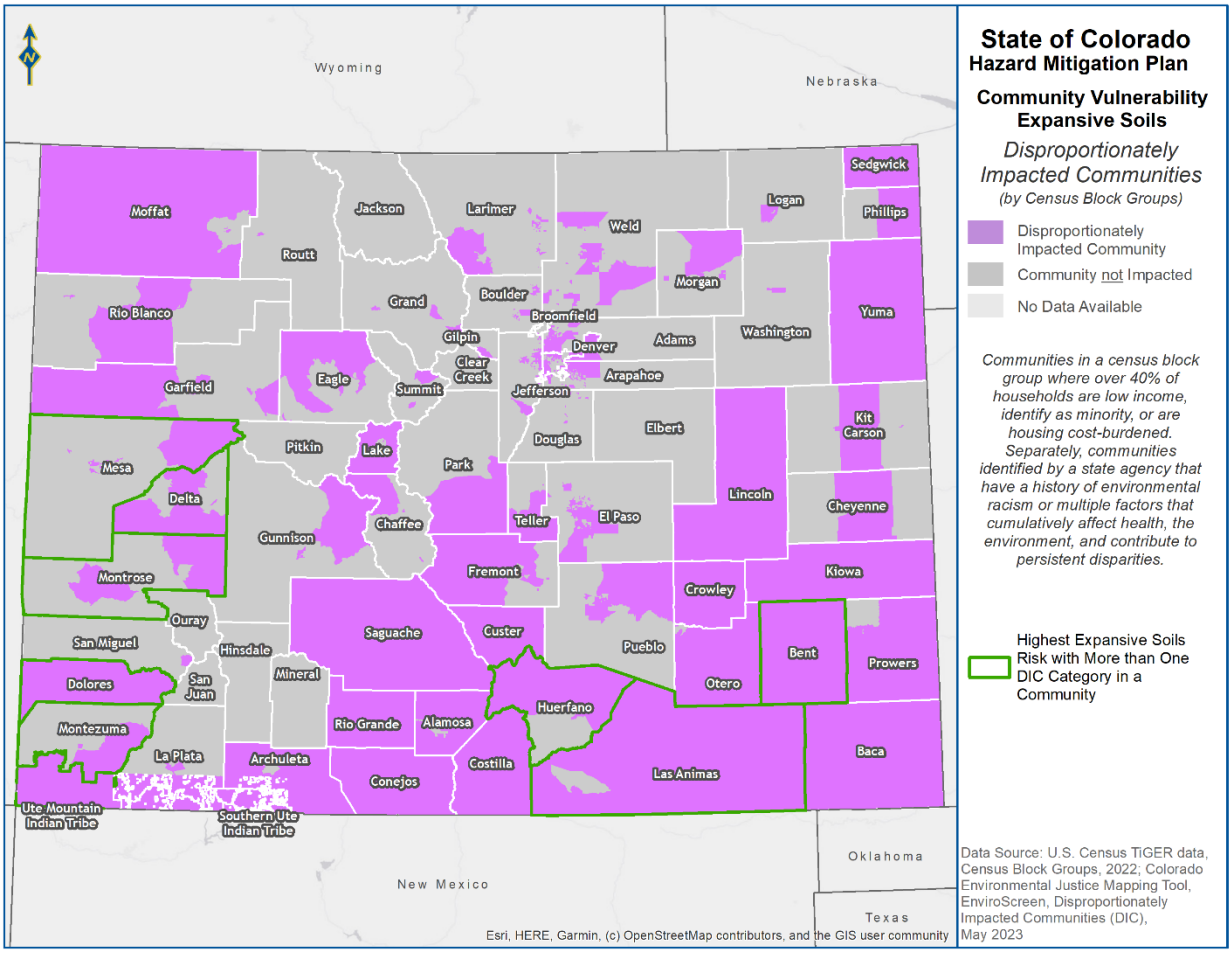
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 71. When comparing these communities to those counties with the highest percentage of expansive soils hazard areas (Figure 68), Bent, Dolores, Delta, Huerfano, Las Animas, Mesa, Montezuma, Montrose, and Pueblo County and the Ute Mountain Ute Tribe each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 71 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to expansive soils include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 72 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Bent, Delta, and Las Animas), “Medium-High” (Mesa, Montezuma, and Montrose), “Low-Medium” (Huerfano), and “Low” (Dolores). Additionally, there is a Community Disaster Resilience Zone (CDRZ) located in DIC identified communities in Pueblo County.

FIGURE 72 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Although expansive soils cause millions of dollars of damage in Colorado every year, the Office of Risk Management (ORM) does not report any losses to state asset buildings due to expansive soils in the past 15 years.

Exposure

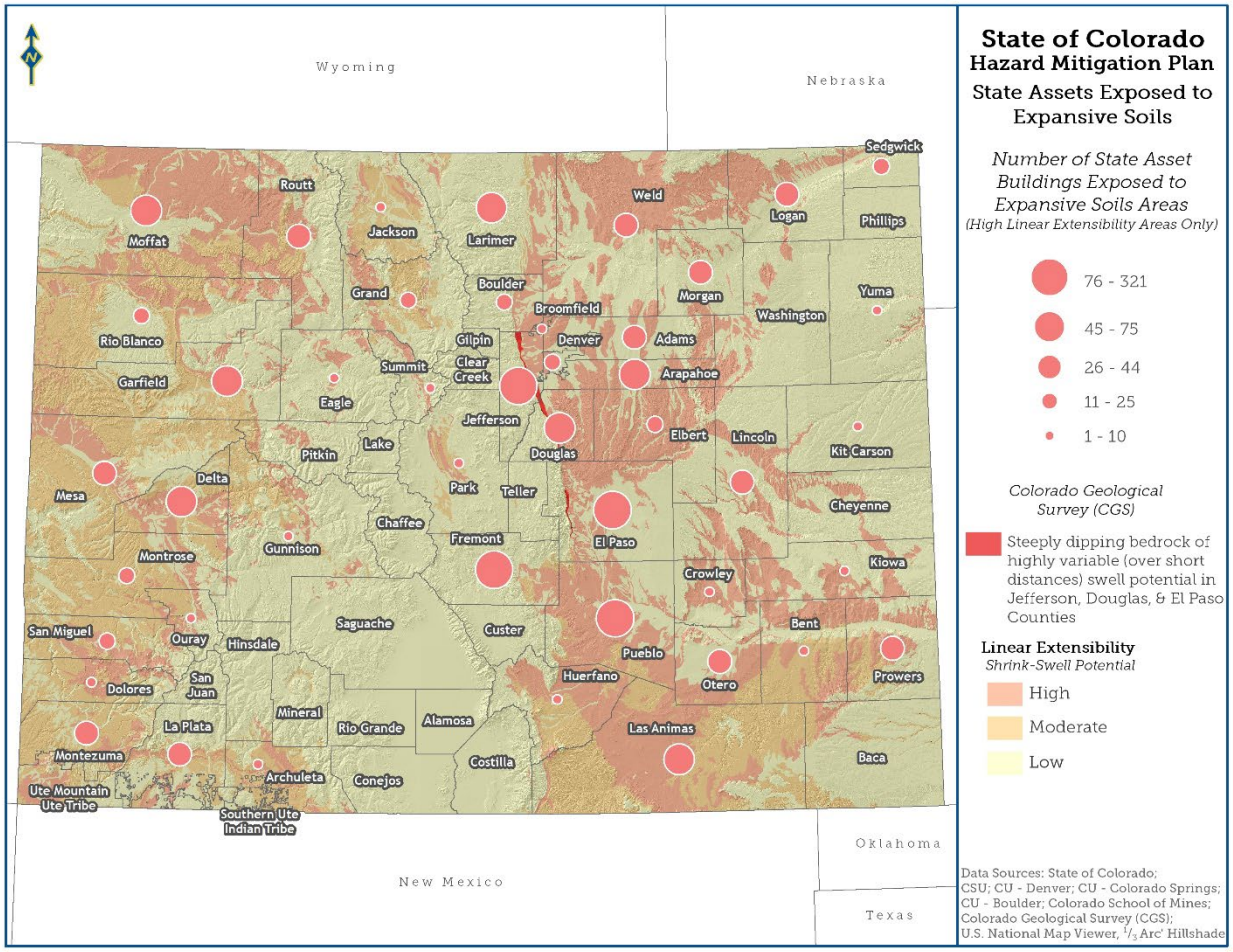
Expansive soils can result in losses to state assets and when these assets are placed in proximity to expansive soils environments the vulnerability increases significantly. This could relate to both state buildings and infrastructure.

Highways are the most vulnerable state asset type exposed to the expansive soils hazard. The largest risk is to those state highways located in identified hazard areas. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

Numerous state asset buildings and infrastructure are exposed to expansive soils across the state. The largest numbers are seen along the Front Range, as well as in Fremont County, as shown in Figure 73.

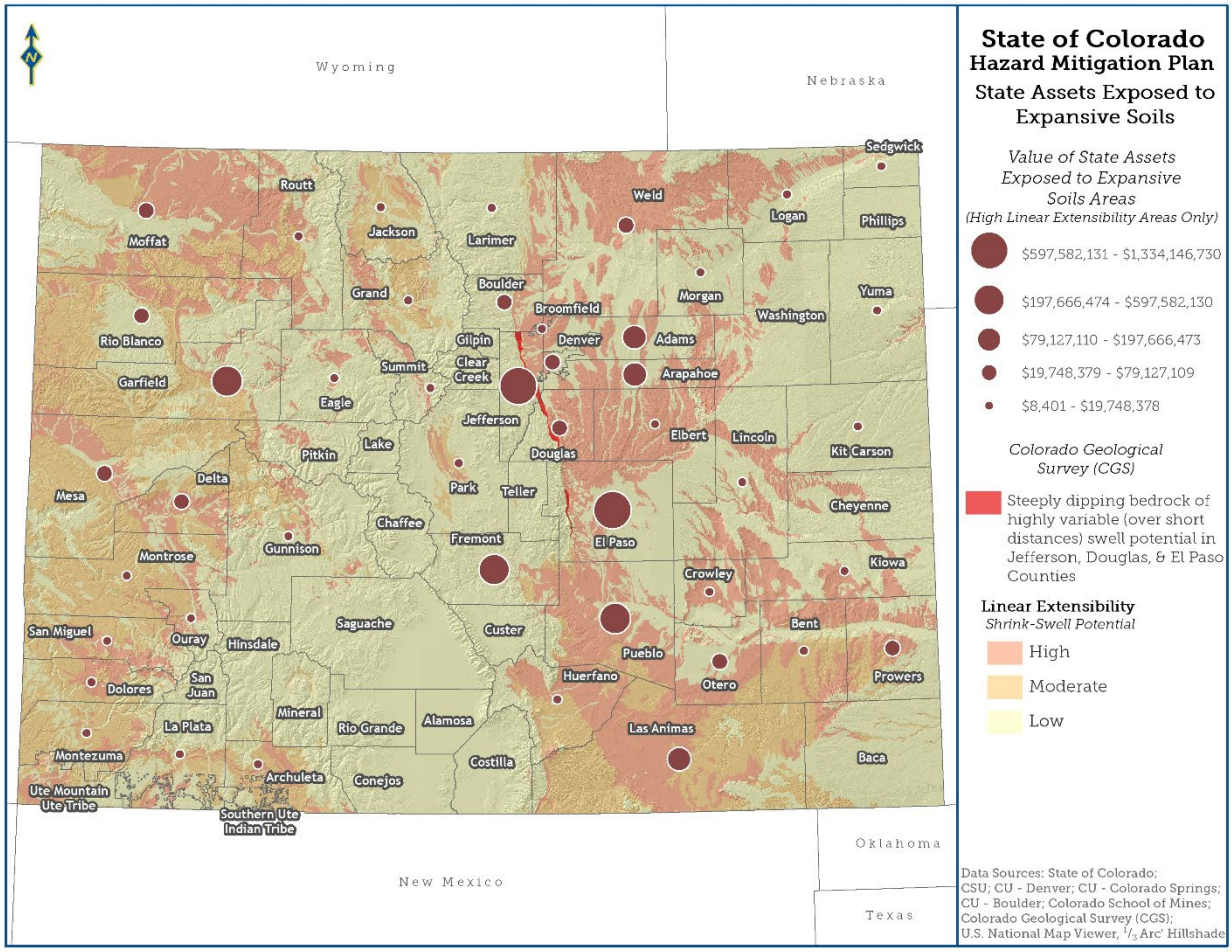
It should be noted that the statewide asset database utilized for this analysis does not contain any “structure type” data that would allow for a more detailed evaluation of specific risk.

FIGURE 73 STATE ASSETS EXPOSED TO EXPANSIVE SOILS



Most of the value for state assets exposed to expansive soils is located in the central portion of the state, as presented in Figure 74. The highest value of exposed assets are found in Jefferson and El Paso counties. The majority of the state is in the lowest value range of $8,000 to $19.7 million.

FIGURE 74 STATE ASSETS VALUES EXPOSED TO EXPANSIVE SOILS



Lifelines

The energy, food, hydration, and shelter, and transportation lifelines across Colorado are most vulnerable to the impacts from expansive soils. It is unlikely that all sectors could be affected, or resources strained due to the relatively small footprint of hazard events. There are likely no long-term effects on recovery and resilience.

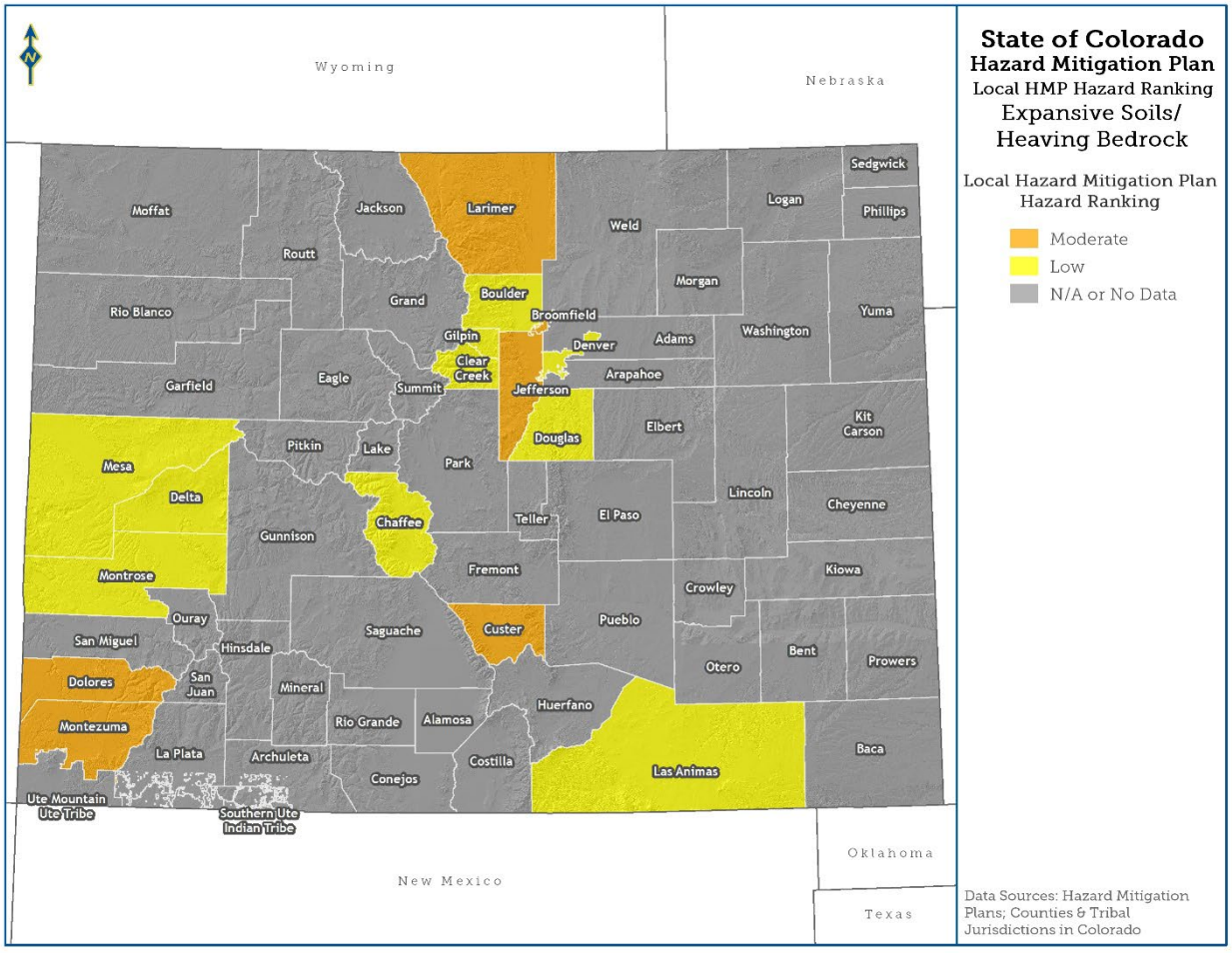
Expan-sive Soils		Energy (Power & Fuel)	Food, Hydration, Shelter				Transportation

Local County / Tribe

Hazard Rankings

As shown in Figure 75, roughly half of the counties that profile the hazard primarily ranked it low risk, while the others ranked the risk moderate. It is notable that some of the counties which appear to have high shrink-swell potential expansive soils did not profile or rank the hazard. While a county may contain large areas of expansive soils there may be no direct risk to people and property, now or in planned development, so a county may not see it as a priority.

FIGURE 75 LOCAL HAZARD RISK RANKING – EXPANSIVE SOILS / HEAVING BEDROCK



Exposure

The expansive soils with the highest shrink-swell potential in Colorado are found sporadically along the Front Range and Eastern Plains, and the northwest and

southwest regions of the state. The areas of steeply dipping bedrock are specific to Jefferson, Douglas, and El Paso counties.

Local-level analysis of expansive soils risk to structures is not provided in any of the state's HMPs for counties located in high risk areas. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Drought, extreme heat, flood, and thunderstorm / lightning can all exacerbate the impacts of expansive soils.

Recent and Future Development

As the population in the state continues to grow, the expansive soil hazard should be evaluated and addressed prior to any new development.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- Areas of known geologic risk across La Plata County are not mapped. Development in these geo-hazard areas may occur in Hermosa.
- Newer construction across Broomfield may have included mitigation techniques to avoid most damage from the hazard, but the dangers continue if mitigation actions are not supported by homeowners. For example, the maintenance of grading away from foundations and the use of appropriate landscaping near structures must be continued to prevent an overabundance of water in vulnerable soils near structures. While continued public education efforts may help increase compliance for landscaping and interior finishing mitigation actions, physical reconstruction of foundations is probably not feasible in all but the most heavily impacted of existing development. Therefore, damages

may be expected into the future for existing structures. Because such a large portion of the County is exposed to expansive soils, limiting development in at-risk areas is not practical.

- As development pressures continue in un-developed areas of Larimer County, vulnerability to soil hazards in those areas is likely to increase.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- As communities continue to grow and expand throughout Garfield County, new buildings and infrastructure become at risk in zones with expansive soils. Of particular concern are areas surrounding the Town of Silt and Town of Carbondale as much of the surrounding land has significant expansive soil risk.

Consequence Analysis

TABLE 28 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Risk is related to anything built on the ground that may be affected from slow movement and includes homeowners, developers, and owners of public facilities and infrastructure. CGS reports that one in five people is affected by expansive soils.
Responders	Some exposure exists to personnel performing routine duties after a specific site is impacted and unstable.
Continuity of Operations (Govt. & Services)	None, or limited loss of facilities or infrastructure function or accessibility, or ability to provide services. May have limited power interruption if not adequately equipped with backup generation.

Consideration	Description
Property, Facilities, & Infrastructure	Instances of property losses due to shrinking and swelling can cause major or long-term property damage impacting structural stability. Instances of infrastructure damage due to shrinking and swelling can cause major or long-term structural damage.
Environment	Limited impact anticipated to the environment other than changes in soil characteristics.
Economic	None, or limited loss of facilities or infrastructure function or accessibility, and limited uninsured damages.
Public Confidence in Govt.	Characteristics of expansive soils such as duration and speed of onset result in limited response functions for government beyond building inspection and repair.

Extreme Heat – High Risk

Definition

Extreme heat can pose severe and life-threatening problems for Colorado's citizens. Definitions of extreme heat events, also called heat waves, vary depending on source, data availability, time period of extreme heat occurrence, and the type of heat metric utilized. Two types of temperature metrics can be used to determine the threshold that characterizes a day as having extreme heat, absolute or relative.

An absolute threshold is based on a daily heat metric that does not change. A day could be categorized as extreme heat at 90°, 95°, 100° or 105° F, depending on whose definition is used and regardless of geographical considerations. Some areas in Colorado do not reach 90°F temperatures but may have a period of notably higher than normal temperatures.

A relative threshold accounts for variations in daily temperatures based on historical distribution of temperature, in a given location, using percentiles such as 90^{th}, 95^{th}, 98^{th}, or 99^{th}. The 90^{th} percentile is equivalent to a 10% chance that temperatures will be above the historical daily threshold for the location. This accounts for the varied geography and climates across the state when determining extreme heat.

Extreme heat is most dangerous when temperatures remain high for multiple days, referred to as an extreme heat event. The number of days required, whether they are consecutive or grouped, and the analysis method all differ throughout climate studies and sources.

Ultimately, multiple days in a relatively short time of unseasonably hot weather may reach the definition of an extreme heat event. For the purposes of the extreme heat event mapping in this section, the definition of an extreme heat event is three consecutive days, with temperatures in the 95th percentile based on the recorded maximum temperature.

Location

Extreme heat has the potential to impact anywhere in the state, although average temperatures across Colorado vary by area and with changes in elevation. Many parts of the state, including much of the eastern and flat-lying areas on the Western Slope, experience extreme temperature variations. Much of the state is categorized as high desert, subject to very dry, hot conditions and frequent droughts.

Metropolitan areas regularly experience higher temperatures than surrounding more rural areas, known as the urban heat island effect. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. The main cause of the urban heat island effect is from the modification of land surfaces from soil and vegetation to human materials which store more heat. On a hot, sunny summer day, roof and pavement surface temperatures can be 50-90°F hotter than the air, while shaded or moist surfaces - often in more rural surroundings - remain close to air temperatures.[27] (EPA, "Heat Island Impacts", accessed December 2017).

Air temperatures in cities, particularly after sunset, can be as much as 15° to 27° warmer than the air in neighboring, less developed regions. In addition to raising average daytime temperatures and reducing night-time cooling effects, heat islands can also exacerbate the impact of extreme heat events. Due to the heat island effect, the major urban areas of the state are likely to experience more extreme heat events than their respective regions overall.

Contributing Factors

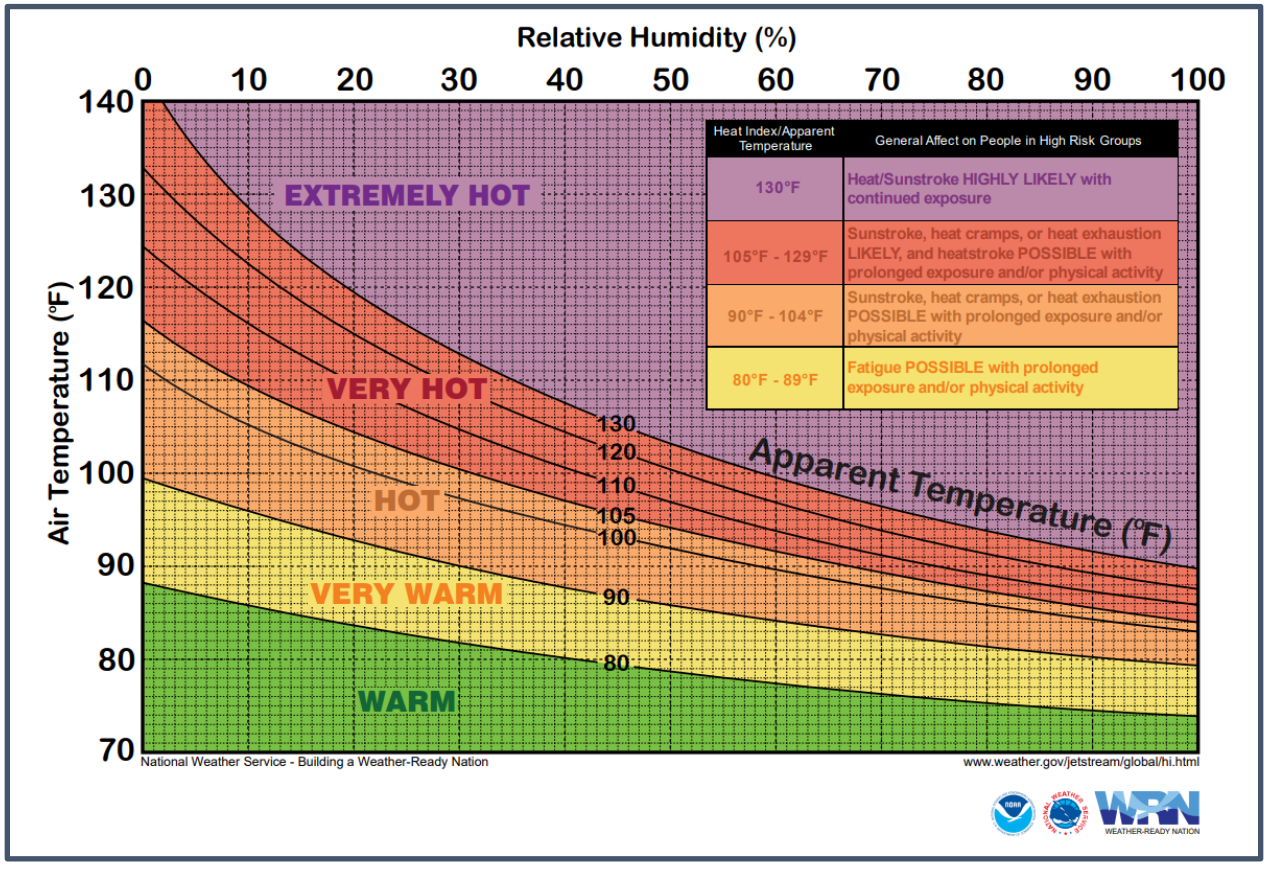
According to the Centers for Disease Control and Prevention (CDC), temperatures of 90°F and above can cause major health impacts, depending on individuals' exposure and the humidity. Figure 76 shows NOAA's National Weather Service (NWS) Heat Index which indicates the way temperature and humidity feel to the human body. The Heat Index table assumes shady conditions with a light wind, while exposure to full

[27] EPA, "Heat Island Impacts", accessed December 2017

sunshine can increase heat index values by up to 15 percent. Figure 77 details the classifications of the various heat categories and general impacts each can have on high-risk groups.

Humidity is not typically considered a major factor in determining extreme heat risks in Colorado's counties. The Heat Index provides an estimation about the "feel" of the weather but conditions for each individual will differ. Indoor conditions may vary, potentially trapping heat and making them more dangerous. This is especially a concern for those who are homebound, in long term care facilities, and those living without adequate cooling capabilities.

FIGURE 76 NOAA HEAT INDEX GRAPHIC[28]



[28] Heat Index | National Oceanic and Atmospheric Administration (noaa.gov)

FIGURE 77 NOAA HEAT INDEX NARRATIVE

Category	Classification	Heat Index/Apparent Temperature	General Affect on People in High Risk Groups
I	Extremely Hot	130°F or Higher (54°C or Higher)	Heat/Sunstroke **HIGHLY LIKELY** with continued exposure
II	Very Hot	105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion **LIKELY**, and heat stroke **POSSIBLE** with prolonged exposure and/or physical activity
III	Hot	90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion **POSSIBLE** with prolonged exposure and/or physical activity
IV	Very Warm	80°F - 90°F (27°C - 32°C)	Fatigue **POSSIBLE** with prolonged exposure and/or physical activity

The HeatRisk[29] tool was created in a collaborative effort between NWS and CDC to "identify temperature thresholds and develop an alert service that issues heat forecasts using data and methods that are relevant from a public health perspective". The tool is specifically designed to forecast risk impacts and educate decision-makers and heat sensitive populations. The HeatRisk tool is meant to ensure communities have the right information, at the right time, to be prepared for upcoming heat events, especially vulnerable populations and underserved communities that are historically disproportionately impacted.

The HeatRisk approach uses the relative threshold, 95th percentile, to identify unusual heat that is unique for each location and date. This allows the approach to better account for acclimation and the variation in climatology that exists across the state. The tool also takes into account the impacts of excessively warm nights and the impacts from heat over the entire 24 hour period, which play critical roles in the health effects of an extreme heat event.

The tool uses the data and methods to deliver the information to the public through mapping. Table 29 shows the HeatRisk categories, including the value, color, and risk

[29] NWS HeatRisk (noaa.gov)

assigned to each. A description of populations that may see the greatest impacts is also shown.

TABLE 29 NWS HEATRISK TOOL INDICATORS

Green 0	**Little to no risk** from expected heat.
Yellow 1	**Minor** – This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	**Moderate** - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
Red 3	**Major** - This level of heat affects anyone without effective cooling and/or adequate hydration. Poor air quality is possible. Impacts likely in some health systems, heat-sensitive industries, and infrastructure.
Magenta 4	**Extreme** - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Poor air quality is likely. Impacts likely in most health systems, heat-sensitive industries, and infrastructure.

Duration of extreme heat events is the factor that most stresses systems, impacts public health, and has lingering effects beyond the days of reported high heat. Delayed impacts after a long event include issues after the heat has subsided, such as deaths and hospitalizations, and potential damages to overstressed systems, including overtaxed power grids.

The combination of extreme heat and the added demand for electricity to run air conditioning causes transmission line temperatures to rise. Power lines can sag due to high temperatures which can lead to power outages. High ambient air temperatures

can impact industry as well, reducing both efficiency and available generating capacity of thermoelectric power plants, as well as coal, nuclear, concentrated solar power, geothermal, and some natural gas power plants[30].

Similarly, temperatures over 90 °F can impact roads, bridges, railways, and airports. Road materials have a limited range of heat tolerance, and road buckling occurs with sustained temperatures above 90 °F. Bridges are particularly vulnerable to extended high temperatures, which stress bridge integrity. Extended periods of extreme heat cause bridges to expand and shorten the useful life of pavement life, which can result in negative economic impacts.

Agriculture can be severely impacted by extreme heat days, especially long duration events. Plant growth can be negatively affected, including the effect of warmer night temperatures on development. Livestock can experience heat stress impacting production and growth.

Past Occurrences

Historical Events

Extreme heat events can have significantly varied definitions. Figure 78 details the extreme heat event totals across the state from 1979 to 2021. This CDC-compiled data presents events of at least 3 consecutive days, with daily high temperatures in the 95th percentile specific to the unique locations. This accounts for the differences in geography and the associated climates.

While the data begins in 1979, it is important to note that across all counties in the state between approximately one-third and two-thirds of these events have occurred since 2010. For example, over half of the events in Custer, Chaffee, Huerfano, and Las Animas counties happened between 2010 and 2021. In Pueblo County, almost two-thirds of the total events occurred since 2010.

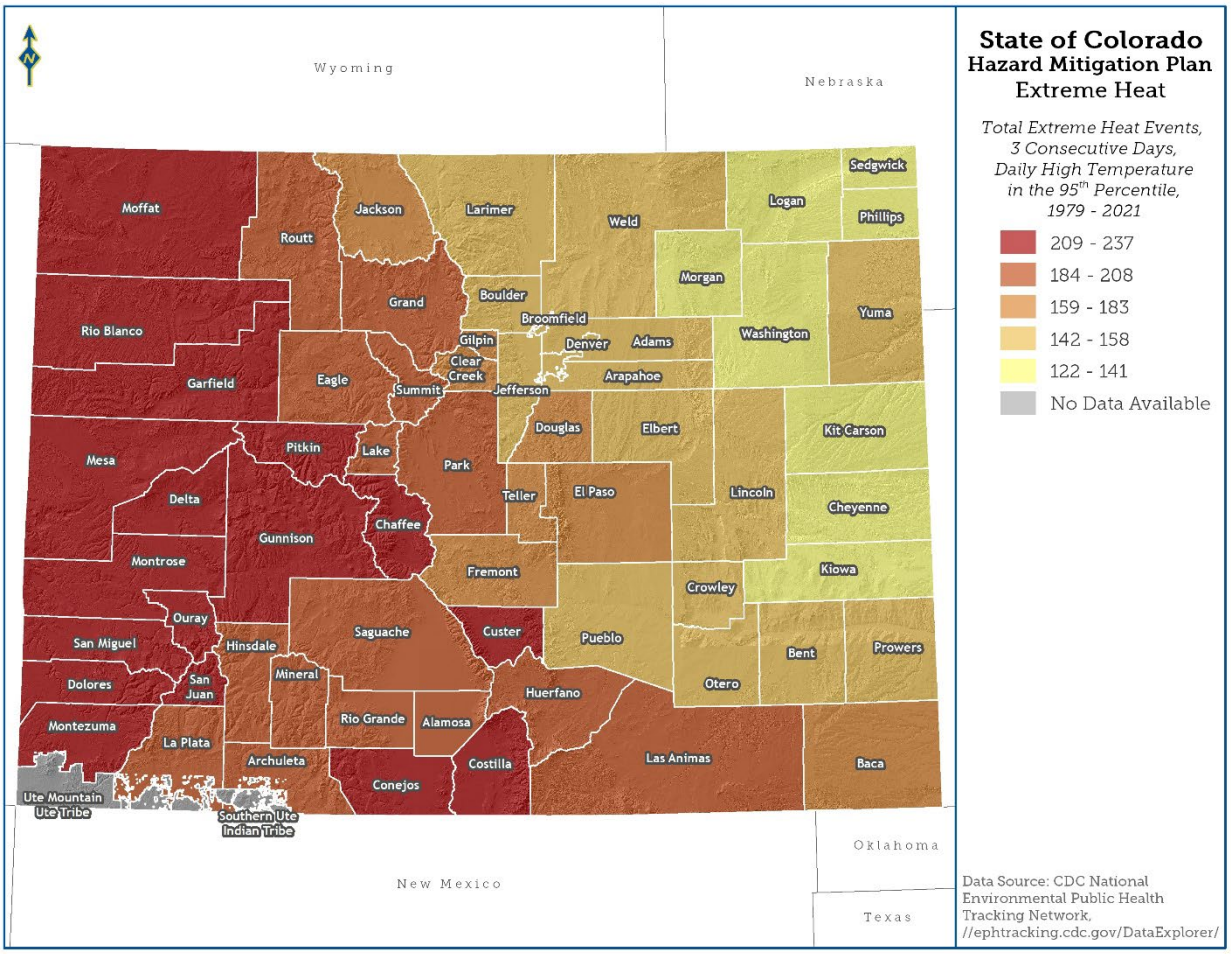
[30] Extreme Weather & Climate Vulnerabilities of the Electric Grid, Oak Ridge National Lab, 2019. p. 9

The map shows the western region of the state and some counties located in the south-central region have experienced the most extreme heat events between 1979 and 2021.

The eastern region by comparison has experienced less total events in a majority of the counties over the same period. Average temperatures tend to be higher in the plains and reaching the 95th percentile occurs less often, or for only one or two days, leading to lower event numbers.

Components within these events including the temperature range within the 95th percentile and humidity levels can further exacerbate dangerous conditions.

FIGURE 78 EXTREME HEAT EVENTS BY COUNTY



Previous Losses

Data from the CDC shows there were 26 deaths attributed to heat in the state between 2016 and 2020. Overall figures available show a total of 57 deaths attributed to heat between 1999 and 2020.

Losses due to extreme heat events can be difficult to quantify, due to the delay in the impacts on a growing crop or the complexity of many hazard events coinciding. It is unlikely the effects can be tracked separately for each hazard.

The United State Department of Agriculture supports farmers through disaster assistance and emergency relief programs for physical losses that result from a hazard. The Secretary of Agriculture is able to designate a declaration for areas affected by these hazards, which makes federal funding available to those impacted.

The most common declaration is for drought, although the program accounts for 24 hazards. Designations can be for primary and contiguous (border sharing) counties, and multiple declarations can be granted in a crop year.

Declarations for "Heat, Excessive Heat, and High Heat" have been granted by the USDA Secretary in the past. In Colorado, historical extremes included 104 primary and contiguous counties in 2012, 146 in 2013, and 112 in 2014. Each of these declarations also included drought and no declarations have been designated for heat related losses since 2015. Figures for the assistance received are not easily available. In addition to ongoing drought issues, there may be more heat related crop and livestock impacts, which can be difficult to monitor as temperatures fluctuate.

Notable Events

The state experienced major, widespread heat waves during the Dust Bowl in the 1930s and the La Nina event in the mid-1950's.

In July 2008, a new record for the number of consecutive days above 90°F in Denver was set, with 24 days, which surpassed the previous record by almost a week. In 2012, the record was matched and that same year the temperature was 6.4°F warmer than

average, making Colorado the warmest state in the country for the month of July. Also in 2012, the state broke eight heat records and tied 15. Eastern state counties, including Prowers and Bent, recorded repeated unofficial highs over 110°F.

During the 1980 heat wave, hundreds of miles of highways buckled across the state. The demand for electric power during heat waves is well documented. In 1980, consumers paid $1.3 billion more for electric power during the summer than the previous year. That demand for electricity, 5.5% above normal, outstripped the supply, causing electric companies to institute rolling black outs.

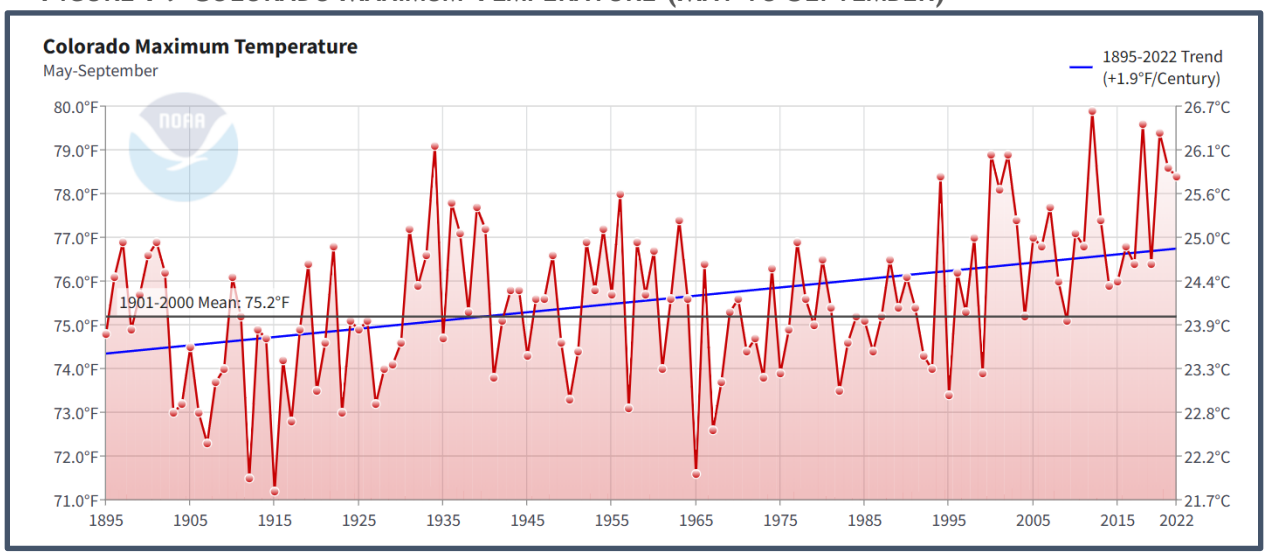
NOAA temperature reporting began in 1872 and data shows there have only been 15 occurrences of two consecutive days of 100°F temperatures since then. The most consecutive days with 100°F was five days, which has occurred three times in 2012, 2005, and 1989. According to the Colorado Climate Center, the highest temperature recorded in Colorado was 115°F on July 20th, 2019, in southeast Colorado at the John Martin Dam in Bent County.

Probability

Extreme heat events will continue and according to the Colorado Climate Center "heat waves are projected to increase in all parts of Colorado as the climate warms, and at a rapid pace." Based on CDC extreme heat event data, 44% of the total events recorded in Colorado since 1979, have occurred since 2010.

Extreme heat events will continue to occur annually (100% chance), although a common definition of the duration and threshold of an event would allow for more cohesive research. Overall, temperatures are increasing, the trend in Figure 79, shows NOAA data, of May to September maximum temperatures, since 1895 suggests the temperatures have seen a steady rise and will very likely continue to do so.

FIGURE 79 COLORADO MAXIMUM TEMPERATURE (MAY TO SEPTEMBER)



Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future extreme heat events. Table 30 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 30 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	At present, extreme heat events occur in lower elevation areas across the state. These events are projected to increase and expand to more northern and higher elevation regions in the future.
Extent/Intensity	Extreme heat events are projected to increase in intensity. The extent of extreme heat events is also projected to increase.
Frequency	The frequency of extreme heat events is projected to rise.
Duration	The duration of extreme heat events is projected to increase.

Risk & Vulnerability

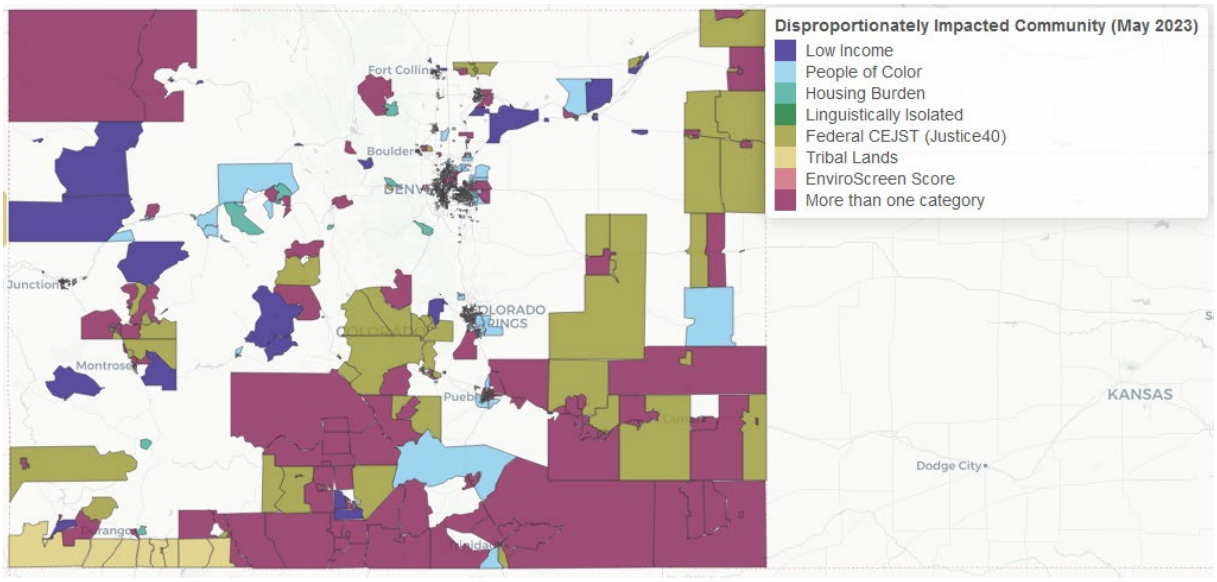
Populations at Risk

All people in the State of Colorado are at risk of the negative impacts of an extreme heat event. Those in underserved communities and with social vulnerabilities are at a disproportionate disadvantage. Multiple factors help to keep individuals healthy during these events, the most critical being safe shelter and adequate cooling capabilities. Groups with specific sensitivity to heat, including the elderly, children, those with chronic illness, and those with access and functional needs may require assistance. This could include people who are isolated, in a long-term care facility, or require medical care, among others.

Those without cooling capability, transportation, or funding to get to a location out of the heat are a crucial population to assist in finding a solution. People working outdoors may not realize their level of vulnerability and communication is paramount to ensuring safety. Those who may not be able to receive heat advisory messages due to language or technology barriers are especially at risk.

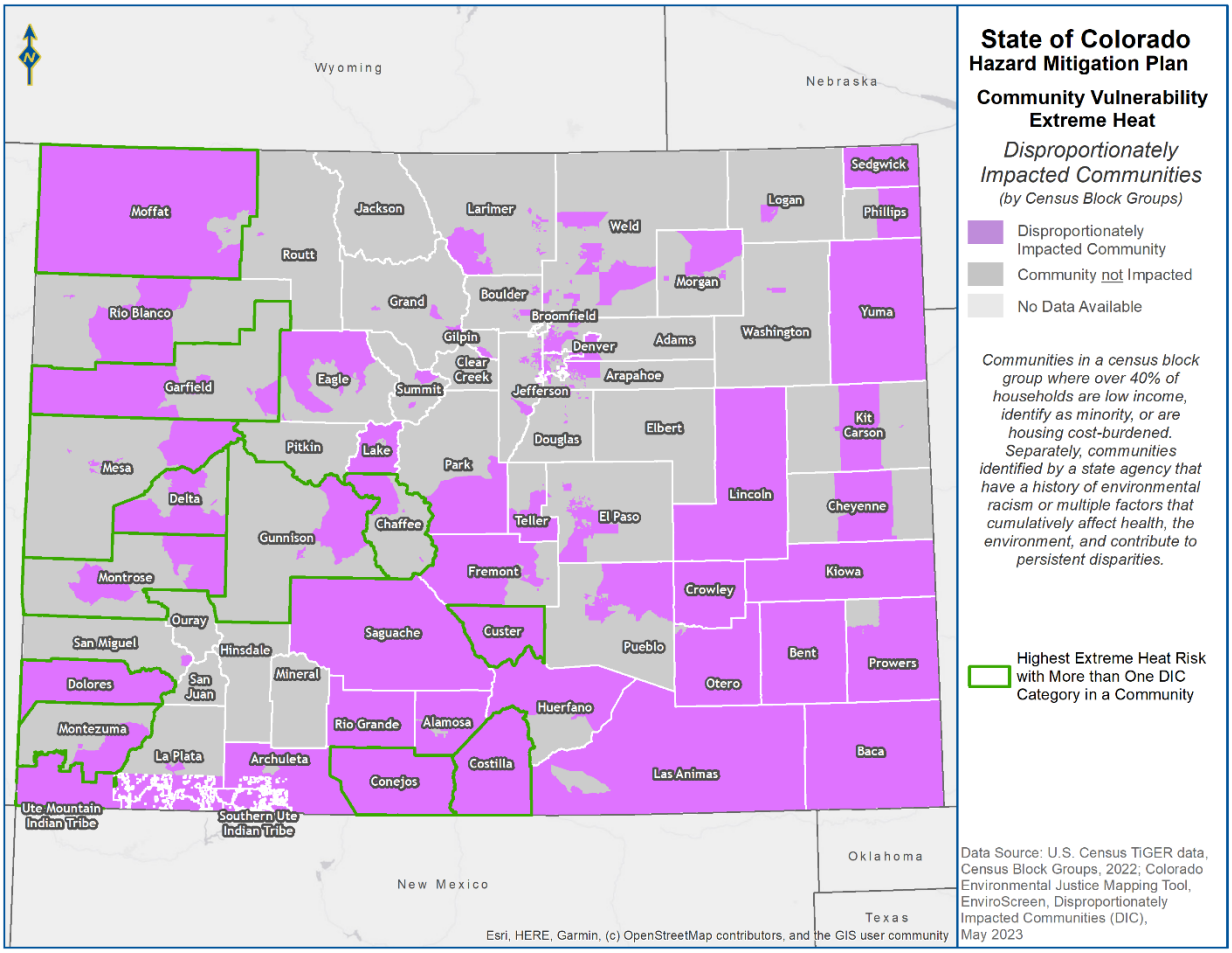
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 80. When comparing these communities to those counties with the highest extreme heat risk (Figure 72), Chaffee, Conejos, Costilla, Custer, Delta, Dolores, Garfield, Gunnison, Mesa, Moffat, Montezuma, and Montrose County each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 80 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to extreme heat include: low income, housing burdened, people of color, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 81 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Conejos, Costilla, Delta, and Moffat), “Medium-High” (Chaffee, Garfield, Mesa, Montezuma, and Montrose), “Low-Medium” (Gunnison), and “Low” (Custer and Dolores).

FIGURE 81 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008, no state asset property losses were reported due to extreme heat.

Exposure

State operated roadways, bridges, rail lines, and power lines and substations in the counties with the highest and most frequent extreme heat locations have been identified as at high risk of damage. These assets may require more frequent repair or replacement with more heat resistant options.

An impact extreme heat has on general building stock and critical facilities is increased demand on air conditioning equipment which in turn may cause strain on

electrical systems. It is important that critical infrastructure have backup electrical generating systems to maintain critical functions and services.

Of those counties at the highest risk from extreme heat events (Figure 78), Chaffee, Garfield, and Mesa County have the most state assets (as shown in Figure 13). Garfield County has the highest asset valuations (as shown in Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from an extreme heat event. All sectors could be affected, straining resources and physical infrastructure, although long-term effects on recovery and resilience are likely minimal. If event frequency, duration, or magnitude of extreme heat events increases some sectors, especially food, hydration, and shelter could see impacts on resilience.

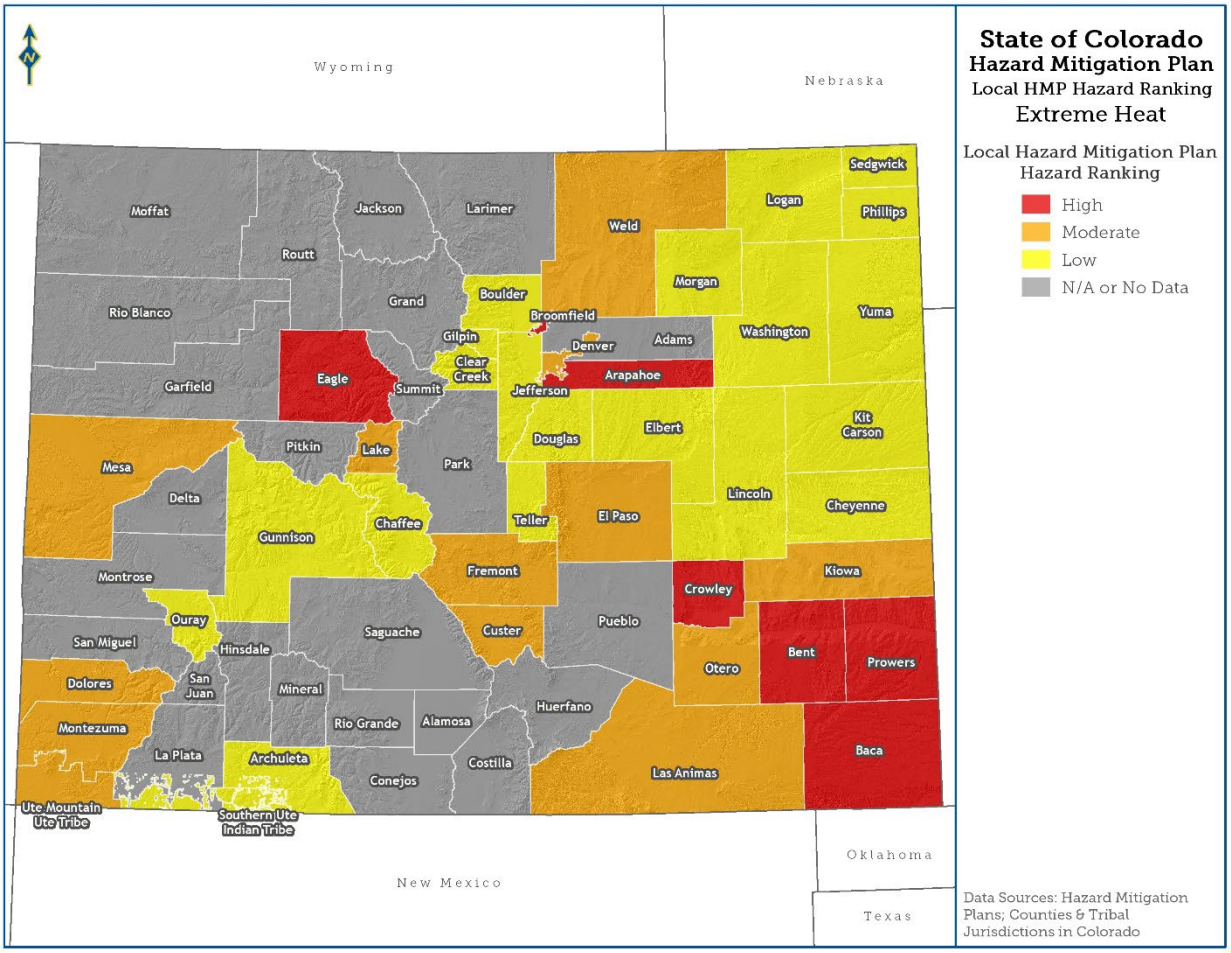
Extreme Heat	Communications	Energy (Power & Fuel)	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation

Local County / Tribe

Hazard Rankings

Extreme heat is profiled in local hazard mitigation plans primarily along the Front Range and eastern portion of the state. Figure 82 shows the majority of the northeast area ranked this hazard risk as low. The southeast had multiple medium and high rankings. The southwestern portion of the state was split between low and medium rankings. Central counties in the state had the range of risk from low to high, with the majority being low.

FIGURE 82 LOCAL HAZARD RISK RANKING



Exposure

All populations are exposed to extreme heat events. Depending on location, these events may be more frequent.

Local-level analysis of extreme heat risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Extreme heat can cause or exacerbate avalanche, drought, erosion / deposition, and wildfire. Drought can impact extreme heat.

Recent and Future Development

Population growth and development contribute to increased exposure of people and infrastructure to extreme heat events and their related impacts. This will continue to amplify the effects of extreme heat events on the public, critical systems, services, and infrastructure. Understanding changes in hazard exposure over time is an important element of comprehensive hazard mitigation planning.

Of those counties experiencing the state's largest percentage of growth (Figure 7), Chaffee, Custer, Garfield, Gunnison, Mesa, Ouray, and San Miguel County have been identified as being at the highest risk from extreme heat events (Figure 78).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of extreme heat.

Consequence Analysis

TABLE 31 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Affect health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality. Impacted ability to comfortably, or safely, withstand high heat events and to access and use disaster resources. Economic and social characteristics include homelessness, poverty, individuals who are socially isolated, those without adequate home

Consideration	Description
	cooling, and individuals without vehicle access. People engaged in outdoor exercise or manual labor are at risk. Trigger life-threatening health impacts for children, older adults, or chronically infirm especially those with diabetes, cardiovascular disease, and other health conditions that weaken bodily temperature control/regulation and breathing.
Responders	First responders should expect an increase in the number of incidents they will respond to during periods of extreme heat. Additionally, their uniforms and personal protective equipment will increase their risk of heat-related illnesses during periods of extreme heat.
Continuity of Operations (Govt. & Services)	Loss of facilities or infrastructure function or accessibility or ability to provide services. Power interruption is likely if not adequately equipped with backup generation.
Property, Facilities, & Infrastructure	Increased wear on roads and bridges and possibility of road buckling; train rails develop some kinks and distort. Possible disruption of airport operations. Major strains on the electricity grid, power lines sag, and possible brown-outs or black-outs.
Environment	Significant impact related to natural ecosystems. Extended periods of extreme heat can stress both flora and fauna species while altering local habitat.
Economic	Potential loss of facilities or infrastructure function or accessibility and uninsured damages. Impacts to the transportation sector and movement of goods. Historic events in Colorado have impacted community business districts where a majority of businesses are lost.

Consideration	Description
Public Confidence in Govt.	Public holds high expectations of government capabilities for warning, public information, and response related to extreme heat events.

Flood - Extremely High Risk

Definition

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas. The inundation is caused by rising water in an existing waterway, such as a river, stream, or drainage ditch. Flooding may also be experienced in areas that are not considered waterways, but where water may still channel and flow under certain conditions. Flooding results when the flow of water is greater than the normal capacity of a channel. Flooding is a longer-term event that may last days or weeks, while flash flooding may be over in a matter of minutes or hours.

The 1% annual chance flood event (i.e. – "100-year-flood") is the standard national measurement for flood mitigation actions and insurance. The 100-year floodplain has a 1% annual chance of being equaled or exceeded in any given year and is considered to be areas of high flood hazard. A 0.2% annual chance flood event (i.e. – "500-year flood") has a 0.2% annual chance of being equaled or exceeded in any given year. The 500-year floodplains are typically considered to be areas of moderate Flood hazard. It should be noted that many floodplains were developed using historical data only, which may not represent current conditions.

In addition to precipitation, flooding can also be caused by snowmelt runoff. Severe flood events may be the result of both, when rain event occurs over a snowpack causing rapid snowmelt.

A flash flood is caused by heavy or excessive rainfall over a short period of time, generally less than 6 hours. These events are usually characterized by raging torrents of water that follow heavy rains, inundating river beds, urban streets, or mountain canyons. Flooding can occur within minutes, or a few hours, following excessive rainfall. Flash floods can also occur even if no rain has fallen, as a result of dam or levee incidents, and debris or ice jam releases.

Groundwater flooding occurs when the water table in permeable rocks rises, which allows the water to enter basements/cellars or to the ground surface. Groundwater flooding is not necessarily linked directly to a specific rainfall event and is generally of longer duration than other causes of flooding (possibly lasting for weeks or even months).

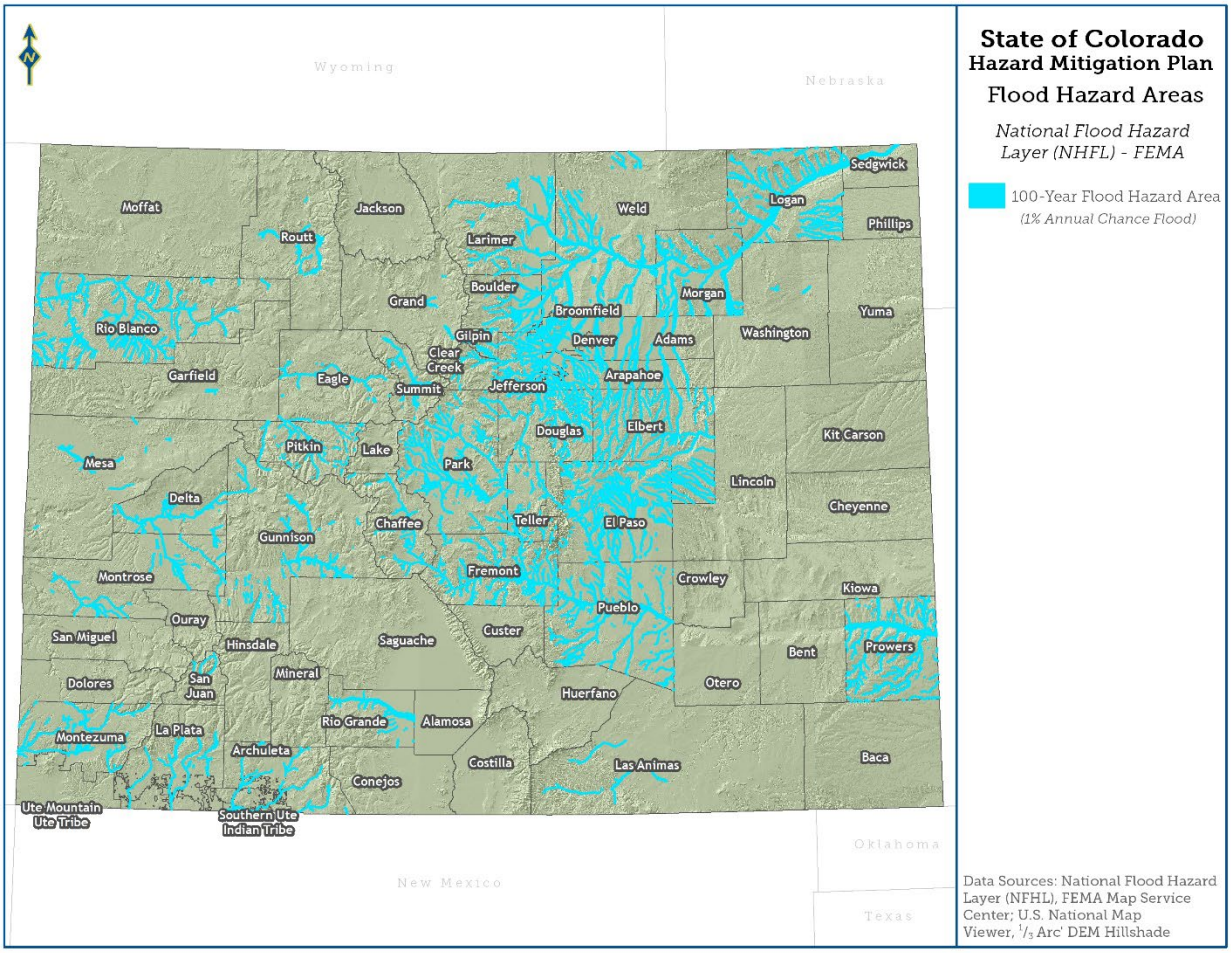
Location

Colorado has seven major river basins including the following rivers: South Platte, Arkansas, Rio Grande, San Juan / Dolores, Gunnison, Colorado, and the Yampa River. Many rivers originate in Colorado, and flood prone areas have been identified across all of the 64 counties in the state and within the Southern Ute Indian Reservation.

Figure 83 presents the currently mapped 1% annual chance floodplains identified through FEMA's National Flood Insurance Program (NFIP). Note that not all Colorado counties currently have digital floodplain maps. New floodplain mapping, and updates to existing floodplains, is a continual effort led by the Colorado Water Conservation Board (CWCB). The Colorado Hazard Mapping & Risk MAP Portal provides the state a single web map to view the most up to date floodplain boundaries and information.

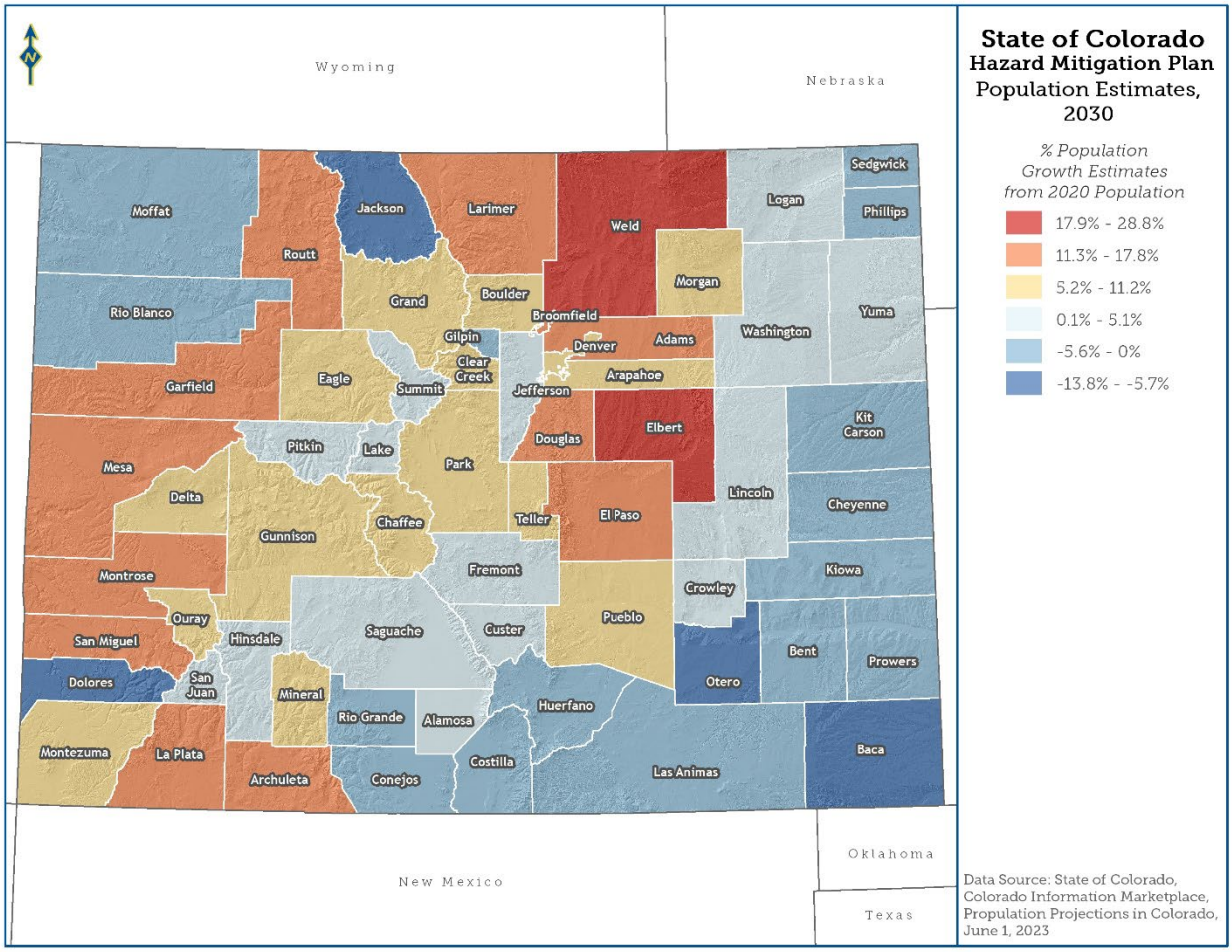
Flooding impacts all parts of the state, either caused by precipitation and/or snow runoff. Flood events may only impact an individual stream or river, but large events can impact multiple rivers at the same time as was experienced during the September 2013 floods.

FIGURE 83 NFIP 1% ANNUAL CHANCE FLOODPLAINS



For comparison, Figure 84 presents the estimated population growth across the state through 2030.

FIGURE 84 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

The rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of location and landform characteristics. Generally, flooding is quite rapid on small (and steep gradient) streams and slow in large (and flat sloped) streams.

Floods can have significant economic, operational, and environmental impacts. The location, magnitude, and timing of a flood are critical factors influencing life safety and damages caused. Destruction of transportation infrastructure affects communities and their economies, causes significant increases in transportation costs, and may impact many of the state's roads and bridges. Communities can become isolated due to damage to critical traffic infrastructure. Communications infrastructure can also be damaged, interfering in the response and recovery efforts.

Structures may be destroyed and it may be necessary to shelter the public following a flood event. Stagnant flood waters pose a threat to public health, as do damaged water treatment and distribution systems. Flood waters can strip areas of vegetation or settle in an area, drowning the habitat which can greatly impact crop lands. The water may also carry chemicals to an area, which can take years to remediate. Colorado's mountain and foothill environments increase the propensity for flash flooding events.

Floods occurring on wildfire burn scars have caused significant losses across the state and are a prime concern following wildfire events. Oftentimes these events lead to debris flow hazards, which are detailed in that respective hazard profile in the E-SHMP.

Past Occurrences

Historical Events

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database[31] is the best available source of data pertaining to past flood events. These historical flooding and flash flooding events, reported between 1950 and 2021, are presented in Figure 85.

Flash flood events are more common across the state and flood events tend to be grouped, suggesting multiple events in close proximity or areas experiencing continual flooding issues. Some flood events are sporadically distributed, especially in the northwest and southwest, which may be the result of a lack of reported or experienced damages for many events.

[31] https://www.ncdc.noaa.gov/stormevents/

FIGURE 85 HISTORICAL FLOOD AND FLASH FLOOD EVENTS

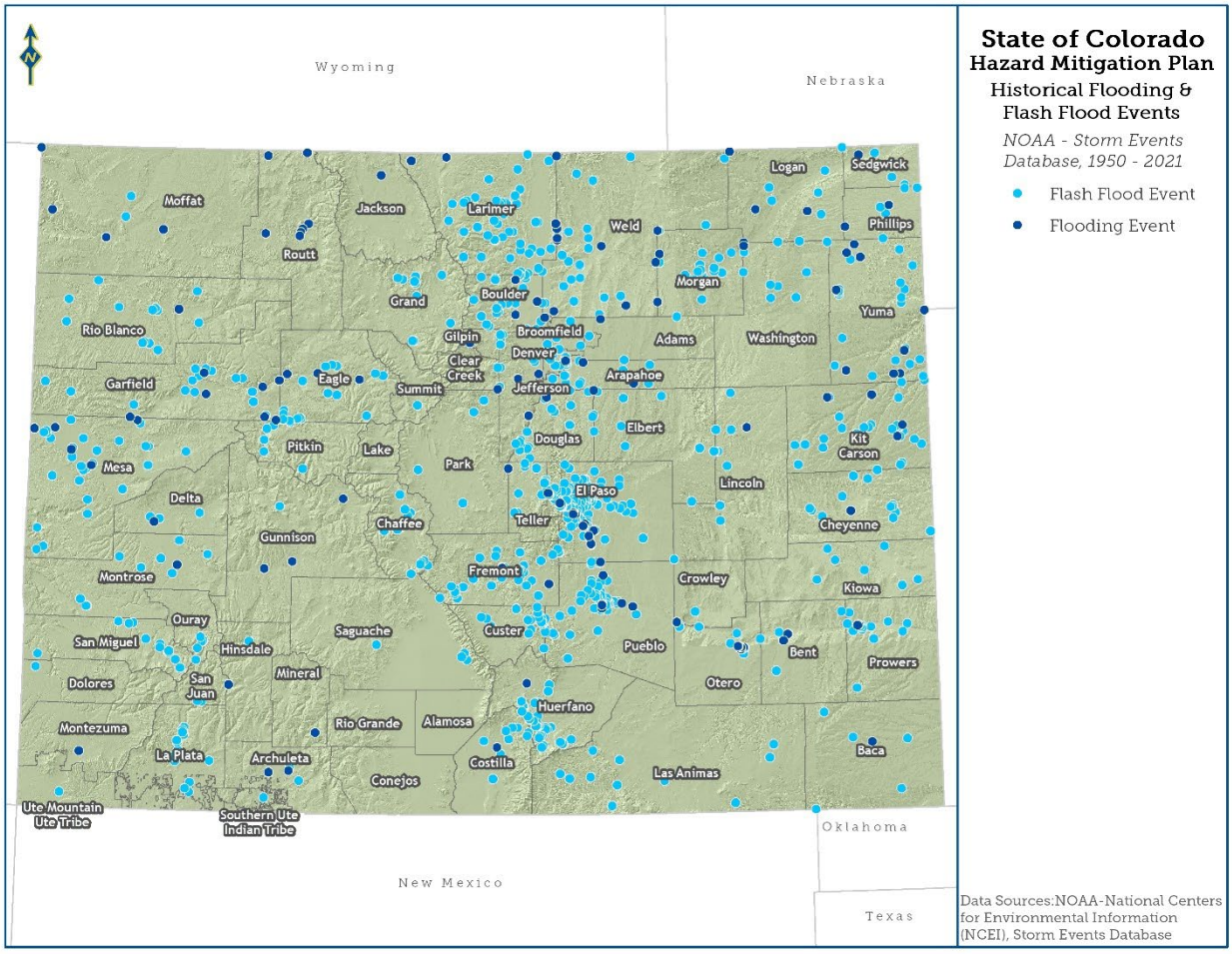
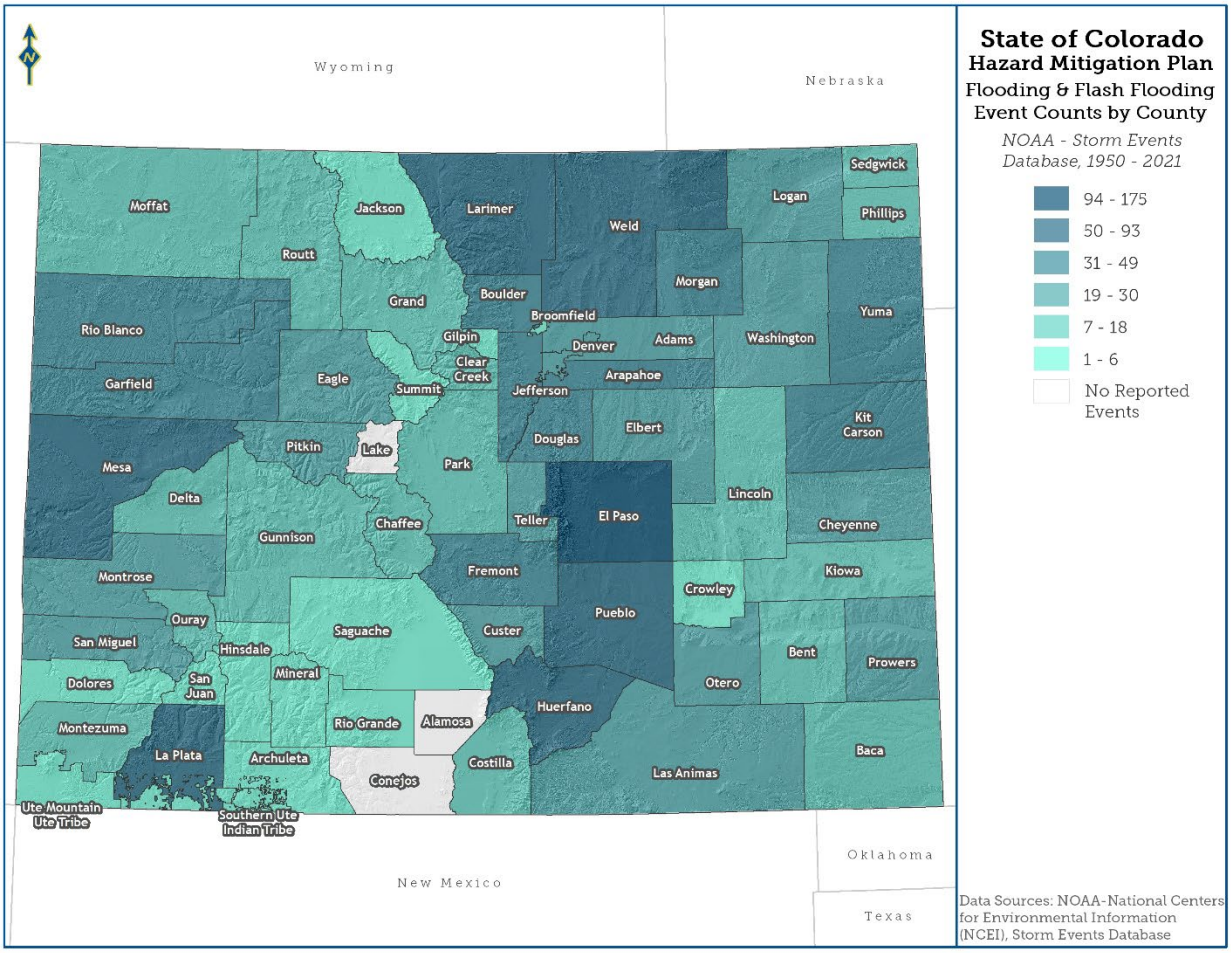


Figure 85 summarizes this data at a county and tribal area level. This shows where the higher counts of past flood events have occurred. In general, flood events are more prevalent across the eastern portion of the state, but there are areas in western Colorado that have experienced a high number of events. El Paso County has experienced almost twice as many flood events as any other county. Other counties with a pronounced flood history include Mesa, La Plata, Larimer, and Weld Counties. A few counties have no reported flood events, but there most likely have been notable flooding in these counties.

FIGURE 86 FLOODING AND FLASH FLOODING EVENT COUNTS BY COUNTY



Previous Losses

Floods in the state have caused extensive damage and numerous casualties throughout history. Table 32 shows notable floods that resulted in casualties. The values have been adjusted to 2022 USD.

TABLE 32 NOTABLE FLOODS WITH REPORTED FATALITIES[32]

Year	Location	Fatalities	Damages (2022 USD)
1896	Bear Creek (Morrison)	27	$11,245,078
1911	San Juan River (Pagosa Springs and San Luis Valley)	2	$9,839,442

[32] Previous Colorado Flood Hazard Mitigation Plan, SHELDUS, NOAA

Year	Location	Fatalities	Damages (2022 USD)
1912	Cherry Creek (Denver)	2	$219,279,025
1921	Arkansas River (Pueblo)	78	$1,388,767,154
1935	Monument Creek (Colorado Springs)	18	$95,583,163
1935	Kiowa Creek (Kiowa)	9	$28,112,694
1955	Purgatoire River (Trinidad)	2	$66,064,834
1965	Arkansas River Basin	16	$375,304,484
1965	South Platte River (Denver)	8	$3,654,650,404
1973	South Platte River (Denver)	10	$709,845,558.00
1976	Big Thompson River (Larimer)	144	$154,619,824.00
1982	Fall River (Estes Park)	3	$89,960,624
1983	North Central Counties	10	$47,791,582
1984	West & Northwest Counties	2	$85,743,720
1995	Western Slope & South Platte	21	$95,583,163
1997	Fort Collins & 13 East Counties	6	$570,533,354
2000-06	Statewide Various Events	5	$156,025,459
2013	Front Range and Northeast Counties	9	$838,945,240
2018	Northeast and South Central Colorado	1	$3,266,550
2019	Statewide Various Events	6	$1,160,250
2020*	Eagle River (Eagle County)	1	No damages reported
2021	Statewide Various Events	4	$3,005,940

Year	Location	Fatalities	Damages (2022 USD)
2022	Statewide Various Events	2	$854,870

There have been notable flood events with immense costs, but fortunately with no casualties. Table 33 details those events that caused damages over $1 million. These values have been adjusted to 2022 USD.

TABLE 33 NOTABLE FLOODS WITH DAMAGES ONLY[1]

Year	Location	Damages (2022 USD)
1864	Cherry Creek (Denver)	$9,839,442
1942	South Platte River Basin	$15,180,856
1957	Western Colorado	$32,329,600
1969	South Platte River Basin	$39,357,772
1970	Southwest Colorado	$23,895,791
1993	Western Slope	$3,795,215
1999	Colorado Springs & 12 East Counties	$182,732,519
2006	Horse Creek, West Creek (Douglas)	$17,766,442
2006	Beaver, Brush Hollow and Eight Mile Creeks (Fremont County)	$2,671,645
2006	Vallecito Creek (La Plata)	$1,335,823
2007	Chalk Creek Canyon (mudflows) (Chaffee)	$2,671,645
2007	Chalk Creek Canyon (Chaffee)	$1,335,823
2010	Statewide Various Events	$1,052,629
2015	Central to Eastern Colorado	$10,773,509
2017	Northeast and South Central Colorado	$1,761,200

2023	Central Eastern Colorado	$43,000,000*

* DR-4731: Damage estimates as of August 2023 and relate to damages caused by all declared hazards for this event (severe storms, flooding, and tornadoes). Additional costs are anticipated and are currently being verified.

Notable Events

While all of these large past events are notable, a few major floods deserve additional background.

June 1921 - Arkansas River[33]

On the afternoon of June 3, 1921, a sudden cloudburst formed over the city of Pueblo, Colorado, bringing heavy rains. Almost simultaneously, torrential rain fell to the north of the city over Fountain Creek, which joins the Arkansas River in Pueblo. Within a few hours, the two streams swelled, and floodwaters inundated the downtown area, destroying large parts of the city. Although no official rainfall reporting stations existed in the city at the time, it is estimated that 6 inches or more fell between June 3rd and 5th.

The flood carried away homes, railroad cars, buildings, and businesses and caused tens of millions of dollars in damages at the time. Accounting for the number of individuals who died in the floods remains a challenge, but estimates range from less than 100 to upwards of 1,500 people. Today, the event is a reminder of how quickly floods in Colorado can form, how devastating their impacts can be, including downstream, and the importance of floodplain management and disaster planning.

June 1965 - South Platte River[34]

[33] Colorado State University: https://libguides.colostate.edu/waterhistory/1921flood

[34] History Colorado: https://coloradoencyclopedia.org/article/south-platte-flood-1965

The South Platte River flood of June 16, 1965 was one of the worst natural disasters in Denver's history. It was part of a statewide flooding event that claimed a total of twenty-four lives across the Arkansas and South Platte River basins. The flooding in Denver caused extreme damage but resulted in fewer local fatalities than in other affected areas. While only two fatalities can be traced to the Denver area, property losses in the metro area were estimated at $543 million.

The flood ravaged hundreds of houses and all but obliterated dozens of businesses, many of which never recovered. It also led to a reappraisal of decades of haphazard urban growth and myopic planning. The disaster became a trigger for long-delayed flood control projects, ambitious urban renewal plans, and a renaissance along the South Platte itself.

July 1976 – Big Thompson Canyon

The widely publicized Big Thompson Canyon flood disaster of July 31, 1976 was a result of an intense thunderstorm cell that stalled over the Big Thompson River Basin and dropped up to 10 inches of rain in a few hours. The total rainfall from this event [was] nearly equivalent to a year's average annual precipitation in this area. The massive amount of rain, combined with the canyon's thin soil, sparse vegetation and steep rock walls, transformed the normally two-foot-deep river into a wall of water 19 feet high.

The immense flash flood roared through the canyon where thousands of people were enjoying the scenery and celebrating Colorado's 100th year of statehood. Two law enforcement officers attempted to warn people of the impending danger, but the sheer volume and velocity of the flood waters were overwhelming. Many people lost their lives trying to outrun the deluge, not knowing that they should climb to higher ground for safety. In two hours, the Big Thompson Canyon flood killed 144 people (including six who were never found), destroyed 418 houses and damaged another 138, destroyed 152 businesses, and caused more than $40 million in damages. The Big Thompson flood remains the deadliest natural disaster in Colorado to date.

September 2013 – Front Range, Foothills, and Eastern Communities

One of the state's most costly and widespread floods affected the Colorado Front Range during September 2013. During the week beginning on September 9, 2013, a slow-moving cold front stalled over Colorado, clashing with warm humid monsoonal air from the south. A report from Accuweather summarized the weather events that led to the flooding as follows:

"The high over the Midwest acted like a giant roadblock and turned what would have been a several-hour event into a week-long ordeal. The result was a plume of heavy rain that re-fired on an almost daily basis from New Mexico to Colorado and southern Wyoming. While the Flood of 1976 was more intense over a small area and the Flood of 1965 was intense and lasted for days, the Flood of 2013 lasted nearly a week and covered hundreds of square miles in multiple states. Rainfall exceeded 12 inches at a number of locations."

Nine people were killed as a result of these floods. Thousands of homes and buildings were damaged or destroyed, forcing several thousand people and pets to evacuate. Boulder County was the most heavily impacted, with devastating damage in Lyons, Longmont, Jamestown, and several other communities, many of which were isolated for weeks after the storms due to road damages and closures. Damages totaled more than $2 billion across 24 counties, 486 miles of CDOT roadways were impacted, and 39 roadways and 120 bridges were temporarily closed. Highway damages alone were estimated at $535 million, and approximately 135 million cubic feet of debris was removed from the transportation network. Some sections of these highways and roads were closed for several weeks after the floods, displacing thousands of residents in the Front Range foothills. The floods also caused crop damage, particularly in agricultural communities in northeast Colorado. Significant impacts were felt by the oil and gas industry, as thousands of facilities were impacted. Eighteen counties were ultimately included in the disaster designation.

Probability

Flooding will continue to occur in Colorado (100% chance) and it is expected that extreme events may become more common. Between 20 and 30 large magnitude floods (in terms of peak discharge) occur somewhere in Colorado every year. Based on historical federally declared flood disasters, the state should expect one declared event every five years.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future flood events.

TABLE 34 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	The location of floods is not projected to change.
Extent/Intensity	The extent and intensity of flash flooding may expand with larger wildfire burn scars creating new areas that are vulnerable to flash flooding during intense summer rainfall events. The extent and intensity of flash floods in urban areas may also increase, owing to expansion of areas covered by impervious surfaces (e.g., roads, parking lots) that can contribute to flooding. Flood intensity may increase due to transition from hail to rain on the Front Range of the Rocky Mountains resulting in higher flash flood risk specifically in eastern Colorado. In the mountainous regions of Colorado, snowmelt-driven spring and summertime floods are expected to diminish, except in areas near recent wildfire burn scars, where flash flooding will increase.
Frequency	There are no clear trends in heavy precipitation events for Colorado, and like annual precipitation, there is considerable variability at annual and decadal time scales. If intense wildfires

	increase, then flash flooding will become more frequent in burn-scar areas.
Duration	The duration of flood events is not likely to change. However, seasonal runoff shifting one to four weeks earlier may contribute to earlier flooding during the spring.

Future Costs

The Future Avoided Cost Explorer (FACE) tool was developed by the state to understand the economic impacts of flood, drought, and wildfire looking forward to 2050. It estimates the expected cost impacts of these three hazards on a selection of economic sectors, under future climate and population scenarios. These costs are expressed in expected annual damages, which are a function of the hazard magnitude, probability, and exposed assets.

For modeling flood scenarios two economic sectors were analyzed, buildings and bridges. For the buildings sector, county-level changes in population were assessed to determine where increased development would occur. Across all counties, it was assumed that local regulations will prevent development within mapped 100-year floodplains, but that future development will be unrestricted in the zone between the 100-year and 500-year floodplains. The change in building replacement cost between the 100 and 500-year floodplains was calculated for each population growth scenario. There was insufficient information on how bridge size and location would be affected by growth, so population scenarios were not applied to these estimates.

Figure 87 presents the state's estimated expected annual damages from flood, based on climate and population change scenarios. These scenarios show that high population growth (with current climate conditions) would increase the expected annual damages by $75 million. Conversely, severe climate change (with the state's current population) increases expected annual damages by over two and a half times.

FIGURE 87 FLOOD EXPECTED ANNUAL DAMAGES BY POPULATION AND CLIMATE CHANGE SCENARIO

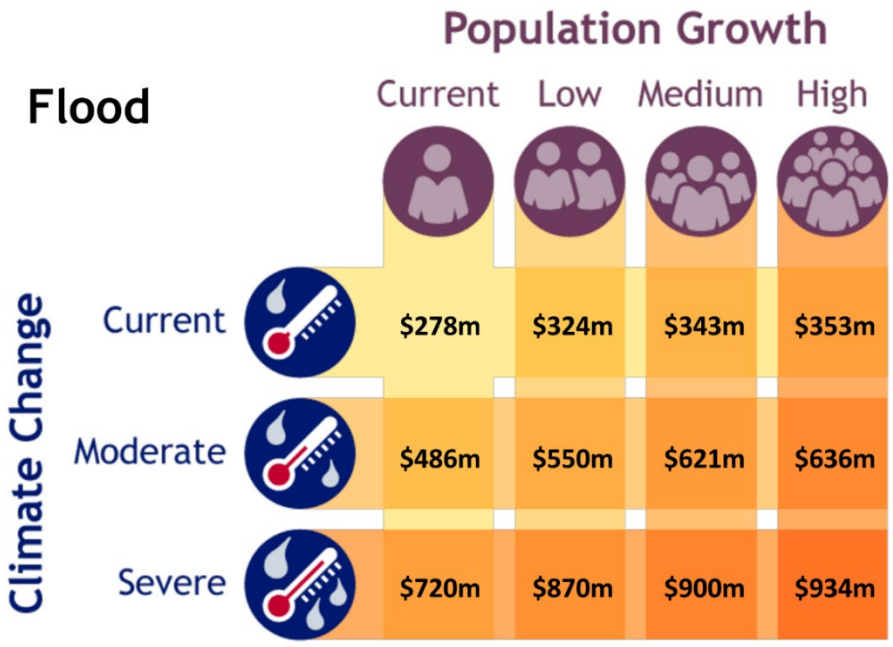


Figure 88 and Figure 89 present this same information, broken down for the buildings and bridges sectors, respectively.

FIGURE 88 FLOOD EXPECTED ANNUAL BUILDING DAMAGES

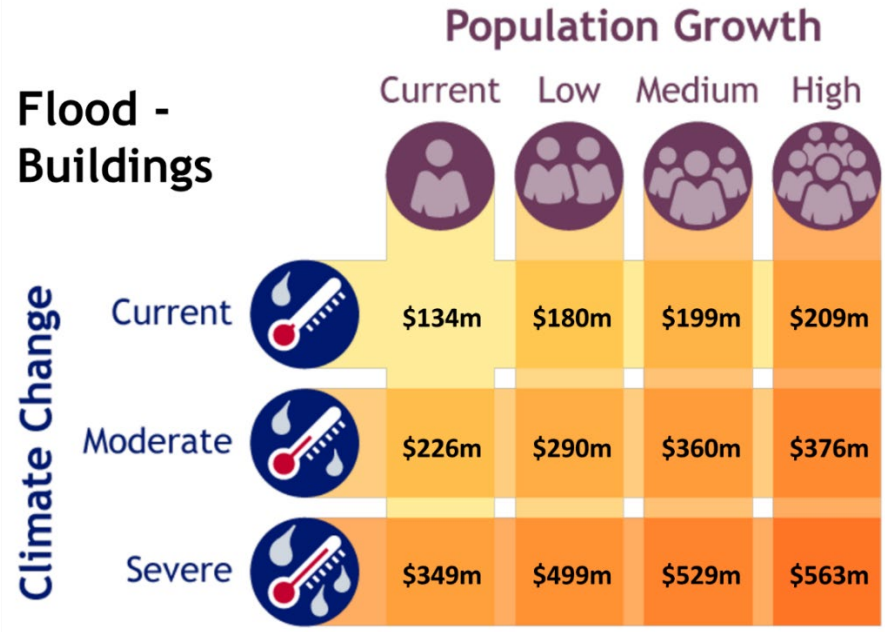
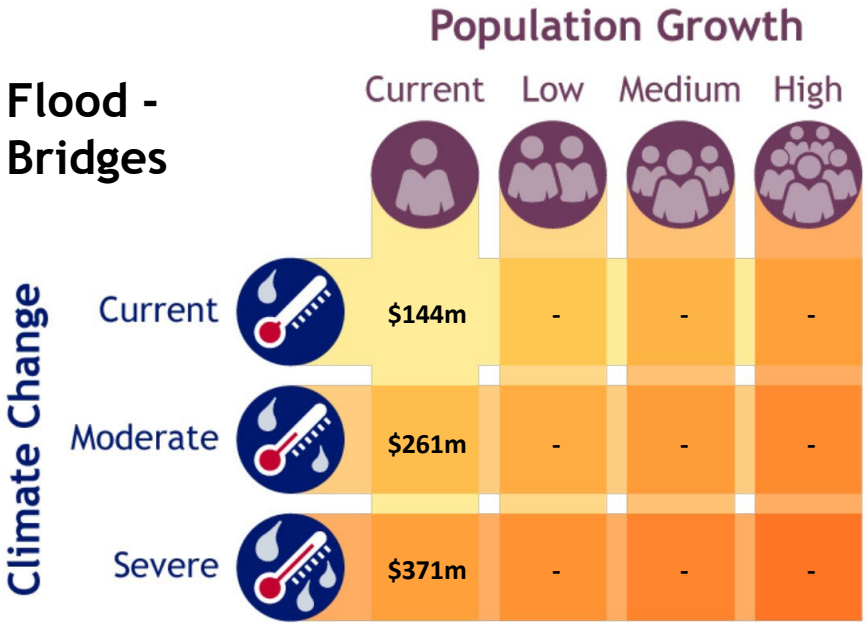


FIGURE 89 FLOOD EXPECTED ANNUAL BRIDGE DAMAGES



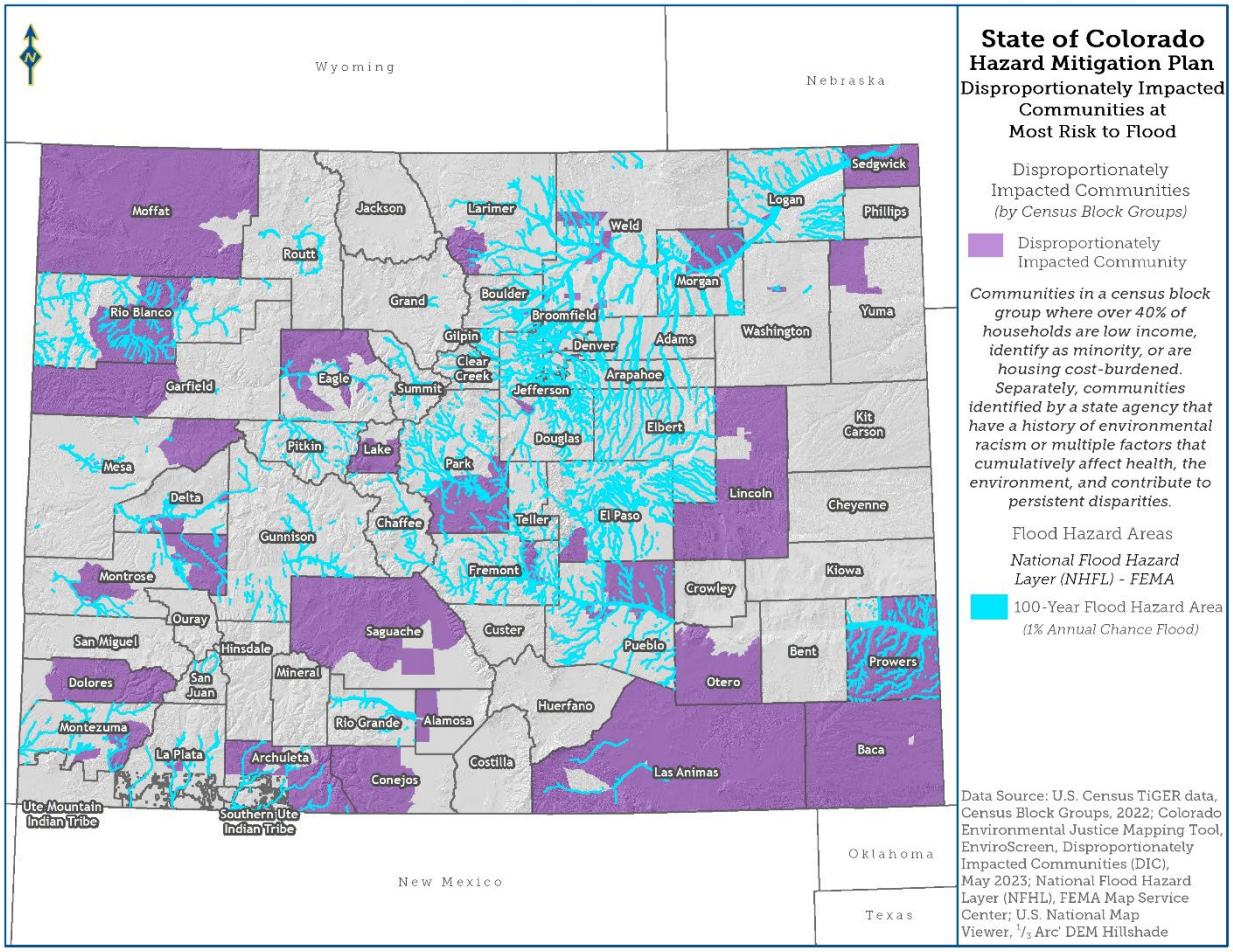
Risk & Vulnerability

Populations at Risk

All populations within or near a 100-year or 500-year floodplain are at risk of a flood event. Socially vulnerable populations and those in underserved communities are at risk of disproportionate impacts from an event. Communities with poor infrastructure may be in more danger if the built environment or stormwater systems are compromised. People with access and functional needs may be unable to get to safety due to a lack of transportation, may be dependent on power for medical devices, may not get emergency communications due to language or technology barriers, and may need accommodations to evacuate or shelter in place.

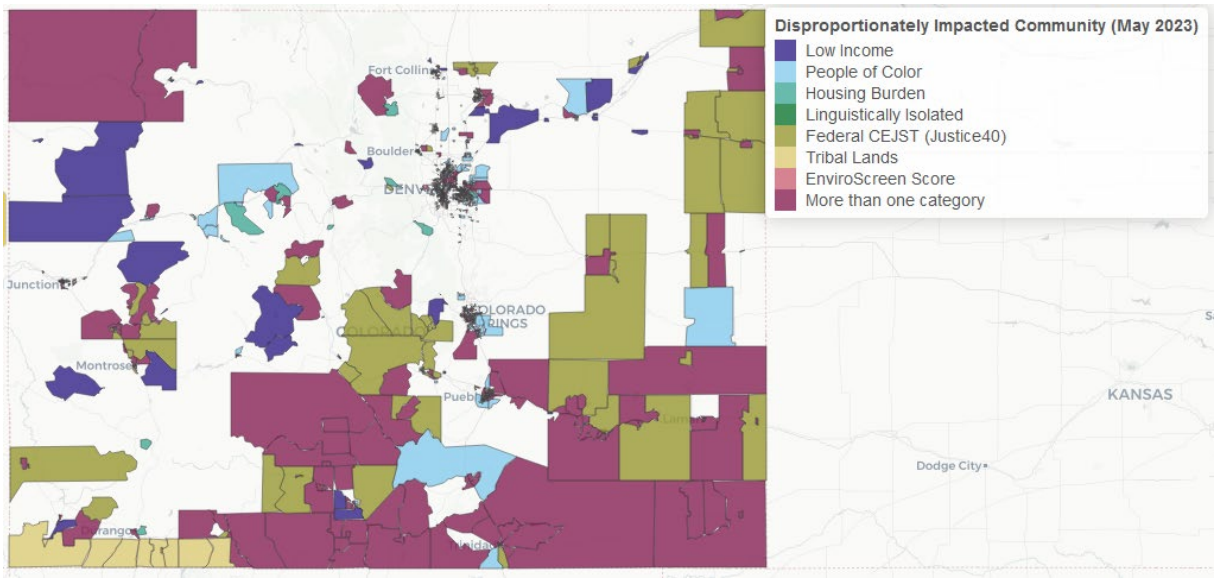
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 90 identifies those DIC communities, at a Census Block Group level, that have mapped floodplains.

FIGURE 90 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



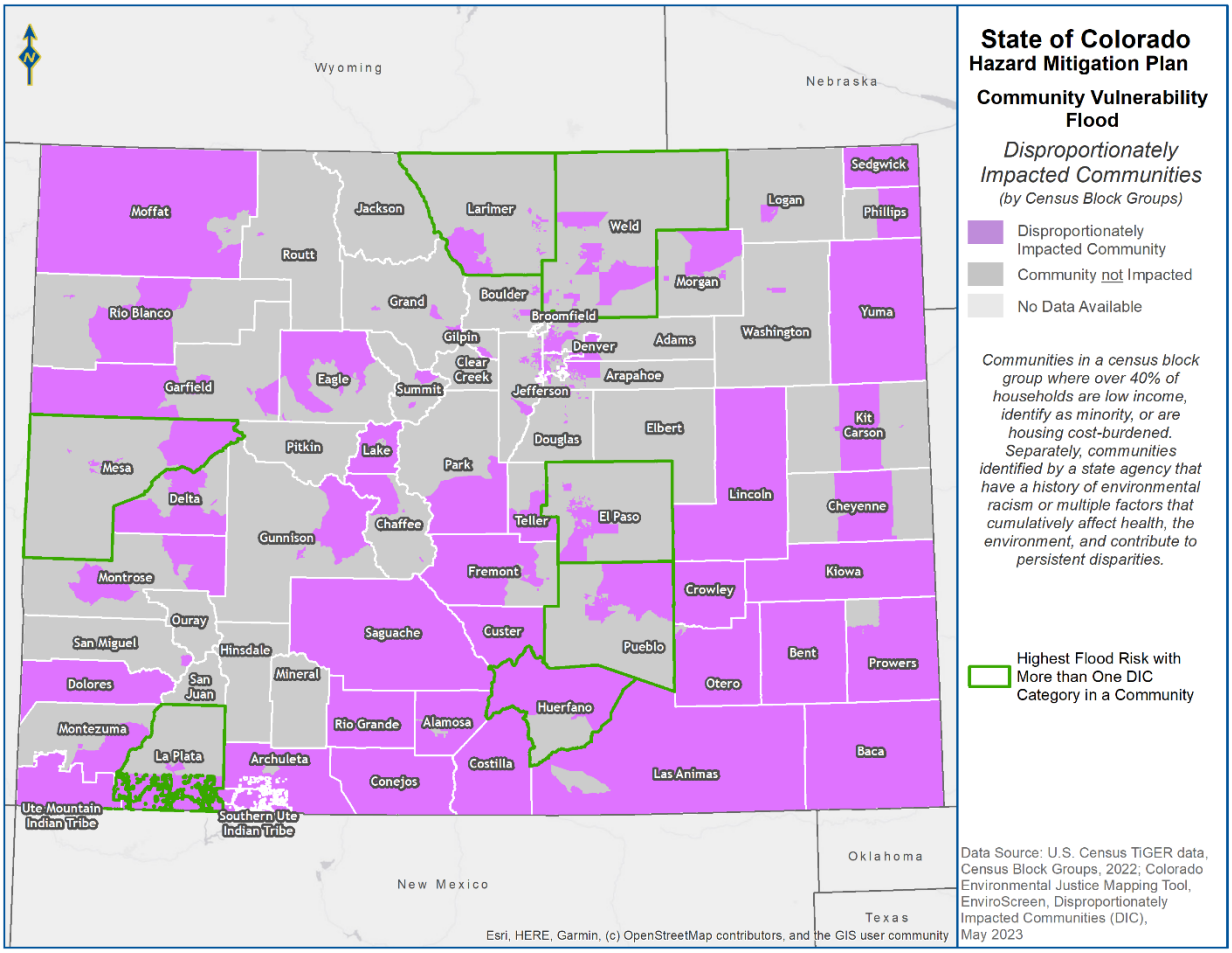
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 91. When comparing these communities to those counties with the highest flood risk (Figure 86), El Paso, Huerfano, La Plata, Larimer, Mesa, Pueblo, and Weld Counties each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 91 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to flood include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 92 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Pueblo), “Medium-High” (El Paso, Mesa, and Weld), and “Low-Medium” (Huerfano, La Plata, and Larimer).

FIGURE 92 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008, there have been 157 property losses reported on state assets due to flooding, resulting in over $17 million in losses. Approximately $12 million of these losses were due to the September 2013 floods.

Exposure

Highways are the most vulnerable state asset type exposed to flood hazard. The largest risk is to those state highways located alongside the state's rivers and streams. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

State assets are exposed to floodplains across the state, as seen in Figure 31, which shows the count of structures exposed to the 1% annual chance floodplain. Note that digital floodplains are not available statewide, so this exposure analysis only pertains to those with digital floodplains. Counties with the highest exposure by structure count include Logan and Park County. Those with the next highest exposure risk are scattered across the state, with many located across the front range.

It should be noted that the statewide asset database utilized for this analysis does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk.

FIGURE 93 STATE ASSET BUILDINGS EXPOSED TO 100- YEAR FLOODPLAINS

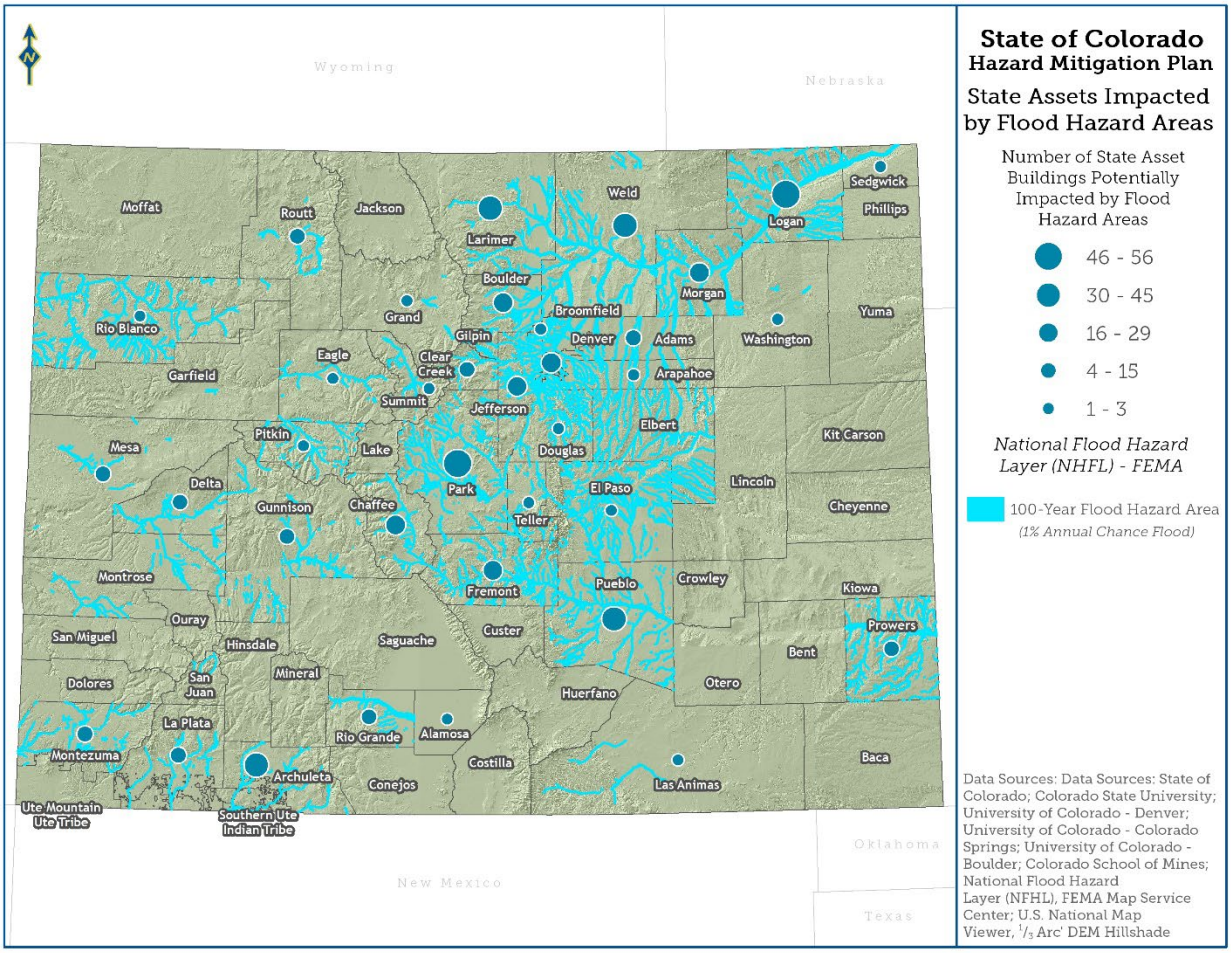
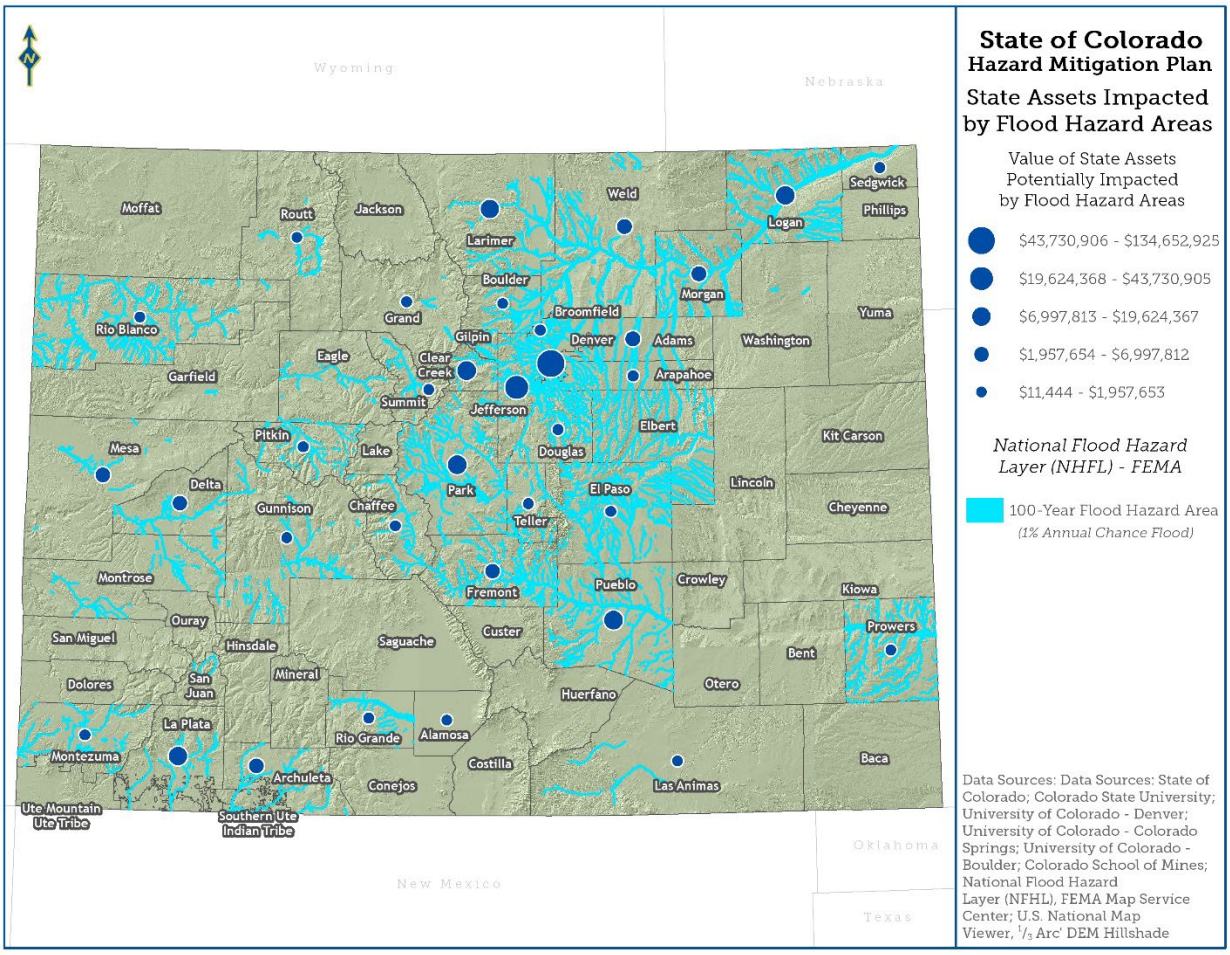


Figure 94 illustrates that while the structure count exposure is scattered across the state, the exposed dollar values are more concentrated mostly around the Denver Metro area.

FIGURE 94 VALUES OF STATE ASSET BUILDINGS EXPOSED TO 100-YEAR FLOODPLAINS



Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a flood event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

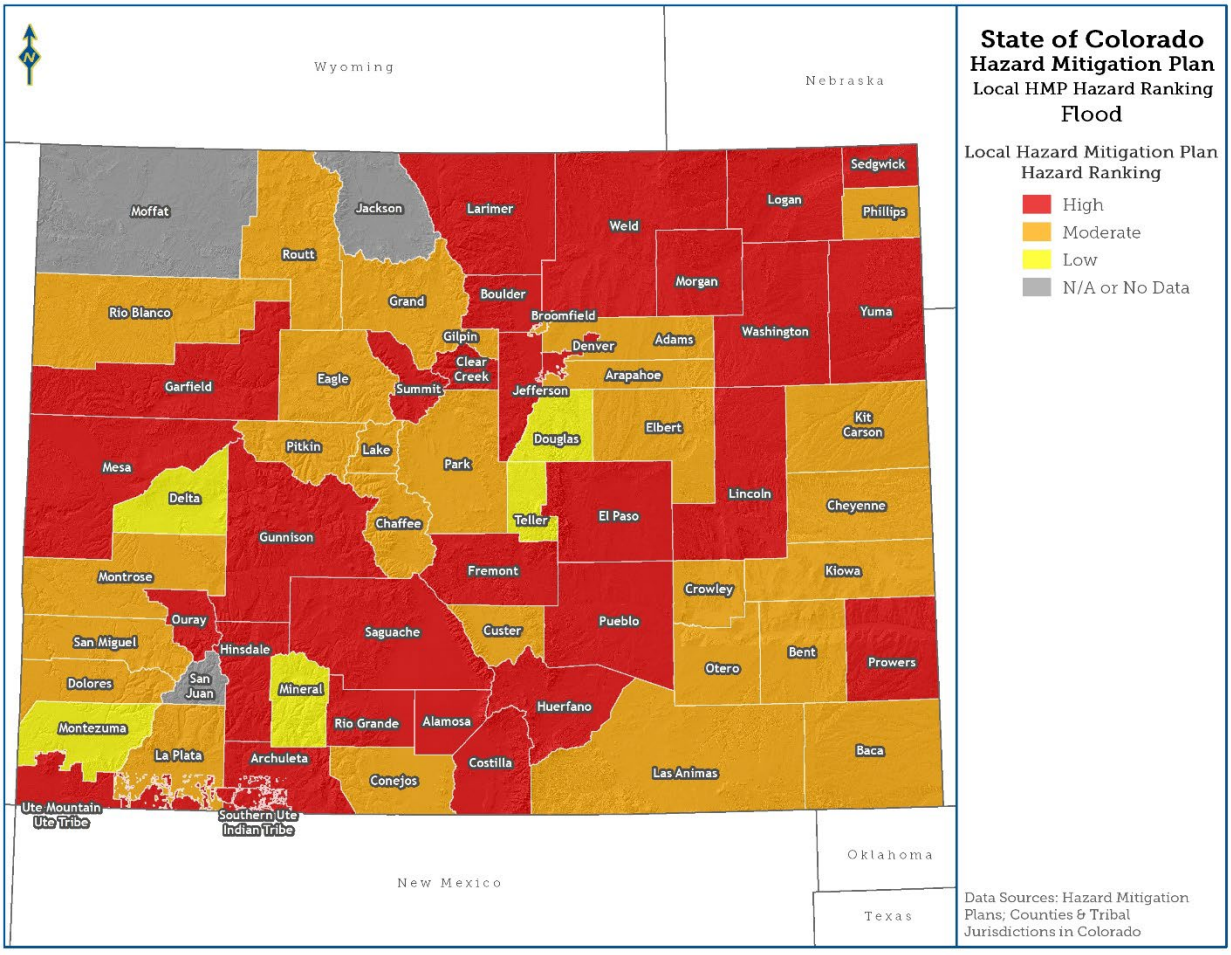
Flood	Communications	Energy (Power & Fuel)	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation

Local County / Tribe

Hazard Rankings

Figure 95 shows that approximately 95% of local hazard mitigation plans profile the flood hazard. Of those, only five counties ranked the hazard as low. The remaining counties were split between high and moderate rankings fairly evenly. These high risk rankings were primarily in counties with a significant history of reported flood events and more prominent floodplains.

FIGURE 95 LOCAL HAZARD RISK RANKING - FLOOD

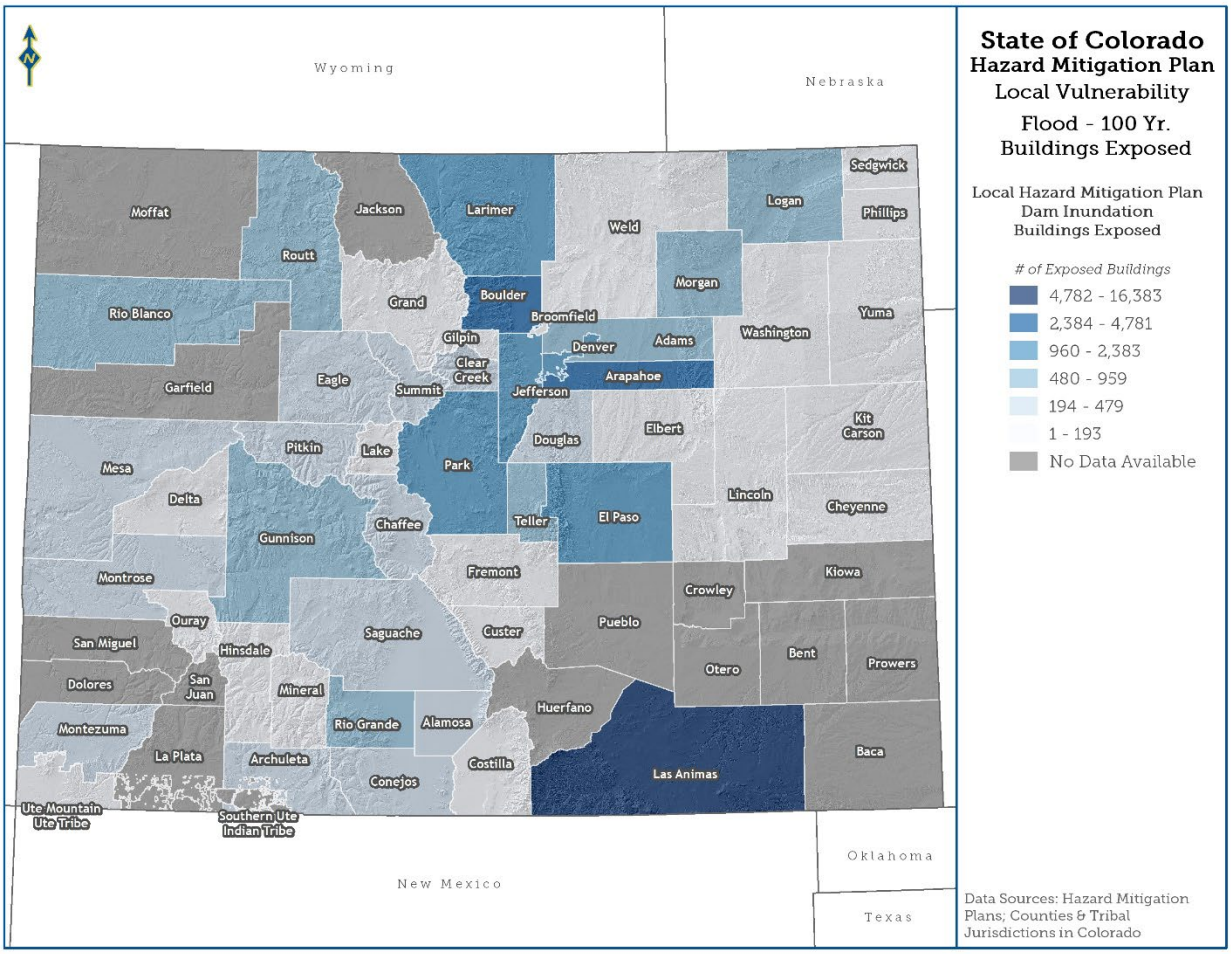


Exposure

A majority of local and tribal plans reported buildings exposed to 100-year floodplain areas. Figure 96 presents the results of this information. The highest number of

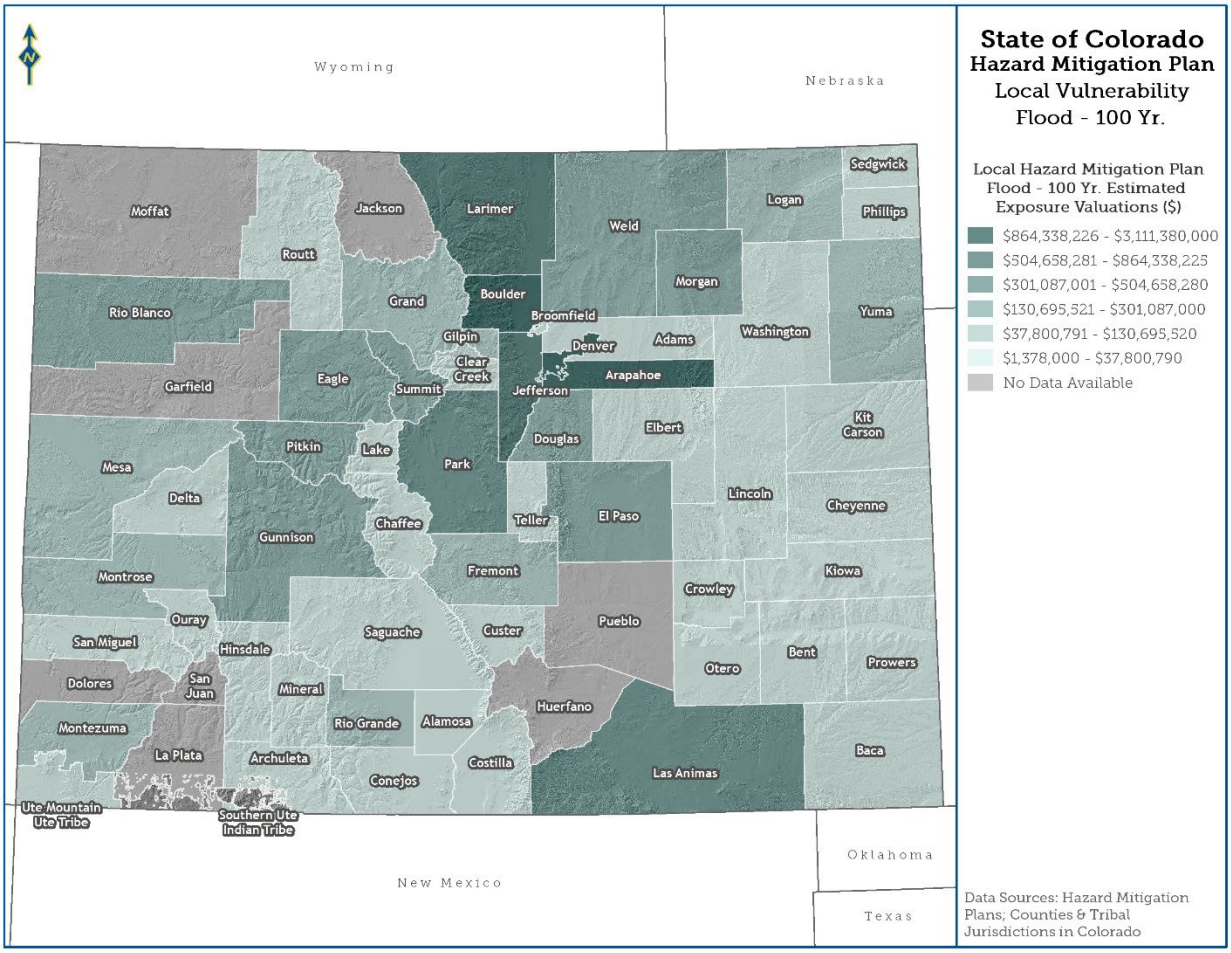
exposed structures is over 16,000 in Las Animas County. This is followed by counties along the Front Range with exposed counts between 960 and 4,781 buildings.

FIGURE 96 LOCAL BUILDING COUNT EXPOSED TO 100-YEAR FLOODPLAINS



Exposure to 100-year floodplain areas, as reported in local hazard mitigation plans, is presented in Figure 97 as a total sum valuation of those structures. This information presents a similar summary to the previous Figure, with the exception of Las Animas no longer showing the highest exposure.

FIGURE 97 LOCAL VALUE OF BUILDINGS EXPOSED TO 100-YEAR FLOODPLAINS



Some local plans assessed the structures to the larger 500-year floodplains. Figure 98 presents the summary of this data and shows the Front Range has counties with the highest building counts exposed. The lower ranges in reported counts for exposed buildings are primarily in the southwest area of the state and to the west of the northern Front Range counties.

FIGURE 98 LOCAL BUILDING COUNT EXPOSED TO 500-YEAR FLOODPLAINS

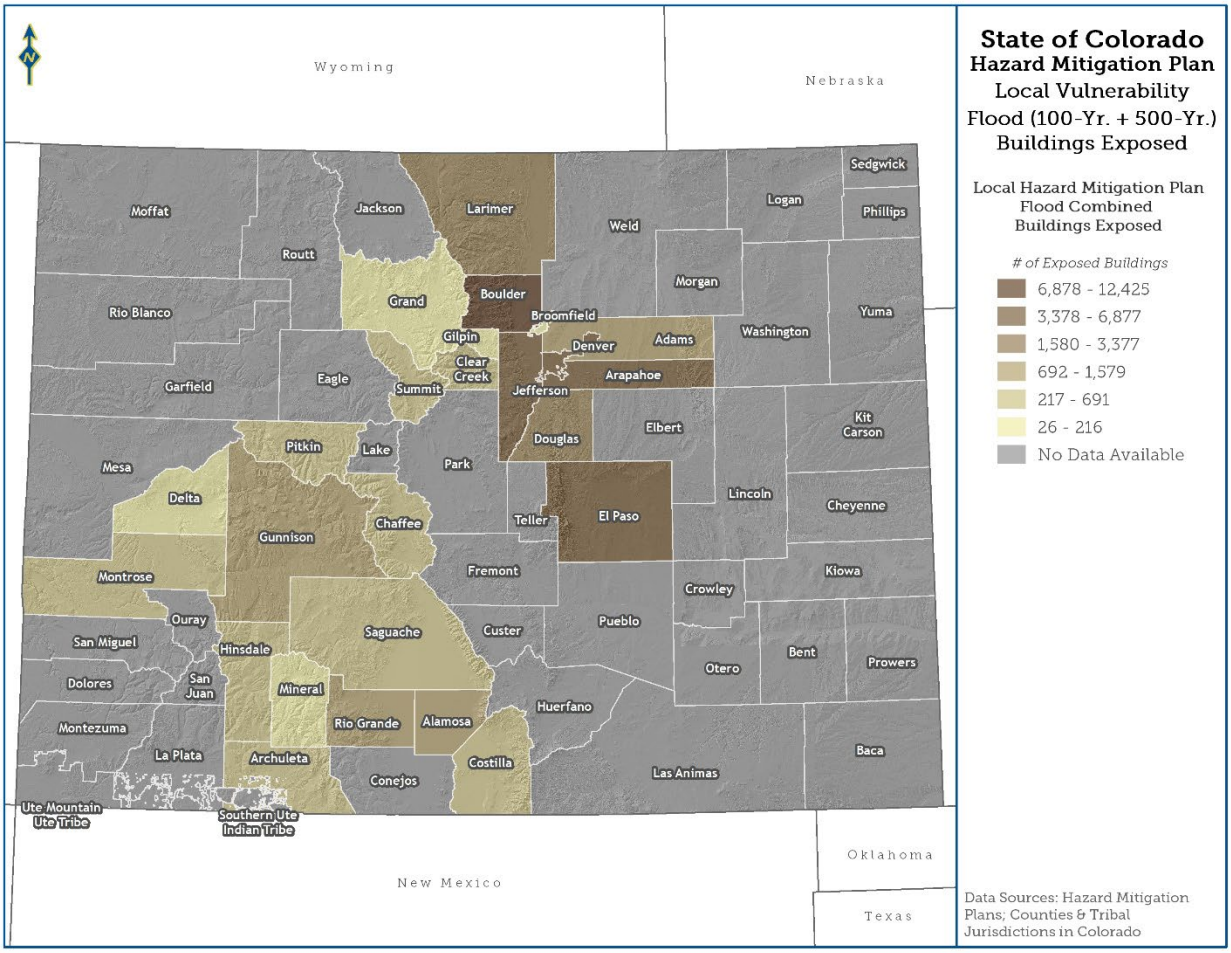
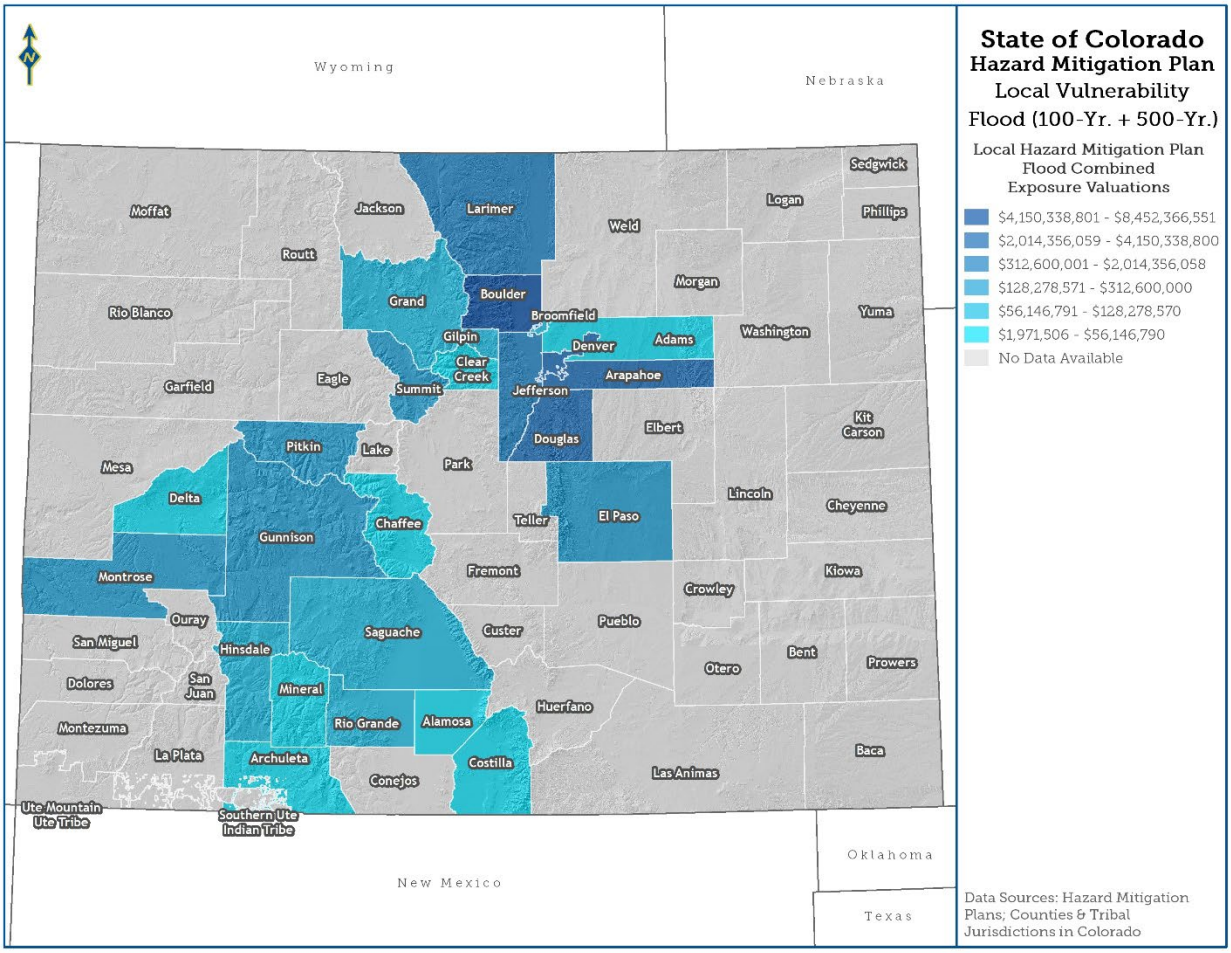


Figure 99 presents the total valuations of those exposed structures to the 500-year floodplains. The highest values are again found along the Front Range.

FIGURE 99 LOCAL VALUE OF BUILDINGS EXPOSED TO 500-YEAR FLOODPLAINS



Interconnected Hazards

Flood can cause or exacerbate numerous hazards including dam / levee incidents, erosion / deposition, expansive soils, ground subsidence, and landslide / debris flow / rockfall.

Floods may result from or be made worse by multiple hazards including dam / levee incidents, earthquake, erosion / deposition, thunderstorm / lightning, and wildfire.

Recent and Future Development

Changes in development patterns can generally be related to changes in population. Population growth and development contribute to increased exposure of people and property to flooding and its related impacts. When the population in a flood hazard

area increases, so too does the vulnerability of the people and property unless mitigation measures are taken.

Understanding changes in hazard exposure over time is an important element of comprehensive hazard mitigation planning. Among other things, increased population growth and development elevate exposure levels of property and people to the impacts of flooding, if development occurs within or near to floodplains or other inundation areas.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- Areas of known flood risk across La Plata County are not mapped by FEMA preliminary or regulatory flood hazard areas. Development in the FEMA preliminary 100-YR Floodplain and also within Geo Hazards may occur in Hermosa.
- Current development and population growth trends necessitate a heightened awareness that the impact of flooding may likely increase in Larimer County over time. As population continues to increase in the county, future development trajectories can be expected to create more impervious surfaces, which in turn can increase runoff and flood potential.
- Some waterways and gulches across Denver have been filled in over the years and built upon, constricting the floodplain. Specific areas include the Globeville, Park Hill, and Montclair neighborhoods.
- Historically, suburban residential development in Arapahoe County has encroached on floodplains throughout the county, specifically along the South Platte River. While development continues, the county is working to retain open space adjacent to floodplains as well as implementing and enforcing the

county's Floodplain Regulations which were updated in 2018 in conjunction with updating floodplain mapping.

- Development in El Paso County along the southern side of Highway 105 coincides with areas of mapped flood risk.
- There is high pressure from the development community to develop residential housing along the San Juan River up to the floodway boundary. Most development that has occurred in Archuleta County has been residential and built to the local floodplain management regulations (lowest floor 1 foot above the base flood elevation). Vulnerability to floods greater than the 1% annual chance flood (base flood) has increased due to this development.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- As population continues to increase in Weld County, future development trajectories can be expected to put more people and property, both private and public, at risk of flooding. The county as a whole should plan for the likelihood of increased exposure of property and humans to flood events.
- Future development in Northeast El Paso County (Region 2) is near the SFHA. Future development in North Central EPC (Reg's 3, 4a, & 4c) is near the SFHA. Future development in Fountain is near the floodway.
- Future development in Garfield County is anticipated to occur along the outskirts of existing communities. Many of the communities in the county have historically developed along the rivers in the county and/or have established rules for development along riverways. Any new facilities or developments

which are constructed along rivers, tributaries, or creeks should evaluate local flood risks.

- Flooding will continue to be a threat to existing development within the San Miguel River watershed. Floodplain management ordinances for the Town of Telluride and the county have been effective in reducing risk to future growth in floodplains.
- Areas of known flood risk are not mapped by FEMA preliminary or regulatory flood hazard areas in La Plata County. Development in the FEMA preliminary 100-YR Floodplain may occur in Hermosa.

Consequence Analysis

TABLE 35 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Impacts of people will change with characteristic of event (e.g., flash flood in a canyon, river flood on the plains, etc.). Localized impacts may be severe with moderate to light impacts for outward or other affected areas. The Big Thompson flood event which resulted from localized heavy rainfall and a subsequent flash flood took the lives of 144 people. Residents/property owners without flood insurance may be impacted greater than those with coverage. Residents may be displaced due to evacuation, damage, or inaccessibility to homes. Persons within flood areas have the potential for direct contact with hazardous materials.
Responders	Need for evacuation support such as door-to-door notification and traffic management may increase responder risk as event escalates. Localized impact expected to limit damage to personnel in flood areas at the time of incident. Impacts to

Consideration	Description
	transportation corridors and communications lines may affect responder ability to effectively respond. There may be a higher risk to responders in flash flood events which are prevalent in the state.
Continuity of Operations (Govt. & Services)	Damage to facilities/personnel in incident area may require temporary relocation of some operations.
Property, Facilities, & Infrastructure	Private property losses with increased risk to those without flood insurance. Localized impact to facilities and infrastructure in incident area. Some severe damage possible. Critical facilities may be impacted by flooding: communications, energy, hospitals, schools, nursing homes, utilities, wastewater and water treatment plants, and roadways. Evacuation routes can become flooded.
Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by flood. Wetland impacts due to flooding can result in water quality and wildlife habitat impacts. Orphan drums (containers that may contain hazardous materials) and releases from oil wells and facilities. Commercial hazmat/hazardous waste. Household hazardous waste. Releases from transportation. Releases into streams and rivers, drinking water supply, ground water, and air.
Economic	Local economy and finances adversely affected, possibly for an extended period of time depending on damage and length of investigation of flood event. Localized disruption of roads, facilities, and/or utilities caused by flooding may postpone delivery of some services.

Consideration	Description
Public Confidence in Govt.	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Ground Subsidence - Low Risk

Definition

Ground subsidence is the sinking of land over human caused or natural underground voids and the settlement of native low-density soils. Natural causes of subsidence include the development of sinkholes, rock sliding downward along faults, and natural sediment compaction. The legal definition of ground subsidence. H.B. 1041, 106-7-103(10): Ground subsidence means a process characterized by downward displacement of surface material caused by natural phenomena such as removal of underground fluids, natural consolidation, or dissolution of underground minerals, or by man-made phenomena such as underground mining.

The types of subsidence are settlement related to collapsing soils, sinkholes in karst areas, and the ground subsidence over undermined areas. In Colorado, the type of subsidence of greatest concern is the settling of the ground over undermined areas.

Collapsing and settling soils are relatively low-density materials that shrink in volume when they become wet, and/or are subjected to great weight such as from a building or road fill. The process of collapse with the addition of water is also known as hydro-compaction.

Sinkholes (i.e. - dolines) occur where evaporite bedrock (gypsum, anhydrite, and rock salt) dissolves or in areas with karst morphology, which occurs when bedrock dissolves. Karst areas are characterized by underground drainage systems such as caverns or caves.

Location

The variance in geography across the state creates very different geologic conditions and therefore unique exposure to the specific hazards impacting communities. Figure 100 illustrates this diversity. It should be noted that the location of undermined areas is not the same thing as subsidence hazard. In general, subsidence hazards typically extend beyond the mapped footprint of a mine. The coal undermined subsidence

areas provide a best available data snapshot, as there are known mines that have not been studied to determine the subsidence risk.

Collapsible soils are present in approximately three-quarters of the counties in the state. The largest area coverage is found in the northwest corner, the Ute Mountain Ute and Southern Ute Indian Tribal lands, and from the Front Range to the eastern border of the state. Sporadic areas of collapsible soils can be found west of the Front Range, as well.

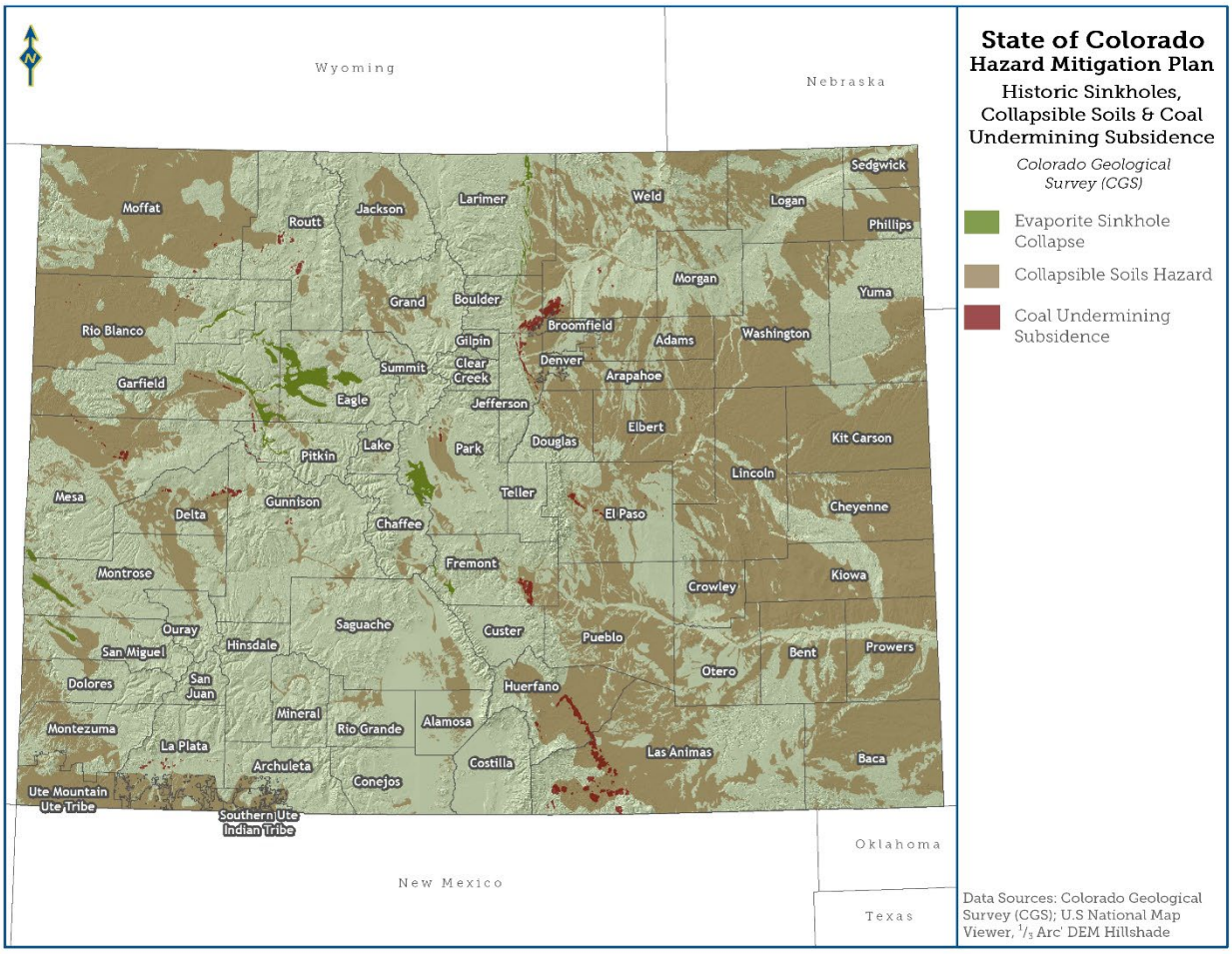
Overall, there is minimal exposure in the state to areas susceptible to evaporite sinkhole collapse, with the most exposure in Eagle, Park, Garfield, and Montrose counties. Smaller areas can be found in San Miguel, Larimer, Mesa, and Fremont counties. The Eastern Plains are largely void of this hazard.

Coal undermined areas are concentrated in a few areas of the state. In the south both Huerfano and Las Animas counties have areas present and most notable is the extension of this hazard area in a line stretching between the counties. This is the longest undermined area in the state as other areas tend to have a tighter grouping. Some counties in the west have small areas that are undermined, though counties in the north central and Fremont County have notable groupings of these areas.

The Colorado Geological Survey (CGS) Abandoned Mine Land Inventory (AMLI) project identified roughly 18,000 abandoned mine-related features on National Forest System lands in Colorado between 1991 and 1999. The mine-related features include mine openings, waste rock dumps, tailings dumps, and mine structures. The Colorado Division of Reclamation, Mining, and Safety (DRMS) estimated that there are approximately 23,000 abandoned mines in Colorado.

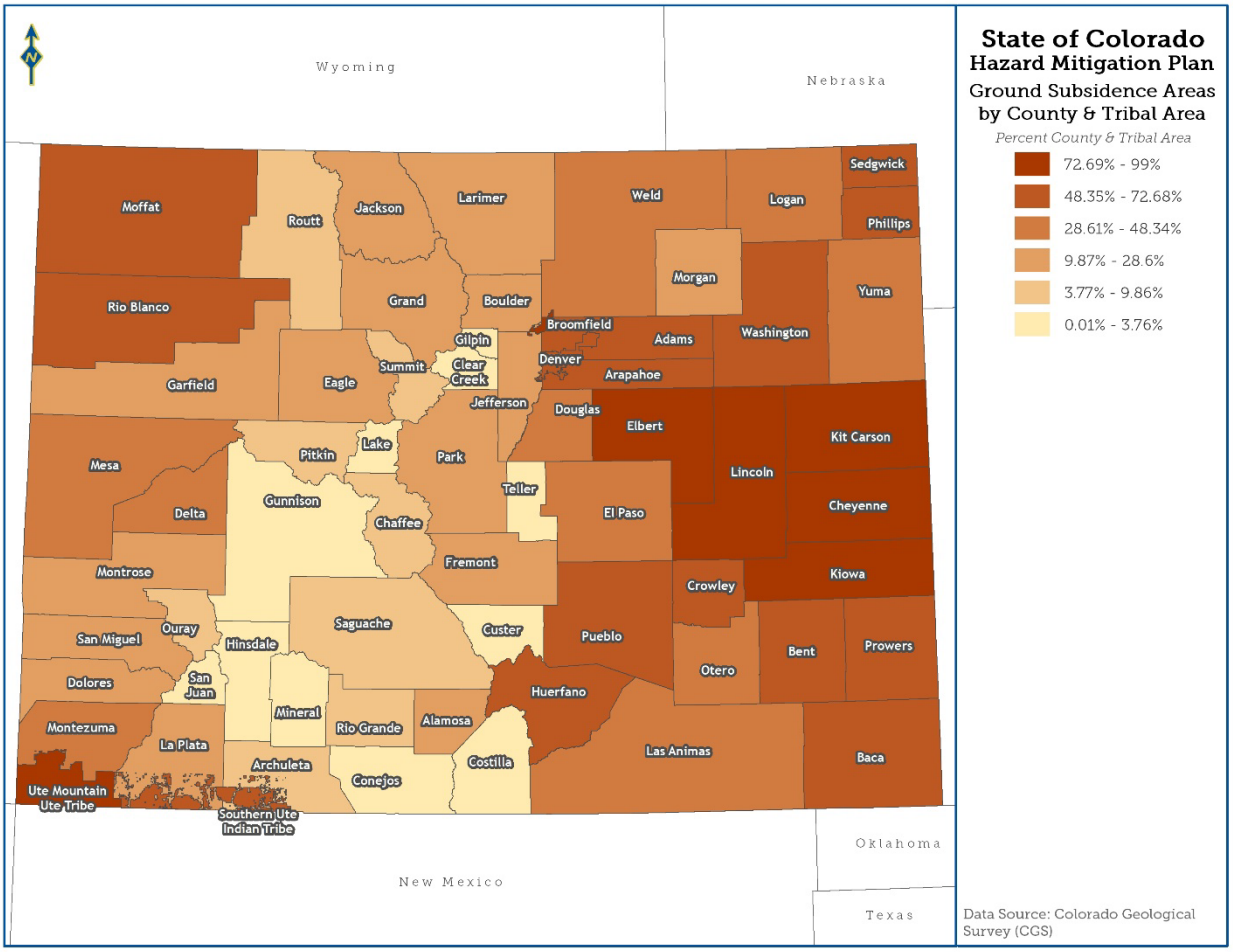
In addition to the AML inventory for USFS lands, CGS maintains a statewide inventory of areas undermined by past coal mining. The inventory also includes an evaluation of subsidence hazards for some coal mines, primarily on the Front Range.

FIGURE 100 SUBSIDENCE HAZARD AREAS



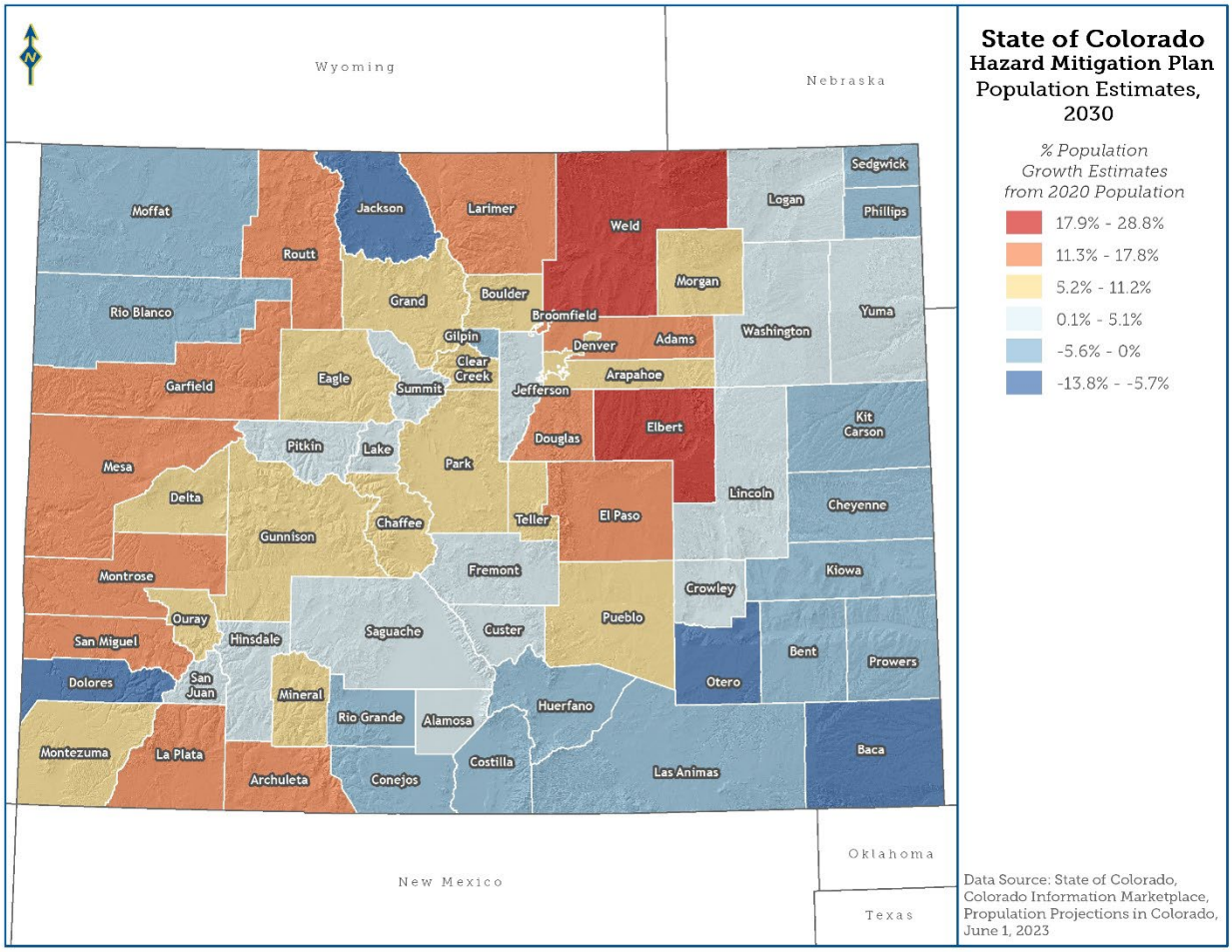
These subsidence areas were collectively assessed to identify the percent of each county and tribal area at risk to these hazards. Figure 101 shows those areas with the highest combined risk are located in the central eastern portion of the state and also the tribal areas in the southwest corner.

FIGURE 101 GROUND SUBSIDENCE AREAS BY COUNTY AND TRIBAL AREA



For comparison, Figure 102 presents the estimated population growth across the state through 2030.

FIGURE 102 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

In Colorado, the types of subsidence of greatest concern for public safety are development of sinkholes in karst areas or over undermined areas. Damages to building and other infrastructure occur due to excessive settlement or ground depressions occurring in areas with collapsible soil, evaporate bedrock, and collapsible soil.

There are many factors that affect the extent of a subsidence hazard. These may include the size of a mine, the susceptibility of the soil to collapse, and composition of the soil. Areas may appear to be free of subsidence for many years, and then undergo renewed gradual or even drastic subsidence.

Subsidence can result in ground displacement of several feet and serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Surface depressions created by subsidence may be filled in, only to sink further because the underground void has not been completely closed.

With few exceptions, collapsible soils occur in dry areas that receive less than 20 inches of annual precipitation. Local groundwater levels generally never rise into these mantles of soil, so they never become saturated. Only through human development and land use do local groundwater levels rise. The soils become introduced to moisture, through combinations of field irrigation, lawn and landscaping irrigation, capillary action under impervious slabs, leaking or broken water and sewer utilities, and altered drainage.

In Colorado, most sinkholes are a product of the dissolution of evaporite rocks. According to the CGS, these evaporite karst hazards have been recognized in several areas of the state, including high growth areas. These areas lie in what are termed regional collapse centers, where subsidence of hundreds to thousands of vertical feet has occurred by the dissolution and deformation of evaporite rocks.

Periodic flooding and draining of abandoned mines can increase the risk of subsidence as mine structures shift underground. Development activities that cause ground vibrations may also accelerate the undermined areas subsidence process.

Past Occurrences

Historical Events

Collapsible soils, evaporite sinkholes, undermined area subsidence are present across the state. Hazard event experiences have been recorded as far back as the early settlers of Colorado. Figure 100 presents the identified subsidence areas across Colorado.

Previous Losses

Previous losses due to collapsible soils, sinkholes, and coal undermined area subsidence can be difficult to quantify as there is no central reporting location for any of these hazards. Although one incident of these hazards can cost millions to repair and remediate, which is shown in the loss figures for some of the notable events.

Subsidence damage can be quite burdensome to individual property owners who own homes over undermined areas. To help with this, CGS established the Mine Subsidence Protection Program (MSPP) in 2016, using a federal grant for $3 million. This program is not insurance, but rather helps to pay damages incurred due to coal mine subsidence. Total MSPP payouts as of August 2023 total more than $902 thousand. Typically, homeowners' insurance specifically excludes subsidence and the MSPP offers assistance up to $100,000 per event.

Notable Events

Collapsible Soils

The first settlers of the Plateau Region of western Colorado, along the Colorado River and the Uncompahgre and Paonia River basins, looked to fruit crops for their livelihood. The semi-arid but moderate climate was well suited for fruit orchards once irrigation canal systems could be constructed. Serious problems occurred when certain lands were first broken out for agriculture and wetted by irrigation. They sank so much in places (up to four feet) that irrigation canal flow directions were reversed, ponding occurred, and newly planted orchards, with fruit trees imported by rail and wagon were lost. While not understood, fruit growers and agriculturists began to recognize the hazards of "sinking ground."

Garfield County: A rancher's stock-watering pond excavated in a pasture collapsed because of hydro-compaction. A bowl-shaped depression 60 feet across and eight feet deep resulted when he attempted to pond water in his field. The soils were so permeable that the pond would not hold water, and the wetted soils under the pond

collapsed. Many roads and other improvements in the vicinity have been destroyed or damaged by soaking of collapsible, low density soils.

Garfield County - 2003: The town of Glenwood Springs lies within the valley confluence of the Roaring Fork and Colorado Rivers. Almost the entire town lies on coalesced alluvial fan and colluvial soils derived from sediments shed from the steep valley sides. These soil deposits are highly susceptible to hydro-compaction. The Terrace development included 13 two-story structures with basement-level garage drive-outs. Thick collapsible soils were previously mapped and identified at the site. These units were built from 2001-2003 and within six months of the first units being completed and sold, collapse of the soil was causing settlement of the back concrete retaining-wall foundations, which caused deflection of interior beams, a host of interior cracks and structural offsets, and distortion of windows and doors. The homeowner's association settled a lawsuit against the developer, the engineering consultants, and builder for $12 million in 2005. Compaction grouting was used to structurally lift the settled areas of the buildings.

Garfield County: The Colorado Department of Transportation (CDOT), recognizing that severe hydro-compaction along a highway alignment could destroy a road, investigated the potential for hydro-compaction along the alignment of Interstate 70 from Rifle to DeBeque. Water was impounded in a small pond and a road fill was placed beside the pond as a model of probable future conditions. The result was that the ground surface sank three feet in one month. The test provided design information to prevent the possible future failure of a portion of the highway. The engineering geologic investigation may have saved taxpayers millions of dollars.

Sinkhole or Evaporative Karst Subsidence

Larimer County – May 1999: On May 1, 1999, a sinkhole spontaneously opened on the westbound shoulder of U.S. Highway 34 within the CDOT right-of-way, about three miles west of Loveland. Just north of the sinkhole the beds of gypsum were historically mined by the United States Gypsum Company. The mine had closed and

the property was being redeveloped as a gated community. The roadside sinkhole was approximately 25 feet in diameter and 20 feet deep.

Garfield County – February 2003: A 24-foot wide sinkhole spontaneously opened on a soccer field at the Colorado Mountain College (CMC) Campus near Spring Valley, about 7 ½ miles southeast of Glenwood Springs. After filling by the CMC physical plant maintenance staff, the sinkhole reopened the next year and enlarged to about 35 feet in diameter.

Garfield County – January 2005: A large sinkhole opened off of County Road 109, across the Roaring Fork River from Highway 82, between Glenwood Springs and Carbondale. The sinkhole occurred in the Iron Bridge community development. It opened at the clubhouse golf cart facility. Reportedly, a small hole, about 10-foot by 10-foot, opened very early that morning and enlarged to a 42-foot diameter and 40-foot deep sinkhole by the middle of the day. In 2002, CGS published a map of evaporite karst hazards for this area of the state.

Garfield County – May 2022: In 2020 a hole was discovered in a culvert along Highway 133 and was deemed eligible for replacement but not rated for priority repair or replacement. Two years later, spring runoff and the resulting buildup dislodged the culvert, collapsing the road. A sinkhole opened and quickly grew. A temporary bridge was contracted by CDOT at an estimated $1.9 million, not including any work on the road, sinkhole, or installation of a new culvert.

Delta and Gunnison Counties – May 2023: A similar incident to the previous year's in Garfield County, a large sinkhole opened on Highway 133, near Paonia. Spring runoff and a damaged culvert were factors in the incident. Subsequent runoff caused erosion and collapse of a section of road 20 to 30 feet wide, spanning across both lanes.

Undermined Areas

Boulder County – 1974: One evening a Lafayette, Colorado, mobile home park resident noticed a two-foot hole in his front yard. By morning the hole was 10 feet deep and 10 feet across. The mobile home was moved as the hole continued to grow until it was about 25 feet deep and 25 feet in diameter. The sidewalk, a telephone pole, a concrete pad, and a fence had to be replaced after the hole was filled. The property owner backfilled the hole, acknowledging the site had previously subsided and had been filled. An inclined shaft to an old coal mine underlies the site, abandoned more than 50 years ago.

El Paso County – 1979: On April 13, 1979, a group of Colorado Highway Department (now the Department of Transportation) maintenance crews found a 500-foot-deep airshaft to the abandoned Klondike coal mine had been reopened by surface subsidence into the mine. A crater about 20 to 25 feet across opened like a funnel into the shaft just off the pavement on the northeast corner of the Interstate 25 and Woodmen Road interchange in Colorado Springs. The shaft was previously capped, but the deterioration of the surface plug caused the reopening.

San Juan County – 1979: In an especially rare event, undermined area subsidence caused a dam failure flood of sorts. In the San Juan Mountains above Silverton, a natural lake (Lake Emma) was completely drained on June 4, 1979 by a series of abandoned mine tunnels beneath the lake.

Jefferson County – 1988: A sinkhole opened up overnight in an open space area next to Deer Creek Middle School. The next day a student fell into the sinkhole but his injuries were minor. The sinkhole suddenly formed when the roof over a void left by a past coal mine collapsed. A sinkhole also suddenly formed in an Albertson's parking lot nearby. No one was injured, but some cars were damaged.

Jefferson County – 1995: Just north of Deer Creek Middle School, the county proposed extending a major road near the same coal mine (Economy Mine). Old mine maps did not show that the proposed extension would be located over undermined areas. Since old mine maps are often inaccurate, Jefferson County decided to drill in the proposed

construction area. The first boring found evidence of mining and confirmed that the risk of sinkholes extended under the road extension. The county spent an additional $500 thousand on 300 linear feet of roadway to mitigate this sinkhole risk.

Weld County - 2017: Interstate 25 crosses several abandoned coal mines in Weld County. Roadway settlement of more than two feet near Erie has taken place in patterns that can be correlated to subsidence over coal mine workings 350 to 400 feet below the surface. Much of the severely damaged road is below original grade, resulting in a mild roller coaster-like ride. Estimates for repair of the damaged three-quarter mile section are about $1 million.

In addition to these events, CGS has recorded several subsidence case studies related to undermined areas in Colorado, as described below. Additional case studies are also documented on the CGS website (http://coloradogeologicalsurvey.org/geologic-hazards/subsidence-mine/case-histories/).

CGS Case Study - Marshall Area (Boulder County) - May 2007: In May 2007, a consultant reported mine-related subsidence features in a property near Marshall being considered for residential development. Upon investigation, a number of subsidence holes and mine-related features were found on the property. An abandoned building showed significant damage possibly related to the old mine. No records of the mine were found, but several old foundations around the property indicate a mine entry exists west of the site. Due to the unknown mine, lack of records, and the presence of subsidence features, the property owner elected not to pursue development.

CGS Case Study - Town of Erie (Boulder/Weld Counties) - December 2008: In December of 2008, a report of a large subsidence hole in a field west of Erie was reported. The hole was about 50 feet in diameter and 35 feet deep before being filled with water. The field where the hole appeared was under consideration for annexation by the town for future residential development. A geophysical investigation conducted three months prior did not show any evidence of voids in the

area. The hole was located outside of the mined area shown on the mine map, indicating that the mine map was inaccurate. During the mitigation process, a secondary subsidence pit of smaller dimensions was found directly west of the original hole. Both holes were backfilled by the Abandoned Mine Lands program.

CGS Case Study - Town of Erie (Boulder/Weld Counties) - January 2009: A large subsidence hole was reported in January 2009 at a residence near the corner of a horse barn. The property owners reported the hole opened up overnight and a fence and gate had been destroyed by the event. The hole measured roughly 25 feet by 25 feet by 15 feet deep and was filled with water. Because of the nature of the opening and the proximity to livestock and human activities, the event was considered a subsidence emergency and was backfilled by the Abandoned Mine Lands program.

CGS Case Study - City of Colorado Springs (El Paso County) – Ongoing: The Country Club Circle area of Colorado Springs has a long history of mine subsidence from multiple mines that were active during the early 1900's. The mining in the area was very shallow, and there is little bedrock between the mine roof and the ground surface. The area is developed with residential neighborhoods, and residents in the area have been living with subsidence for decades. Starting in 2005, the Abandoned Mine Lands program has been working to try to grout the homes in the area to prevent further damage. The money for this effort was made available by the Office of Surface Mining, based on the history of ongoing damage and the age of the residential structures involved. Many of the residents are enrolled in the Mine Subsidence Protection Program. Structures built after 1989 would generally not qualify for assistance and would have to rely on the developer to adequately address potential subsidence hazards.

CGS Case Study - Colorado School of Mines (Jefferson County) – Ongoing: The Colorado School of Mines (CSM) has had ongoing subsidence issues related to the old clay mines west of the main campus for decades. At one point, one of the married student housing units was so badly damaged that it was uninhabitable. In recent years, the

school has made the subsidence-prone area into an athletic field; however, ongoing subsidence-related issues are still being reported. Sidewalks, streets, and two-story buildings have sustained substantial damage from settlement. The problem continues despite repeated repairs and some corrective work.

During the construction of the fields in 2004, depressions started occurring. In the spring of 2005 the area reactivated from the snowmelt runoff. Several open holes in the field were visible, and the street near the sorority houses was damaged. The structures themselves were not, as they sit on deep piers on the sandstone that was not mined. A grouting program was implemented to try to stabilize the area in 2005; however, in 2006 additional street damage occurred and several new depressions were found in the field. In 2008, the DRMS conducted a geophysical survey to try to establish areas where voids still existed so that a mitigation strategy could be developed to avoid future damage.

Probability

Natural processes will be continuous and indefinite (100% chance). Based on the notable events reported since 1974, there is an approximately 37% chance of experiencing a notable ground subsidence event in a given year. Considering that these hazards are not always reported this likelihood could be higher. As development pressures continue in ground subsidence areas, these hazards may be exacerbated.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are not expected to influence future ground subsidence events.

Risk & Vulnerability

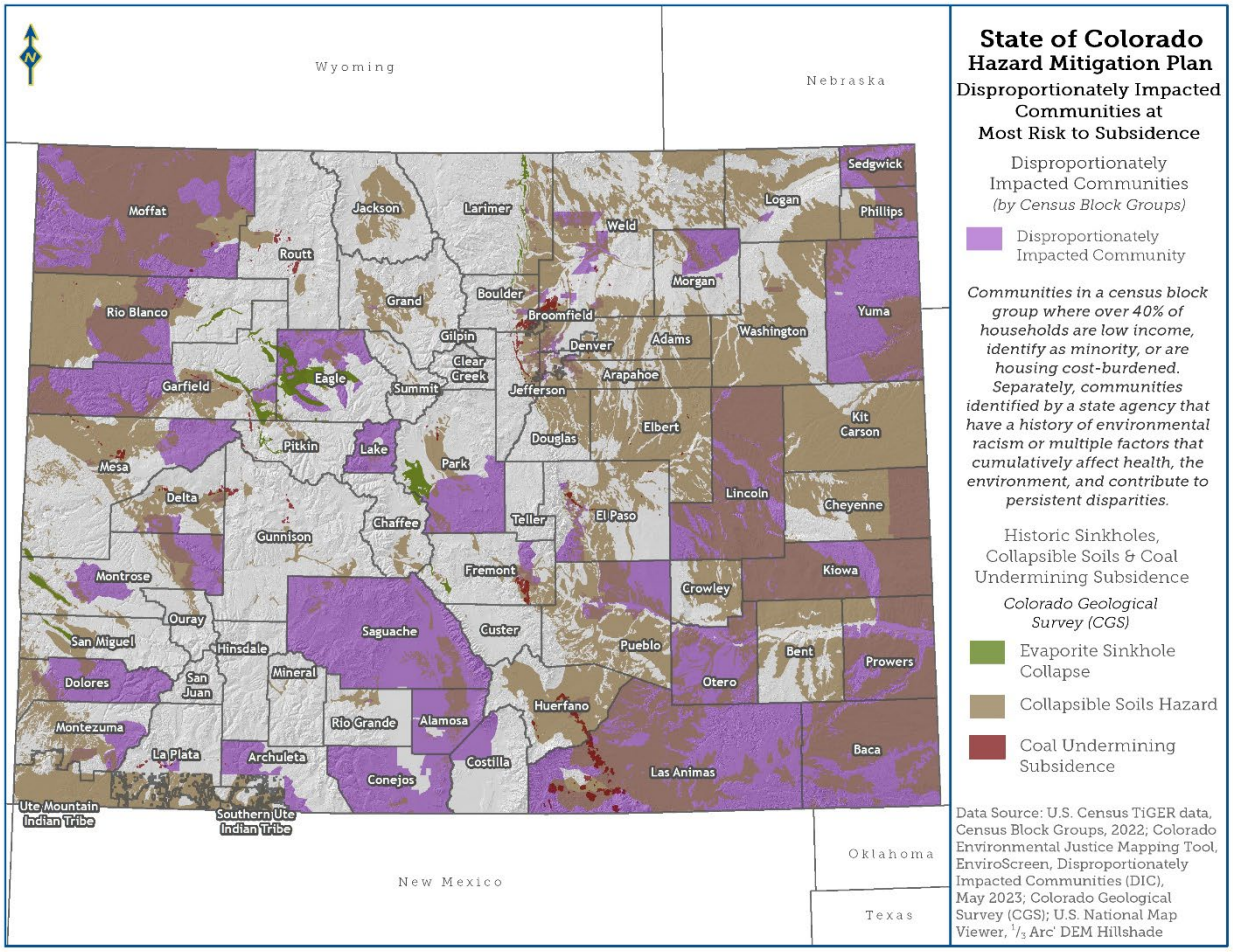
Populations at Risk

Anyone living over or near an undermined area or other area susceptible to ground subsidence is at risk from the hazard. In many cases it is known where mines are located, as well as the shaft openings. The Colorado Division of Reclamation, Mining

and Safety (DRMS) continues to safeguard mine openings and mine subsidence features.

The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 103 identifies those DIC communities, at a Census Block Group level, that have mapped ground subsidence risk.

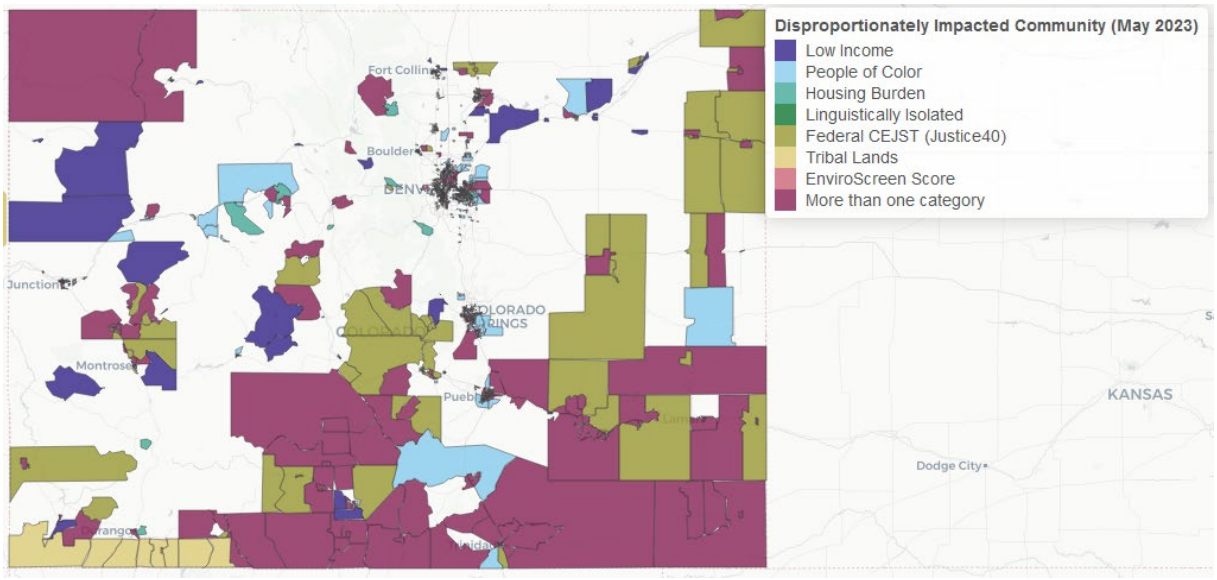
FIGURE 103 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 58. When comparing these communities to those counties with the highest percentage of ground subsidence hazard areas (Figure 101),

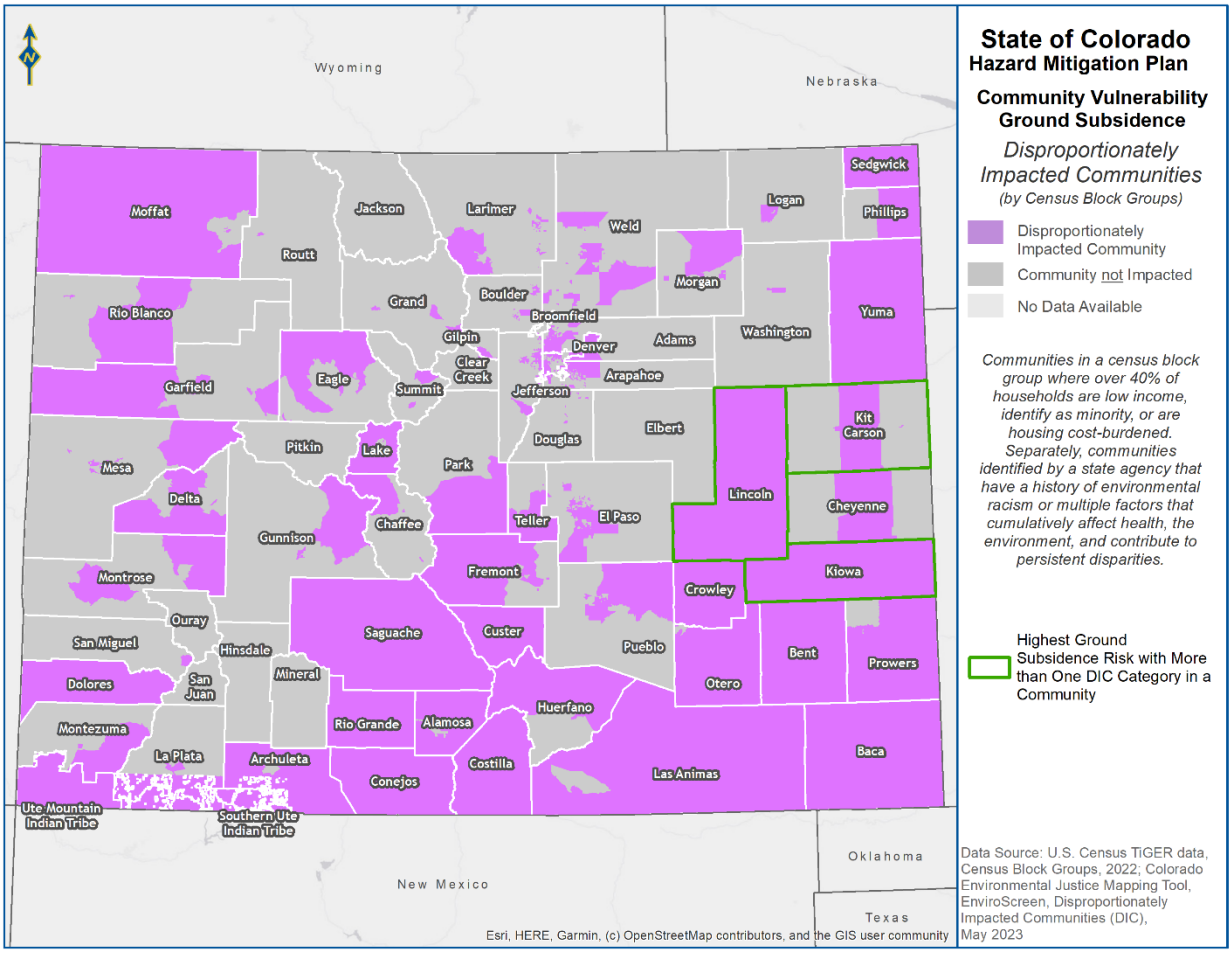
Kiowa, Kit Carson, and Lincoln County each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 104 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to ground subsidence include: low income, people of color, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 105 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (Kit Carson and Lincoln) and “Low” (Kiowa).

FIGURE 105 COMMUNITY VULNERABILITY



State Assets

Previous Losses

There are no reported losses of state asset buildings due to subsidence, sinkholes, or undermined areas. There have been reported events impacting highways with limited loss information as documented in the Notable Events section.

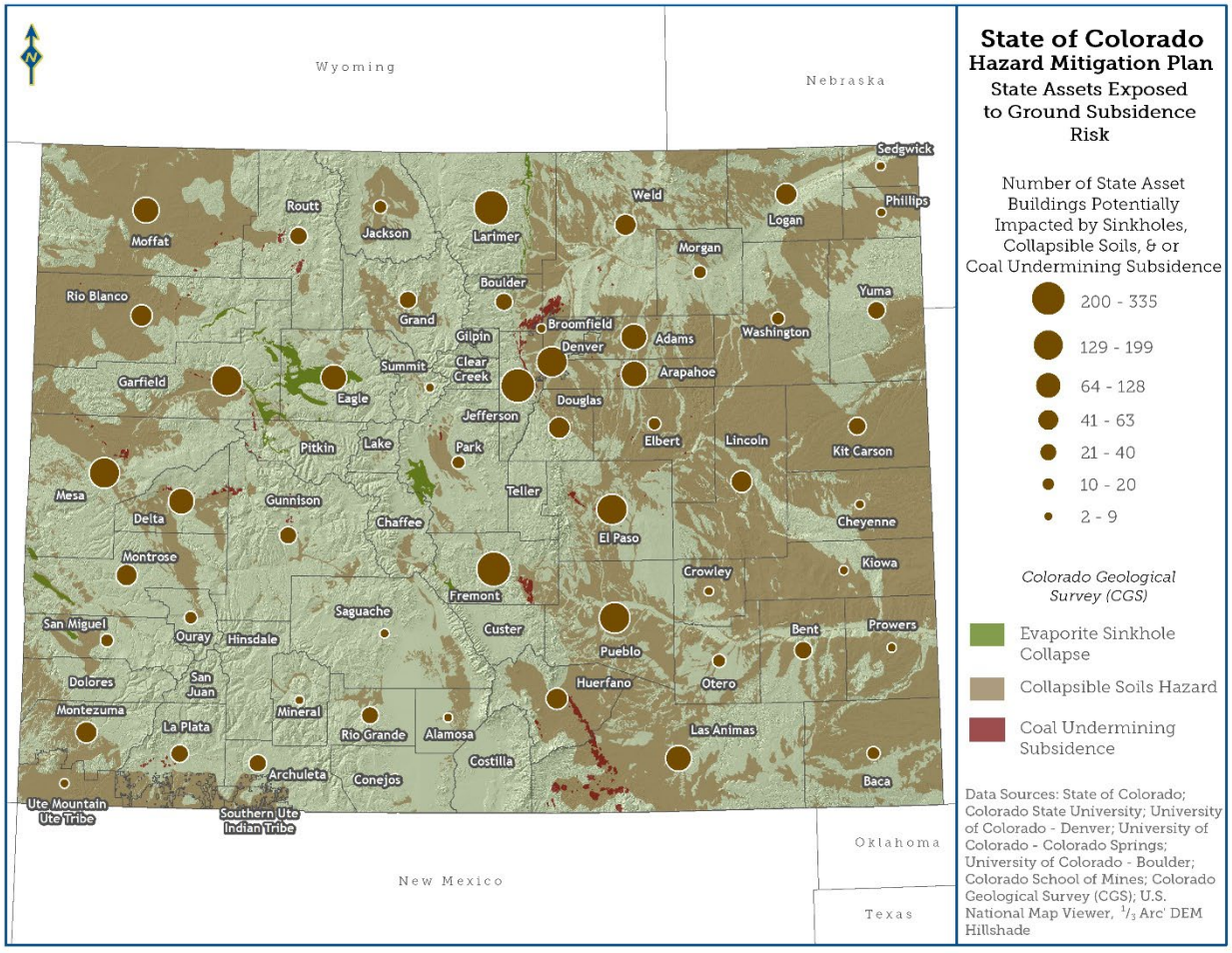
Exposure

Highways are the most vulnerable state asset type exposed to ground subsidence hazard. The largest risk is to those state highways located in known hazard areas. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

There are four state-owned dams located in mapped collapsible soils areas. These include the Horseshoe Lake, Flagler, Upper Highline, and Garnet Mesa dams.

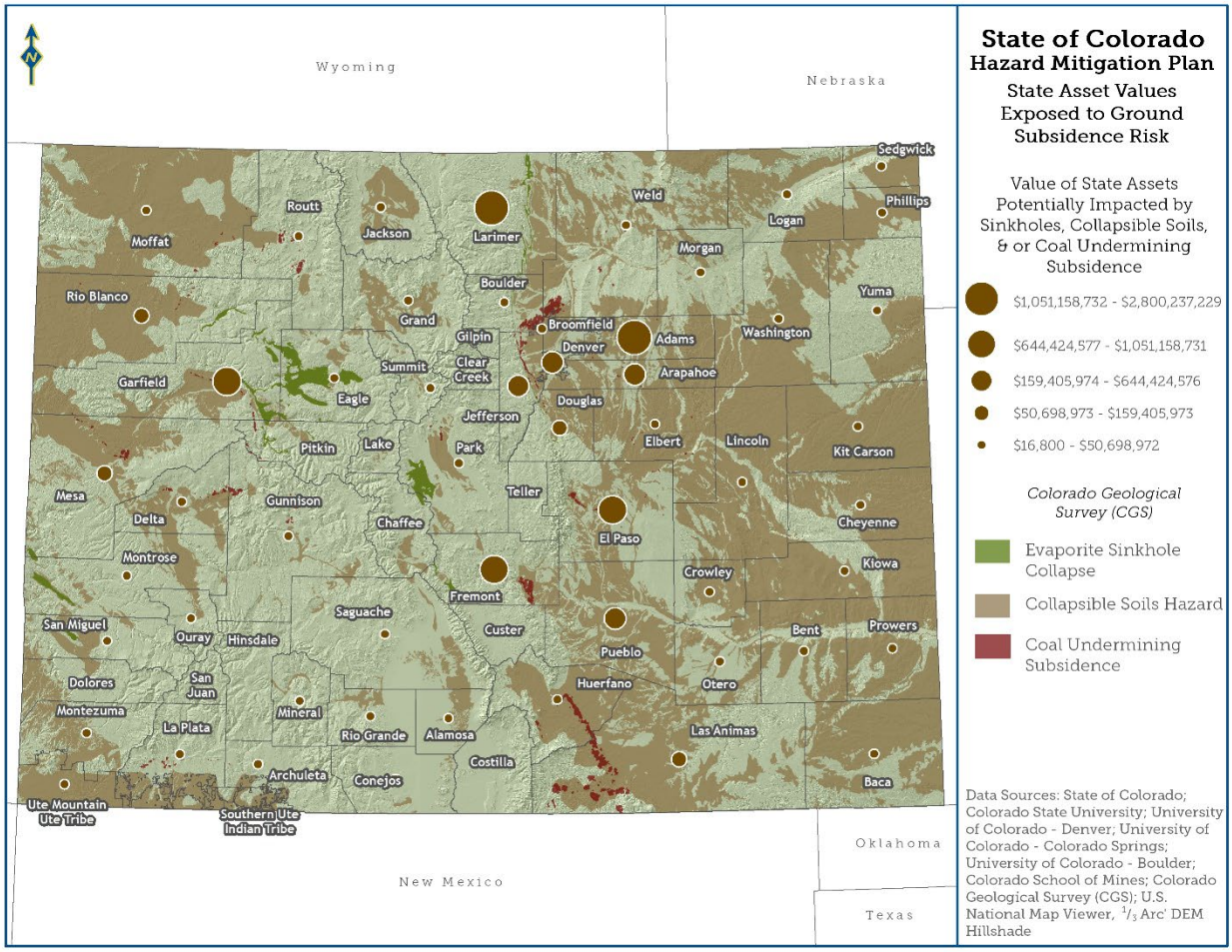
Figure 106 illustrates the large portion of state asset building exposure that occurs in and around the Front Range. The northwest area counties have significant exposure as well.

FIGURE 106 STATE ASSETS EXPOSED TO GROUND SUBSIDENCE



Shown in Figure **107**, a majority of the exposed state asset values is within counties along and near the Front Range, with Garfield County being an outlier on the West Slope.

FIGURE 107 STATE ASSET VALUES EXPOSED TO GROUND SUBSIDENCE



Lifelines

Communications, energy, and transportation are the community lifelines most vulnerable to the impacts from ground subsidence. It is unlikely that all sectors could be affected, or resources strained due to the relatively small footprint of hazard events. There are likely no long-term effects on recovery and resilience.

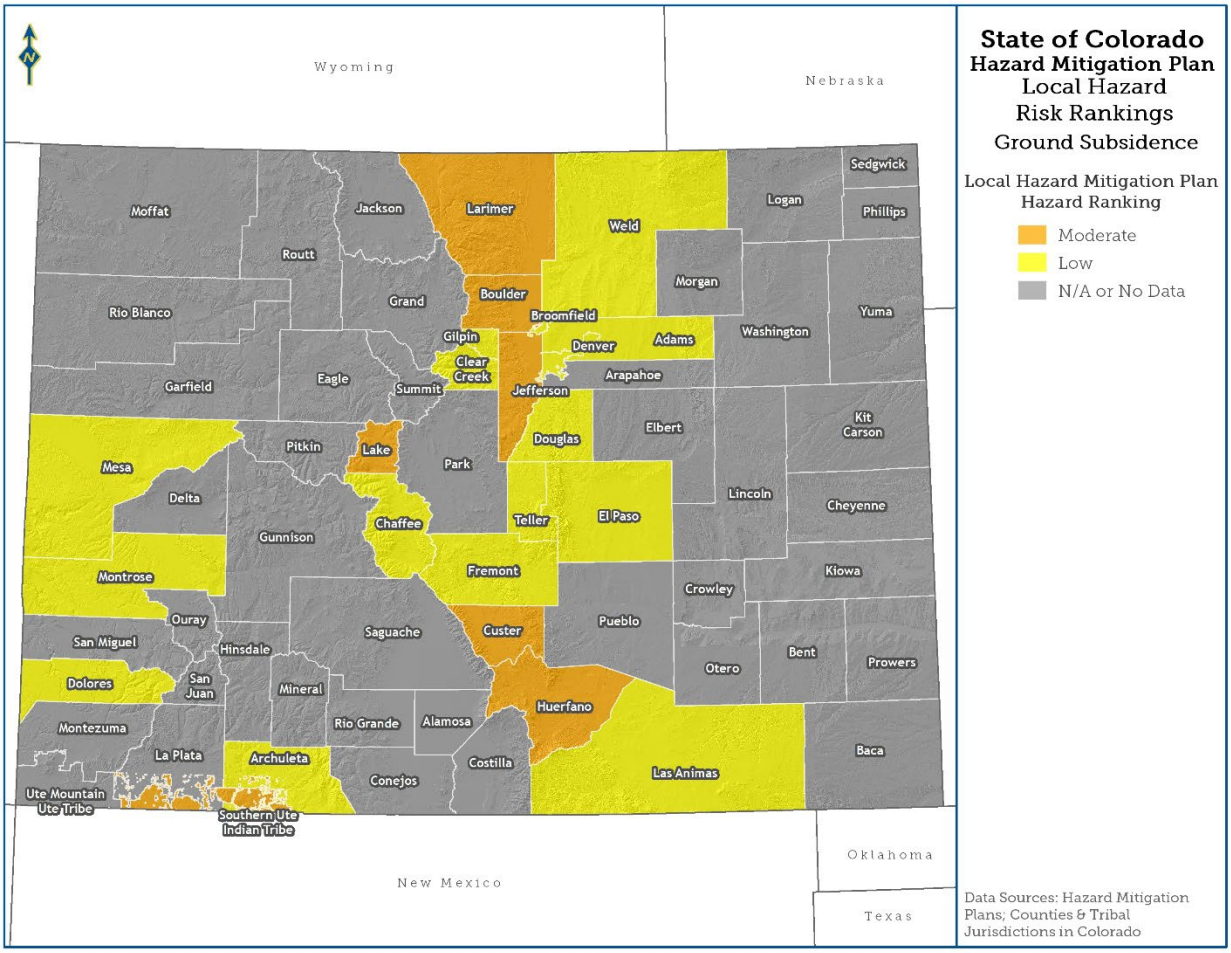
Subsid-ence	Communications	Energy (Power & Fuel)					Transportation

Local County / Tribe

Hazard Rankings

Figure 108 presents local hazard mitigation plans which ranked ground subsidence hazards. There are no high risk rankings across the state. The majority of plans, approximately two-thirds, rank the hazard as low risk, while the remaining counties determined a moderate risk.

FIGURE 108 LOCAL HAZARD RISK RANKINGS – GROUND SUBSIDENCE



Exposure

Exposure varies greatly across the state and differs based on the specific type of subsidence.

Local-level analysis of ground subsidence risk to structures is not provided in any of the state's HMPs for counties located in high risk areas. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Ground Subsidence areas have the potential to cause a dam / levee incident. These hazards can be the result of or worsened by a dam / levee incident and flood.

Recent and Future Development

As Colorado's population continues to grow and the need for additional housing increases, more people and property may be affected by subsidence. Local land use planning agencies should consult federal and state sources including CGS, the US Forest Service, the Bureau of Land Management, and the Colorado DRMS to identify known abandoned mine lands and other subsidence hazards before beginning development projects. Engineering geology and geotechnical investigations can help in identification of hazards and mitigation strategies.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- Areas of known geologic risk across La Plata County are not mapped. Development in these geo-hazard areas may occur in Hermosa.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- None of the counties with the highest future development projections provided any specific content about future development.

Consequence Analysis

TABLE 36 - EMAP IMPACT SUMMARY

Consideration	Description
Public	A low risk to homeowners, developers, and owners of public and private facilities and infrastructure, unless a structure is located in a high risk area or if a rapid subsidence event occurs.
Responders	Some exposure exists to personnel performing routine duties after a specific site is impacted and unstable.
Continuity of Operations (Govt. & Services)	None, or limited loss of facilities or infrastructure function or accessibility, or ability to provide services. May have limited power interruption if not adequately equipped with backup generation.
Property, Facilities, & Infrastructure	Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. Instances of infrastructure damage due to compressing soil can cause major or long-term structural damage.
Environment	Subsidence events can alter the morphology and hydrology of an impacted area.
Economic	None, or limited loss of facilities or infrastructure function or accessibility, and limited uninsured damages.
Public Confidence in Govt.	Characteristics of ground subsidence such as duration and speed of onset result in limited response functions for government beyond building inspection and repair.

Hail – Low Risk

Definition

Hail occurs when atmospheric water particles in thunderstorms form into rounded or irregular lumps of ice that fall to the earth. Strong updrafts in storm clouds carry water droplets to altitudes with temperatures below freezing. As the frozen droplets rise and fall within the cloud, they gather layers of ice and grow larger, until their weight is too great for the wind to keep them aloft.

The Colorado Resilience Framework notes that "such conditions are typical of spring and summer storms on the Eastern Plains of Colorado and are exacerbated by strong updraft potential along the front of the Rocky Mountains." Hail is often associated with the types of severe thunderstorms that can also produce tornadoes.

Location

Hail can occur anywhere in the state. However, some areas see more frequent hail events which may bring damaging hailstones more often. The National Weather Service (NWS) states the highest frequency of damaging hail appears to occur near the border of Wyoming, Nebraska, and Colorado. The area where these three states meet – "hail alley" – averages seven to nine hail days per year.

In Colorado, areas range from one to 13 severe hail days per year. The primary threat of hail is east of the Continental Divide along the Front Range and across the Eastern Plains. These areas receive the highest frequency of severe hail (.75 inch and greater diameter) in the state. Since 1955, over 90% of all reported hail events occurred in these eastern regions.

Contributing Factors

Hail is more variable, in frequency, magnitude, and geography, than almost any other climatic event. In addition to hailstone size, strong winds accompanying hail greatly increase the damage potential. Table 37 details the different hailstone diameters and associated damage level.

TABLE 37 HAILSTONE DIAMETER DESCRIPTIONS[35]

Size	Damages	Diameter	Comparison
Small	Minimal	Less than .75 inch	Peas to Marbles
Large	Minor	.75 inch to 1.75 inch	Nickels to Golf Balls
Very Large	Moderate	1.75 inch to 2.75 inch	Golf Balls to Baseballs
Giant	Major	Larger than 2.75 inch	Softballs or Grapefruits

Hailstones of one to two inches in diameter (which may fall at a rate of 80 miles per hour) occur many times in eastern Colorado each summer, but fortunately occur over small areas.

The National Oceanic and Atmosphere Administration (NOAA) Storm Prediction Center Severe Weather Database, which maintains records on reported hail events since 1955, shows that reported hailstones in Colorado are, on average, 1.2 inches in diameter. Hailstones four inches or larger have been reported on 50 occasions, mostly in northeastern Colorado. Stones of that size have been known to penetrate some roofs and car windshields. Colorado's damaging hail season is from mid-April to mid-August. About 35% of reported hail events took place in June, and hailstorms are most likely to be destructive in mid-June.

Past Occurrences

Historical Events

The events shown in Figure 109 illustrate how extensive the hail hazard is in the state. Over 13,000 events have been recorded since 1955 according to the NOAA Severe Weather Database. With hail sizes recorded up to 4.83 inches in diameter, the number of hail events is not the only incredible aspect. These events are primarily east of and along the Front Range, although there are some groupings of events in the western portion of the state.

[35] Hail Threat Defined - National Weather Service

A storm that occurred on August 8, 2023 formed the largest hailstone to be recorded in the state. This 5.25” hailstone fell between Kirk and Idalia in Yuma County.

FIGURE 109 HISTORICAL HAIL EVENTS

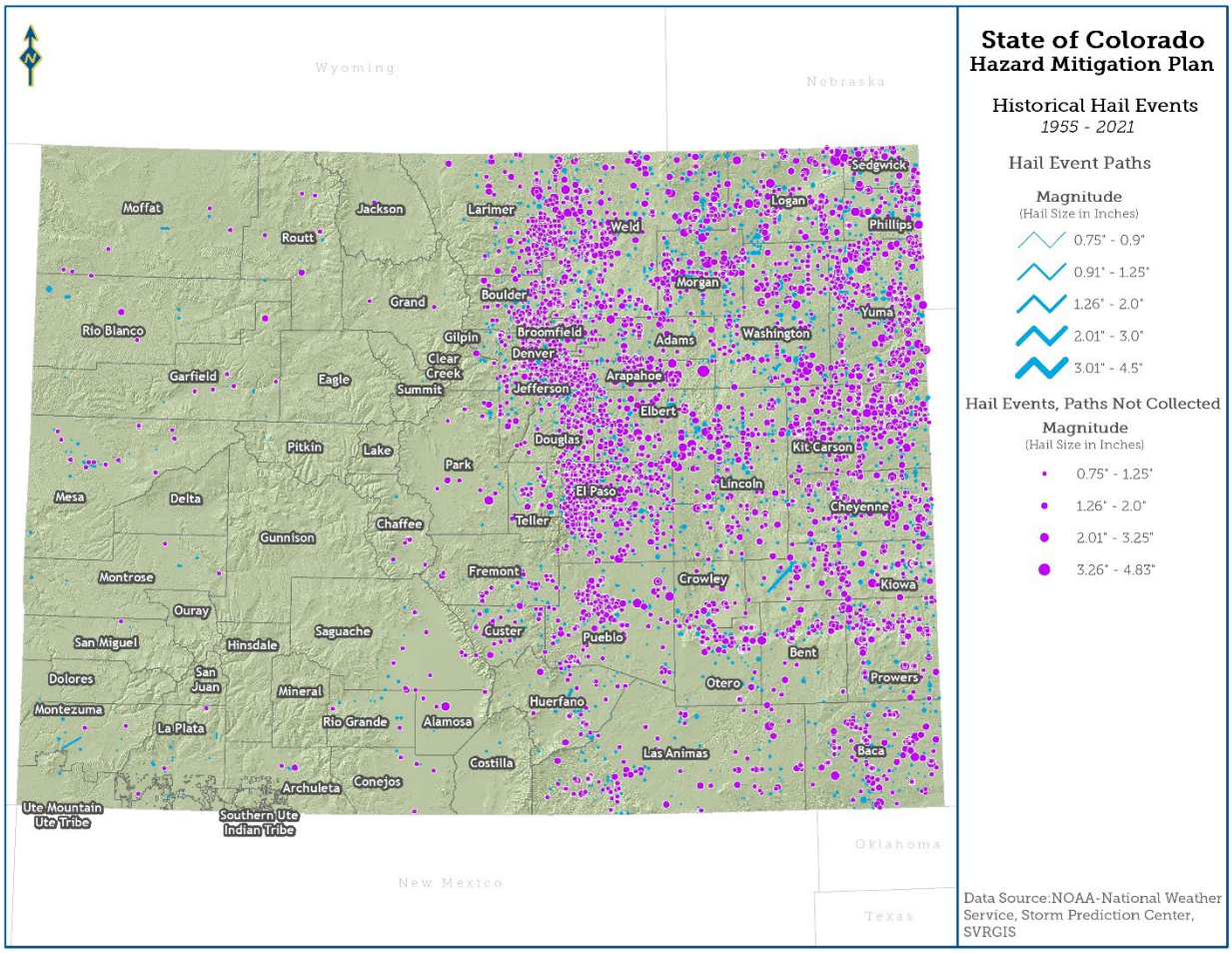
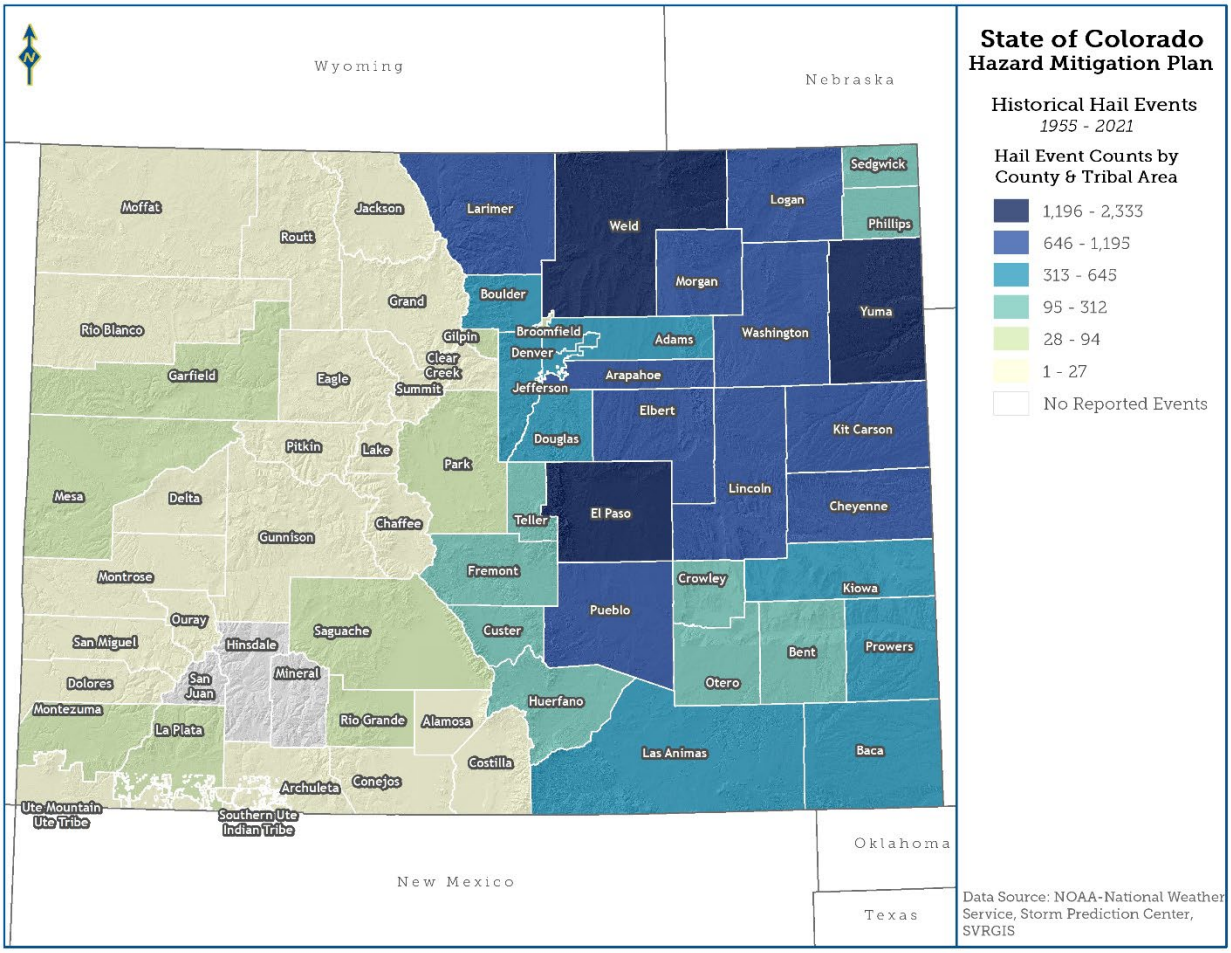


Figure 110 illustrates this data for all recorded hail events between 1955 and 2021 at a county and tribal area level. This clearly shows these types of events are much more prevalent across the eastern portion of the state, with the northeast experiencing the most.

FIGURE 110 HISTORICAL HAIL EVENTS BY COUNTY AND TRIBAL AREA



Previous Losses

Hail damages may be reported to multiple databases, only through insurance claims, or not at all. Often reported damages are estimated and may not accurately reflect what was truly incurred in losses. The property damages that have been reported to NOAA, since 1955, for hail events are estimated at $5 billion.

Since 1995, there have been 15 storms with over a million dollars in crop damages, with an estimated total of $108.9 million in losses. The greatest reported losses were in Weld County in 1995 with $250 million in total damages, of which approximately $25 million was for crops including the loss of 22,000 acres of plants.

Since 1986, hail has resulted in a reported 130 injuries in Colorado, according to the NOAA Severe Weather Database. Sixty of these injuries occurred during the same storm in 1990.

Table 38 details the 12 costliest hail events to occur since 1984. The events are ordered by cost, with both the event cost at the time of occurrence and the 2023 USD adjusted cost figures.

TABLE 38 COSTLIEST HAIL EVENTS IN COLORADO[36]

Date	Location	Cost When Occurred ($ Millions)	2023 Cost ($ Millions)
May 8, 2017	Denver Metro	2.3 billion	2.8 billion
July 20, 2009	Denver Metro	767.6	1.0 billion
July 11, 1990	Denver Metro	625.0	1.45 billion
June 6-15, 2009	Denver Metro	353.3	499
July 28, 2016	Colorado Springs	352.8	445
June 6-7, 2012	Front Range	321.1	424
June 13-14, 1984	Denver Metro	276.7	807
June 18-19, 2018	North Denver and Denver Metro	276.4	333
July 29, 2009	Pueblo	232.8	329
October 1, 1994	Denver Metro	225.0	460
September 29, 2014	Denver Metro	213.3	273
May 22, 2008	Windsor	193.5	272

[36] Hail Damage and Statistics - Rocky Mountain Insurance Information Association

Notable Events

City of Fort Collins – 1979: Deaths from hail are rare, with only a few fatalities ever reported in the United States. One of these occurred during a 1979 hailstorm in Fort Collins. Several sources, including The (Fort Collins) Coloradoan newspaper, report that an infant died after being struck on the head by a large hailstone.

Denver Metro Area – July 11, 1990: A hail event struck the Denver area causing $625 million in damages, or nearly $1.45 billion USD 2023. A severe thunderstorm developed near Estes Park and moved southeast, producing hail up to 2.75 inches in diameter across seven counties, as well as flooding and two small tornadoes. The hail damaged thousands of homes and tens of thousands of vehicles. It is Colorado's most harmful hail event with 60 reported injuries, 47 of which occurred from golf ball-sized hail at Elitch Gardens Theme Park.

Denver Metro Area - June 22, 1996: A severe thunderstorm producing large hail, from .75 to 2 inches in diameter, developed near the foothills and moved east, northeast across northern portions of the metro area. The hardest hit areas were the cities of Arvada and Westminster, northwest of Denver. The insurance industry estimated $60 million in damage to homes and personal property and $62 million in damage to automobiles for a total of $122 million in insured losses. This estimate also included the cities of Golden, Thornton, and Wheat Ridge.

Northwest Denver Suburbs – July 20, 2009: In the evening, a strong storm hit the northwest suburbs of Denver, with hail one inch in diameter and up to an inch of rain in less than an hour. Numerous cars, windows, and roofs were damaged. A greenhouse containing more than $250,000 worth of plants was destroyed. Straight-line winds of 80 miles per hour uprooted mature trees and damaged roofs. The storm left 50,000 residents without power. The Rocky Mountain Insurance Information Association (RMIIA) identified $767.6 million in damages.

Multiple damaging events also occurred in June and July 2009. Severe weather from June 6 to 15, including golf ball and baseball sized hail and multiple tornado

touchdowns, resulted in over 34,000 insurance claims totaling an estimated $353.3 million in insured losses. The weather system caused damages from Aurora to Fort Collins. A storm in the Pueblo Area, on July 29, caused more than $200 million in damages to property and crops. A total of $1.4 billion in insured losses was reported in 2009.

Northeast and Southern Counties, Denver Metro Area - September 29, 2014: Per the RMIIA, a storm pounded thousands of vehicles and roofs—causing wide-spread damage, street flooding and pelted the south metro area with golf ball-sized hail. Damages estimated at $213.3 million in insured losses resulting from 43,584 auto and homeowners insurance claims within a month after the storm. The damage estimates include 29,297 car insurance claims adding up to more than $87.2 million and 14,287 property insurance claims at more than $126 million.

Greater Denver Metro Area – May 8, 2017: In the late afternoon, a severe thunderstorm struck the Denver area, bringing large hailstones, strong winds, heavy rain, and flash flooding. Hail was reported across 11 counties, with official reports of hailstones up to 2.75 inches. The hail caused extensive damage to homes, businesses, and cars across a large part of Denver and its western suburbs, as well as Greeley. The RMIIA stated that approximately 100,000 homeowner insurance claims were filed due to the storm. The storm struck during commuting hours exposing innumerable cars on the road. The hail broke skylights at the Colorado Mills Mall in Lakewood, letting in rain that flooded the stores, common areas, and electrical and mechanical systems. An auto dealership in Lakewood reported more than 250 vehicles were damaged. Broken windows were reported at a medical center in Wheat Ridge and an apartment complex near Regis University. An estimated $2.1 million in damages to state vehicles, including Colorado State Patrol and Central Services fleet vehicles, resulted from the storm. With estimated damages of $2.3 billion, the storm surpassed the 1990 and 2009 hail events and ranks among the costliest disasters ever in Colorado.

El Paso County – June 13, 2018: A rare nocturnal hail event during the early morning hours, produced hail up to 3 inches in diameter. Media reports indicate the event caused $169 million in damages to vehicles, trees, roofs, siding, windows, skylights, and other parts of homes. Some of the larger reported hailstones ranged from the size of hen eggs to tennis balls and tea cups across the county.

Front Range and Northeast Plains – June 19, 2018: Very large hail, up to 3 inches in diameter, pummeled portions of the Front Range Urban Corridor and extended across the northeast plains of Colorado. Collapsed roofs due to hail were reported, with major hail damage across northern portions of the Denver metro area. A total of four short-lived tornadoes touched down in the open country of Lincoln and Weld counties. In Lincoln County, thunderstorms produced damaging wind gusts up to 70 mph. The RMIIA estimated the property damage from the storm totaled $276.4 million.

El Paso County – August 6, 2018: A severe hail event, with hail up to the size of softballs or 4 inches in diameter, hit the county and sections of northern Pueblo county. Media reports indicate that this event caused $172 million in damages to vehicles, trees, roofs, siding, windows, skylights and other parts of homes. Especially hard hit locations included portions of Colorado Springs, the Broadmoor area, the Cheyenne Mountain Zoo and the communities of Fountain and Widefield. Eight people were injured when the storm impacted the Cheyenne Mountain Zoo, in addition four animals died. The larger reported hailstones included hail the size of ping pong balls, golf balls, tennis balls, baseballs, tea cups, and softballs.

Statewide - July 2023: More hail covered the state of Colorado in 2023 than any season since data collection began in 2006. There were 70 days where at least one large hail report was made (through July 20th, 2023) in the state. Hail is considered large when it is between .75 and 1.75 inches in diameter. Also as of July 20th, the NWS issued 892 severe thunderstorm warnings, which are for the storms capable of producing hail. This is 343 times more than the previous record set in 2016, for warning data collected since 1986. Based on the hail event data for the state since

2006, multiple counties set records for hail days. Denver County experienced seven different days with large hail, the most on record for the county and El Paso County saw 19 days with reports of large hail. This surpasses the number of days in any county in any year, through July 20th, 2023.[37]

Probability

Hailstorms resulting in property or agricultural damage occur multiple times every year (100% chance). According to NOAA Severe Weather Database there have been a total of 39 hail events reported with over $1 million in property damages since 1955. Based on this figure, there is a 57% chance a hail event will occur somewhere in the state causing damages of $1 million or more in any given year.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future hail events. Table 39 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 39 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Hail events occur across most areas of the state. Large hail is most frequent in the eastern part of the state. Future changes to the location of large hail remain uncertain.
Extent/Intensity	Future changes to the extent of hailstorms are unclear. Small hail may become less frequent, owing to increasing temperature causing this hail to melt and fall as rain. However, large hail may increase in frequency in eastern Colorado, owing to an increase in conditions supporting intense thunderstorms.

[37] 2023: Most large hail recorded in Colorado ever | 9news.com

Impact	Projected Change
Frequency	Small hail may become less frequent, owing to increasing temperature causing this hail to melt and fall as rain. However, large hail may increase in frequency in eastern Colorado, owing to an increase in conditions supporting intense thunderstorms.
Duration	Hailstorms are generally very short-duration events, and this is not expected to change in the future.

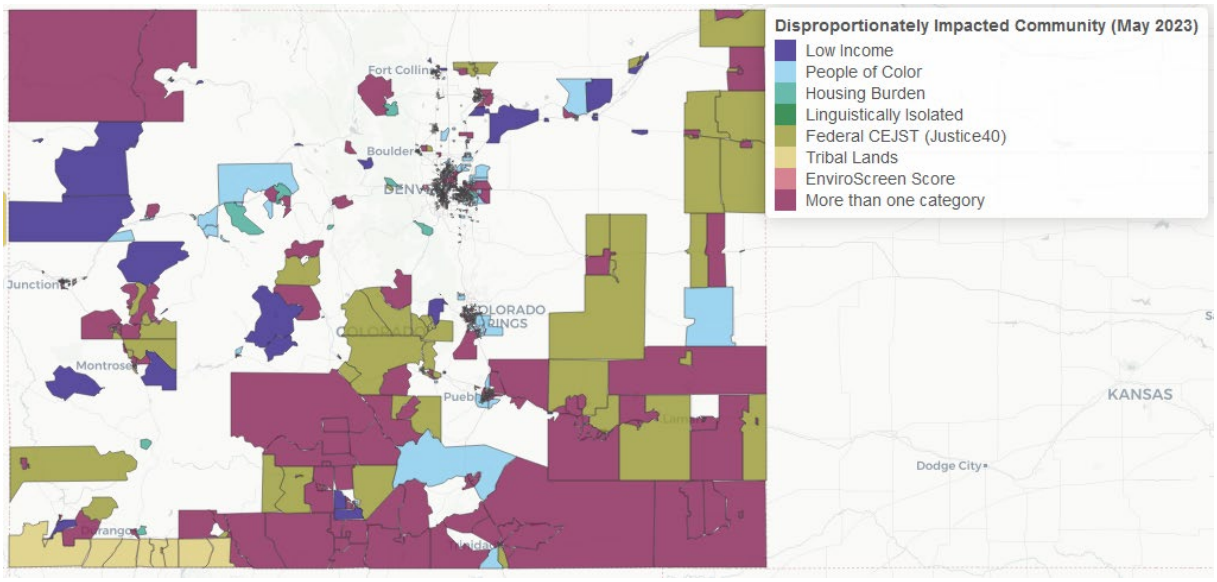
Risk & Vulnerability

Populations at Risk

All populations are at risk of experiencing a hail event. Those who are outdoors at the time a storm occurs are incredibly vulnerable and could experience injury or death. People can potentially be hurt in their homes during a hail storm if the hailstones are large enough to break windows or skylights. This is a concern for people in their cars as well since hail has been known to go through windshields.

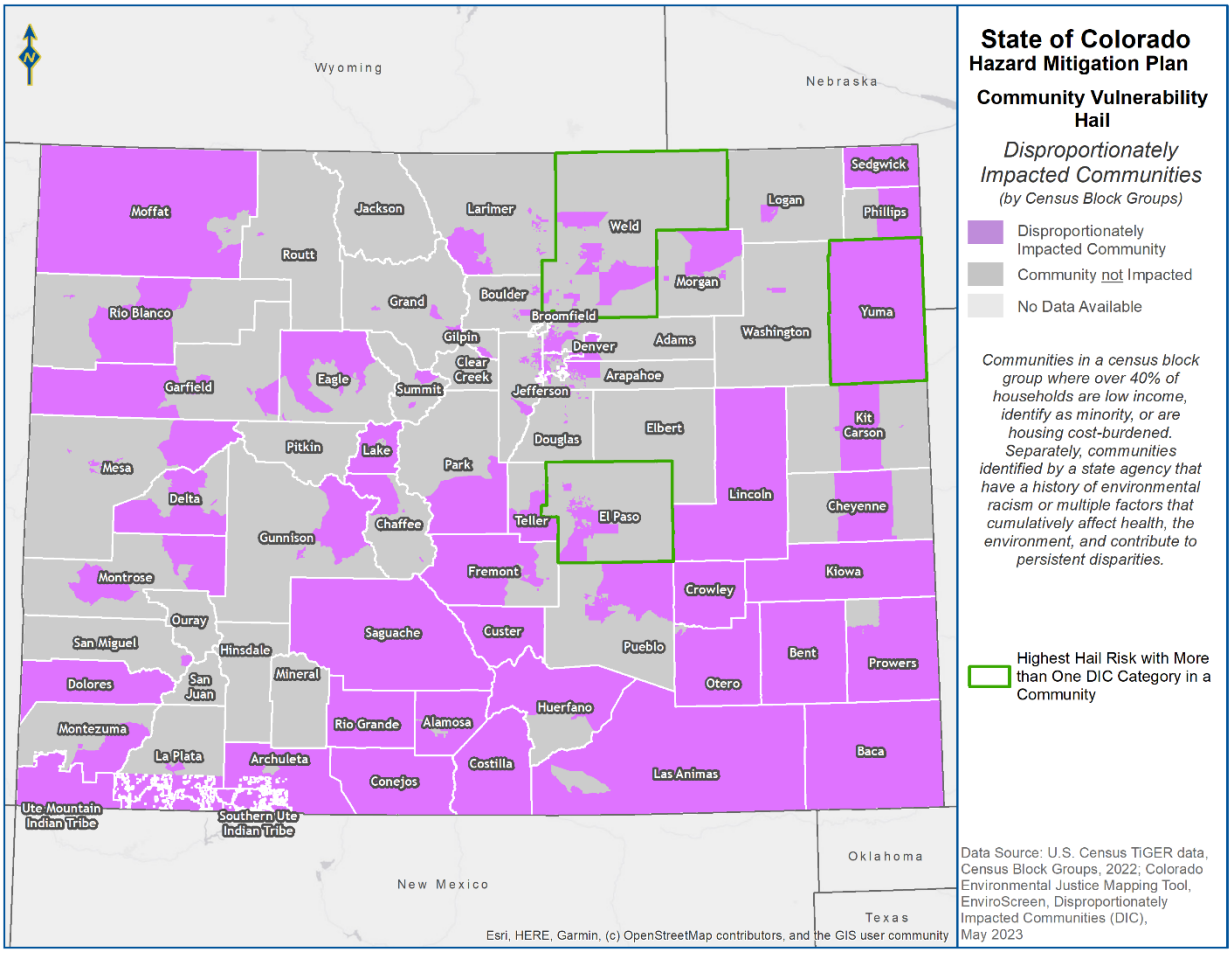
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 111. When comparing these communities to those counties with the highest hail risk (Figure 110), El Paso, Weld and Yuma County each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 111 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to hail include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 112 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (El Paso, Weld, and Yuma).

FIGURE 112 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Data from the Office of Risk Management database shows that since 2008, there have been 127 property losses reported on state assets due to hail. Of those, 22 losses occurred in 2017 and all resulted from four hail events. One event, on May 8, 2017, accounts for 16 of the total losses, approximately $4.2 million which included an estimated $1.9 million in damage to state vehicles. Of the estimated losses of $5 million from all 2017 events, the damages from the storm on May 8 represent 84% of the total.

Since 2017, 27 events have caused nearly $4 million in damages. The most damaging hail event during this period occurred on June 12, 2018 at Pike's Peak State College and resulted in $1.3 million of damage.

From 2008 to 2016, a total of $6.6 million was paid to cover losses to state assets due to hail, most of which was for roof damages and state vehicle damages.

Exposure

Although hail-producing storm events that impact state assets occur multiple times a year, they vary greatly in location and degree of damage. With sporadic occurrence and unpredictable resulting damages, general vulnerability to state assets is low. The costs of a comprehensive structural mitigation is likely to exceed the benefits.

Vehicles are the most vulnerable state asset type exposed to hail. The largest risk is to those vehicles located in the eastern portion of the state. The largest potential impacts resulting from an event could include damaged or totaled vehicles.

Of those counties at the highest risk from hail events (Figure 110), El Paso County has the most state assets and highest asset valuation (as shown in Figure 13 and Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts of a hail event. All sectors could be affected and due to the unpredictable nature and geographic coverage of hail storms, impacts could be felt in multiple areas across the state. Depending on the extent of damages, communities could potentially have negative effects on local recovery and resilience. The state overall is not likely to see any long-term impacts on risk and resilience or a strain on resources.

Hail							

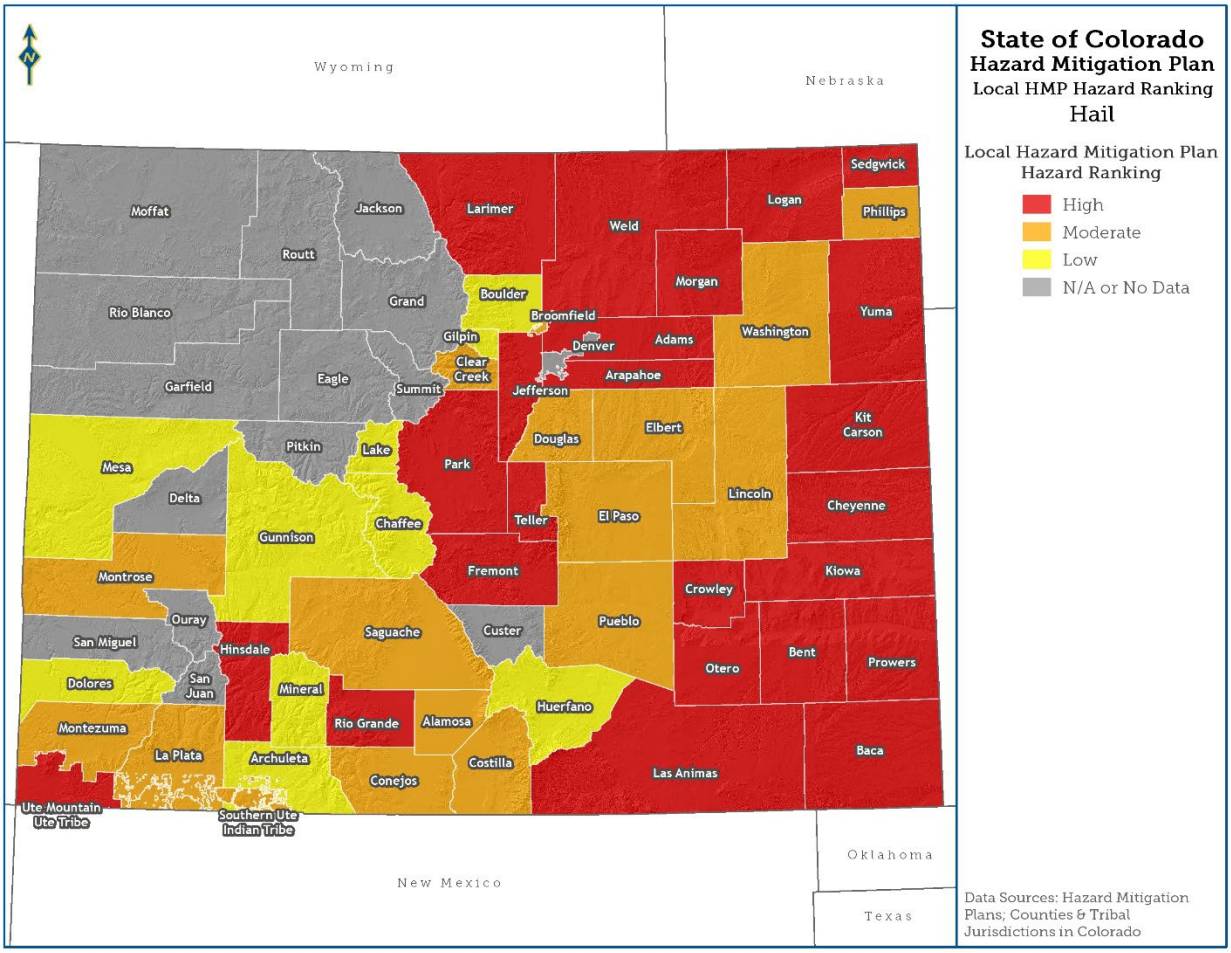
Local County / Tribe

Hazard Rankings

Figure 113 presents the local hazard risk rankings for the hail hazard. Based on historical hail event data, the high risk rankings on the eastern side of the state are warranted. The moderate rankings in areas with seemingly similar history of hail may be influenced by diminished intensity instead of quantity or frequency. Some storms cause damages which can financially devastate a community or county, while others may get numerous storms often, over decades, but have been fortunate to not see true destruction.

Hail is unpredictable in timing, duration, geographic span, frequency, occurrences, and the size of the stones. This ranking is an example of local priorities shaped by concerns and hazard experiences.

FIGURE 113 LOCAL HAZARD RISK RANKINGS



Exposure

All areas of the state are vulnerable to hail events, although some areas have a more frequent history of reported events and are more conducive to the factors needed for storms carrying hail to occur. This is shown in the dramatic number of hail events that have occurred on the eastern side of the state, compared to the western side. See previous Figures in this section.

Local-level analysis of hail risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Hail has the potential to cause or worsen dam / levee incidents, flood, and thunderstorm / lightning events. Hail can be the result or exacerbated by severe wind, thunderstorm / lightning, and tornado.

Recent and Future Development

Development and population growth contribute to increased exposure of people and property to the impacts of hail. Due to the unpredictability and varied geography of hail, there is no opportunity to build in an area without potential events. However, impacts may be mitigated by using appropriate building materials and design.

Of those counties experiencing the state's largest percentage of growth (Figure 7), El Paso and Weld County have been identified as being at the highest risk from hail events (Figure 110).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of hail.

Consequence Analysis

TABLE 40 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Injuries and deaths have occurred from hail. Motorists, outdoor workers, and outdoor recreationists are at risk from direct impact or deteriorated road conditions due to precipitation on the road surface.

Consideration	Description
Responders	Some exposure exists to personnel performing routine duties when an event occurs; otherwise storm-related duties are typically post-event. Some impact related to unsafe road surface conditions from hail on roadways.
Continuity of Operations (Govt. & Services)	None or limited loss of facilities or infrastructure function or accessibility or ability to provide services.
Property, Facilities, & Infrastructure	Generally, many instances of small amounts of damage reflect high event-wide property losses, including to structures and vehicles. Buildings and equipment are exposed to hailstorms; however, there is typically limited loss of facility use or infrastructure function or accessibility and limited uninsured damages. The clogging of stormwater infrastructure could cause short-term flooding.
Environment	Limited short-term impacts such as leaf and small limb removal from leaves and plants.
Economic	Insurance claims from large hailstorms tend to be small in amount (i.e., property by property damages) but high in the total number of claims, which results in high aggregate insured losses. Crop damage and loss to agriculture may be significant and result in agricultural disaster declarations.
Public Confidence in Govt.	Characteristics of hailstorms such as duration and speed of onset result in limited response and recovery functions for government beyond first responders.

Landslide / Debris Flow / Rockfall - Moderate Risk

Definition

A landslide is a general term for a variety of mass-movement processes (i.e. - mass wasting events) that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Some of the natural causes of ground instability are stream and lakeshore erosion, heavy rainfall, a decrease in the shear strength of the slope material, and an increase in the shear stress borne by slope materials. In addition, many human activities can make earth materials less stable and increase the chance of ground failure. Human activities contribute to soil instability through improper grading of slopes, removal of vegetation, excessive irrigation, or overloading slopes with fill, structures, or pavements.

Landslide

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, which includes evaluating the slope, history of prior failure, and the strength of the soil or rock. Cuts to the toe of a slope by natural erosion or human activity can also cause landslide events.

Deep-seated landslide failures typically have a slow onset and can be monitored through soil moisture levels and inspecting for ground cracking or slumping in areas of previous landslide activity.

Debris Flow

Debris flows are fast-moving landslides that are particularly dangerous to life and property because they move quickly, destroy objects in their paths, and often strike without warning. Debris flows generally occur during periods of intense rainfall or

rapid snowmelt and usually start on hillsides or mountains. Debris flows can travel at fast speeds and can carry large boulders, trees, and cars. If a debris flow enters a steep stream channel, they can travel for several miles, impacting areas unaware of the hazard. Areas recently burned by a forest fire are especially susceptible to debris flows, including the areas downslope and outside of the burned area. Debris flows are sometimes referred to as mudslides, mudflows, or debris avalanche.

Rockfall

Rockfall is a type of fast-moving landslide that happens when rock bounces, or rolls from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion, or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope, such as cutting and filling activities, can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Spring is typically the landslide/rockfall season in Colorado as snow melts saturates the ground and temperatures enter into freeze/thaw cycles.

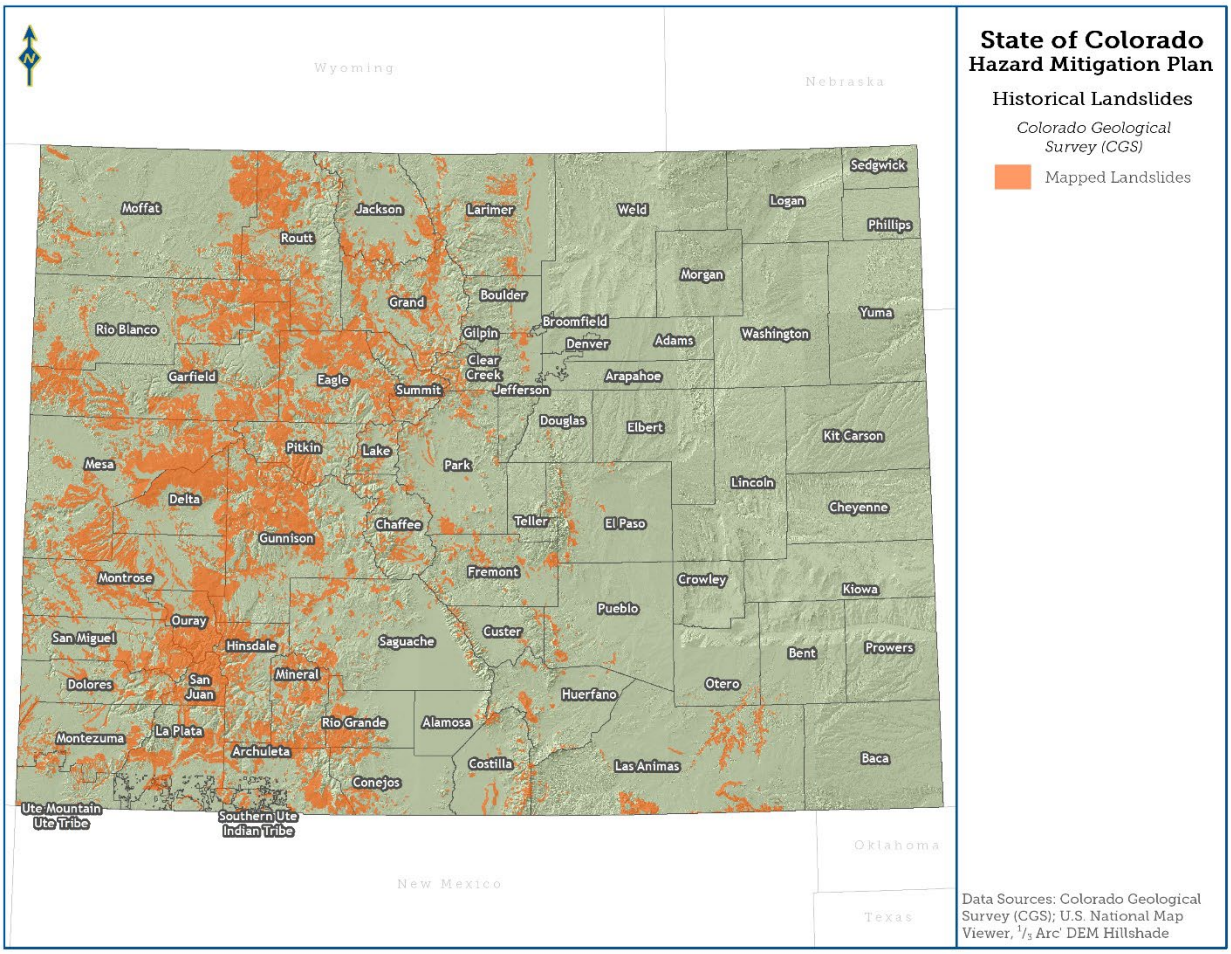
Location

Land movement related to landslides, debris flows, and rockfalls occurs naturally across Colorado on an ongoing basis. Because this hazard is oftentimes correlated with slope and elevation change, these events largely occur in the mountainous region from the Front Range to the Western Slope, with the threat generally increasing with slope and susceptibility.

Landslides are mapped by the Colorado Geological Survey (CGS) and can be seen in Figure 114. Most of these historical events occurred along mountain ranges. The events occurred primarily from the Front Range to the western side of the state. Although the exceptions are in the southeast where Las Animas County has an extensive history of landslide incidents. Otero County has also experienced some incidents along its shared border with Las Animas County.

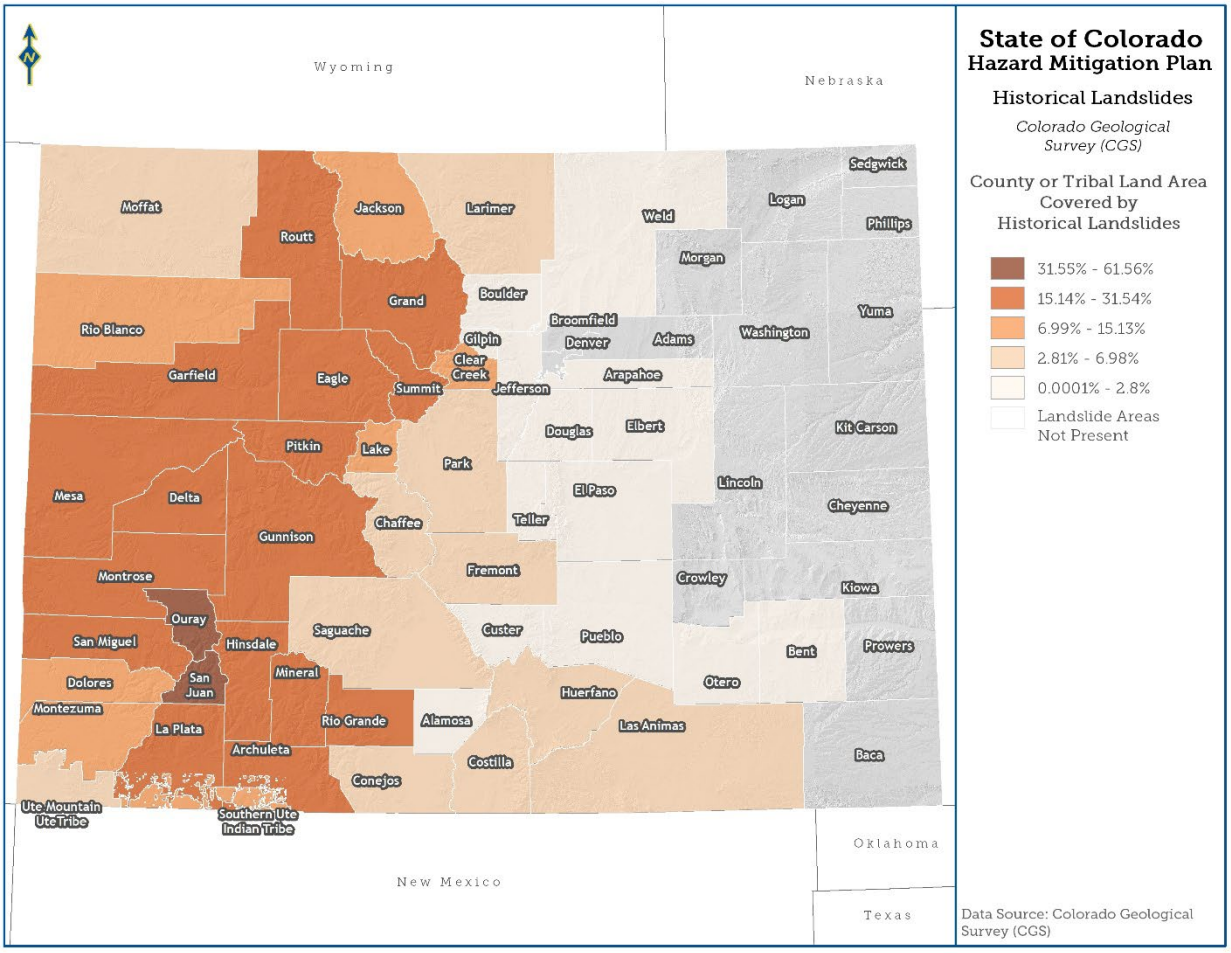
Some areas have more concentrated groupings of historical events, and the majority of these areas correspond with high elevations.

FIGURE 114 KNOWN LANDSLIDE AREAS



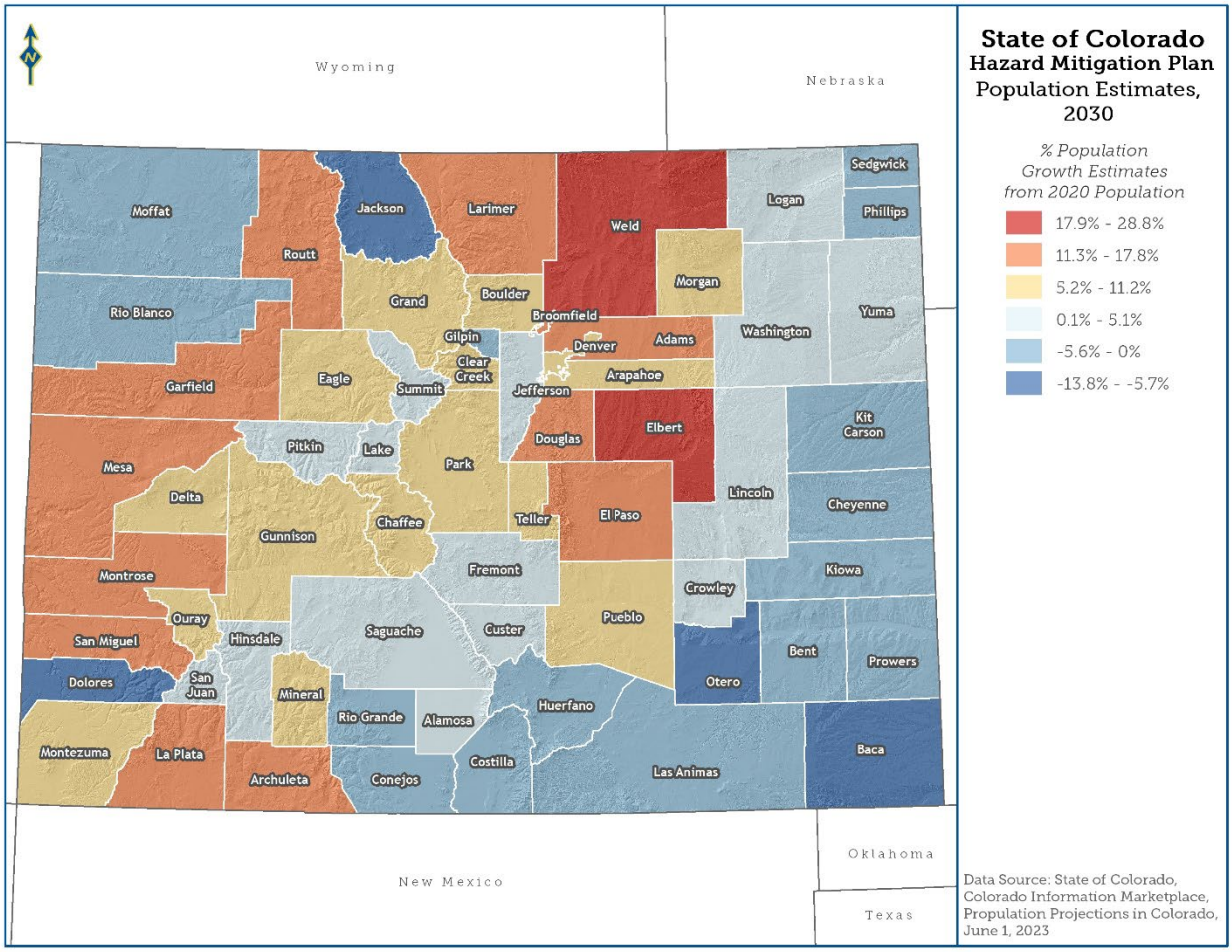
These landslide areas were collectively assessed to identify the percent of each county and tribal area at risk to these hazards. Figure 115 shows those areas with the highest risk are all located in the western half of the state.

FIGURE 115 KNOWN LANDSLIDE AREAS BY COUNTY AND TRIBAL AREA



For comparison, Figure 116 presents the estimated population growth across the state through 2030.

FIGURE 116 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

These mass wasting events can damage and destroy buildings, transportation infrastructure, railroads, energy pipelines and electrical infrastructure, mines, oil and gas wells, water control structures, and surrounding habitats. Earth movement hazards cause significant costs and delays to travelers, workers, the delivery of services, and local economies.

Precipitation, temperature variations, topography, and geology affect all of these events. Typically, there is a landslide and rockfall “season” in Colorado that occurs during springtime freeze-thaw cycles and increased precipitation as rain.

Debris flows are also some of the most dangerous mass wasting events and cause damages with the force of the flow itself and the burying or erosion by mud and debris. The heavy mass pushes in walls, removes buildings from foundations, fills in basements and excavations, and sweeps away cars, trucks, heavy equipment, and other substantial objects. Boulders and trees swept along by the muddy mass demolish buildings and flatten what is in their path. In mountainous areas, portions of valleys have been eroded to a depth of several feet by the flow process.

Rockfalls are a very dangerous form of mass wasting because they incorporate a sudden, incredibly rapid release of bedrock. The release of material found in rockfalls, combined with the sheer size and weight of the material that is falling, is what gives these events the potential to have devastating effects on human life and infrastructure. Most fatalities from rockfall in Colorado happen on roads or major transportation corridors, but there have been injuries and fatalities caused when structures are impacted.

All mass wasting events are influenced by seasonal patterns, precipitation, and temperature patterns. Many of Colorado's events occur along transportation networks because soil and rock along the transportation corridor has been disturbed by roadway construction. Railroads are also routinely impacted by these events.

There are a number of Colorado communities that have developed at the mouth of mountain canyons where the gradient of a stream abruptly decreases. The geographic extent of mass wasting events tend to be associated with areas of significant elevation change over a short distance, although debris flows have the capacity to move significantly further down a channel than landslides and rockfalls.

Past Occurrences

Historical Events

Mass wasting events events are present across much of the state and are continually occurring. Hazard event experiences have been recorded as far back as the early settlers of Colorado.

A number of agencies monitor many of these mass wasting hazards. As mentioned previously, CGS maps statewide landslides and the Colorado Department of Transportation (CDOT) monitors approximately 750 areas for rockfall risk. A number of agencies are involved with debris flow mapping.

Previous Losses

Based on data from the NCEI Storm Events Database, since 2003 there have been 14 direct injuries and 7 deaths attributed to landslides and debris flows in the state. A majority of these losses were caused by debris flows. Historical reported property damages total nearly $160 million. These figures are considered to be under-reporting past damages, as this information is not available for many events, even those that are reported.

Most of the losses incurred in the state affect CDOT's infrastructure. Annual damages are estimated to be in the millions of dollars.

Notable Events

The following events are notable due to the magnitude of the hazard impact, including causing immense property damages, economic losses, and casualties.

Interstate 70 Events

The transportation corridor where many of the larger incidents have occurred is along Interstate 70 (I-70). This major highway is essential for travel and transport across the state, region, and nation. Table 41 illustrates some of these events which includes

deaths, long closures, and some details for the scale of the material that fell. Other notable events with more details are highlighted in the narratives following the Table.

TABLE 41 NOTABLE MASS WASTING EVENTS IMPACTING INTERSTATE 70

Year	Location	Event
1983, 1984	Dowds Junction, Eagle County	Landslides blocked Interstate 70.
1997	Palisade, Mesa County	Mudslide closed four-mile stretch of westbound I-70.
2003	Central Colorado River Basin west of Glenwood Springs, Garfield County	A rockfall crashed into seven vehicles and covered the west bound lanes of I-70. One person died when a 3ft diameter boulder caved in a vehicle. At least six were injured. The rockfall began over 200 ft above I-70.
2004	Near Glenwood Springs, Garfield County	Massive rockfall closes I-70. Between 30-40 large rocks fell onto the road, including boulders up to 8 x 10 feet.
2006	I-70 Mountain corridor, Garfield County	Rockfall kills 1, appr. 500 cubic yards of material fell
2010	Glenwood Springs, Garfield County	Rockfall closes 17-mile stretch of Interstate 70
2016	Glenwood Canyon, Garfield County	Massive rockfall on I-70, west of the Hanging Lake Tunnel, forced thousands onto a 146-mile detour. Boulders hit three vehicles, gouged holes in the asphalt, and damaged guardrails. No injuries were reported.

Year	Location	Event
2019	Glenwood Canyon, Garfield County	250 to 300 tons of rock fell on I-70 at 1am. The largest estimated at 8 ft in diameter. The event resulted in a four hour detour for motorists.

Garfield County - March 8, 2010: Early in the morning a large rockfall in Glenwood Canyon shut I-70. Twenty boulders, ranging from 3 feet to 10 feet in diameter, fell on the interstate. These heavy rocks punched many holes through the roadway, including one that was 20 feet by 10 feet. The largest boulder weighed 66-tons. CDOT crews were able to restore one lane in each direction within four days. Between maintenance, traffic control, and repairs, the total cost of the incident was $2.2 million.

Garfield County – July 29, 2021: Major flash flooding and debris flows occurred throughout Glenwood Canyon from the Grizzly Creek Fire burn scar, as a result of significant rainfall from showers and thunderstorms. Multiple mudslides were reported by CDOT. Numerous vehicles were trapped between slides for several hours. CDOT reported damage to the structure of Interstate 70, which remained closed for over two weeks due to cleanup operations and surveys. Reported damages of $125 million.

Garfield County – July 31, 2021: Multiple debris flows occurred along I-70 within the Grizzly Creek Fire burn scar from MM 123 and Hanging Lake Tunnel. CDOT described the damage from the new flows as extreme. New debris piles were 17 feet tall over the roadway and house-sized boulders fell. Hanging Lake trail was considerably damaged. At least seven bridges were destroyed, washed downstream or severely damaged. Reported damages of $25 million.

Landslide / Debris Flow

The events in Table 42 involve landslides and debris flows since 1903. Some of these events destroyed towns, impacted waterways, and caused multiple deaths. Other notable events with more details are highlighted in the narratives following the Table.

TABLE 42 NOTABLE LANDSLIDE AND DEBRIS FLOWS EVETS

Year	Location	Event
1903	South of Glenwood Springs, Garfield County	Debris flows covered railroad line causing a train wreck and one death.
1912	Brownsville, Clear Creek County	Debris flows engulfed and destroyed a community.
1914, 1969	Telluride, San Miguel County	Debris flows in Coronet Creek, flooding in San Miguel River.
1924	DeBeque Canyon, Mesa County	Landslide blocked Colorado River, resulted in relocation of a community, highway, and railroad.
1930s, 1940s	Marble, Gunnison County	Debris flows nearly destroyed the town.
1937	Glenwood Springs, Garfield County	Debris flow covered town with 2 ft deep mud.
1976	Big Thompson Canyon, Larimer County	Interrelated landslide/ flood - Mountain torrent flood.
1977	Glenwood Springs, Garfield County	Debris flow. Losses between $500,000-$1 million. 200 acres of residential district buried up to 14’ deep.
1981-1982	Ouray, Ouray County	Debris flows in Canyon, Cascade, Portland Creeks, etc. Flooding in Uncompahgre River.

Year	Location	Event
1984	15 Western Slope Counties	Floods / landslides. Major Disaster Declaration (DR-719). Over $6.6 million in federal, state, and local disaster assistance.
1984	Telluride, San Miguel County	A student at Western State College died after her car washed off Hwy 145 near Trout Lake and fell 150 ft.
1985	Garfield and Eagle Counties	The largest debris flow in Colorado history, a 175-foot thick mass of debris a mile long and 1,000 feet wide.
1996	Aspen, Pitkin County	Debris flows covered a parking lot up to 5ft deep. Six cars were buried, the Music Hall was damaged.
1999	El Paso County & other counties for flood	Floods, mudslides, landslides. Presidential disaster declaration. Estimated over $30 million in infrastructure, including road repairs and utility lines, and property damage. Several residences condemned.
2007	Alpine, Chaffee County	Evacuation of 98 people. $33,000 in infrastructure damage. Homes filled with mud. 65 people affected.
2008	Archuleta County	Xcel Energy pipeline ruptured along the East Fork Road.
2013	Manitou Springs, El Paso County	One dead after mudslide and flash flooding caused massive damage in the 2012 Waldo Canyon burn scar.
2013	Boulder County, El Paso, San Miguel	Mudslides damage property and kill 3 (1 in Jamestown and 2 in Boulder) in aftermath of September flooding.

Year	Location	Event
2013	US Hwy 550, Red Mtn Pass, San Juan County	Mudslides trapped three motorists and closed Red Mountain Pass for five hours, three slides reported.
2015	El Paso County	Over 30 homes were affected, causing over $7 million in damage. Major Disaster Declaration declared.
2022	US Hwy 550 Red Mtn Pass, San Juan County	A significant mudslide buried the road under three feet of mud and debris. CDOT used several pieces of heavy equipment to clear mud, boulders, rocks, and trees.

Other major landslide and debris flow events to highlight include:

Boulder County – July 2011: After the 2010 Four Mile Canyon fire ravaged over 6,400 acres, several models suggested probabilities of debris-flow occurrence greater than 60 percent, and more had probabilities greater than 45 percent. Two post-fire debris flows occurred in the Fourmile Canyon burn area. On July 7, four reported debris flows occurred at mile marker 8 and beyond. On July 13, six roads (including Four Mile Road and Gold Run at Dixon) closed due to debris flows. The 2010 estimated costs for debris-flow mitigation in the Fourmile Canyon burn area was $1,809,540.

Mesa County – May 25, 2014: The longest landslide in state historical record occurred in west-central Colorado, six miles southeast of the town of Collbran in Mesa County. The 2.8-mile-long slide covered a square mile of the West Salt Creek valley and resulted in three fatalities. Local seismometers recorded a magnitude 2.8 earthquake from the event with a seismic wave train duration of approximately 3 minutes. The toe of the landslide came within 200 ft. of active gas-production wellheads. The loss of irrigation ditches and water impacted local ranches and residents.

Rockfall

Table 43 presents details of some of the notable rockfall events across the state. Rockfall events have caused deaths and injuries, as well as significant damages to transportation infrastructure and personal property. Other notable events with more details are highlighted in the narratives following the Table.

TABLE 43 NOTABLE ROCKFALL EVENTS (2005-2022)

Year	Location	Event
2005	Grand Valley west of Grand Junction, Mesa County	An Amtrak train derailed in Ruby Canyon after hitting a 12x12 ft boulder. Three engines and five cars derailed. Four crew and two passengers were slightly injured.
2006	Northwestern San Juan Mountains, southwest of Ouray County	A rockfall fell onto Camp Bird Road and killed a driver when a boulder went through the vehicle's roof.
2011	Red Rocks Park, Jefferson County	Seven injured in rockfall at Red Rocks park
2012	South of Aspen, Pitkin County	1 hiker dead, 1 injured after rockfall
2013	Chaffee County	5 hikers killed by rockfall near Mt. Princeton
2013	Highway 133 south of McClure Pass, Garfield County	Seven or eight rocks ended up on the highway. CDOT says together they measure 120 ft long, 50 ft wide and 20 ft tall. The rocks left a hole about two ft deep, 12 ft long and 10 ft wide in the road. Repairs took a week. A similar event occurred in 2014 near McClure Summit.
2014	Mesa County	A "rock avalanche" moved almost 3 miles down the valley of West Salt Creek, burying almost 600 acres

Year	Location	Event
		of land under 38 million cu yd of debris. Highest reported speed was 140 mph. 3 men were killed.
2016	Delta County	Over 100 tons of debris fell onto Highway 133 which sees over 1,100 vehicles per day, approx. 6% are trucks. The slide caused a multi-day road closure and a 3-hr detour.
2022	Jefferson County	A boulder about 12 ft x 12ft broke free from a cliff face and rolled into two homes making them uninhabitable.

Other major rockfall events to highlight include:

Jefferson County - March 1974: A boulder the size of a car hurtled down the steep west side of the Lyons hogback. It bounced into a new subdivision and stopped after going through a wall in the back of a home. No one was injured. Property damage was about $10,000, including the cost of measures to prevent similar incidents at that site in the immediate future.

Routt County - Mid to Late 1990s: A technique called “long-wall mining” is often the most economical method for underground extraction of coal. In the mid to late 1990s, a long-wall mining operation at the Foidel Creek Mine was extended below the surface exposure of a Twenty Mile Sandstone. This rock face is comprised of a 100-foot thick, massively bedded, sandstone cliff that is exposed on the slope above Routt County Road 27. The strain from the ground subsidence fractured and broke almost 1½ miles of the exposed sandstone cliff, resulting in several large rockfall events with some rock blocks the size of small homes. Mitigation techniques included introducing a milelong span of ditches and berms that were constructed on the slope above Routt County Road 27.

Jefferson County – June 21, 2005: A high-profile rockfall event occurred along U.S. Hwy 6 in Clear Creek Canyon, approximately 10 miles west of Golden, CO. Approximately 2,000 cubic yards of rock slid from a pre-existing road cut on the north side of the road and covered the road. Two tractor-trailers caught in the rockfall were pushed off the road by the debris. The tractor-trailers were totaled, but the drivers sustained only minor injuries. The road was closed until the end of August 2005.

Dolores, Montezuma County, and Rico, Dolores County - May 24, 2019: Two massive boulders estimated to be 8.5 million and 2.3 million pounds rolled down the mountainside and across CO Hwy 145. The fall is estimated to have started 1,000 ft above the roadway. Th smaller boulder carved an 8 ft trench in the highway and rolled off the side. The second boulder, the size of a two-story house, came to a rest in the trench. In June, CDT chose to reroute the highway around the boulder to save taxpayers money. The reroute cost $1.3.

Probability

Mass wasting events will occur each year in the state (100% chance), although the events are sporadic and can be unpredictable. Geologic studies can determine the location of historic paths and deposits which can be a potential indicator of future events. While these events will occur somewhere in the state every year, the exact locations, the number, frequency, and severity fluctuate.

These events can occur at any time of the year from almost any location along a slope. Known instabilities of hillsides and cliff faces can be instrumentally measured to determine if movement is occurring.

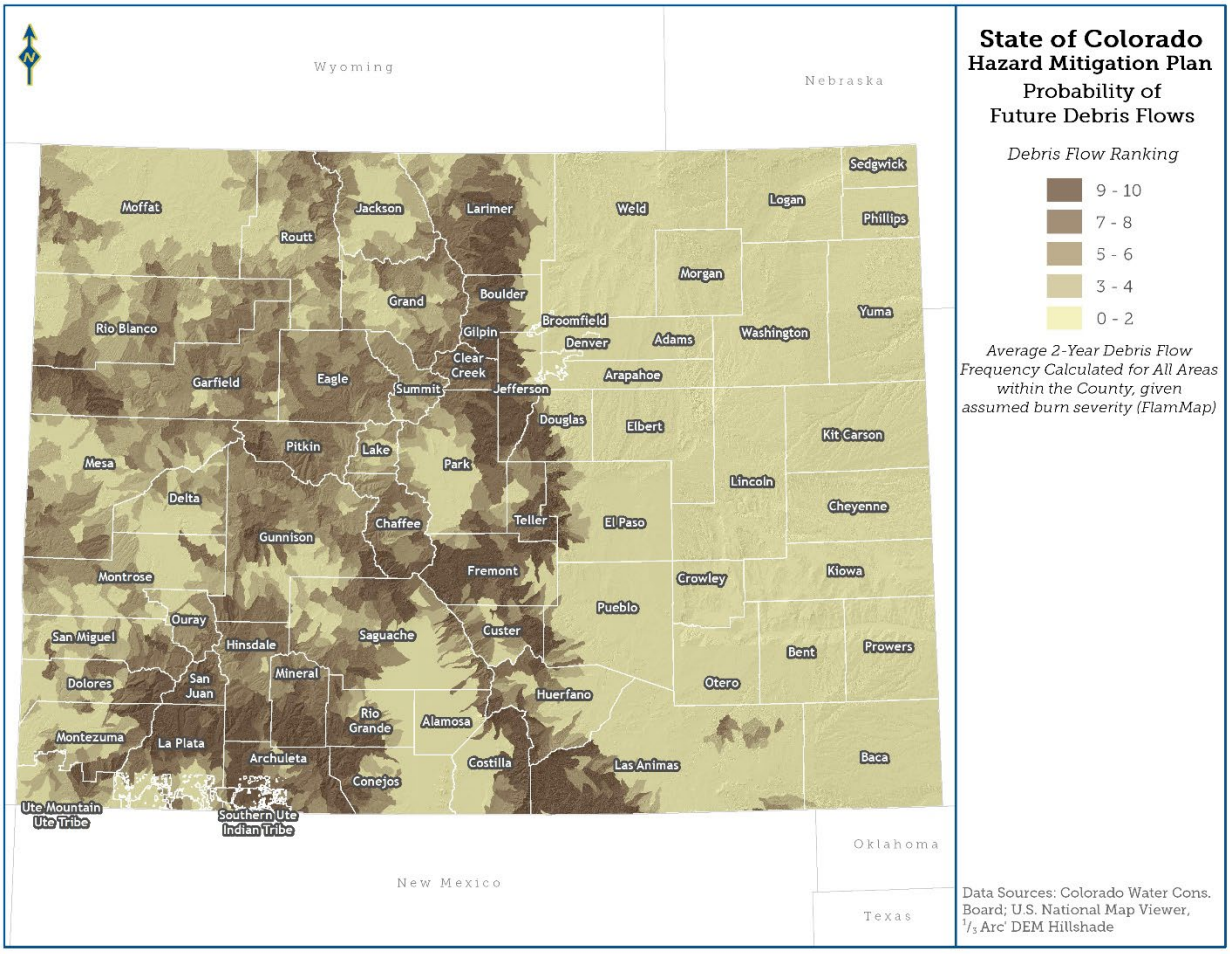
Debris Flow

Based on the recent Wildfire Ready Watersheds assessment by the Colorado Water Conservation Board (CWCB), Figure 117 details the probability that a debris flow will

occur within a two-year period across HUC 12 watersheds, given assumed burn severity (FlamMap).

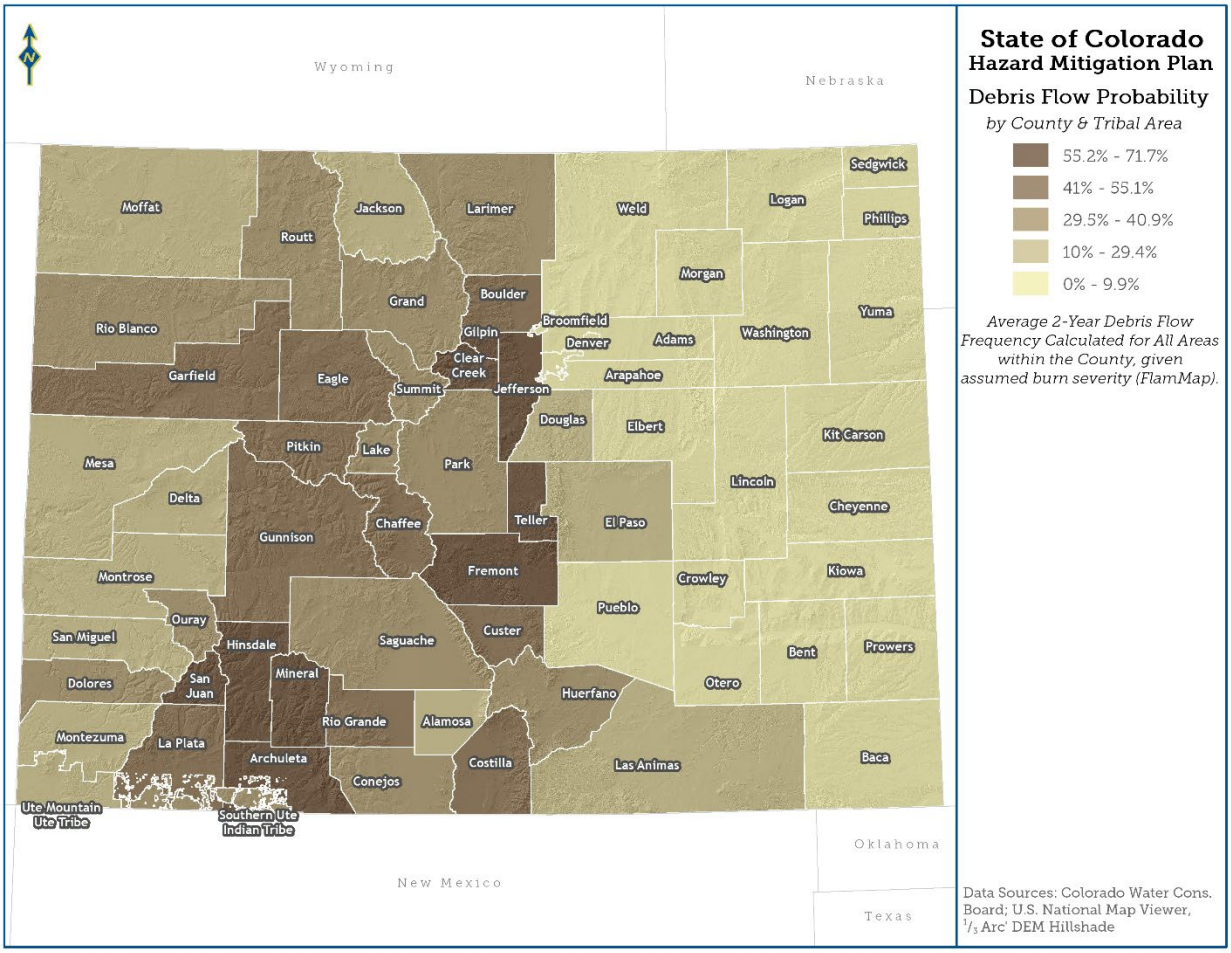
The highest probabilities of a debris flow event are located along the Continental Divide and the San Juan Range. The remaining highest probability areas occur mainly across western portions of Colorado.

FIGURE 117 PROBABILITY OF FUTURE DEBRIS FLOWS



These debris flow probabilities were collectively assessed to identify the average probability of each county and tribal area. Figure 118 shows those areas with the highest combined risk are located in the San Juan Range and a few counties located in the middle of the state.

FIGURE 118 DEBRIS FLOW PROBABILITY BY COUNTY AND TRIBAL AREA



Climate Change Impacts

Climate change projections for more intense precipitation coupled with cycles of drought and/or wildfire events have the potential to increase mass wasting incidence. The following table presents a breakdown of these projected changes in the hazard's location, extent/intensity, frequency, and duration.

TABLE 44 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Landslides, debris flows, and rockfalls are of greatest risk in mountainous regions of the state. Larger wildfire burn scars may

Impact	Projected Change
	create new areas that are vulnerable to landslides and debris flows during intense summer rainfall events.
Extent / Intensity	The extent and intensity of debris flows may expand with larger wildfire burn scars creating new areas that are vulnerable to flash flooding during intense summer rainfall events. The anticipated increases in intense precipitation events will lead to more mass wasting, regardless of wildfires.
Frequency	There are no clear trends in heavy precipitation events for Colorado, and like annual precipitation, there is considerable variability at annual and decadal time scales. If intense wildfires increase, then landslides and debris flows will become more frequent in burn-scar areas.
Duration	N/A

Per CDOT's 2021 Climate Resilience Study, climate change will affect mass wasting hazards in different ways. Both rockfalls and debris flows are expected to increase their frequency and magnitude (FM) due to increases in the number of extreme freeze/thaw days and increases in winter precipitation. Winter precipitation is also expected to increase FM for shallow and deep landslides. The increase in the number of extreme heat days and decrease in summer precipitation will also increase debris flow FM.

A decrease in summer precipitation is expected to decrease the FM for both debris flow and shallow landslides. Note that the study also points out that changes in FM will have a significant economic impact.

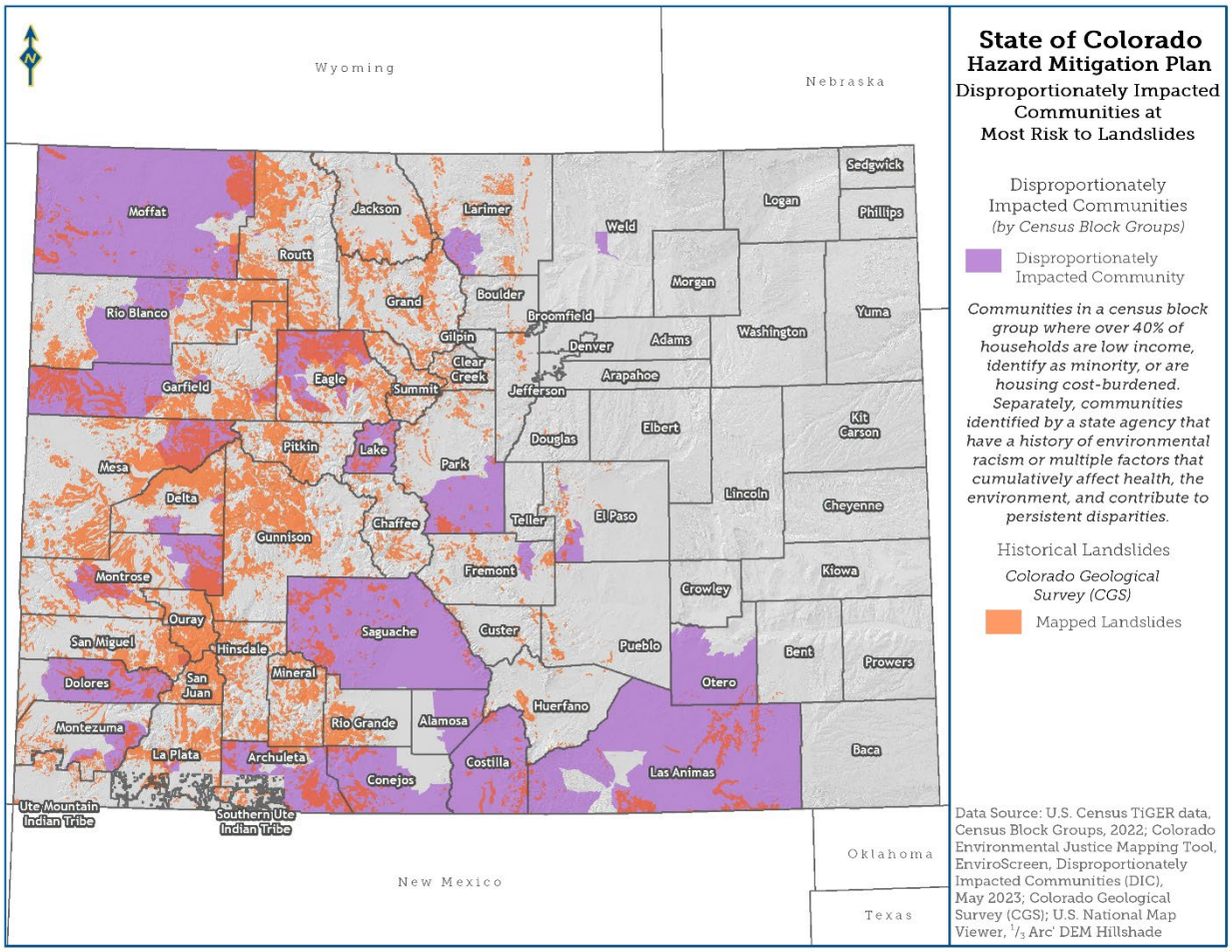
Risk & Vulnerability

Populations at Risk

Populations living in or near areas with topography that may produce one of these mass wasting hazards are at risk. Those traveling through transportation corridors with a risk of these hazards, especially rockfall and debris flow, are exposed to potential events.

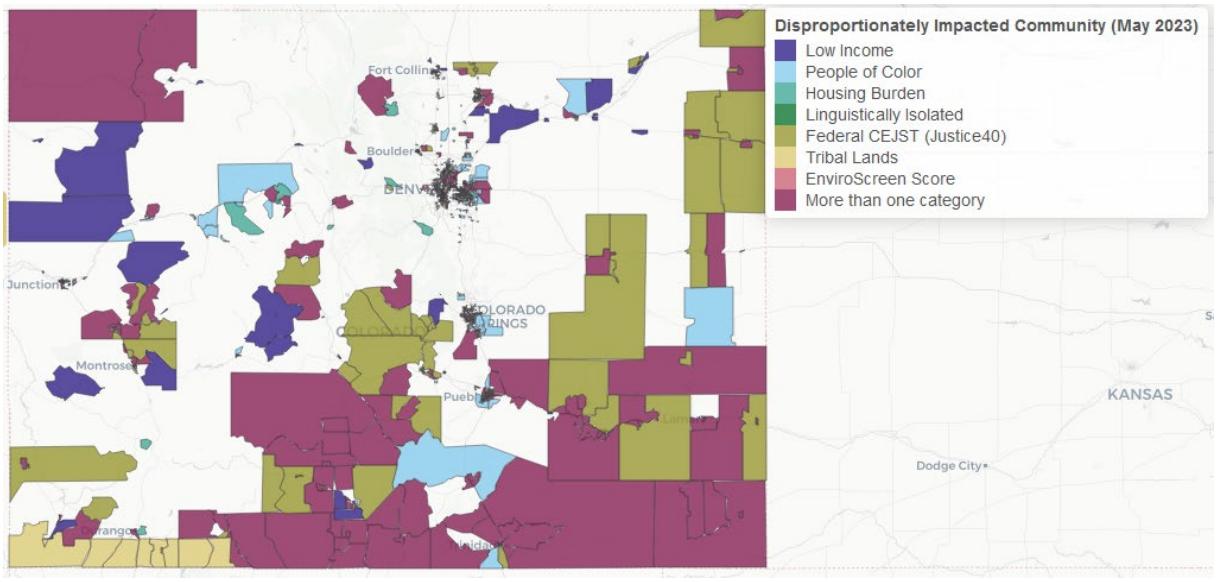
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Figure 119 identifies those DIC communities, at a Census Block Group level, that have mapped wind deposits.

FIGURE 119 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



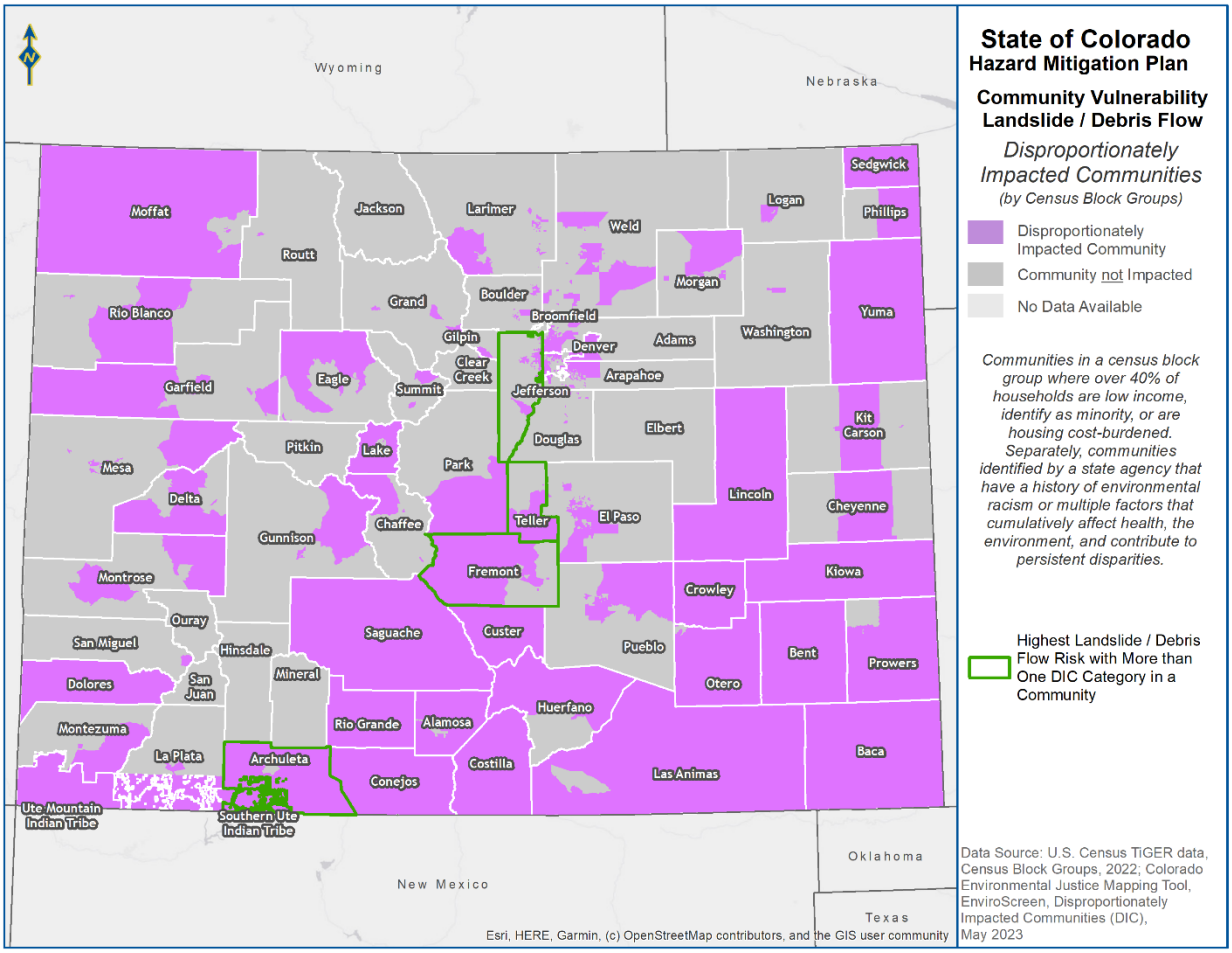
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 120. When comparing these communities to those counties with the highest percentage of landslide hazard areas (Figure 115) and highest debris flow probability areas (Figure 104), Archuleta, Fremont, Jefferson, and Teller Counties each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 120 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to landslide and debris flow include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 121 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (Fremont), “Low-Medium” (Archuleta), and “Low” (Jefferson and Teller).

FIGURE 121 COMMUNITY VULNERABILITY



State Assets

Previous Losses

The Office of Risk Management (ORM) reports that two assets were damaged by rockfall events. While one was minor, the larger event impacted Glenwood Canyon on 2/5/2019 and totaled $190 thousand in damages.

Statewide, past losses from mass wasting events are mainly focused on CDOT infrastructure. These values can include the costs of CDOT response, temporary measures for allowing vehicles to pass, the calculation of costs for vehicles stuck or that needed to detour, and the cost of repair or mitigation projects.

Also per CDOT's 2021 Climate Resilience Study, "estimated annual direct departmental costs from geohazard events averages about $17 million to $20 million…each year. Over one-half of the direct costs is the result of landslide. CDOT maintenance work orders suggest routine maintenance response for rockfall creates an annual direct cost of over $5 million. In terms of larger rockfall events, the economic impact for two rockfall events that closed I-70 for several days in 2004 and 2010 was estimated to be more than $40 million each."

Two examples of repair costs are from CDOT projects on CO Hwy 133. A 2021 landslide impacted CO Hwy 133, near Paonia, and the repair project total was $2.8 million. In 2023, a rockfall event on CO Hwy 133 occurred, north of McClure Pass and south of Carbondale, causing damages that require an estimated repair cost of $3.9 million.

Exposure

Highways are the most vulnerable state asset type exposed to landslide / debris flow / rockfall hazard. The largest risk is to those state highways located in known landslide areas, or highways located within or near recent wildfire burn scars. The largest potential impacts resulting from an event could include highway closures, local/regional supply chain disruptions, and local economic hardships.

The greatest debris flow impact would involve an event affecting I-70 in the mountains. Impacts would be widespread and similar in nature to those recently experienced in the Glenwood Canyon, as post-fire debris flows and the risk of these events have caused numerous closures of I-70. These affected local and regional economies and caused supply chain disruptions at the state and national levels.

Bridges and tunnels are another notable vulnerable state asset. Specific structures include the Eisenhower-Johnson Memorial Tunnels and the Hanging Lake Tunnels. Impacts would be widespread and similar in nature to those recently experienced in the Glenwood Canyon, as post-fire debris flows and the risk of these events have

caused numerous closures of I-70. These affected local and regional economies and caused supply chain disruptions at the state and national levels.

CDOT's Geohazards Program designs mitigation plans, reviews consultant designs, performs site inspections during construction, responds to rockfalls, and addresses other geological hazard related emergencies. For the FY2022-2023, CDOT Geohazards Program budget allocated $10 million for response and mitigation. This does not include project repair costs, which in one year could easily exceed this allocated amount. CDOT monitors more than 750 locations recognized as having chronic rockfall hazards.

There are four state-owned dams located in mapped landslide areas. These include the Alberta Park, Spring Creek, Trujillo Meadows, and Beaver Park dams.

In assessing the potential impacts from landslides to state assets, Figure 122 shows the count of state asset buildings exposed to those hazard areas.

FIGURE 122 STATE ASSET BUILDINGS EXPOSED TO LANDSLIDE RISK

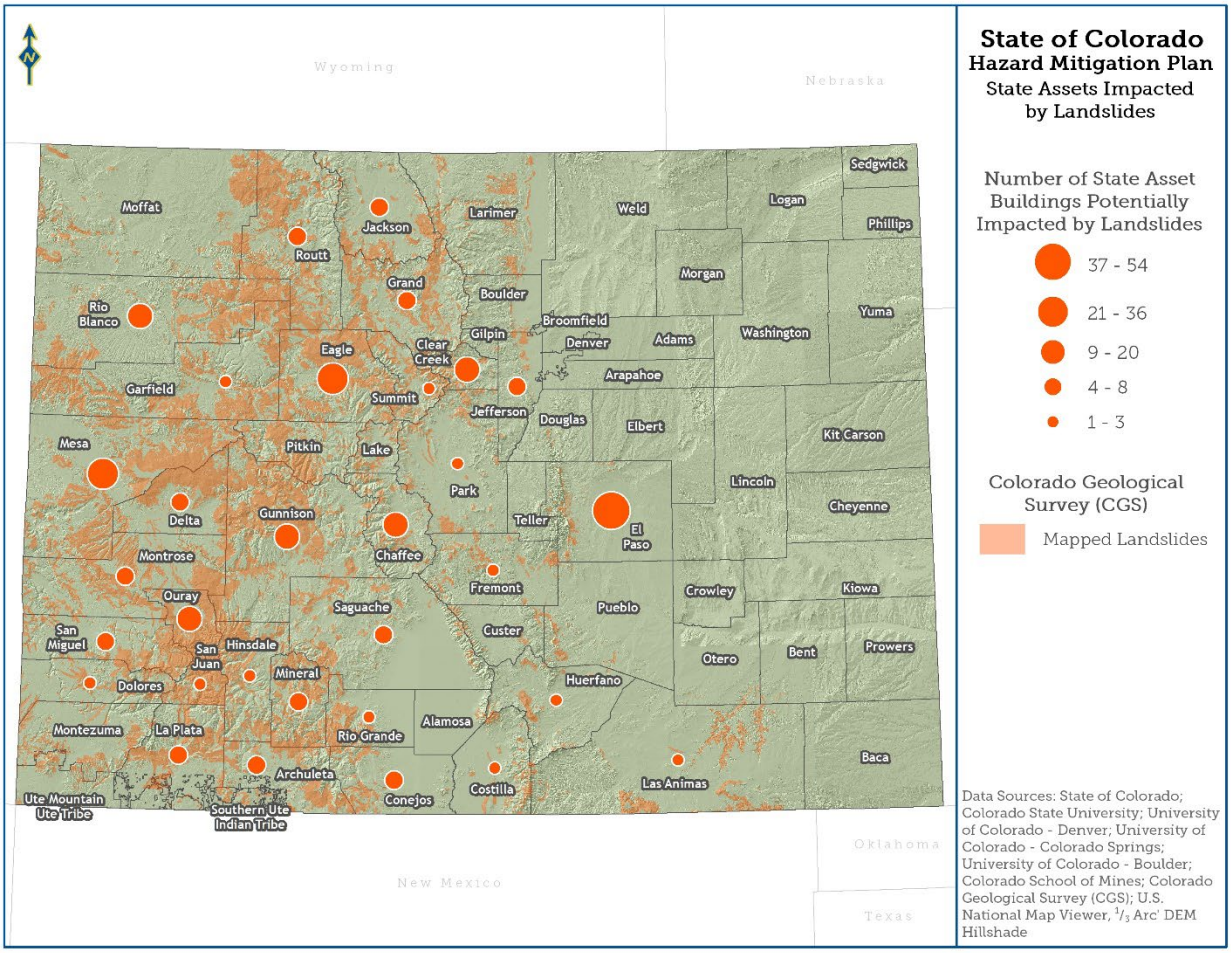
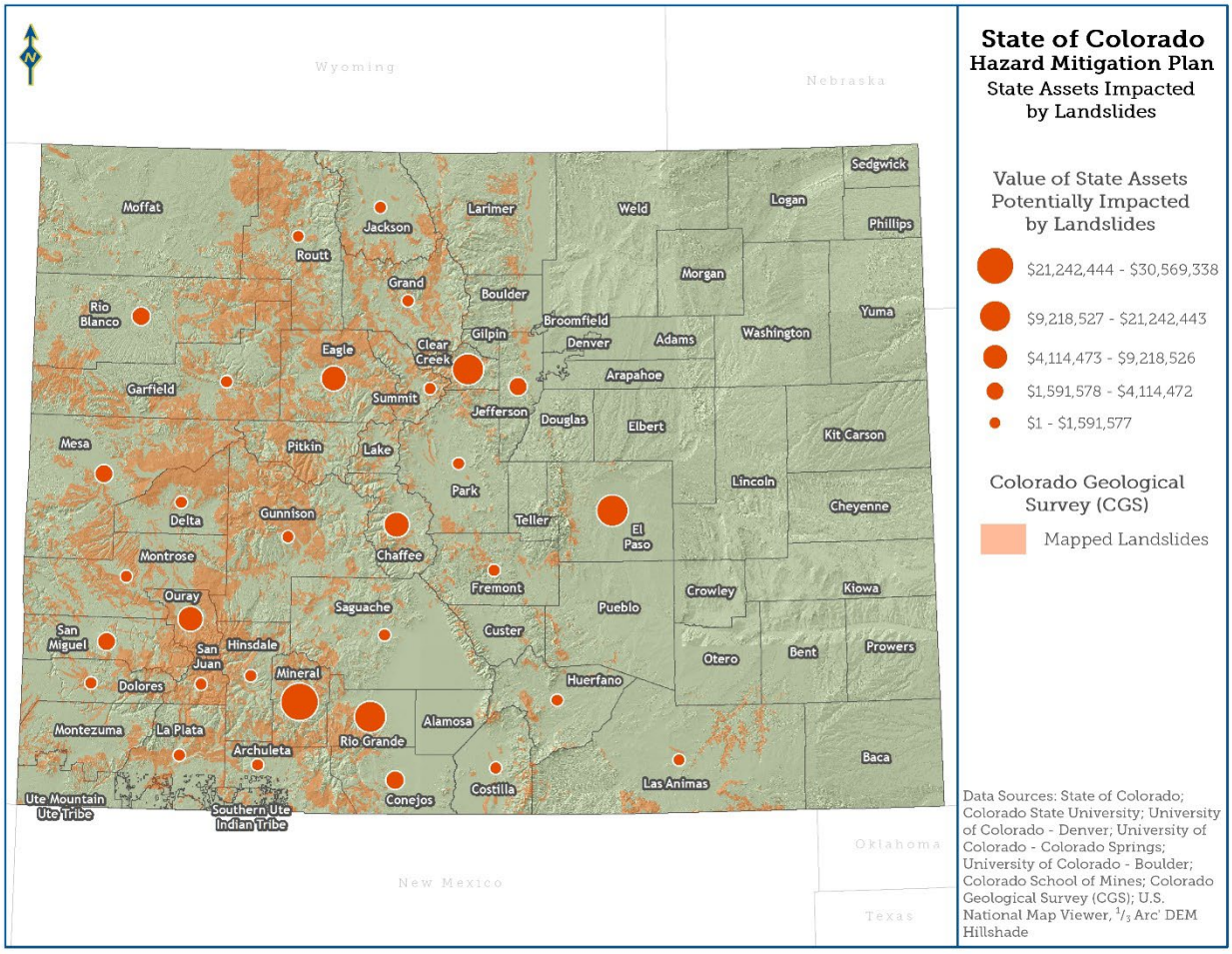


Figure 123 presents this same analysis, but instead shows the total valuation of those exposed assets. Presenting the data in this way provides different takeaways than the previous Figure. Counties with the highest exposed valuations are scattered across much of the western half of the state, with El Paso County being an outlier in the front range.

FIGURE 123 VALUES OF STATE ASSET BUILDINGS EXPOSED TO LANDSLIDE RISK



Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a mass wasting event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

Land-slide / Debris Flow	Communications	Energy (Power & Fuel)	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation

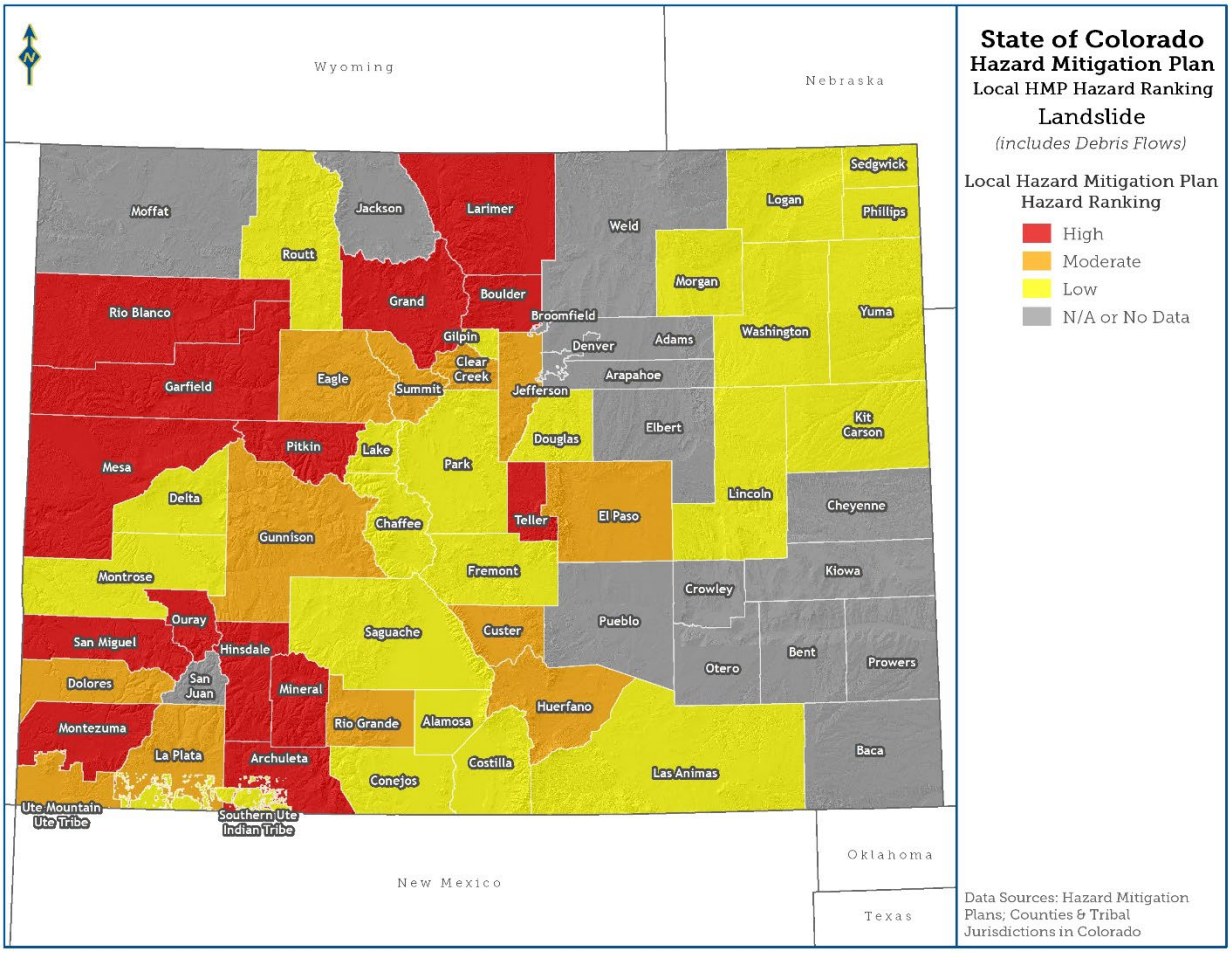
Local County / Tribe

Hazard Rankings

Figure 124 presents the hazard ranking for those counties and tribal areas that profiled landslide, including debris flow, which span from low to high risk. Most of the high risk areas are located across the western slope, but there is also concern in portions of northern Colorado. Many of those areas have experienced recent devastating wildfires and may be more aware of the risk that their communities face relating to their recent burn scars.

It may appear that a county should rank the hazard risk differently due to the amount of historical events presented previously. However, recognizing the subject matter expertise at the local level is more important than assuming a map alone, without context, can be representative of the risk hazards pose at the local level.

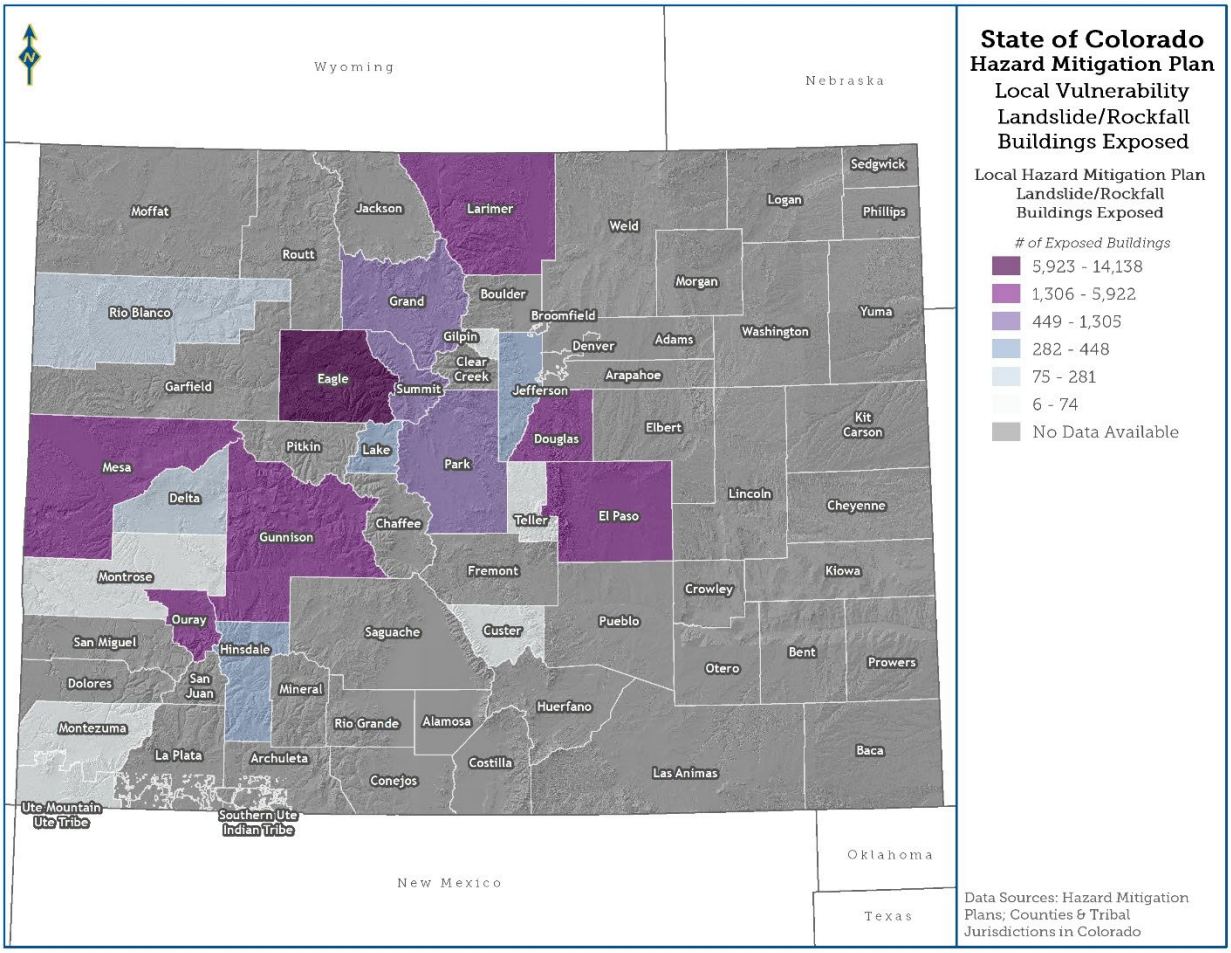
FIGURE 124 LOCAL HAZARD RISK RANKING - LANDSLIDE AND DEBRIS FLOW



Exposure

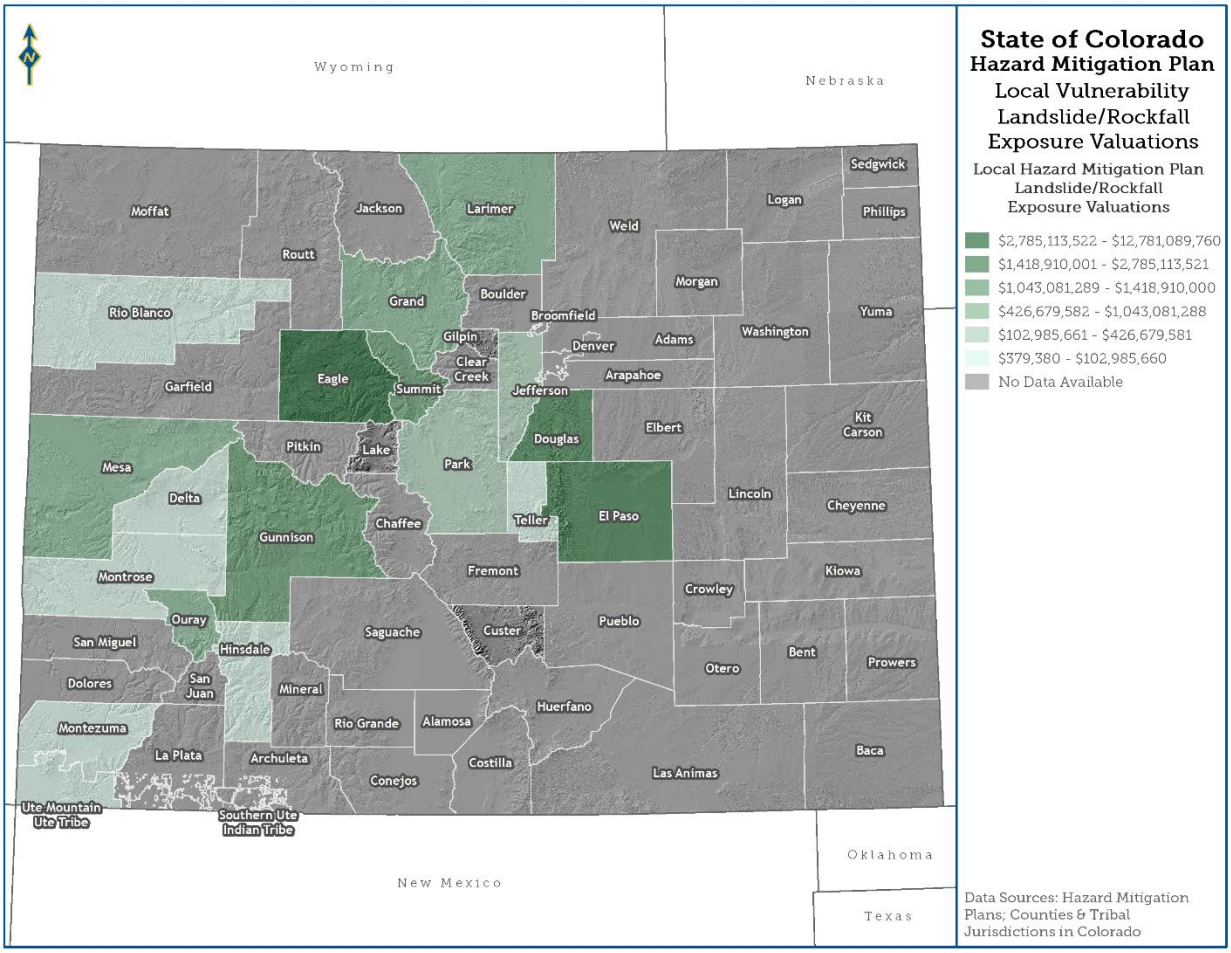
Building exposure to landslide and rockfall susceptible areas, as reported in local hazard mitigation plans, is presented in Figure 125 as a total count of structures. While noting that local assessment methodologies may vary, it is still important to consider the exposure being assessed by the local governments.

FIGURE 125 LOCAL BUILDING COUNT EXPOSED TO LANDSLIDE / ROCKFALL VULNERABLE AREAS



Exposure to landslide susceptible areas, as reported in local hazard mitigation plans, is presented in Figure 126 as a total sum valuation of those structures.

FIGURE 126 LOCAL VALUE OF BUILDINGS EXPOSED TO LANDSLIDE VULNERABLE AREAS



Interconnected Hazards

Landslide / debris flow / rockfall hazards have the potential to cause: avalanches, dam / levee incidents, erosion / deposition, and flood. These hazards may be the result of dam / levee incidents, earthquakes, erosion / deposition, flood, and wildfire.

Recent and Future Development

Future development, including infrastructure, could be vulnerable to mass wasting events if not accounted for in siting and design. Growth in many areas in mountain counties are constrained by federal lands which can force growth onto hazard areas. In addition, residential and business growth in these hazard areas may occur due to the beauty and seclusion that these areas provide. With continued growth in the

mountain tourism industry, as well as development, more vehicles will be traveling transportation corridors prone to these hazards.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- Mismanaged intense residential and recreational development (development near steep slopes) across La Plata County could increase the probability of washouts, sloughing, erosion, rockslides and landslide events occurring in the county.
- In Mineral County, ongoing pressures for residential and business growth in areas highly impacted by landslides will continue as available land for development decreases in mountain communities.
- Development has occurred on the Corbett Creek and Cutler Creek debris fans in unincorporated Ouray County. The City of Ouray, Town of Ridgway, and unincorporated County have experienced population growth over the last decade. Development in areas identified as having a landslide risk has increased vulnerability to this hazard.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- Future development in Routt County could lead to more homes in landslide risk areas if development and building permits are not carefully managed.
- While communities in the Roaring Fork Valley have enacted strict development standards for development on slopes and hillsides, the potential for extreme

precipitation events fueled by climate warming may present increased risks to people and property in Eagle County.

Consequence Analysis

TABLE 45 - EMAP IMPACT SUMMARY

Consideration	Description
Public	At risk are people in areas burned by wildfires, motorists along highways, tourists and recreationists on or near steep slopes. Possible deaths, injuries, and property loss.
Responders	Some exposure exists to personnel performing routine duties when event occurs; some post-event duties may expose personnel to areas of geologic instability.
Continuity of Operations (Govt. & Services)	None or limited loss of facilities or infrastructure function or accessibility or ability to provide services.
Property, Facilities, & Infrastructure	Limited damage to personal property occurs from this event. Occasional vehicles are struck by falling rocks or debris. Post-precipitation events in burn areas have resulted in active debris flows causing significant damage. Transportation infrastructure is typically the most impacted resource in Colorado from landslides and rockfalls though residential structures have also been impacted.
Environment	Events may expose additional earth that is prone to the same movement, perpetuating the hazard.
Economic	With a large enough event, closure of transportation routes may negatively impact Colorado's tourism industry.
Public Confidence in Govt.	Duration of response and repair to closed or blocked roadways is visible and often reported in the media which may lead to public perceptions of capability.

Pandemic - High Risk

Definition

The World Health Organization (WHO) declares a pandemic when the growth of a disease is exponential and there are confirmed cases in at least three countries in two WHO regions. Declaration of a pandemic is not based on virology, population immunity, or disease severity. In a pandemic the disease affects several populations, countries, and potentially continents, as opposed to regional epidemics. This wide geographical reach is what makes pandemics lead to large-scale social disruption, economic loss, and general hardship.

The Centers for Disease Control and Prevention (CDC) defines an epidemic as a disease with rates that are clearly above the expected occurrence in a community or region. An epidemic disease does not necessarily have to be contagious, an example being the West Nile virus. A once-declared epidemic can progress into pandemic status.

The pathogen must meet three conditions before a viral 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.

While uncommon, bacteria can also cause pandemics by spreading through food, water, and human to human transmission, such as cholera. The WHO has recently brought attention to the potential increase of bacterial pandemics as antibiotics are becoming less effective in treatment and bacteria are able to mutate rapidly.

Generally, pandemic events cause sudden, pervasive illness in all age groups. The exact size and extent of the infected population is dependent upon how easily the illness is spread, the mode of transmission, and the amount of contact between infected and non-infected persons.

Location

Pandemics occur across vast geographical regions, without regard to state or country boundaries, or continental distance. With the ease of international travel, a virus can spread across the globe within a day. As an example, a flight from Sydney, Australia to Denver, Colorado is less than 19 hours of travel time.

Contributing Factors

The magnitude of a health-related emergency on the health of the population will range significantly depending on the aggressiveness and mortality rate of the disease, the ease of transmission, the preparedness of the medical field, the availability of medical supplies, and the availability of vaccines.

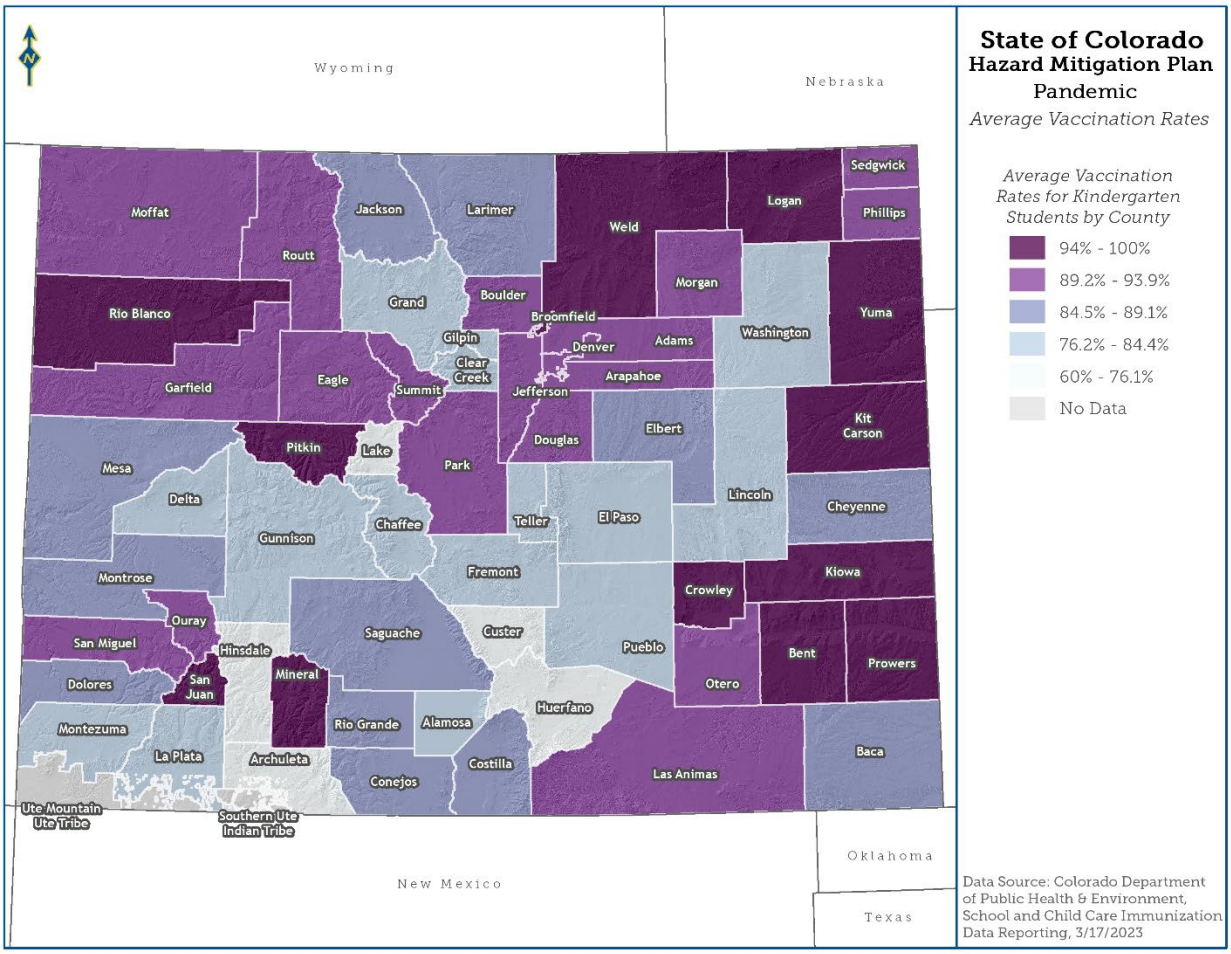
A novel virus with unknown transmission rates and health effects, and lack of established safety protocols early in the spread can be detrimental. Delays in vaccine development and delivery can magnify negative effects. These effects are illustrated with the mutation of the original SARS-CoV-2 virus which caused the COVID-19 pandemic. The impacts on public health, the medical field, the economy, and the overall mental health of the population require long term recovery, preparedness, and mitigation efforts.

Vaccines are not only critical when a novel virus is discovered, but as an overall public health benefit for existing diseases. For example, the CDC states that during 2019-2020, flu vaccination prevented an estimated 7.5 million influenza illnesses, 105,000 influenza-associated hospitalizations, and 6,300 influenza-associated deaths. While these influenza strains are unlikely to evolve to epidemic or pandemic levels, this illustrates the influence that vaccinations can have on the population's wellbeing.

Vaccinations are not typically tracked for adults, although children must receive certain vaccinations in order to enter kindergarten. While this is not a full picture of the state population's willingness to get vaccines, it does illustrate an overall understanding of who is adhering to public health requirements. The goal for

vaccination rate is 94%-95% and less than 20% of the state's counties meet this threshold.

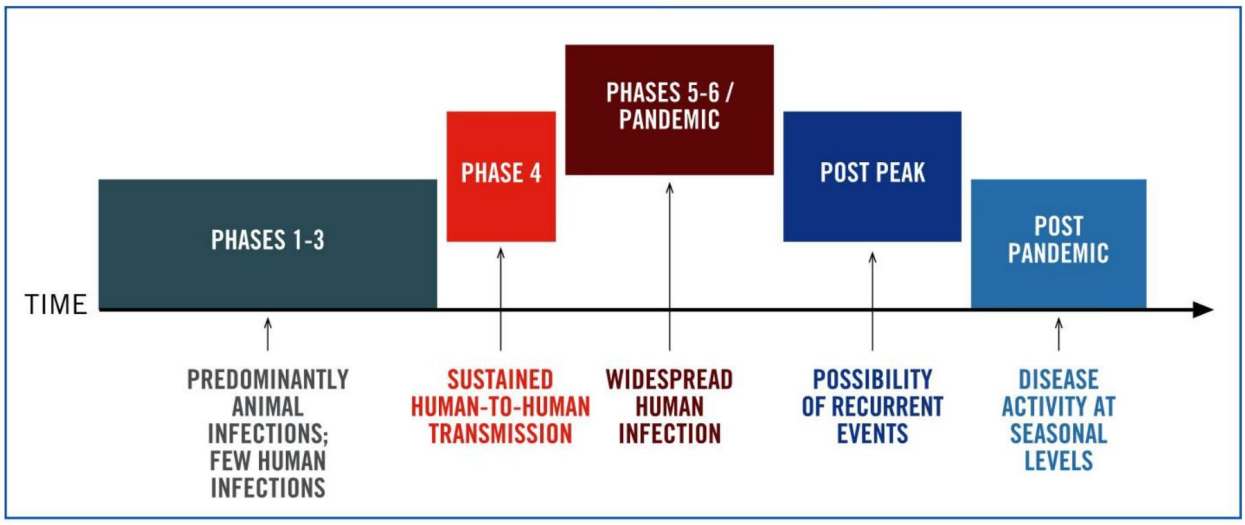
FIGURE 127 AVERAGE VACCINATION RATES BY COUNTY



The evolution, or phases, of a viral infection into a pandemic, according to WHO, are shown in Figure 128[38]. These were updated in 2009 and are the basis for protocols around the world.

[38] The WHO Pandemic Phases. World Health Organization; 2009, https://www.ncbi.nlm.nih.gov/books/NBK143061/

FIGURE 128 WORLD HEALTH ORGANIZATION PHASES OF A PANDEMIC



Examining assumptions in existing pandemic plans and highlighting the gaps in systems across the country is crucial to comprehensive mitigation. The unexpected mass closure of multiple sectors can stall local economies and community operations leading to extensive social service needs. The resulting unemployment can result in rent payment and food access crises. Housing those with the disease while they recover can prove difficult, especially vulnerable populations and those in overcrowded quarters. Underequipped and understaffed medical facilities exacerbate the inability to adequately care for large groups. Public health suffers, beyond the disease, as people may not get regular medical care or mental healthcare.

There is a likelihood of future pandemics and as planning moves forward, an overarching understanding of disease complexity is important. Accounting for the concept of variability in the characteristics of a disease is critical when looking at contributing factors to the impacts on population health, the economy, the supply chain, and the capabilities of the medical system, as well as other community sectors.

Other factors that can contribute to perpetuating and intensifying pandemic impacts are funding shortages, inter-departmental and stakeholder communication issues, political will and support, lack of cross-sector coordination with public health and

other medical entities, and a disconnect between response efforts, planning efforts, and leveraging pandemic mitigation content.

Past Occurrences

Historical Events

There have been five pandemics in approximately 100 years.

Previous Losses

Quantifying losses due to a pandemic is complicated and reliant on data that may not be available. First, lives lost are the most important to acknowledge and the resulting impacts to communities, from those losses, must be recognized. Businesses may close, families may struggle financially, and communities may not recover. Each disease affects the population differently and drastic changes to the makeup of society, such as age and gender, can have long term impacts.

During the COVID-19 pandemic the state unemployment rate was at its highest, 11.6% in May 2020, which was almost five times higher than in August 2019. In 2020, the Colorado Tourism Office reported a $9 billion loss and a loss of over $2.6 billion was reported for the creative industries, including the arts, culture and heritage, and architecture. The Colorado Restaurant Association reported losses in the industry of over $3 billion. Other public-facing industries, such as retail and personal care, also saw tremendous losses. Agriculture, mining, and construction were impacted by increased material costs, trade and transportation issues, and workforce loss, as employees tested positive for COVID-19 spreading it to others in close quarters.

FEMA Public Assistance recovery costs totaled $2.05 billion for Colorado over the course of the COVID-19 event.

Notable Events

Four of the most serious pandemics that the Centers for Disease Control and Prevention (CDC) has recorded are the result of influenza viruses. The pandemic in 2019 was a coronavirus.

1918 Spanish Flu: In 1918, a powerful strain of the flu, colloquially known as "Spanish Flu," spread throughout the world. The virus was extremely deadly, bringing on pneumonia that filled its victim's lungs with fluid. Worldwide, an estimated 21-50 million people died between 1918 and 1919 as a result of the flu. In Colorado, an estimated 8,000 people were killed by the flu and complications. The state had one of the highest mortality rates in the country, possibly because of the large population with compromised lung function, including miners and tubercular patients. It would not be uncommon for terminal patients to request their caretakers to end their life. The 1918 Spanish flu pandemic remains the worst-case pandemic event on record.

The Denver Library website provided an excerpt from the autobiography of Nova Eisner Rose, detailing the effects of the Spanish Flu on her family:

"Father caught it. Mother took a leave of absence [from teaching at Denver's Whittier School] and went up to nurse him, but she herself became so tired she then sent for me to come from my college freshman year and relieve her. The second day after I arrived, Father died of a massive hemorrhage. His body was taken to Denver for burial, but the day of the funeral I couldn't raise my head from the pillow. People avoided gatherings in those days, so Mother alone saw my Father buried (Denver's Influenza Pandemic of 1918, Denver Public Library, 2018)."

1957 Asian Flu: In February 1957, a new influenza A (H2N2) virus emerged in East Asia, triggering a pandemic ("Asian Flu"). This H2N2 virus was comprised of three different genes from an H2N2 virus that originated from an avian influenza A virus, including the H2 hemagglutinin and the N2 neuraminidase genes. It was first reported in Singapore in February 1957, Hong Kong in April 1957, and in coastal cities in the United States in summer 1957. The estimated number of deaths was 1.1 million worldwide and 116,000 in the United States.

1968 Flu: The 1968 pandemic was caused by an Influenza A (H3N2) virus comprised of two genes from an avian Influenza A virus, including a new H3 hemagglutinin, but also contained the N2 neuraminidase from the 1957 H2N2 virus. It was first noted in the

United States in September 1968. The estimated number of deaths was one million worldwide and about 100,000 in the United States. Most excess deaths were in people 65 years and older. The H3N2 virus continues to circulate worldwide, as a seasonal Influenza A virus. Seasonal H3N2 viruses, which are associated with severe illness in older people, undergo regular antigenic drift.

2009 Swine Flu: In the spring of 2009, a new version of the H1N1 virus emerged. This version, due to its genetic lineage, became known as Swine Flu. By June, the Centers for Disease Control and Prevention (CDC) had stopped counting cases and declared it a pandemic. The CDC estimated that there were 60.8 million cases, 274,304 hospitalizations, and 12,469 deaths throughout the United States. A vaccine was distributed in the U.S. in October 2009 and the pandemic was declared over on August 11, 2010.

In Colorado, there had been 2,041 hospitalizations across 54 counties by May of 2010. A total of 69 people died. Unlike most other pandemics, deaths were fairly spread out amongst all age groups, with younger generations taking more of the brunt. Approximately 17% of the total deaths were under 18 years of age. This is likely because older generations had been exposed to another version of H1N1 at some point in their lives, giving them some immunity, while those who were younger had no existing immunity. Of those who were hospitalized, the CDC estimated that about 70 percent of them belonged to a high-risk group, meaning they likely had existing complications that only compounded the illness.

2019 Novel Coronavirus (COVID-19): In December 2019, COVID-19 emerged in China and the first confirmed COVID-19 case in Colorado presented on March 5, 2020. As of writing this plan, WHO data counts fatalities in the US as over 1.1 million deaths and globally over 6.9 million. The COVID-19 pandemic has affected approximately 1.8 million people in Colorado, with over 15,200 deaths. Vaccines became available in December 2020 and over 72% of Coloradoans, roughly 4.1 million, have completed the primary series of vaccine doses based on Colorado Department of Public Health and

Environment (CDPHE) data. On May 11, 2023, the COVID-19 public health emergency was declared over in US.

Probability

It is not a matter of if, but when another pandemic will happen. CDPHE considers a pandemic to be inevitable, there is a 100% chance that a future pandemic will occur. However, there is no definite way to predict when a pandemic might happen. Some indicators will be present, but not every new virus turns into a pandemic. Based on historical events, there have been five pandemics since 1918, which leads to a 4.8% chance of a pandemic occurring in any given year.

As far as potential diseases, pandemic influenza continues to be a focus for the CDC, as well as collaboration with USDA to monitor numerous zoonotic diseases. At the international level, the WHO publishes a list of the diseases with the greatest epidemic and pandemic threat, most recently in 2023.

The impact of the next pandemic on Colorado cannot be predicted, but lessons learned from the COVID-19 pandemic will inform future planning, policies, and protocols.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future pandemic events. The following Table 46 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 46 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Climate change will influence vector-borne disease prevalence, but the direction of the effects (increased or decreased incidence) will be location- and disease specific.

Impact	Projected Change
Extent/Intensity	Intensity is projected to increase. Disadvantaged populations are expected to bear a greater burden from climate change as a result of their current reduced access to medical care and limited resources for adaptation strategies. Extent of certain diseases is expected to increase.
Frequency	Additional research is needed to determine the effects of climate change on the frequency of epidemics and pandemics.
Duration	Additional research is needed to determine the effects of climate change on the duration of epidemics and pandemics.

Risk & Vulnerability

Populations at Risk

All populations are at risk of being infected and certain populations may have worse outcomes than others. Those who have a chronic illness, children, and the elderly, and those who are unable to seek medical care either due to lack of transportation, funding, or other barriers such as language are at most risk. Additional populations at risk include those who are unable to leave their jobs to stay home, including low wage workers. Those living in crowded households or in group quarters also have an increased vulnerability.

State Assets

Previous Losses

A catastrophic and widespread pandemic event would overwhelm large segments of the workforce. Hospitals throughout the state would largely have to rely on the equipment, medicines, and expertise at their disposal, as federal and state resources would be stretched thin throughout the country. However, since 2008, no state asset property losses have been reported due to a pandemic.

Exposure

State employees are the most vulnerable state asset type exposed to pandemic hazard. The largest risk is to healthcare and other front-line workers. The largest potential impacts resulting from an event could include a partial shutdown of some state services, as experienced during COVID-19.

Lifelines

The potential of a pandemic to infect large numbers of the population creates a possible consequence of an extensively reduced workforce across all sectors. For this reason, all community lifelines across Colorado are vulnerable to the impacts from a pandemic event. All sectors could be affected whether by inadequate workforce numbers, economic instability, straining of health and medical resources, and potentially have long-term effects on recovery and resilience.

Pand-emic							

Local County / Tribe

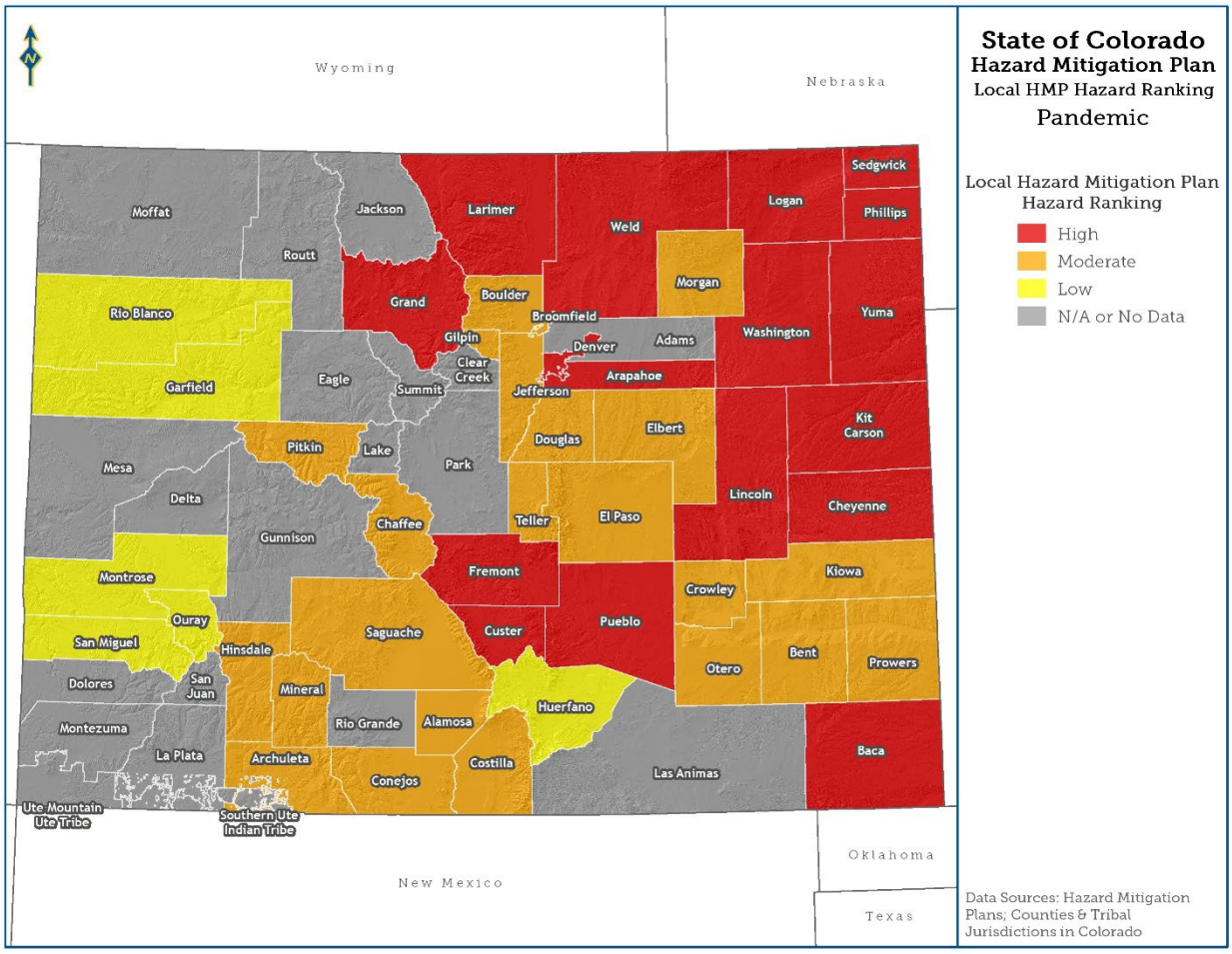
Hazard Rankings

Prior to COVID-19, few local hazard mitigation plans included a pandemic hazard profile. As local HMPs have been updated since 2020, Pandemic has been included both as a priority for communities and importantly to align with the state plan. Aligning with the state plan allows local government to ensure an understanding of the hazard, exposure, and risk to communities.

Numerous factors play a role in ranking a hazard and pandemic is especially multi-faceted. These communities ranked the risk based on their experiences, capabilities, and priorities. Each county likely had a very different experience during COVID-19, influencing the overall rank. These varying factors are illustrated in Figure 129. Over one-quarter of the counties in the state ranked the risk of the pandemic hazard as high. Approximately one-third of the counties ranked the risk as moderate. Only a few

counties ranked the risk as low. Undoubtedly more counties will profile the Pandemic hazard going forward.

FIGURE 129 LOCAL HMP PANDEMIC HAZARD RANKINGS



Exposure

All people in Colorado are exposed to a pandemic. Factors around age, health, profession, living situation, and more alter the extent to which one is exposed and vulnerable.

Interconnected Hazards

Severe weather events, especially prolonged storms requiring people to shelter closely can exacerbate the spread of the disease. Flooding can impact water safety and potentially introduce an illness that spreads among the population.

Wildlife vehicle collision numbers increased during the COVID-19 pandemic as people drove faster on empty roads and animals were less cautious around traffic corridors.

Recent and Future Development

Population growth and development contribute the greatest to pandemic exposure. Increased interaction between people throughout a community will likely cause a disease to spread rapidly and a larger population can contribute to overtaxing local medical facilities.

Consequence Analysis

TABLE 47 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Approximately 30 percent of the general public could become seriously ill. Half of those may require medical care, and 10 percent may need to be hospitalized.
Responders	Medical staff would be overburdened with hundreds of additional cases on top of their normal workload. Most other responders will be impacted in similar proportions to the general public, thereby reducing available responders. EMS responders will experience greater exposure.
Continuity of Operations (Govt. & Services)	With an estimated 30 percent of the workforce absent, the continuity of government may be severely affected. The state has Continuity of Operations Plans (COOPs) for pandemics that seek to minimize the amount of time and efficiency lost to a pandemic.
Property, Facilities, & Infrastructure	Property would not be directly affected by a pandemic. Facilities and infrastructure would not be directly affected by a pandemic.
Environment	There are not likely to be any environmental effects from a pandemic.

Consideration	Description
Economic	In the event of a pandemic, upwards of 50 percent of the working population may be out sick. Fear of public gatherings would eliminate most in-person commerce.
Public Confidence in Govt.	It is expected that the government will work towards a solution that will end the pandemic, typically by helping to distribute vaccines and antiviral agents. Continual, accurate, and consistent public messaging and outreach across all agencies is vital to confidence in the government. Public health orders regarding measures to mitigate risk including interference in business operations and mask mandates can fuel distrust and frustration.

Pest Infestation – Low Risk

Definition

Pests are any organism (insects, mammals, birds, fungi, or non-native species) that are a threat to other living species in its surrounding environment. Pests compete for natural resources, can damage habitats and croplands, and can transmit diseases to humans, plants, crops, and livestock.

The Colorado Department of Agriculture (CDA) defines a pest infestation as "the occurrence of one or more pest species in an area or location where their numbers and impact are currently or potentially at intolerable levels" or a "sudden increase in destructiveness or population numbers of a pest species in a given area."

There are pests across Colorado, but for the purpose of this pest infestation hazard the current focus is on rangeland grasshoppers, the emerald ash borer (EAB), and the Japanese beetle.

Grasshoppers have ruined crops and rangeland since the 1800s when settlers came to Colorado. An annual occurrence, the pest numbers can fluctuate greatly, as well as geographically. Grasshopper species that cause damage are indiscriminate about food sources from gardens to crops and rangelands. Losses in crops impact yields reducing revenue and loss of vegetation can equate to lower livestock weights and economic losses for ranchers. Crops may be protected by control methods, such as insecticides, but the vast area of rangelands makes control difficult.

One of the pests collaboratively monitored and managed by the Colorado State Forest Service (CSFS) is the EAB which is an insect native to Asia. It was introduced into North America during the 1990s. Since its discovery in Michigan in 2002, the insect has killed millions of ash trees throughout the central and northeastern US and Canada.

EAB is now considered the most destructive tree insect pest ever to be introduced into North America[39].

The Animal & Plant Health Inspection Service (APHIS) describes the Japanese beetle as a highly destructive plant pest that can be very difficult and expensive to control. Japanese beetle grubs damage lawns, golf courses, and pastures by feeding on grass roots. Japanese beetle adults attack the foliage, flowers, or fruits of more than 300 different ornamental and agricultural plants.

Location

Pest infestations are statewide, with regional propensity depending on the specific type of pest. Rangelands across the state can be devastated by grasshopper infestations, while certain types of trees and plants can be targeted by specific insects in rural, urban, or forested areas.

The United States Department of Agriculture (USDA) defines rangelands as including all grasslands, shrublands, and forested lands that can, continually, or periodically (naturally or through management) support an understory of herbaceous or shrubby vegetation that is forage for grazing or browsing animals.

Contributing Factors

There are numerous variables that impact the duration, spread, and potential damages from pests. Early detection and effective management methods will shorten the length of time the infestation occurs, as well as the critical task of keeping the pest in a contained geographic area. These both limit the potential damages that can be done by a pest and help to curb any economic losses that may be incurred.

Some of the variables that can interfere with successful pest management include the ability and distance a pest is able to travel, the rate or quantity of reproduction, the availability of preferred food, weather conditions, and the difficulty of locating them.

[39] Emerald Ash Borer: A Green Menace - Colorado State Forest Service

A widespread insect infestation, such as the emerald ash borer, can create public safety threats from the collapse of affected trees due to high winds or ice/snow accumulation. Falling trees or limbs can bring down power lines, damage public and private structures, and cause injuries or death. Other insects (bark beetles) have been known to infest trees in mountainous regions, leaving innumerable dead trees as fuel for wildfire.

Past Occurrences

Historical Events

The state has issued and received multiple disaster declarations related to insects. USDA Secretarial Disaster Declarations were given in 2003, 2005, 2005-2006, 2006, and once each year between 2012-2015. Two state disaster declarations were made, in 1980 and 1981, for grasshopper infestations.

Generally, the Eastern Plains and northwest Colorado show the highest numbers of grasshopper adults, largely in the range of three to eight adults per square yard. Some isolated areas in Colorado have experienced more than 15 adult grasshoppers per square yard.

The EAB was first detected in Colorado in the City of Boulder in September 2013 and the whole city was presumed infested at the close of 2015. Within six counties, primarily along the Front Range, there have been 14 towns and cities with confirmation of EAB presence. Three of these infestations have been discovered since 2022.

The history of the Japanese beetle in Colorado was shared by CDA in a 2022 article[40]. The initial discovery in the state was in 1995 and it was detailed that “on the Western Slope a Japanese beetle was discovered by a Master Gardener in 2002. According to data from the Upper Grand Valley Pest Control District (UGVPCD), the area around the

[40] Japanese Beetle Detection and Eradication Measures on the Western Slope, CDA, 2022

UGVPCD acted decisively to eradicate the pest and reduced its population by 99% over five years".

Previous Losses

There are no recent loss figures available specific to Colorado for the impacts of grasshoppers, EAB, or the Japanese beetle. However, in 2014 the USDA explained efforts to control the Japanese beetle throughout its life cycle were estimated to cost more than $460 million ($592 million 2023 USD) a year, half of which was attributable to the efforts at larval stage, as grubs, alone[41].

While the USDA may provide opportunities for funding to recover from a disaster, there are not many other sources to recoup losses. APHIS does assist private landowners with serious infestations by coordinating areawide grasshopper management programs.

Notable Events

In July 2022, more than 230 Japanese beetles were trapped in a Grand Junction neighborhood, in Mesa County. The beetles are located in many parts of the state currently.

During the summer of 1937, in Centennial, an infestation of grasshoppers was so immense that the National Guard used flame throwers to try and stop the destruction. It was estimated that approximately 7 billion grasshoppers covered 10 square miles of Colorado farmland. Losses of $12 million ($254 million 2023 USD) occurred, $3 million of which were crops and $9 million for poison to destroy the pests[42].

Probability

Pest infestations and related disease are actively occurring in Colorado and will continue to as a process of nature. Not all infestations begin with the introduction of a new species, such as the Japanese beetle or EAB, but more often are a result of the

[41] Managing the Japanese Beetle: A Homeowner's Guide, 2014
[42] Plague of Locusts in 1937, Colorado National Guard, 2014

increased numbers of a native pest. Grasshoppers, while damaging to the natural habitat, have been part of the ecosystem historically. Mountain pine beetles, fir beetles, and spruce beetles are all native to Colorado, but in great numbers have wreaked havoc in the forests.

These infestations will continue for an unknown duration and once controlled new pests will be introduced, or native pests will proliferate and find a place in their preferred location. Some will have the potential to be more detrimental than others based on multiple variables. According to the CSFS, approximately 15% of the trees in Colorado's urban forests are ash, making the EAB a major threat to urban forests statewide.

The Japanese beetle is considered a threat by the CDA to various areas of the state, due to the voracity of the pest, the susceptibility of the crops, and flight distance of the pest.

Pest infestations of some kind will occur in Colorado every year (100% chance).

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future pest infestation events.

TABLE 48 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Pests are projected to expand into more northern and higher elevation regions as average temperatures increase.
Extent/Intensity	Pest infestations are projected to increase in intensity as average temperatures increase. Extent may also increase.
Frequency	Pest infestations are projected to increase in frequency due to increased temperatures.

Impact	Projected Change
Duration	Crops are vulnerable to increased weeds and pests due to a longer growing season.

Risk & Vulnerability

Populations at Risk

People are not likely to be harmed directly by a pest infestation, depending on the number and type of pest. Primarily, the risk is monetary as economic loss due to infestation can be extensive for some. Recovery may be difficult for those impacted by infestations and losses incurred by communities may not be easily recovered.

State Assets

Previous Losses

Since 2008, no state asset property losses have been reported due to a pest infestation.

Exposure

No state assets are anticipated to be directly affected by pest infestation.

Lifelines

Food, hydration, & shelter is the lifeline vulnerable to the impacts from a pest infestation event. Pest infestation is not likely to impact immediate food availability, however the repercussions of reduced crop yields can be felt economically through losses at local, regional, and state levels. The secondary hazard of wildfire can result in the need for mass sheltering and state response to support local jurisdictions. These consequences could potentially strain resources and could have long-term effects on recovery and resilience.

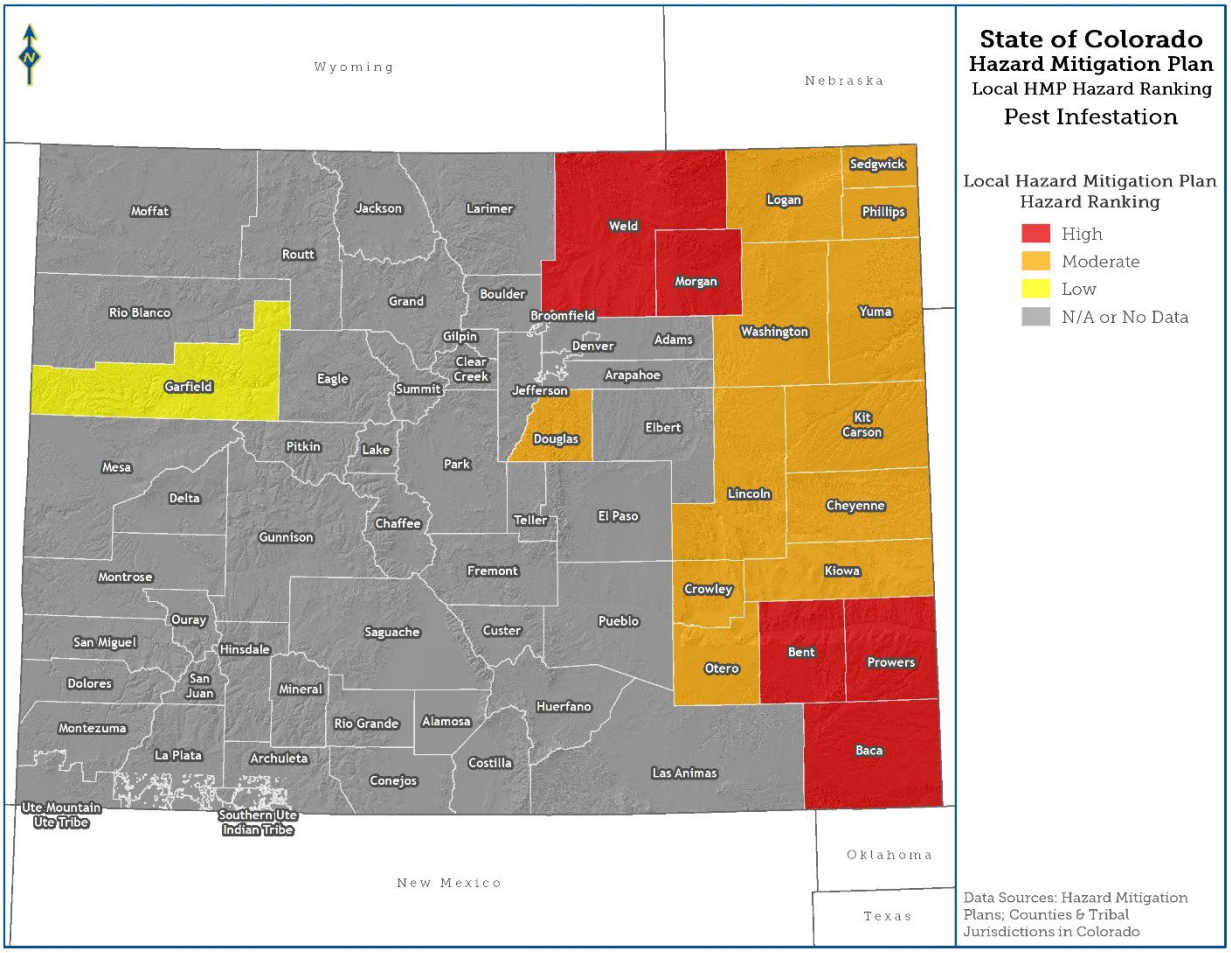
Pest Infest-ation							

Local County / Tribe

Hazard Rankings

Local risk ranking for pest infestation is shown in Figure 130. The eastern region of the state and a few other counties ranked the risk of pest infestation. The majority ranked it as moderate, while roughly one-third chose a high risk ranking. The knowledge of the amount of rangeland in the east and the impacts of grasshopper events corresponds to this side of the state profiling and ranking pest infestation.

FIGURE 130 LOCAL HAZARD RISK RANKINGS



Exposure

Exposure to pest infestation differs dramatically depending on the type of pest, location, and amount of their preferred food source, as well as the ability to control or mitigate the situation. Not all pests are tracked or forecasted in the same manner or reported to a dedicated database which increases the difficulty to understand potential exposure.

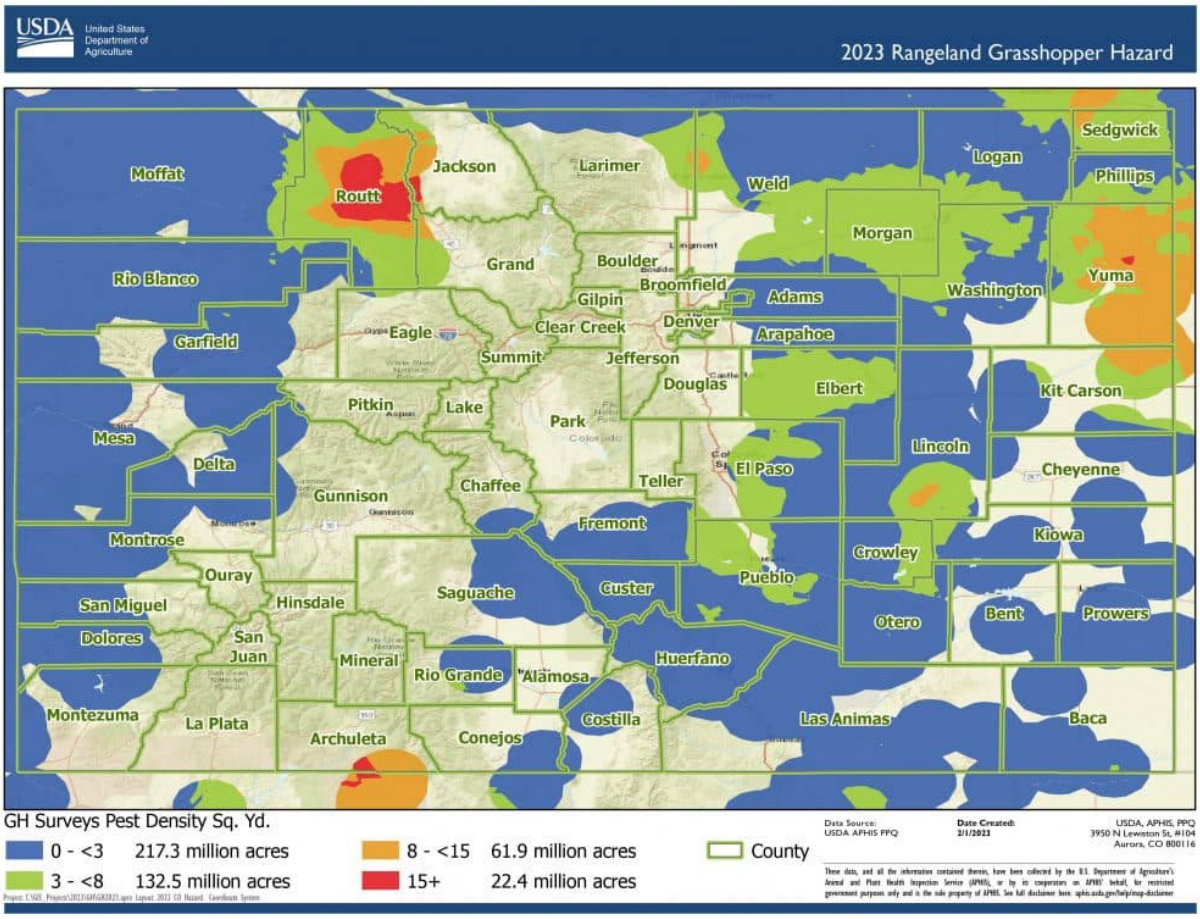
There are 66,700,000 acres in Colorado of which about 43,100,000 acres are used primarily for rangeland (65%). In Colorado approximately 27,500,000 acres of range is found in the mountain areas while 15,600,000 acres are found in the plains area[43].

Beginning in 1994, the USDA, in collaboration with APHIS, annually releases the Rangeland Grasshopper Hazard maps (Figure 131). These maps forecast the pest density for the western United States. The maps summarize the grasshopper densities of the previous year to show the anticipated risk, or hazard, of grasshopper problems.

The counties of Routt, Jackson, Yuma, and Archuleta, which have a combined total of 22.4 million acres of rangeland, are estimated to have at least 15 grasshoppers per square yard in 2023. Primarily surrounding those areas, 61.9 million acres in the state are expected to have between eight and 15 grasshoppers per square yard.

[43] Range and Pasture Management. James Hannebaum, Colorado State University 2018

FIGURE 131 2023 USDA COLORADO RANGELAND GRASSHOPPER HAZARD MAP



Interconnected Hazards

Pest infestations can be exacerbated due to drought, in some cases such as grasshoppers. In turn, damage done to croplands by grasshopper infestation can increase the occurrence of erosion / deposition. Another example are bark beetle infestations that result in large-scale die off of trees. These dead trees can fuel Wildfire, increasing their intensity and duration.

Recent and Future Development

Future development can be impacted by pest infestations, such as the issue of the EAB destroying urban ash forests. Future development should take diversification of plants into account when creating new built environments. Grassland or rangeland converted to cropland creates additional agricultural land that may be exposed to

grasshoppers outbreaks. Development of commercial or residential areas near rangeland or crops could expose the population to more pests.

Consequence Analysis

TABLE 49 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Persons in agriculture and livestock industry. Mental health issues such as stress, anxiety, depression, and addiction recurrence may arise with loss of income in agricultural areas.
Responders	No impact.
Continuity of Operations (Govt. & Services)	None or limited loss of facilities, infrastructure function, accessibility, or ability to provide services.
Property, Facilities, & Infrastructure	Property impacts are likely limited to vegetation loss with cascading effects of erosion and deposition. Property values may decrease with trees impacted by the EAB.
Environment	During a severe outbreak, grasshoppers may remove more vegetation than cattle in a given pasture and perpetuate erosion through the degradation of vegetation. Decline in urban forests from EAB may impair air quality and water quality in communities, and add to extreme heat risk.
Economic	Crop and rangeland damage occur on an annual basis and in outbreak years, large amounts of rangeland and crops may be destroyed. Costs of damage to farmers and ranchers can reach into the millions of dollars in outbreak years. Economic impact to communities may be extensive for EAB.
Public Confidence in Govt.	Expectations of farmers and ranchers are largely related to the provision of financial resources for insecticides and the

Consideration	Description
	availability of financial assistance through disaster declarations.

Severe Wind – Low Risk

Definition

Severe wind encompasses multiple types of wind events which include straight-line winds, microbursts, downbursts, and derechos among others. Also, in the cold season Chinook and Bora winds can be dangerous.

Straight-line winds are any thunderstorm wind that is not associated with rotation. This term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft. A downdraft is a small-scale column of air that rapidly sinks toward the ground.

Microbursts are small, concentrated downbursts that produce an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph.

Downbursts are strong downdrafts with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Downbursts can occur with showers too weak to produce thunder.

A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.

During the cold season the two main causes of high winds in Colorado are the air pressure difference between strong low pressure and cold high pressure systems. Chinook winds are warm, dry winds that occur on the downward slope of a mountain and cause a rapid rise in temperature, snowmelt, and sometimes flooding. Bora winds, which are cold and dry, are generated similarly to Chinook winds. Both of these winds can exceed 100 mph in extreme cases, bringing the potential for widespread damage. Winds of 60 to near 100 mph will occur in and near the foothills of the Front Range.

Location

Severe winds can affect every community in Colorado. The National Weather Service's Severe Weather Database, which began tracking severe wind in 1955, shows that reports are particularly common in northeastern Colorado, including the Front Range and the northern Eastern Plains.

Wind speed in Colorado is correlated with elevation. The highest winds in the state are concentrated along the north central mountains west of Fort Collins. Wind speed patterns on the Eastern Plains are affected by the Palmer Divide in relation to elevation changes associated with the Platte and Arkansas River basins.

Contributing Factors

Severe winds are a threat to life safety, property, crops, and livestock. Depending on the speeds, duration, location, elevation, and property in the area, a wind event can devastate a crop yield, tear off roofs of homes and outbuildings, overturn equipment and semi-trailer trucks, uproot large trees and snap power poles in one gust. The ability of winds to move large debris creates a hazard for the public. Strong winds can turn a controllable wildfire into a conflagration in a matter of minutes.

Mid and upper-level winds over Colorado are much stronger in the winter than in the warm season, because of the huge difference in temperature from north to south across North America.

The Colorado Department of Transportation included the dangers of straight-line winds in their Threat Hazard Identification and Risk Assessment report: "The property damage from straight-line winds can be just as extreme as that of a tornado, since the damage from straight-line winds is more widespread and usually affects multiple counties. In addition to property damage to buildings (especially less sturdy structures such as storage sheds, outbuildings, etc.), there is a risk for infrastructure damage from downed power lines due to falling limbs and trees. Large-scale power failures, with hundreds of thousands of customers affected, are common during straight-line wind events."

Past Occurrences

Historical Events

Historical severe wind events are clustered along the eastern side of the state, most notably in the northeast. There are also clusters along the Front Range and the Urban Corridor. In addition, when looking at the rest of the map a pattern develops of events being clustered near areas of population or popular transportation routes.

This is referred to as Urban Observation Bias, where more reports come in from areas with a larger number of people to witness them. This includes communities in more rural areas and is logical in that people will not report events that do not impact them. In addition, wind speeds are recorded at weather stations and often at airports, which are both typically located close to the populations they serve.

The importance of this is the understanding that wind events are likely underreported, especially damaging wind events which may impact someone, but the information is not shared to a database. The person may only work with their insurance company, who do not report claims for privacy reasons. Also, lack of equipment to record wind speeds may be a factor in underreporting.

According to the National Centers for Environmental Information (NCEI) Storm Events Database, 48 dust storm events were reported across 25 days, affecting 11 counties, between January 2002 and December 2022.

The events shown in Figure 132 represent the best available data for events between 1955 and 2021. There are multiple instances in counties across the state of events with wind speeds between 84 and 103 miles per hour (mph). A majority of the events reported, especially in the central region between Boulder and El Paso counties fall in the range of 33 to 63 mph.

FIGURE 132 HISTORICAL WIND EVENTS

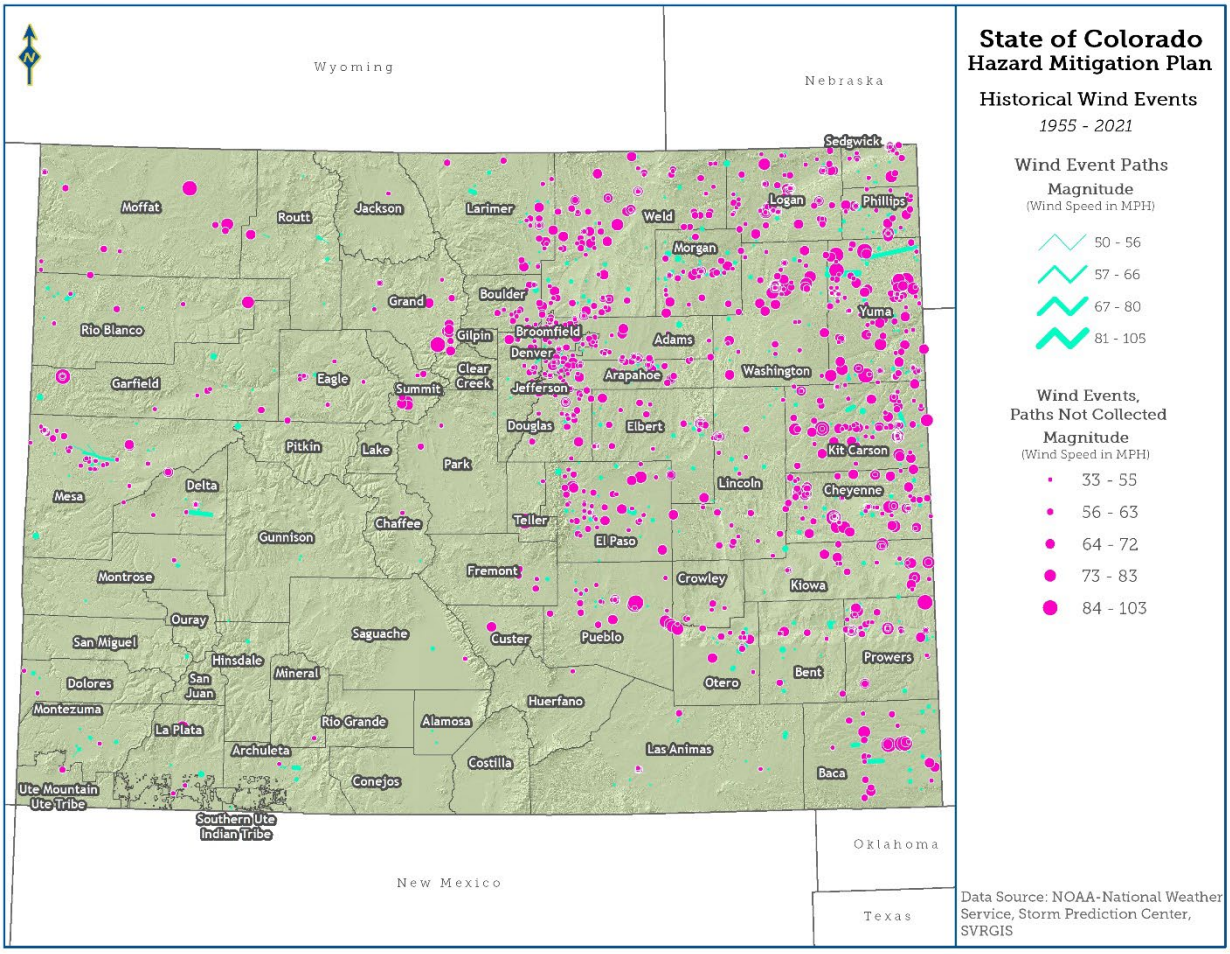
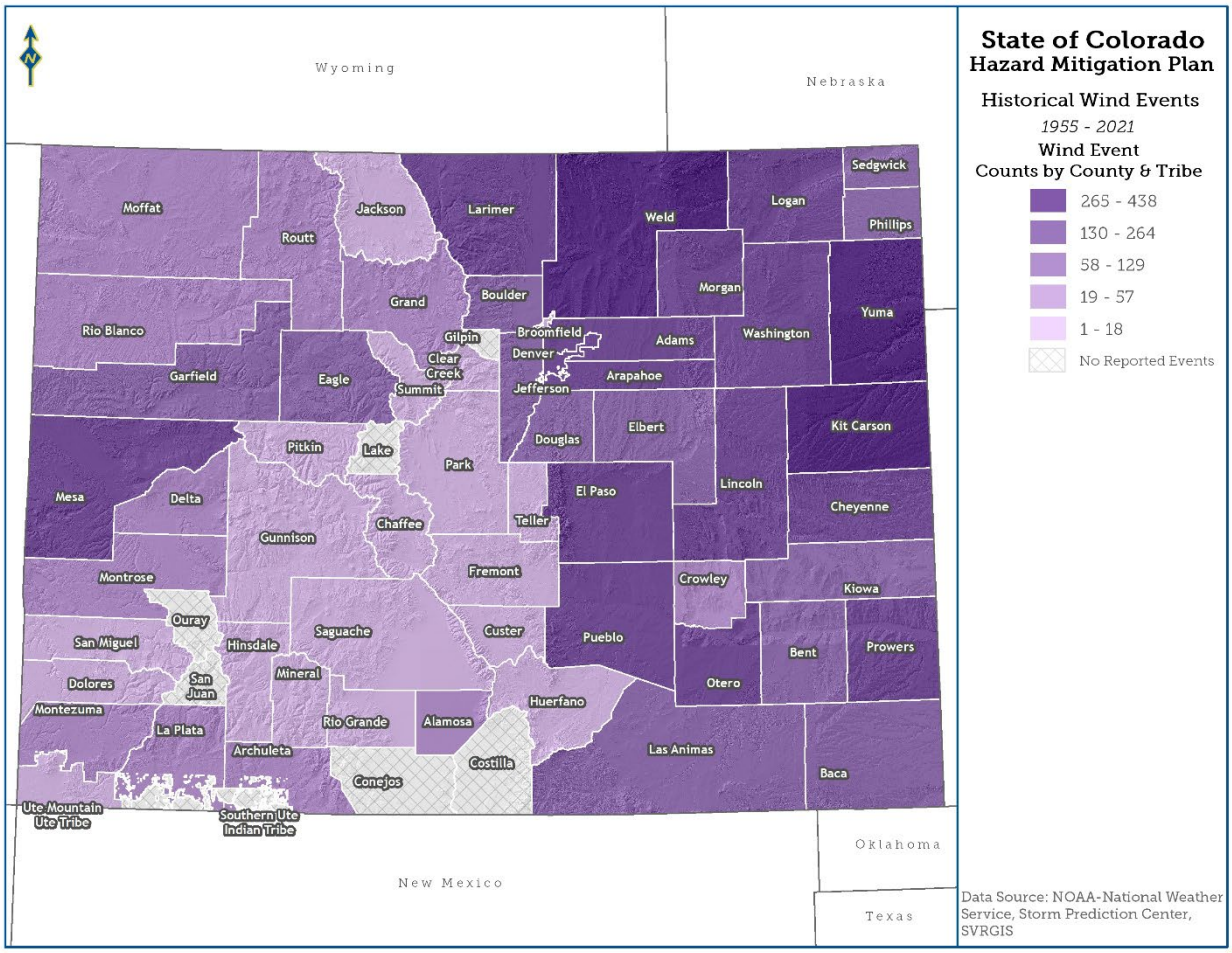


Figure 133 summarizes these historical events at the county and tribal area level. Not all events may be represented, however Colorado weather and geography are

conducive to severe wind across the state. A majority of those reported severe wind events occur in the northeast corner of the state.

FIGURE 133 WIND EVENT COUNTS BY COUNTY AND TRIBAL AREA



Previous Losses

Data from NOAA National Center for Environmental Information (NCEI) details from 1996 to 2016, wind events have caused a reported $40 million in property and crop damage. Wind events have also resulted in 13 deaths and more than 200 injuries in the state since 1987.

Of the United States Department of Agriculture Disaster Declarations in the state since 2012, seven have included high winds as an impacted hazard.

Notable Events

Las Animas County – July 14, 1989: About 100 National Guard troops were injured, including about 20 who were hospitalized, after a thunderstorm with 60 mph winds struck an encampment at Pinyon Canyon near Trinidad. The winds brought down 12 to 15 large tents, including a field hospital, and sent debris flying.

Front Range and northern Eastern Plains - May 20, 2001: According to National Weather Service records: "Intense winds developed as a vigorous cold front, accompanied by a line of thunderstorms, spilled over the Cheyenne Ridge and moved rapidly across the urban corridor and northeast plains." Wind gusts of more than 80 mph were recorded at the Greeley Airport and near Pueblo, downing trees and power lines across the region. Temperatures dropped from the mid-70s to mid-30s within one hour. Blowing dust and debris reduced visibility to zero in some locations and caused a multi-vehicle accident on U.S. Highway 85 between Greeley and Fort Lupton, resulting in six minor injuries. On Interstate 70 and Interstate 76, vehicles were blown off the roadways. At least 12 flights headed for Denver International Airport (DIA) had to be diverted, and departing flights were grounded for an hour. At the time, this was the costliest wind event in 20 years. About $2.5 million in damage was reported at the time, or $4.3 million in 2023 USD.

Kit Carson, Phillips, Washington, and Yuma Counties – April 8, 2013: High winds from a fast-moving cold front spread across the urban corridor and northeast plains. Wind gusts up to 60 mph were observed as the cold front made its way across the region. Damaging straight-line winds were most intense in and around Washington County where three weak tornadoes developed. The straight-line winds flipped a mobile home, blew the roof off a barn and downed power lines. Half the town of Akron was without power after six power poles were downed between Brush and Last Chance. In Denver, the cold front produced a peak wind gust to 52 mph when it moved through DIA. Winds uprooted trees, caused flight delays and cancellations. In Longmont, a tree was uprooted and fell on a house.

Logan, Phillips, Sedgewick, and Washington Counties – June 18, 2014: Severe thunderstorms broke out across the northeast plains. Intense straight-line winds downed trees and power lines across Washington, Sedgwick, and Phillips Counties. A barn, grain bins, and transmission tower were severely damaged.

Cheyenne and Kit Carson Counties – July 9, 2014: Strong storms moved southeast from the Akron area during the evening and formed a line of storms extending from Burlington southwest to near Kit Carson. Strong winds up to 63 mph were observed by the Automated Surface Observing System (ASOS) site at the Kit Carson County airport. The strong outflow winds resulted in blowing dirt briefly reducing visibility to near zero in a few areas. Six utility poles were blown down on Highway 385 south of Burlington. Tree damage was reported at a nearby farmstead.

La Plata and Prowers Counties – July 12, 2014: Severe thunderstorms produced severe winds across portions of the southeast plains in Prowers County. Vehicles and trailers were damaged from a strong thunderstorm microburst in the community of Rockwood in La Plata County.

Baca County – July 30, 2014: A storm produced damaging winds just outside Vilas. An 84-year-old man died. Damage occurred with a very compact microburst. A manufactured home was completely destroyed, along with three power poles.

Kit Carson County – June 5, 2015: Late in the afternoon through evening, a series of strong to severe storms moved across east-central Colorado. Estimated wind gusts of 85 mph laid over pine trees and bent a radio tower west of Kanorado in Colorado.

Adams, Washington, and Yuma Counties – May 24, 2016: A long-lived supercell thunderstorm produced widespread wind and hail damage, and several tornadoes. The supercell formed over south Denver and tracked east/northeast across northeast Adams, southern Morgan, and northern Washington Counties, then moved into Yuma County. The path through the northeast was approx. 121 miles from southeast Denver to the Yuma County line. Power poles were sheared off at the base by straight-line

winds, as it moved across northeast Adams County. As the storm crossed northern Washington County, the damage path was more extensive. Wind driven hail up to 1.75 inches brought damage from Akron to the Yuma County line. Power poles snapped near Otis. Up to 10 structures were damaged or destroyed from near Platner to the Yuma County line.

Crowley, El Paso, and Otero Counties – June 12, 2016: Severe storms produced hail up to the size of golf balls and severe wind gusts. A man was killed in northeast Otero County when severe winds flipped his mobile home.

Cheyenne, Kiowa, and Prowers Counties – July 15, 2016: A severe storm produced a wide swath of damaging winds and a tornado across eastern Kiowa and northeastern Prowers County. Power poles, 18 in all, were snapped between Sheridan Lake and Towner. Windows were broken in many structures, including the Plainview School. Stadium lights were destroyed. Eight miles south of the school, a hog farm sustained roof damage. In northeast Prowers County on County Road 35, a house and barn were severely damaged. Many power poles were snapped. In the afternoon, a severe thunderstorm moved south along the Kansas/Colorado border into Cheyenne County. The storm produced two tornadoes and hail up to baseball size.

Yuma County – July 22, 2016: A line of strong to severe thunderstorms moved east across the county. As the storms moved through the Town of Yuma the straight-line winds blew down power lines.

Kiowa and Prowers Counties – September 4, 2016: Strong thunderstorms produced damaging wind gusts across portions of Kiowa and Prowers Counties. Damage to utility poles, irrigation pivots, and a semi-trailer were reported in the Wiley and Mays Valley areas.

Colorado Springs – January 9, 2017: Gusts exceeding 100 mph killed two people on the city's southwest side, both of whom were struck by debris and later died of their injuries. While Colorado Springs saw some of the most intense gusts from the winter

storm system, severe winds were recorded at locations across the eastern mountains and Interstate 25 corridor well into the next day. Colorado Springs Utilities reported that the storm damaged 52 percent of the city's overhead electric system, causing $1.6 million in losses and knocking out power to almost 40,000 customers. Two students at a Colorado Springs school were injured by a falling tree. The winds also damaged roofs, overturned semi-trailers, uprooted trees, and blew down street signs. Overall, damage estimates are as high as $20 million.

Adams, Arapahoe, Denver, Lincoln, and Yuma Counties – May 7, 2017: Microburst winds downed trees and power poles across parts of Adams, Arapahoe, Denver, and Douglas Counties. Electrical lines and branches were snapped causing scattered power outages. In the evening strong storms moved northeast across Yuma County. Two of these thunderstorms caused damage. One blew an empty cattle trailer for a semi over on its side, and another storm caused an electrical pole to lean over at nearly a 45-degree angle.

Baca County – June 25, 2017: Very large hail and severe winds in Walsh caused extensive damage to structures and vehicles. Power was out for several hours and some businesses were closed for several days for clean-up. Microburst winds occurred west of Walsh. Trees and tree limbs were downed, damaging power lines, structures, and vehicles. Two people had minor injuries.

Cheyenne County – August 11, 2019: Significant damage and a power outage was reported by emergency management in Arapahoe, due to thunderstorm wind gusts. Damage reports from the public in Arapahoe included destruction of a 30 ft x 80 ft steel Quonset hut, numerous power lines were downed, roofs blown off multiple houses, and a large steel building with a concrete base was destroyed. Reported damages were $80,000.

Moffat County – June 6, 2020: A negatively tilted trough moved through western Colorado causing a widespread severe weather event that would become the first derecho to impact the Western Slope in well over a decade. Severe storms produced

wind gusts upwards of 60 to 80 mph on average with some gusts topping 80 to 100 mph in some areas due to strong downburst winds. There were multiple reports of uprooted trees, downed power lines, and at least one roof was torn off with others significantly damaged. Several houses/cabins and vehicles were damaged by falling trees and/or large hail. Very heavy rain led to flash flooding. Property damages of $300,000 reported.

Northern Front Range, Northeast – June 6, 2020: Most of the wind damage occurred due to a rare derecho; a large fast-moving complex of thunderstorms with powerful straight-line winds. The derecho formed in Utah and moved across the mountains, the I-25 corridor, and the eastern plains in the afternoon and early evening. Gusts from 60 to 80 mph were common with a few gusts exceeding 90 mph. The highest gust observed was 110 mph, at the Winter Park Ski area, around 12,000 feet. Xcel Energy stated more than 208,000 customers lost power statewide. Wind toppled a billboard, crashing onto Denver bakery. In another incident, two injuries occurred in Denver, one seriously.

Kit Carson County – September 1, 2021: Intense straight-line winds due to the microburst near the Burlington airport. Intermittent damage consistent with wind speeds in the 100-115 mph range. A tree at the airport and four power poles at the Kit Carson Correctional facility were snapped. Damage due to winds in the 60-80 mph range continued to the north of I-70. Additional damage included uprooted trees, damage to the wind and visibility sensors of the KITR ASOS, a camper trailer, garage doors, fences, windows, siding and roofs of outbuildings and a mobile home. Shipping containers and semi-truck trailers were flipped. Burlington lost power as a result of the storm. Reported property damages: $170,000.

Probability

Windstorms resulting in property or agricultural damage occur multiple times every year (100% chance). Over the last two decades, Colorado has experienced an average

of about two wind events per year that result in injuries, death, or damages of at least $50,000.

This pattern is likely to continue as development continues across the state. Certain construction materials and practices could reduce potential damages for new structures. However, severe wind will still present a threat to life safety despite lower damage costs.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change on severe wind events are unclear. The following Table 50 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 50 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Severe wind events occur across much of the state. The area at risk to severe wind events is not projected to change.
Extent/Intensity	It is unknown if or how the intensity of severe wind events will change. Extent is not projected to change.
Frequency	The frequency of severe wind events is not projected to change.
Duration	It is unknown if or how the duration of severe wind events will change.

Risk & Vulnerability

Populations at Risk

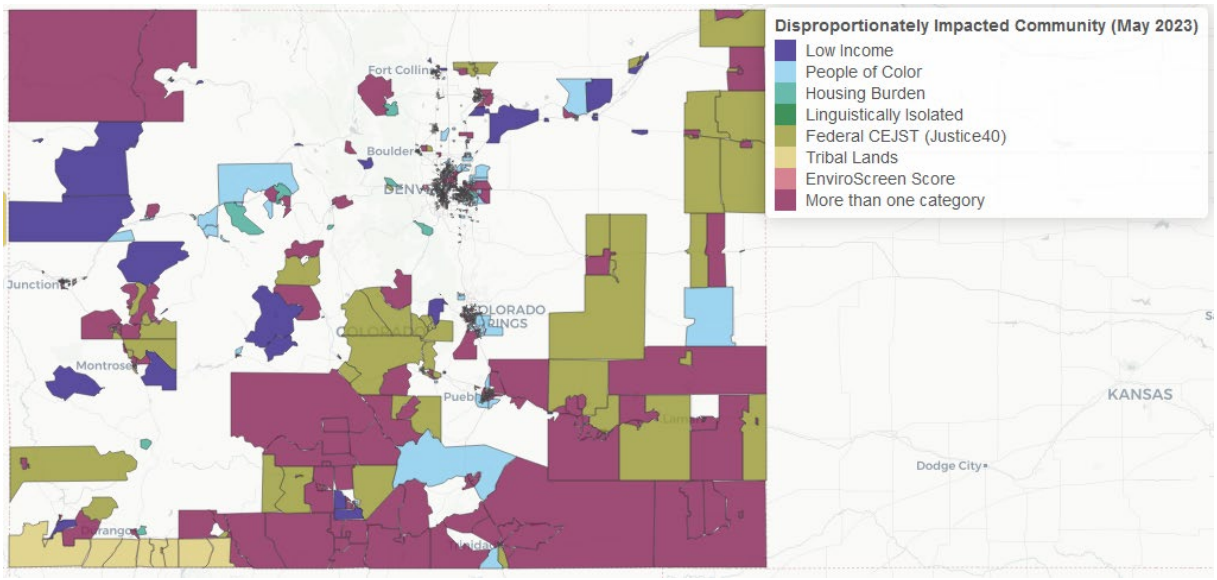
All populations are at risk from severe wind events, although some may be more adversely impacted due to multiple factors including those with outdoor occupations, those living in mobile homes or trailers, people who may be dependent on electricity

for healthcare needs, and those who may be unable to recover from damages due to inadequate financial means.

Those in the agricultural crop sector are also potentially at greater risk if a wind event were to damage crops and impact yield for the producers.

The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 134. When comparing these communities to those counties with the highest severe wind risk (Figure 133), Kit Carson, Weld, and Yuma County all contain Census Block Groups that are the most vulnerable in Colorado.

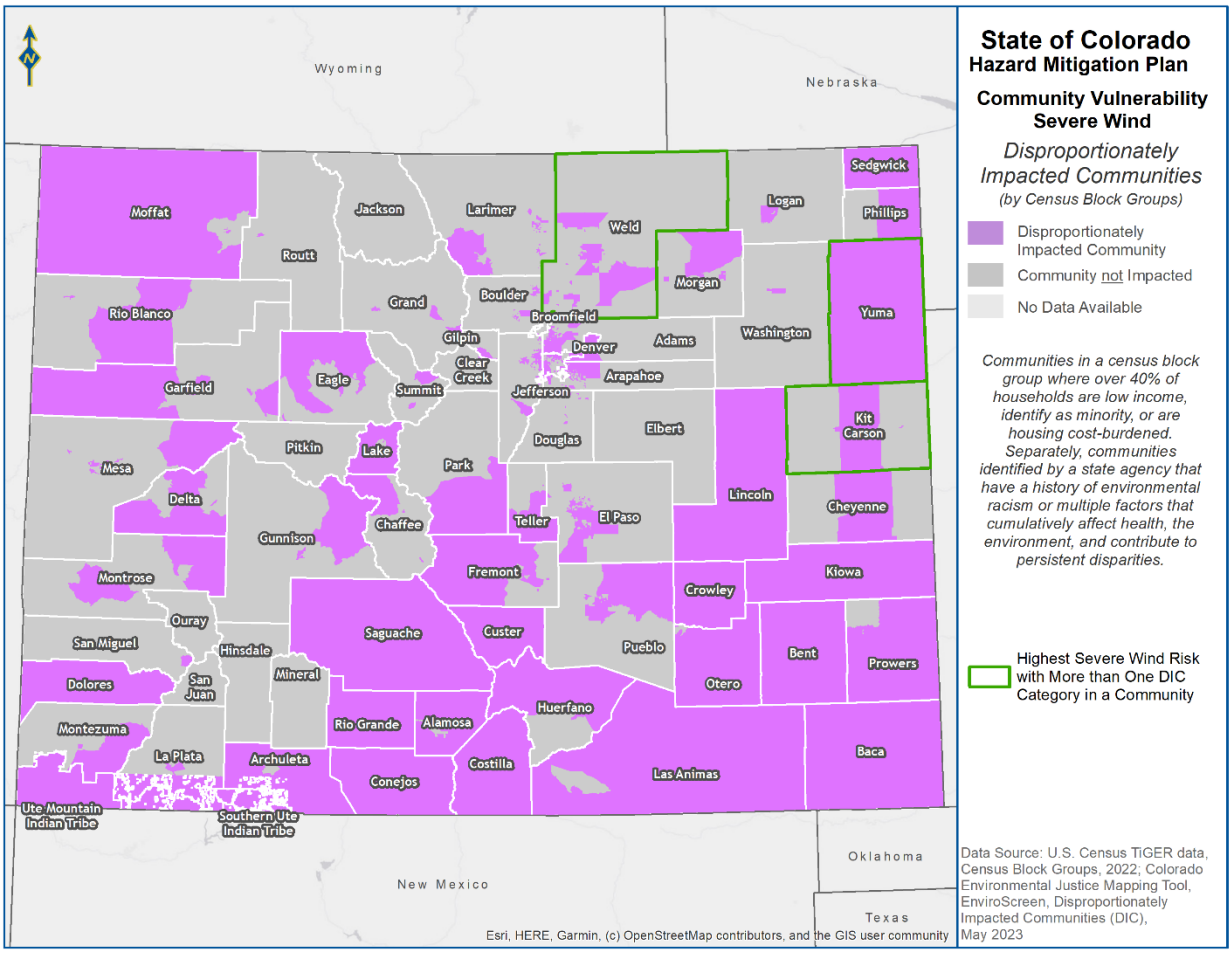
FIGURE 134 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to severe wind include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 135 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (Kit Carson, Weld,

and Yuma). Additionally, there is a Community Disaster Resilience Zone (CDRZ) located in DIC identified communities in Kit Carson County and two in Yuma County.

FIGURE 135 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008 there have been 191 property losses reported on state assets due to wind as reported by the Office of Risk Management (ORM).

Since 2017 there have been 57 reported events totaling $5.7 million. The costliest event occurred at the Sterling Correctional Facility on April 7, 2022 and totaled $2.15 million in losses. Another large loss occurred at this same location on December 15, 2021 and totaled $858 thousand.

From 2016-2017, 23 of these events occurred. During this time, a total of $4.9 million was paid to cover losses due to wind.

Reported damages tended to involve signs, fences, power lines, trees falling into buildings, gutters, and minor roof damage. One additional loss to report includes $777,619 to replace the roof of a residence hall at Colorado Northwestern Community College's Rangely campus in Rio Blanco County, which was torn off by a 2011 windstorm.

Exposure

The most vulnerable state asset that is susceptible to high winds are the Digital Trunked Radio System (DTRS) towers that are scattered across the state. These towers are positioned in specific areas where there is little geographic protection against high winds due to the requirement that these towers have "line-of-sight" capability. The largest potential impacts resulting from an event includes limited, or no first responder communications in the coverage area.

Of those counties at the highest risk from severe wind events (Figure 133), Weld County has the most state assets and highest valuations (as shown in Figure 13 and Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a severe wind event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

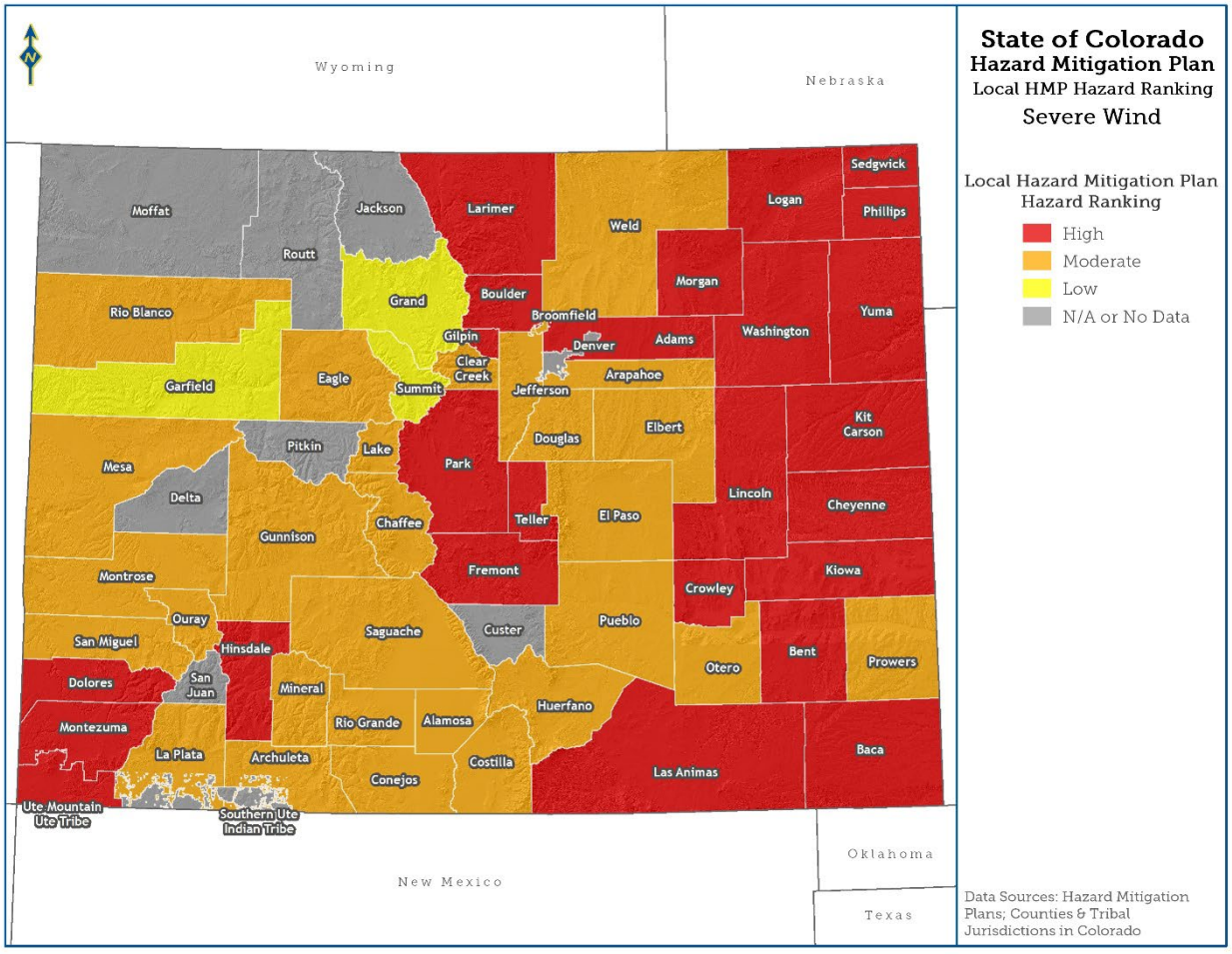
Severe Wind							

Local County / Tribe

Hazard Rankings

Approximately half of the counties ranked the risk of severe wind as moderate. Areas that ranked the risk as high are primarily located along the Front Range and the eastern portion of the state. The southeastern and southwestern counties, and the Ute Mountain Ute Tribe also ranked the risk as high. Figure 136 presents these rankings.

FIGURE 136 LOCAL HAZARD RISK RANKINGS



Exposure

All areas of the state are vulnerable to severe wind events, although some areas have a more frequent history of reported events. Counties in the northeastern quadrant of the state see the most exposure. See previous Figures in this section.

Local-level analysis of severe wind risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Severe Wind can cause or exacerbate erosion / deposition, hail, severe winter weather, thunderstorm / lightning, tornado, and wildfire. Thunderstorm / lightning and tornado can result in severe winds.

Recent and Future Development

Of those counties experiencing the state's largest percentage of growth (Figure 7), Weld County has been identified as being at the highest risk from severe wind events (Figure 133).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of severe wind.

Consequence Analysis

TABLE 51 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Motorists, air travelers, outdoor workers, outdoor recreationists; population of the counties determined most at risk.

Consideration	Description
Responders	Some exposure exists to personnel performing routine duties when an event occurs; otherwise, storm-related duties are typically post-event.
Continuity of Operations (Govt. & Services)	None, or limited loss of facilities or infrastructure function or accessibility, or ability to provide services.
Property, Facilities, & Infrastructure	Some instances of small amounts of property damage to structures and vehicles. Falling limbs or trees and downed power lines may impact property. Buildings and equipment are exposed to windstorms. Value of state assets located in highest wind-prone counties is high.
Environment	Typically leaf and small limb removal from trees and plants; some microburst or straight-line winds will down large limbs or trees. Limited short-term impacts.
Economic	None or limited loss of facilities or infrastructure function or accessibility, and limited uninsured damages.
Public Confidence in Govt.	Characteristics of windstorms such as duration and speed of onset result in limited response and recovery functions for government beyond first responders.

Severe Winter Weather – High Risk

Definition

Hazardous winter weather includes events related to heavy snow, blowing snow, ice, sleet or freezing rain, and extreme cold temperatures. These types of severe winter weather may include one or more of the following factors:

- Blizzards, as defined by the National Weather Service (NWS), 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 three hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can occur together. Falling or blowing snow usually creates large drifts from the strong winds, which may also support dangerous wind chills. The reduced visibilities make travel, even on foot, particularly treacherous. A ground blizzard can develop, in the absence of precipitation, when strong winds lift snow off the ground and severely reduce visibilities.

- Extreme cold events can occur over extended periods throughout Colorado. The definition of extreme cold varies in different parts of the country, and in some cases throughout the state. This is due to the relative temperatures of different geographies and what is considered the norm during the winter season. An extreme cold event is when temperatures drop dramatically below the typical temperature and are especially dangerous over a prolonged period.

- Heavy snow may fall in large quantities during winter storms. Six inches or more in a span of 12 hours, or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The NWS issues alerts for events, based on multiple factors, which may include watches, warnings, and advisories. Smaller amounts of snow can make travel hazardous, but may only result in minor inconveniences. Heavy wet snow may cause broken tree branches and power outages, if it falls in autumn before trees have shed all leaves, or in spring if trees have budded and grown leaves.

Heavy snow can also damage crops depending on the growth stage of the plants.

- 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 or ice accretion. 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 accumulations 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.

Location

The entire State of Colorado can be impacted by severe winter storms. These events can cover large areas and can affect multiple towns, cities, and counties. Larger systems can impact the entire state.

Contributing Factors

Several times a year, typically between November and April, Colorado receives heavy snow, blowing snow, and extreme cold temperatures. Often throughout the winter season at least one part of the state is under a winter weather watch, warning, or advisory.

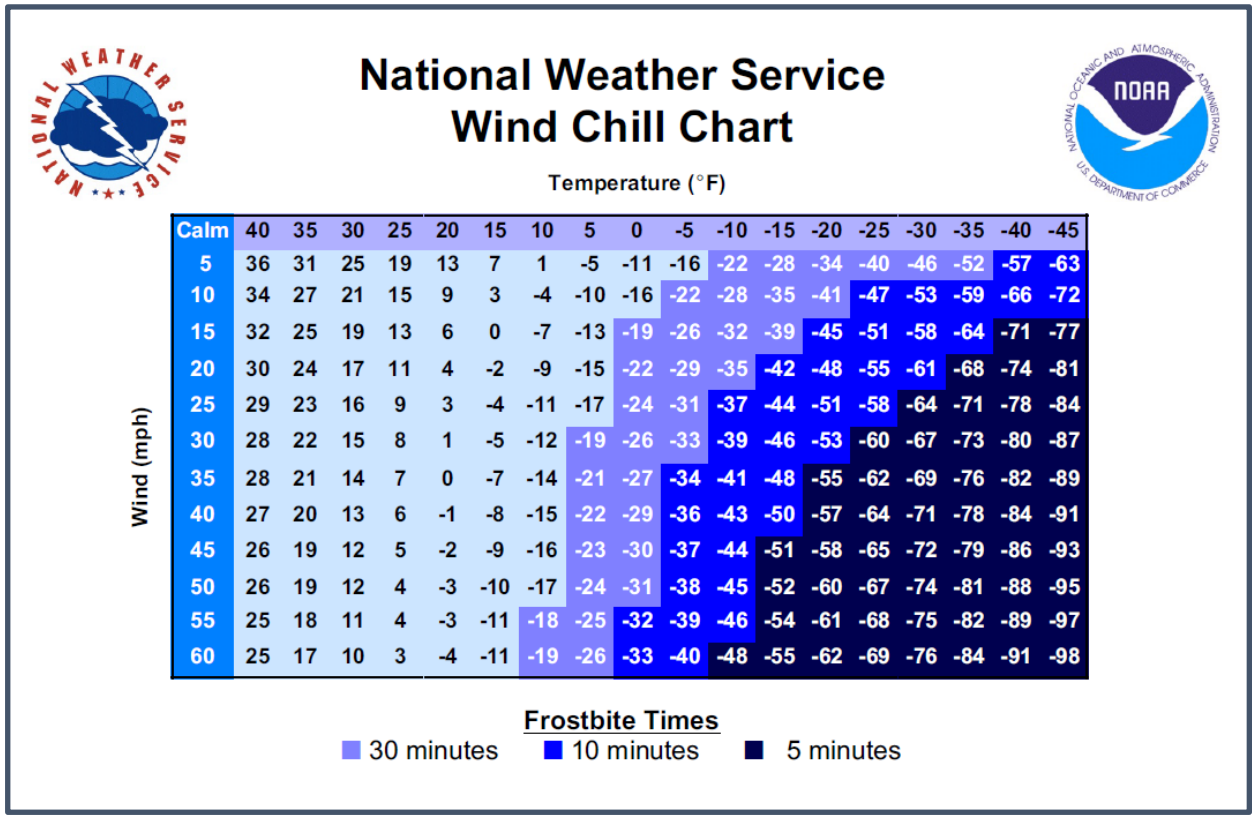
Severe winter weather can cause hazardous driving conditions, communications and power failure, community isolation, and adversely affect business continuity. Roads, rail systems, airports, and key local transportation nodes can be disrupted leading to cascading impacts on the larger regional transportation networks. Emergency response and recovery efforts can be impeded. Use of heating systems during extreme

temperatures can overload or damage utilities, potentially causing failure of the community power systems.

Wind chill is how cold it "feels" and is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases it draws heat from the body, driving down skin temperature and eventually, internal body temperature. This effect makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can become frostbitten in 30 minutes.

The NWS provides a chart to illustrate the effects of wind on perceived temperature. Figure 137 shows the expected wind chill based on temperature and wind speed, including the time period of when dangerous effects occur.

FIGURE 137 WIND CHILL CHART



National Weather Service
Wind Chill Chart

Temperature (°F)

Wind (mph)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

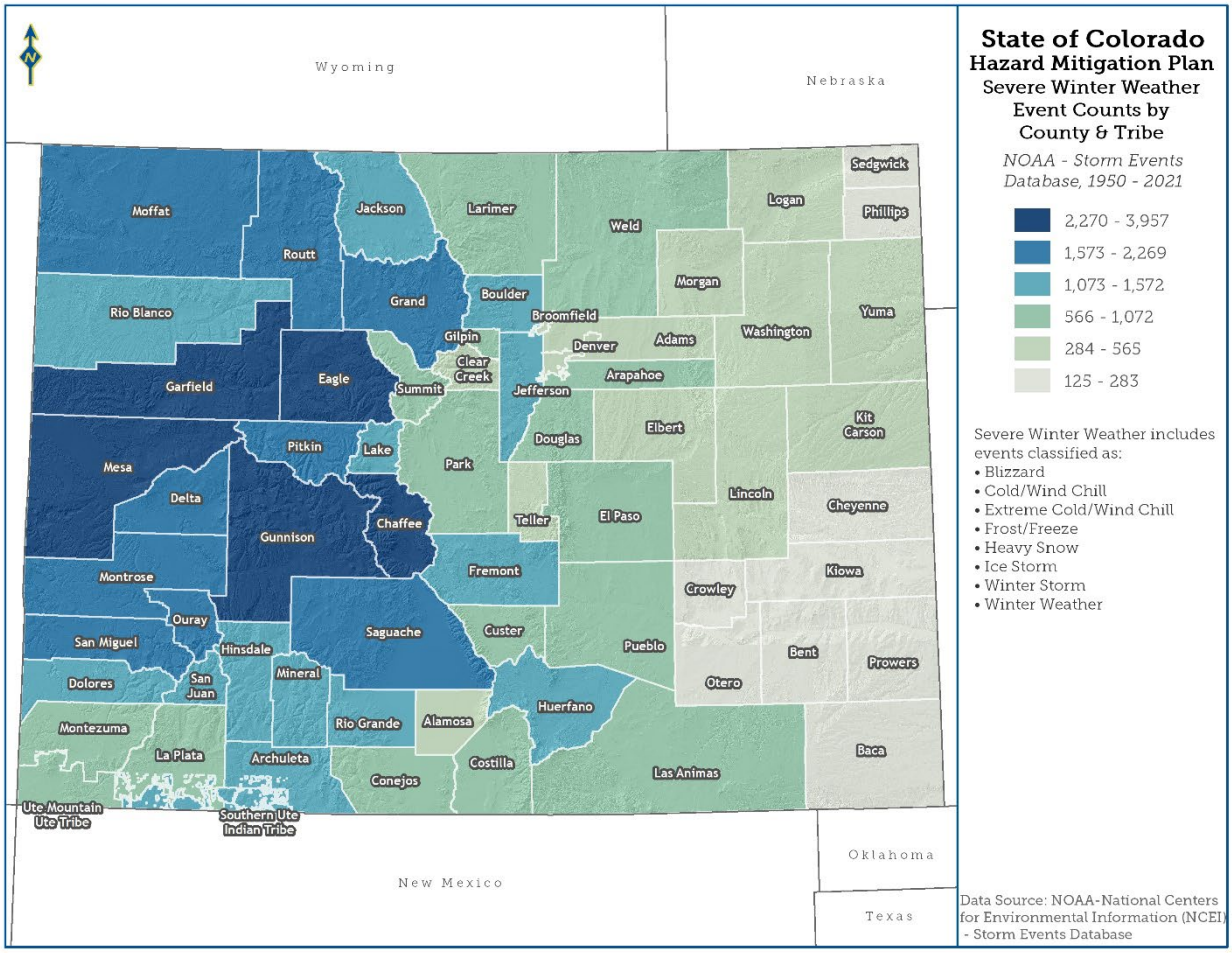
Frostbite Times
30 minutes 10 minutes 5 minutes

Past Occurrences

Historical Events

Severe winter weather occurs annually in Colorado, with some events causing immense damages and loss of life. Records from the National Centers for Environmental Information (NCEI) were used to summarize event counts by county and tribal area, as shown in Figure 138. The largest numbers of reported severe winter weather events are all seen across the western portion of the state, with the highest totals located in west-central Colorado.

FIGURE 138 SEVERE WINTER WEATHER EVENTS BY COUNTY AND TRIBAL AREA



Previous Losses

Based on data from the NCEI Storm Events Database, since 1996 there have been 27 direct injuries and 21 deaths attributed to severe winter weather events in the state. Historical reported property damages exceed $100 million and reported crop losses exceed $9 million. Both of these figures are considered to be under-reporting past damages, as this information is not available for many events, even those that are reported.

Both the state and federal government have issued disaster declarations in Colorado relating to severe winter weather events. There have been six state emergency declarations since 2017 relating to severe winter weather events. These types of events overall account for 12% of all past state hazard declarations.

There have been a total of three federal declarations relating to severe winter weather events, accounting for 9% of all past federal declarations. Below are details of some more recent federal declarations, refer to the Disaster Declaration Annex for details on all snow and winter related declarations.

In April 2001, the state incurred severe winter storms that included high winds and ice, resulting in downed power lines and poles. This left numerous residences and businesses without power. The state requested and received a Presidential Disaster Declaration (DR-1374). This made $4.6 million available in public assistance funds and over $550,000 was received in hazard mitigation funds for this storm.

In March 2003, Colorado received an Emergency Declaration (EM-3185) for a snow emergency for the winter snowstorms on the 17th through the 20th. Twenty-nine counties requested assistance. The state and communities received $6.2 million in federal funds through the public assistance program. No hazard mitigation funds were included with the emergency declaration. The Rocky Mountain Insurance Institute estimates the blizzard was the most expensive winter storm from snow and ice damage in Colorado history. The estimated cost was at least $93.3 million from more than 28,000 claims filed ($154.7 million 2023 USD).

In December 2006, two major snowstorms resulted in both federal (EM-3270, EM-3271) and state emergency declarations. These events made $11 million in public assistance funds available.

Notable Events

April 14 – 15, 1921 – A storm brought 85 inches of snow to Silver Lake, Colorado in 27.5 hours and a total of 96 inches in two days. This was considered a record across the country by the US Weather Bureau at the time.

December 26, 1982 - A storm buried Colorado in up to four feet of snow leaving behind closed roads and airports and thousands of stranded travelers. At least two people in Colorado froze to death.

November 28, 1983 - A major winter storm lingered unexpectedly over Denver and eastern Colorado, all but isolating about two million people. Blizzard warnings were posted for northeast Colorado and winter storm warnings were issued in the southeastern part of the state.

October 24 – 26, 1997 – A rare October blizzard, which required a State of Emergency declaration from the Governor, took the lives of seven people, three of whom froze to death. According to NWS records, the storm brought snowfall of one to two feet that fell in south central Colorado and throughout the southeast Plains. Parts of the Wet Mountains, Beulah, Walsenburg, and areas near La Junta had around three feet of snow. In northern Colorado Springs as much as three feet of snow fell and at Palmer Lake, on the Palmer Divide, 52 inches of snow was reported. In the Black Forest and Monument, three to four foot amounts were the norm. The deep snow was blown and piled into drifts anywhere between three and 15 feet deep.

March 17th to March 20th, 2003 - A large, slow moving, moist system set up over the southern Great Plains and brought rain and snow to southern Colorado. Snow amounts just north of Colorado Springs reportedly reached above 3 feet and in Huerfano County amounts close to the mountains ranged to nearly 4 feet. Sustained winds of 20 to 40 mph caused blowing and drifting snow, and blizzard conditions closing several highways and portions of Interstate 25. Snow drifts of 4 to 10 feet were common across portions of northern El Paso County, north of Colorado Springs. Amounts were around 5 feet in Custer County northeast of Westcliffe. In the northern mountains east of the Continental Divide, the Front Range Foothills and Palmer Divide, snowfall totals ranged from 3 feet to over 7 feet.

Across the Urban Corridor, up to 135,000 people lost power and it took several days, in some areas, to restore power. In the Urban Corridor and adjacent plains snow amounts ranged from one to three feet. Avalanches in the mountains and foothills closed many roadways, including Interstate 70 in both directions, stranding hundreds

of skiers and travelers. Denver International Airport (DIA) was closed, stranding approximately 4,000 travelers.

December 31st, 2006 - Travelers were stranded after a powerful winter storm piled drifts, up to 10 feet high, across much of the plains. National Guard troops rescued 44 people from the storm.

February 2012 - A slow moving and powerful storm system brought heavy snow to areas in and near the Front Range foothills, with blizzard conditions over the northeastern plains. In the Front Range foothills, the snow piled up to over four feet in some areas. Across the Palmer Divide, snow and gusty winds resulted in road closures with snow drifts ranging from two to five feet in depth. Northerly winds 15 to 25 mph were common with gusts to 40 mph.

At DIA, 12.5 inches of snow fell on the 3rd, beating the record of 7.5 inches for the date and setting a daily record for February. DIA canceled over six hundred flights. Blowing snow produced near zero visibilities and officials closed the westbound lanes of I-70 between the Kansas state line and Denver, and the eastbound lanes from Denver to Limon. Other road closures included: State Highway 86, between Kiowa and I-70, U.S. Highway 40, between Limon and Eads, and State Highway 71, from Last Chance to Limon to Ordway.

January 27 – 31, 2013 – The event began on the 27th under a moist southwest flow, following a storm that vacated the area earlier on the same day. Snowfall began for some lower elevations of northwest Colorado late on the 26th. The storm moved over the region on January 28th and 29th, producing the greatest amount of snowfall for most areas during the five-day period, including a moist northwest flow on January 30th and 31st.

Notable snowfall included 44 inches at Silverton Mountain Ski Area and 50 inches at Steamboat Springs Ski Area. Wind gust speeds varied across zones in the affected

region from 20 mph up to 60 mph. Blowing and drifting snow was reported across impacted areas, as well as some localized blizzard conditions.

April 15, 2013 - A strong upper level jetstream moved over northern Colorado and produced bands of very heavy snow. The heaviest snowfall was concentrated along and north of the I-70 Corridor and extended from the mountains and high valleys to the urban corridor and northeast plains of Colorado. The snow fell at a rate of two to three inches per hour during the late afternoon and evening hours forcing the cancellation of 25 flights at DIA. I-25 was closed in both directions between Wellington and Cheyenne due to snow and blowing snow.

March 22 – 23, 2016 - A powerful blizzard developed across the Front Range late on the 22nd, tracked east-southeast across Utah, and continued into southeast Colorado through much of the 23rd. The storm rapidly intensified as it reached eastern Colorado, producing extremely heavy and intense snowfall with peak rates exceeding three inches per hour. Heavy snow and wind gusts in excess of 50 mph east of Interstate 25 produced blizzard conditions and zero visibilities. The storm began with rain on the plains and changed to snow during the early morning hours of the 23rd. Snowfall rates of one to two inches per hour were common, and several inches of snow accumulated for the morning commute. Many roads became impassable due to the depth of fallen snow, drifting snow, and near zero visibility.

Widespread road closures included Interstate 76 from northeast of Denver to the Nebraska state line, Interstate 70 east of Denver to the Kansas state line, and much of Interstate 25, from near Castle Rock to Colorado Springs and from Highway 7 north to the Wyoming border. The Colorado Department of Transportation estimated over 2,000 vehicles became trapped on Interstate 25 near Monument Hill alone, with hundreds of stuck or abandoned cars elsewhere. Numerous power outages occurred and at the peak, several hundred thousand residents along the Front Range were without power. DIA was closed for seven hours with around 1,300 canceled flights. The power outages shut down the fuel farm pumps and deicing facility, and the main

road to the airport was impassable for much of the day. It was the first time since December 21, 2006 DIA had been shut down due to snow conditions.

One to two feet of snow fell across much of the Front Range urban corridor, with over 30 inches in some foothill locations. Most of the snow fell within a 12-hour period from the early morning to the afternoon. A peak wind gust of 59 mph was recorded at DIA. South of Denver, over the Palmer Ridge, 12 to 18 inches of snow was reported, with six to 10 inches across the northeast plains of Colorado. The official snowfall reported at DIA was 13.1 inches. The snow was very heavy and wet and many areas received one to two inches of precipitation. In the foothills, some locations received nearly three inches of water from this storm.

January 8 – 10, 2017 - Heavy snow fell across the state between January 8th and 10th. On the 9th, there was a period of freezing rain in some valleys, resulting in the paralysis of traffic in Mesa County, and portions of Garfield and La Plata Counties. After the storm had passed, Avalanche Warnings were issued for mountainous areas throughout the state.

On March 13, 2019, an extremely powerful low-pressure system developed over southern Colorado, setting a record for the lowest pressure ever recorded over Colorado, at Lamar, of 970.4 mb. According to NWS, the system officially met the criteria of a "Bomb Cyclone", in which barometric pressure readings dropped in excess of 24 mb over a 24-hour period.

This storm created widespread blizzard conditions across northeast Colorado, Palmer Divide, and over El Paso County. Wind gusts were experienced from 60 to 80 mph, with locally up to 100 mph. One to three feet of snow fell across the mountains with up to 52" at Wolf Creek Pass. Nearly 1,400 flights at DIA were canceled due to the storm and over 5,000 passengers spent the night at DIA. All major highways and interstates were closed outside of the Denver area, including I-76 northeast to the Nebraska border, I-70 to the Kansas line, I-25 south to Colorado Springs, and I-25 from Wellington to the Wyoming line.

Multiple multi-car accidents occurred and travelers were stranded across northeast Colorado and the Palmer Divide. In northern El Paso county alone, at least 1,500 people were stranded. The Colorado National Guard was activated to aid in over 100 search and rescue operations. At one point 445,000 customers were without power, some well into the next day. One known fatality occurred, a Colorado State Trooper was killed along I-76 northeast of Denver.

Extreme Cold Events

Temperature extremes are a factor in severe winter weather events. Table 52 details some of the notable events with dangerous temperatures reported since 1983.

TABLE 52 NOTABLE EXTREME COLD EVENTS

Date	Event Description
1983	Cold spell. Readings to -21F, coldest recorded temperature in 20 years.
1989	Extreme cold, snow, wind. Main airport closed. Poor visibility; 46-car pile-up on I- 25.
March 1995	Freeze in western Colorado. Readings below critical values in orchard areas; 10% of crops damaged.
April 1995	Readings to 13F in the City of Arapahoe area. ~$1,000,000 in wheat crop damage.
January 1996	Southeast Colorado, wind chills from -30F to -50F.
February 1996	Wind chill -25F to -50F in the southeast plains. Lows in Pueblo -26F, Colorado Springs -18F.
March 1996	Bitter cold and gusty in southeast Colorado. Wind chill -25F to -40F.
December 1996	In southeast Colorado, wind chills of -20 to -35F. One death reported.

Date	Event Description
December 1996	Readings -30F to -45F in east central and northeast Colorado. In south-central and southeast Colorado wind chill -20F to -40F. Denver area with a low -9F.
January 1997	Wind chills -25F to -35F in southeast Colorado and foothills. Northeast wind chill -25F to -50F.
April 1997	Freeze in western Colorado. Temperatures dropped below critical levels for most fruit varieties. Majority of stone fruits lost, most apples and pears survived. ~ $9,000,000 crop damage.
April 1997	Single digit temperatures, highs below freezing, freezing drizzle, and light snow in east central Colorado. Schools closed one to two days for ice. Many car accidents.
October 1997	Blizzard in the eastern Front Range. Snow to four inches in foothills. Gusts to 70 mph. Wind chill –25F to -40F. State of Emergency declared. Five deaths; two injuries; more than 24,000 cattle lost.
June 1998	Record cold morning temperatures, lows below freezing in east central Colorado. Crop and garden damage.
December 1998	In northeast Denver, overnight temperatures dipped below 0F for six consecutive days. The reported low was -19 F. Five deaths and 15 injuries reported. Power outages, cracked water pipes.
January 1999	Wind Chill readings below -35F across all of far eastern Colorado.
April 1999	Record low temperatures in the Grand Valley destroyed a large percentage of the fruit crop in Mesa County. Minimum temperatures in the lows 10s to 20sF. ~$8,800,000 crop damage.
June 1999	In southwest Colorado a late freeze destroyed grapes and vegetables. ~$4,000 crop damage.
June 2001	Hard freeze in southwest Colorado causing widespread damage to pinto bean and tomato crops near Cortez. ~$250,000 crop damage.

Date	Event Description
December 2005	Extreme cold and wind chill. Record breaking cold temperatures in western Colorado. Frozen water pipes burst in many areas. ~$100,000 property damage.
December 2009	Wind chill values of -25F to -30F and temperatures from -5F to -15F in northeast Colorado
February 2011	Wind chill temperatures ranged from -30F to -50F, winds gusts 25 to 40 mph, for much of Colorado
February 2011	Cold air temperatures and strong wind in the Tri-State area resulted in wind chill between -25F and -30F. Wind chill dropped to -27F at the Burlington Automated Surface Observing System (ASOS).
February 2014	Temperatures fell into the teens below zero due to an arctic air mass over the areas of Kit Carson and Yuma Counties The lowest wind chill of -35 reported at the Burlington airport and Seibert.
December 2014	Wind chills of -25F or colder were across Kit Carson, Cheyenne, and Yuma Counties.
December 2016	Wind chills ranged between -25F and -30F for much of Colorado.
March 2019	In Yuma and Kit Carson Counties wind chills from -25F to -33F were recorded.
February 2021	Wind chills dropped below -25F with a recorded low wind chill of -44F in the eastern region.
February 2022	In eastern Colorado wind chills values as low as -25F were recorded.

Probability

Every county in Colorado has experienced winter weather every year on record and this will continue in the future (100% chance). Conditions that produce severe winter weather occur annually. There is currently no reason to assume this will change.

Atmospheric activity will continue to produce severe winter weather throughout the state on an annual basis, largely occurring between October and March. Some late season storms may occur, extending into April or May.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future severe winter weather events. Table 53 presents a breakdown of these projected changes in terms of hazard: location, extent/intensity, frequency, and duration.

TABLE 53 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	The area at risk to winter storms is not projected to change.
Extent/Intensity	It is unknown if or how the intensity of winter storm events will change. Extent is projected to increase. Winter precipitation events are projected to increase in magnitude.
Frequency	The seasonality of winter storms may change as a result of increasing temperatures and changing weather patterns, but the direct influences on winter storm frequency are unclear.
Duration	It is unknown if or how the duration of severe winter weather events will change.

Risk & Vulnerability

Populations at Risk

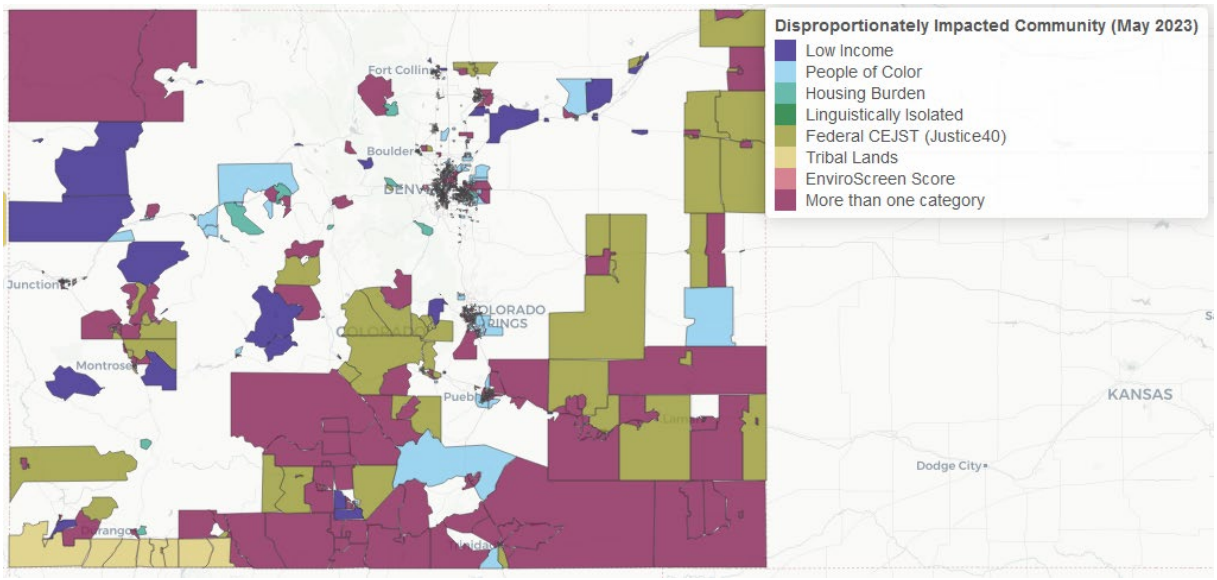
All people in the state of Colorado, during periods when severe winter weather is possible, are at risk of the impacts from an event. There are some populations which may experience a disproportionately negative impact from severe winter weather consequences including populations that identify as having access and functional needs, those who are isolated, those who require medical equipment or care, those

who are unable to safely heat their homes or find shelter, and those who are more susceptible to the dangers of cold temperatures.

Additionally information on snow removal and safety can be found on CDOT's Winter Driving website.

The State of Colorado recently defined what it terms "disproportionately impacted communities" (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as "more than one category" are the most vulnerable across the state, as shown in Figure 139. When comparing these communities to those counties with the highest severe winter weather risk (Figure 138), Chaffee, Eagle, Garfield, Gunnison, and Mesa County all contain Census Block Groups that are the most vulnerable in Colorado.

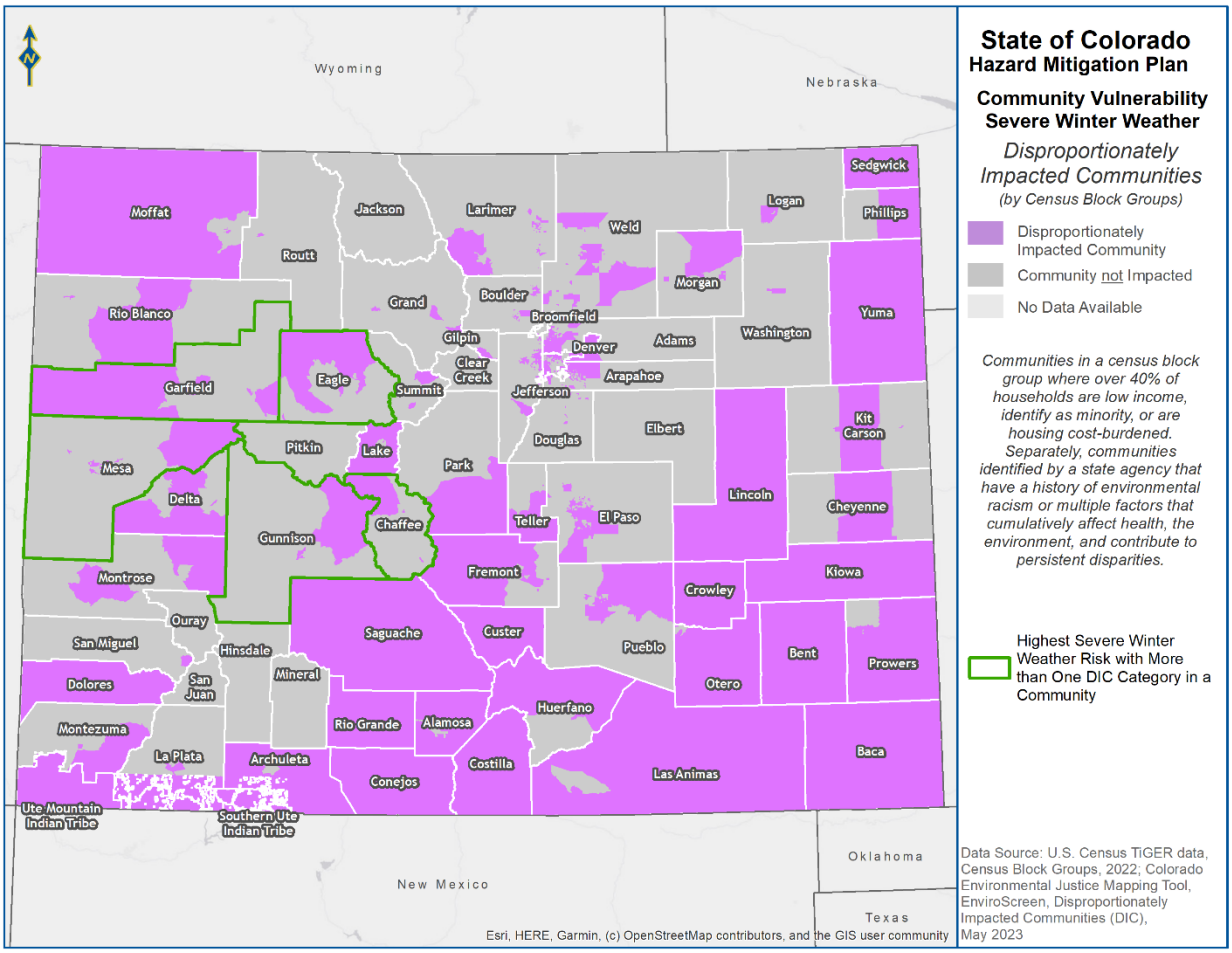
FIGURE 139 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to severe winter weather include: low income, housing burdened, people of color, linguistically isolated, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 140 highlights these counties. These counties have the following

statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (Chaffee, Garfield, and Mesa), and “Low-Medium” (Eagle and Gunnison).

FIGURE 140 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008, 60 state asset real property losses were attributable to freezing temperatures or winter weather including snow, ice, and sleet. The greatest vulnerability to state assets was when freezing temperatures caused water pipes to burst and resulted in plumbing infrastructure and water damages.

In December 22, 2022 a extreme cold event cost $876 thousand in damages. Two other reported losses caused over $330 thousand in damages each, both occurring on February 14, 2021 due to sub-zero temperatures.

Total losses incurred for the severe winter weather events between 2008 and 2017 was roughly $1.9 million. Total losses since 2017 have exceeded $2.5 million.

Exposure

All state assets are exposed to the impacts of severe winter weather events. State facilities are the most vulnerable state asset type exposed to winter weather hazards. The largest risk is to structure water systems that can experience freezing temperatures. The largest potential impacts resulting from an event could include structural and building inventory damage.

Of those counties at the highest risk from severe winter weather events (Figure 138), Chaffee, Garfield, and Mesa County have the most state assets exposed (as shown in Figure 13). Garfield County has the highest amount of asset valuations exposed (as shown in Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a severe winter weather event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

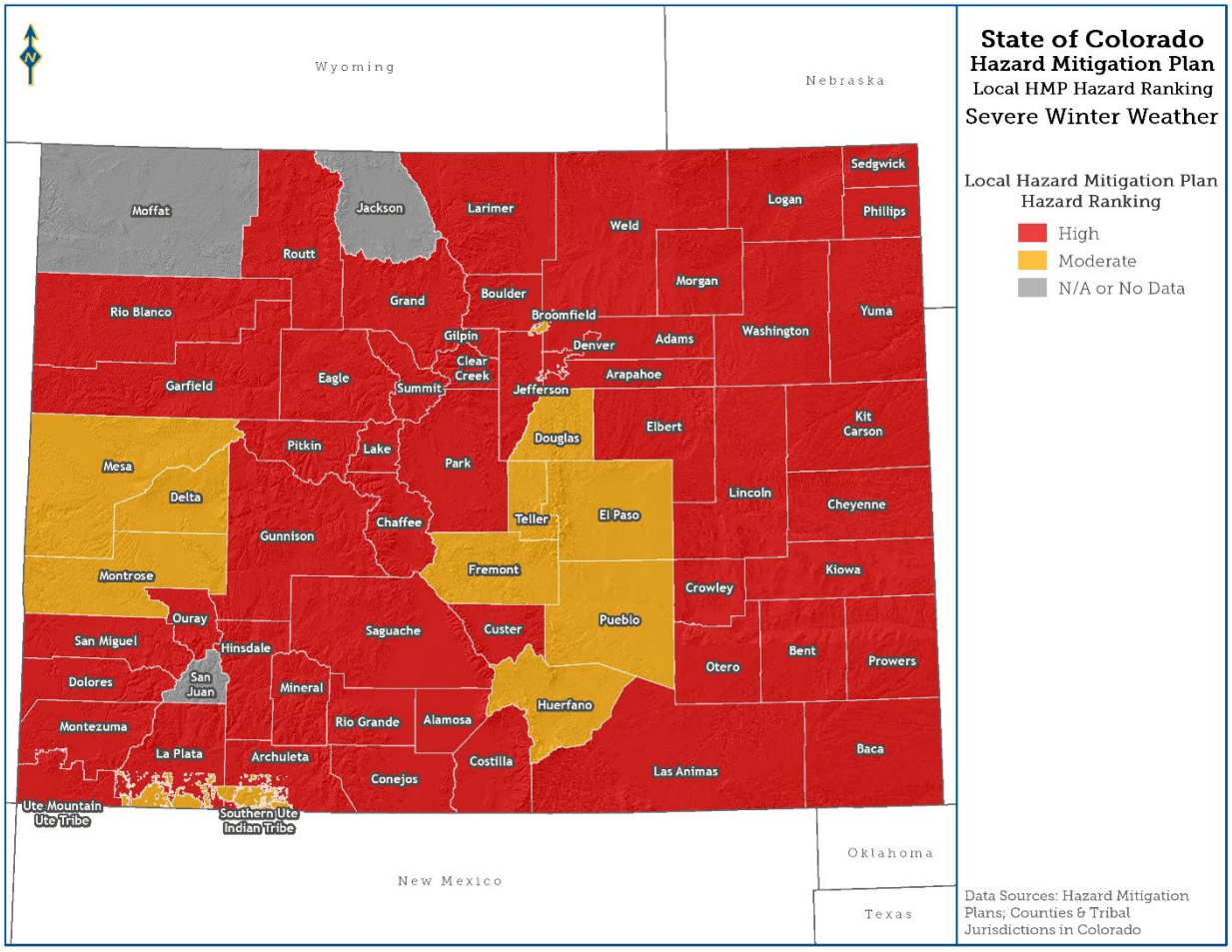
Severe Winter Weather							

Local County / Tribe

Hazard Rankings

More than three-quarters of the state ranked severe winter weather risk as high. The remaining counties ranked the hazard as medium. There were no low hazard rankings.

FIGURE 141 LOCAL HAZARD RISK RANKINGS



Exposure

All counties are exposed to the hazards of severe winter weather, although some geographies see a much higher frequency and therefore a higher exposure. This is shown in the large number of events occurring along the western half of the state. See previous Figures in this section.

Local-level analysis of severe winter weather risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Severe wind can exacerbate severe winter weather events. Severe winter weather can result in avalanches.

Recent and Future Development

Counties with a large change in expected growth, as well as a history of significant winter weather events, are most at risk for future exposure. Population growth and increased development are related to more roadways and people traveling during winter events. New Colorado residents may be uneducated about winter weather and travel safety.

Of those counties experiencing the state's largest percentage of growth (Figure 7), Chaffee, Eagle, Garfield, Gunnison, and Mesa County have been identified as being at the highest risk from severe winter weather events (Figure 138).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of severe winter weather.

Consequence Analysis

TABLE 54 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Motorists, outdoor workers, outdoor recreationists, outdoor sporting participants; homeless persons; persons with energy dependent medical needs; persons with pre-existing medical conditions; statewide population.
Responders	Exposure exists to personnel performing routine duties when event occurs; storm-related duties may be during event. Snow and blowing snow, ice, and extreme cold will provide adverse working conditions.
Continuity of Operations (Govt. & Services)	Potential loss of facilities or infrastructure function or accessibility, or ability to provide services. May have power interruption if not adequately equipped with backup generation. Regional limitations to mobility from heavy snowfall affecting workforce/essential personnel.
Property, Facilities, & Infrastructure	Buildings, vehicles, and equipment are exposed to winter weather. Heavy snow and ice, complicated by strong winds, may result in structural damage, collapse, or instability. Buildings, equipment, and utility infrastructure are exposed to heavy snow and ice, sometimes complicated by strong winds. Majority of state losses attributable to precipitation-related events, many winter related. Limited access to, or ability to maintain operations of public transportation, or access to transportation hubs.
Environment	Impact related to tree damage, particularly ice and snow buildup resulting in downed limbs. May serve as precursor to other hazards such as avalanche.

Consideration	Description
Economic	Potential loss of facilities or infrastructure function or accessibility and uninsured damages. Impact to transportation sector and movement of goods. Lost revenue due to decreased business patronage or inability of workers to reach employment locations.
Public Confidence in Govt.	Public holds high expectations of government capabilities for reducing impact of snow and ice events related to transportation (roads, bridges, airports, rail). High expectations for rapid power restoration.

Thunderstorm / Lightning – Low Risk

Definition

Thunderstorms are dangerous electrical storms capable of producing high winds, heavy rains, lightning, and hail. The typical thunderstorm is 15 miles in diameter and is formed in what is known as a cumulonimbus cloud. Thunderstorms often occur in large groups, or fronts, and are often felt over an entire county or regional area within a state. Per the National Weather Service (NWS) of the estimated 100,000 thunderstorms that occur each year in the United States, about 10 percent are classified as severe. Every thunderstorm needs three basic components:

- Moisture to form clouds and rain;
- Unstable air which is warm air that rises rapidly; and,
- Lift, which is a cold or warm front capable of lifting air to help form thunderstorms.

Lightning is a luminous, electrical discharge in the atmosphere caused by the electric-charge separation of precipitation particles within a thunderstorm. The sudden burst of heat caused by these discharges results in the expansion of air, causing a sound wave known as thunder.

There are two main types of lightning, cloud-to-ground (CG) and intra-cloud flashes which do not reach the ground. On average there are approximately 5 to 10 times more cloud flashes than CG lightning in a storm according to the National Oceanic and Atmospheric Administration (NOAA). However, in any given storm there may be multiple CG lightning flashes. The NWS determines lightning threat based on the likelihood that CG lightning from thunderstorms will occur combined with the anticipated flash rate. A rate of 1-3 flashes of CG lightning per minute is considered occasional, while 12 flashes of CG lightning per minute is excessive.

Location

Thunderstorms and lightning can occur anywhere within the State of Colorado. These types of storms can cover large areas and can affect multiple towns, cities, and counties. Larger systems and lines of storms can impact the entire state.

Lightning occurrence is increased in some areas due to a combination of topography, low-level wind flow regime, and low-level atmospheric moisture.

According to Vaisala (née Global Atmospherics, Inc.), common locations of lightning strikes include open fields, ball fields, under trees, water-related/boats, golf courses, and near heavy equipment such as tractors.

Contributing Factors

The NWS considers a thunderstorm severe if it produces one inch or larger hail and winds of 58 miles per hour (mph) or stronger. Storms of lesser scale can still cause considerable damage.

Cloud-to-ground lightning is the most threatening risk from thunderstorms due to its ability to cause death, injury, wildfires, and damage to property. The extent of lightning is dependent upon a multitude of factors. Ground elevation, ground humidity, and wind currents are all elements that may affect the frequency of lightning.

Large outdoor gatherings such as sporting events, fairs, and concerts are particularly vulnerable to thunderstorms and lightning. Outdoor recreation is a large part of Colorado culture which contributes to exposure and the high lightning death and injury tolls seen in the state.

Thunderstorms have notable secondary hazards including flooding from intense rainfall events, particularly in the spring when it mixes with snowmelt. Debris flows in post-burn areas can also result from thunderstorm events. Lightning strikes have the ability to set off wildfires, which during the drier seasons, can be devastating and cover huge swaths of land. Wildfires can destroy thousands of acres of forests,

devastate crops and livestock, and cause millions in damages to buildings, communications systems, and power infrastructure.

Past Occurrences

Historical Events

As shown in Figure 142, thunderstorms and lightning occur across the state, although events reported since 1950 are concentrated from the Front Range to the eastern border of the state.

FIGURE 142 HISTORICAL THUNDERSTORMS AND LIGHTNING EVENTS

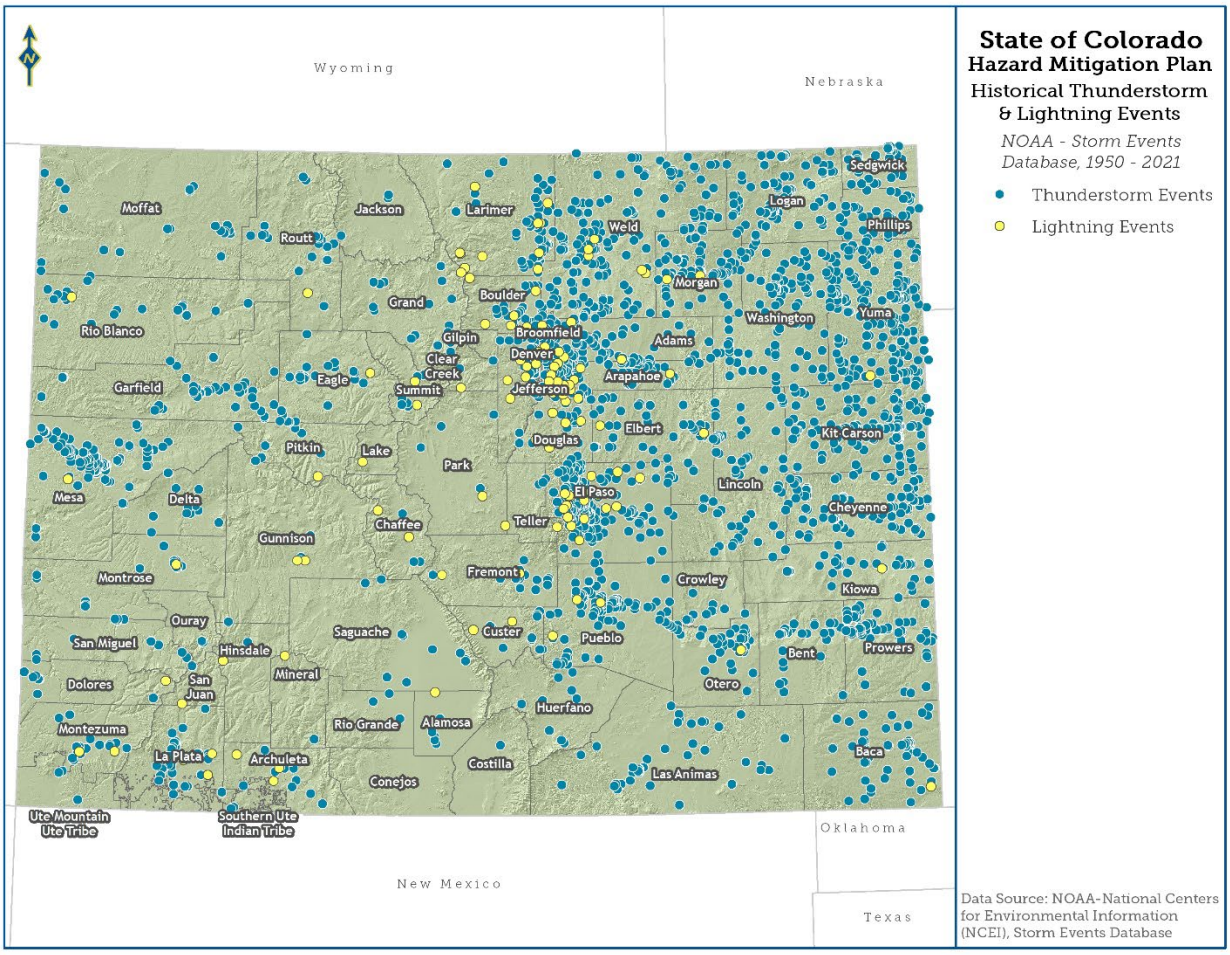
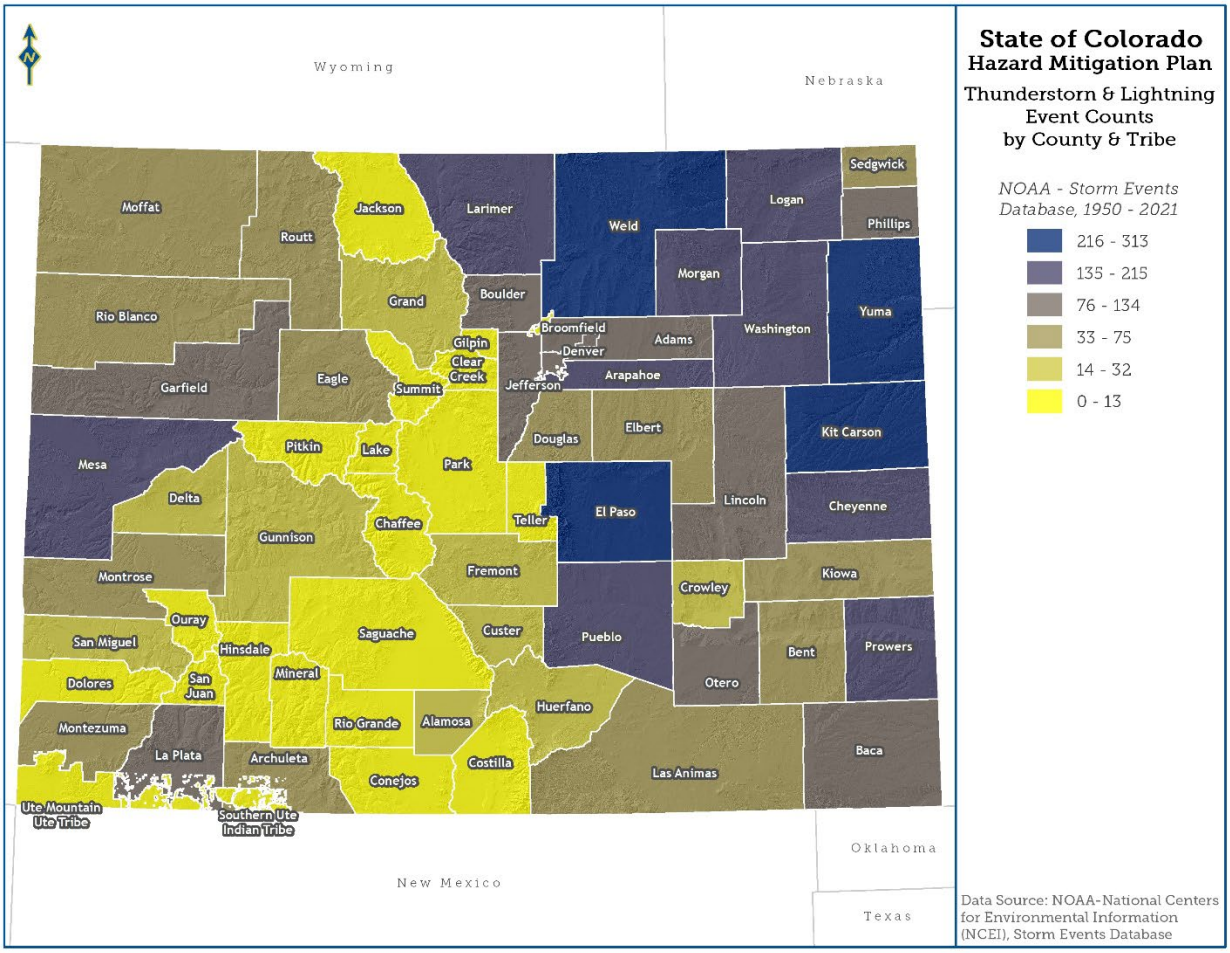


Figure 143 summarizes this information at the county and tribal area scale, which shows the majority of reported events have occurred in the Front Range and northeastern plains.

FIGURE 143 THUNDERSTORM AND LIGHTNING EVENTS BY COUNTY AND TRIBAL AREA



Previous Losses

Thunderstorms and lightning have taken a large toll on Colorado in terms of injury, loss of life, and property damage. Data from National Center for Environmental Information (NCEI) shows that, from 1950 through 2022, lightning caused a total of $11.5 million in property damages and $160,040 in crop damages. Over the same period thunderstorms reportedly caused $24.4 million of property damages and $18 million in crop damages. Since 1996, 49 deaths and 285 injuries have been attributed to lightning strikes.

Notable Events

On June 16, 1997, two 400-gallon capacity barrels at an oil storage facility were struck by lightning and exploded into flames.

On June 23, 1997, Lightning struck the tower of the Cathedral of the Immaculate Conception, in Denver. The bolt knocked chunks of rock from the top of the tower and blew a 4-ft wide hole about halfway down the side. It punched at least two holes in the tile roof and shattered part of the stone railing.

On August 31, 1997, one person died and one person was injured when a reported 115 mph microburst wind struck a mobile home and rolled it a few hundred yards. The debris and intense damage spread 50 to 75 yards across. The damages were reported at $80,000.

On July 24,1999, during a thunderstorm intense straight-line winds associated with a wet microburst blew six vehicles off Interstate 76, including a pickup pulling a horse trailer. Windows were blown out of homes and vehicles in the Fort Morgan and Brush areas and 10 people were treated at area hospitals for cuts and bruises. In addition to property damages, numerous crops were reportedly flattened due to heavy rain, hail, and damaging winds.

On June 19, 2000, in Garfield County, a line of thunderstorms appeared as a bow echo on radar displays and produced very strong winds that blew down about 500 acres of old growth forest. Trees blocked New Castle to Buford Road for several days until workers completed the tree removal. Radar measured the bow echo moving eastward at 64 knots (74 mph).

On August 18, 2000, strong thunderstorm winds totally leveled 300 acres of old growth forest along a southwest-northeast oriented valley in Baylor Park. Another 1,700 acres of partial forest blowdown occurred adjacent to the total blowdown area.

On August 22, 2000, over $2 million in reported property damage when lightning struck, igniting a fire that burned down a 10-unit apartment building, in Sedalia, Douglas County.

On July 31, 2003, two people horseback riding in Garfield County died in the area of Battlement Mesa, when they sought shelter under a tree and were struck by lightning.

On June 19, 2004, 19 golfers were struck by lightning near the town of Kremmling in Grand County, while participating in the Kremmling Cliff Classic Golf Tournament, located on a bluff a mile or two north of town. This "golf tournament" consisted of hitting golf balls off the edge of a cliff at targets in the valley below. Of the 19 golfers who were affected by the flashes, four were taken via helicopter to a hospital in Denver. Eyewitnesses and victims to the event indicated two flashes actually hit the bluff where the 19 golfers were injured.

Between July 2nd and 3rd, 2005, severe thunderstorms battered Larimer County and brought strong winds to Boyd Lake. A boat capsized, drowning two women and hospitalizing four others in the boat. On July 3rd, lightning struck near a beach area at Boyd Lake. Nine people were injured, five of which were treated at the park, and four others were hospitalized.

On May 9, 2007, lightning struck a 33-ft marble statue of Jesus at Mother Cabrini Shrine, in the foothills of Golden. The blast broke off one of the statue's arms and a hand, and also damaged a foot. The statue was sent from Italy in 1954. Reported damages were $200,000.

On September 2, 2007, a 21-year-old male was killed by lightning while inside a tent, which was located in the foothills, eight miles southwest of Colorado Springs. Three other people were also in the tent when the flash occurred, but they received only minor injuries.

On July 24, 2008, in the early evening, two graduate students were struck by lightning in a heavily treed area on the Colorado State University campus, in Fort Collins. One student was pronounced dead shortly after and the other succumbed to his injuries two days later.

On June 19, 2011, two rounds of severe storms rolled across the northern third of Yuma County during the evening hours, resulting in widespread wind damage. Winds estimated to be around 90 mph destroyed grain bins, overturned irrigation sprinklers, tore off sections of roofs, broke windows, overturned a cattle trailer, and destroyed crops. Thousands of acres of cropland were impacted by hail accompanying the storm, resulting in around $18 million in damages. Dollar estimates of damage are approximate and based on figures from the USDA.

On June 30, 2011, severe thunderstorms produced intense straight-line winds in Granby, Grand County, causing extensive damage. Town officials estimated at least 30 trees were knocked down within the city limits from the storm. Two roofs were separated from buildings. Damage to the high school was estimated to be at least $200,000. Debris from the wind blew out vehicle windows. Power was knocked out temporarily in several areas of the county. Very strong thunderstorm winds were also observed across portions of the Urban Corridor and Northeast Plains of Colorado. An intense microburst wind destroyed a Ferris wheel in Merino and caused one minor injury. A lightning strike destroyed a home in north Denver.

July 13th, 2013, during a training exercise 12 soldiers were struck by lightning south of Butts Field on the north side of Fort Carson. Two soldiers were taken to a hospital in Colorado Springs, one in critical condition. The other ten were taken to the post hospital and released.

May 7, 2017, In Sedalia, a 37-year-old woman and her horse were killed after lightning hit a nearby tree. A teenage girl was also seriously injured.

August 13, 2017, Lightning struck two mountain bikers who had gotten below tree line to seek shelter. One mountain biker was killed. The other only had minor injuries and her clothes were shredded. They had been riding on a trail just above the 10,200 foot level on the East Fork Trail near the Lizard Head Wilderness Area. The mountain bikers were either under or very near a tree when struck by lightning.

May 6, 2019, A severe thunderstorm produced large hail from quarter to ping pong ball size. Four men were struck by lightning and one injured in NE Elbert County.

June 30, 2019, Eight hikers were injured at the Devil Head Lookout by a nearby lightning strike. Five hikers were able to walk out unassisted, while two other required assistance. Most complained of having tingling sensations, while two suffered from minor burns. The eighth victim suffered critical injuries and had to be carried out by stretcher and taken to a nearby hospital. Elsewhere, severe thunderstorms produced large hail, from quarter to golf ball size and damaging wind gusts across Washington, Weld, Logan and Phillips counties.

July 1, 2019, One confirmed lightning injury occurred in downtown Canon City. An 11-year-old female was struck inside her home near a sink and had to be transported to a local hospital with non-life threatening injuries.

July 14, 2019, Two hikers were struck by lightning on Bear Peak off the Bear Peak Trail. The male hiker sustained a direct lightning strike and died later at the hospital. The female hike sustained minor injuries from an indirect strike.

August 17, 2019, A hiker was seriously injured by lightning while hiking in Rocky Mountain National Park.

June 6, 2020, An upper level trough moving northwest across the state led to numerous reports of high wind gusts. Most of the wind damage occurred with the passage of a rare derecho; a large fast-moving complex of thunderstorms with powerful straight-line winds. By midday the derecho, which originated over the Great Basin, moved over the northern and central mountains, and then rapidly northeast across the I-25 corridor by mid afternoon. These storms then tracked across the plains from late afternoon into the early evening hours. Wind gusts from 60 to 80 mph were common with a few gusts exceeding 90 mph. The highest gust observed was 110 mph, at the Winter Park Ski area, around 12000 feet. Xcel Energy said in a press release that more than 208,000 customers lost power because of the storm

statewide. The intense wind toppled a billboard that crashed onto Denver bakery. Two delivery trucks parked nearby were heavily damaged. Two injuries occurred in Denver, one seriously. A man and his nine-year-old daughter were injured by a fallen tree. Lightning struck and killed one person and injured another in a Durango subdivision.

July 17, 2020, Three individuals camping near Gunnison Colorado were struck by lightning as a thunderstorm passed through. All three were injured, with one 15-year-old male seeking medical treatment.

July 8, 2023, A large storm system moved over Central Eastern Colorado. This system caused flooding and spawned damaging tornadoes. The event resulted in a Presidential Disaster Declaration (DR-4731). As of August 2023, total event damages are estimated at $43 million.

Probability

Thunderstorms will occur annually (100% chance) and can occur at any time and location under proper conditions. Thunderstorms most often occur from late spring through summer, most notably from May through September.

Based on historical events with reported damages or deaths since 1997, there is a 76% chance of a damaging or deadly thunderstorm or lightning event occurring in a given year.

Climate Change Impacts

According to the best data available at the time of this plan update, Table 55 shows the future impacts of climate change on thunderstorms and lightning are still unclear.

TABLE 55 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Thunderstorm and lightning events occur across all of the state. The area at risk to lightning events is not projected to change.

Extent/Intensity	No clear projected trend in the frequency or intensity of warm-season convective storms has been identified for Colorado. Therefore, the intensity and extent of thunderstorm and lightning events is not projected to change.
Frequency	The frequency of thunderstorm and lightning events is not projected to change.
Duration	It is unknown if or how the duration of thunderstorms and lightning will change.

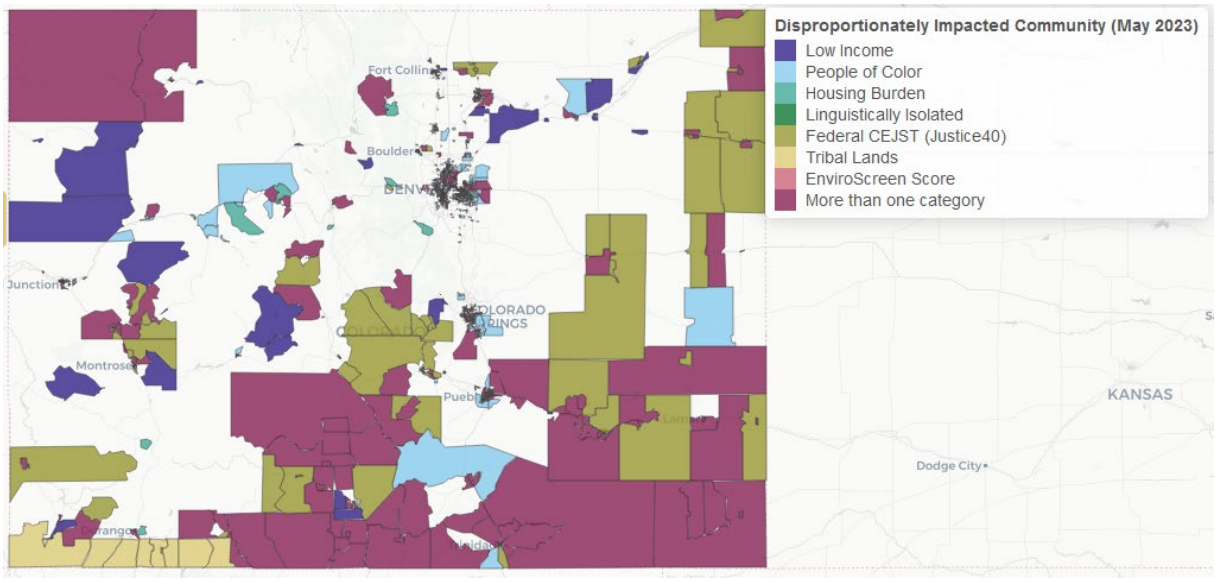
Risk & Vulnerability

Populations at Risk

All populations are at risk from the impacts of thunderstorms and lightning. People who work outdoors or recreate outdoors potentially have more exposure to thunderstorm events and therefore lightning. Power outages due to storms negatively impact communities, especially those populations who require electricity for medical or self-care needs. Those with limited English may also be impacted by a lack of public education content and an inability to receive weather alerts.

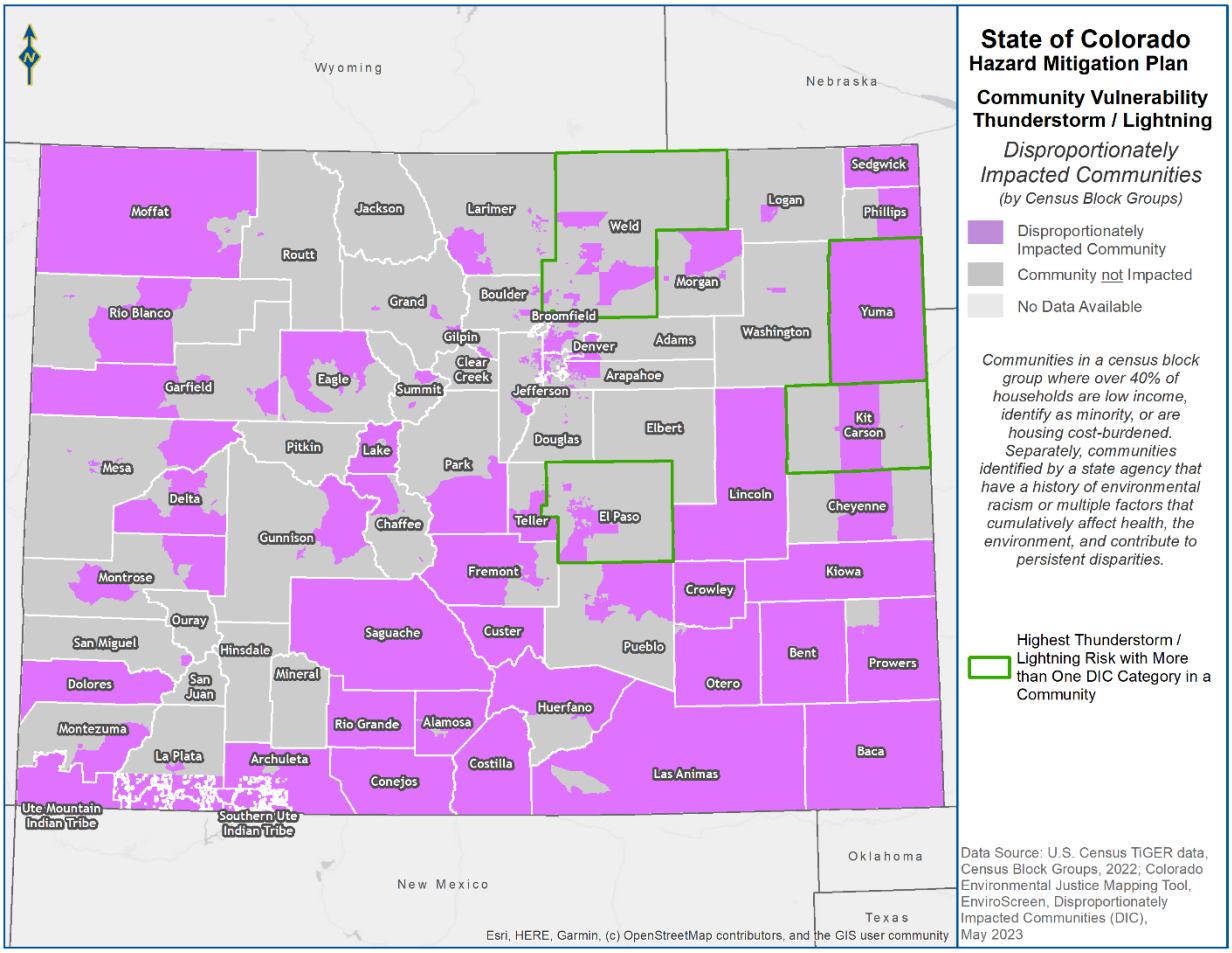
The State of Colorado recently defined what it terms “disproportionately impacted communities” (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 139. When comparing these communities to those counties with the highest thunderstorm/ lightning risk (Figure 143), El Paso, Kit Carson, Weld, and Yuma County all contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 144 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to thunderstorm / lighting include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 145 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Medium-High” (El Paso, Kit Carson, Weld, and Yuma). Additionally, there are two Community Disaster Resilience Zones (CDRZ) located in DIC identified communities in Yuma County.

FIGURE 145 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Between 2008 and 2022, the Office of Risk Management (ORM) reports that 66 severe thunderstorm and lightning events damaged state assets. These events resulted in $1.45 million of losses, some of which occurred to critical facilities such as within the state correctional system. A vast majority of these events were due to lightning strikes.

These lightning strikes resulted mainly in damages to building contents such as electric and power equipment and systems. These content damages included items such as HVAC controls, alarm systems, breakers, general electrical panels, security

cameras, and generators. There were three events where the losses to electrical equipment reached close to $200,000.

Exposure

All state assets are exposed to thunderstorm and lightning events. State facilities are the most vulnerable state asset type exposed to lightning. The largest risk is to electrical building systems. The largest potential impacts resulting from an event could include system damage and loss of system functionality.

Of those counties at the highest risk from thunderstorm / lightning events (Figure 143), El Paso County has the most state assets and asset valuations exposed (as shown in Figure 13 and Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

Communication, energy, food, hydration, and shelter, and transportation are the community lifelines most vulnerable to the impacts from a thunderstorm and lightning event. Resources are not likely to be strained and no long-term effects on recovery and resilience are expected. Although, a large-scale power outage resulting from a storm could stress some systems.

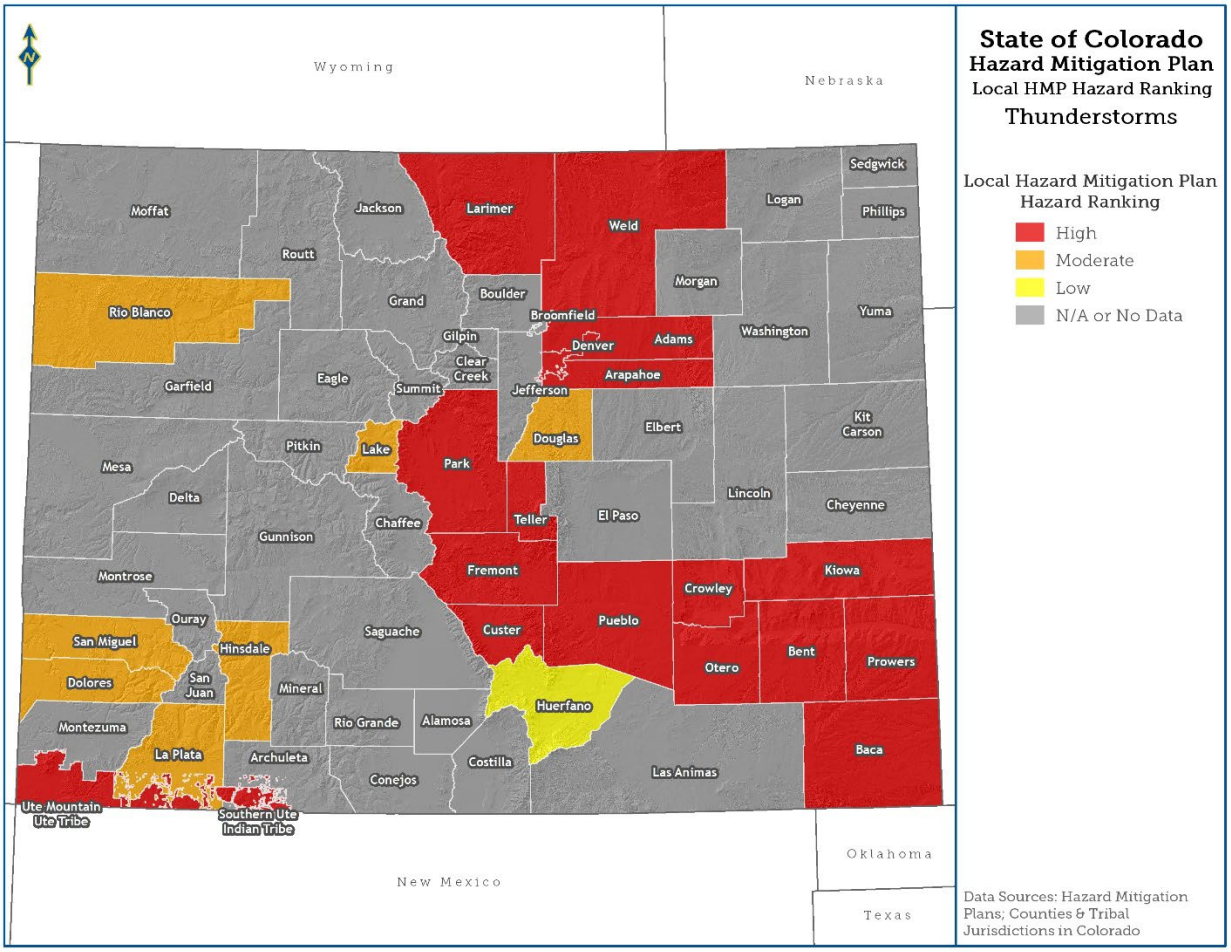
Thunder-storm & Light-ning							

Local County / Tribe

Hazard Rankings

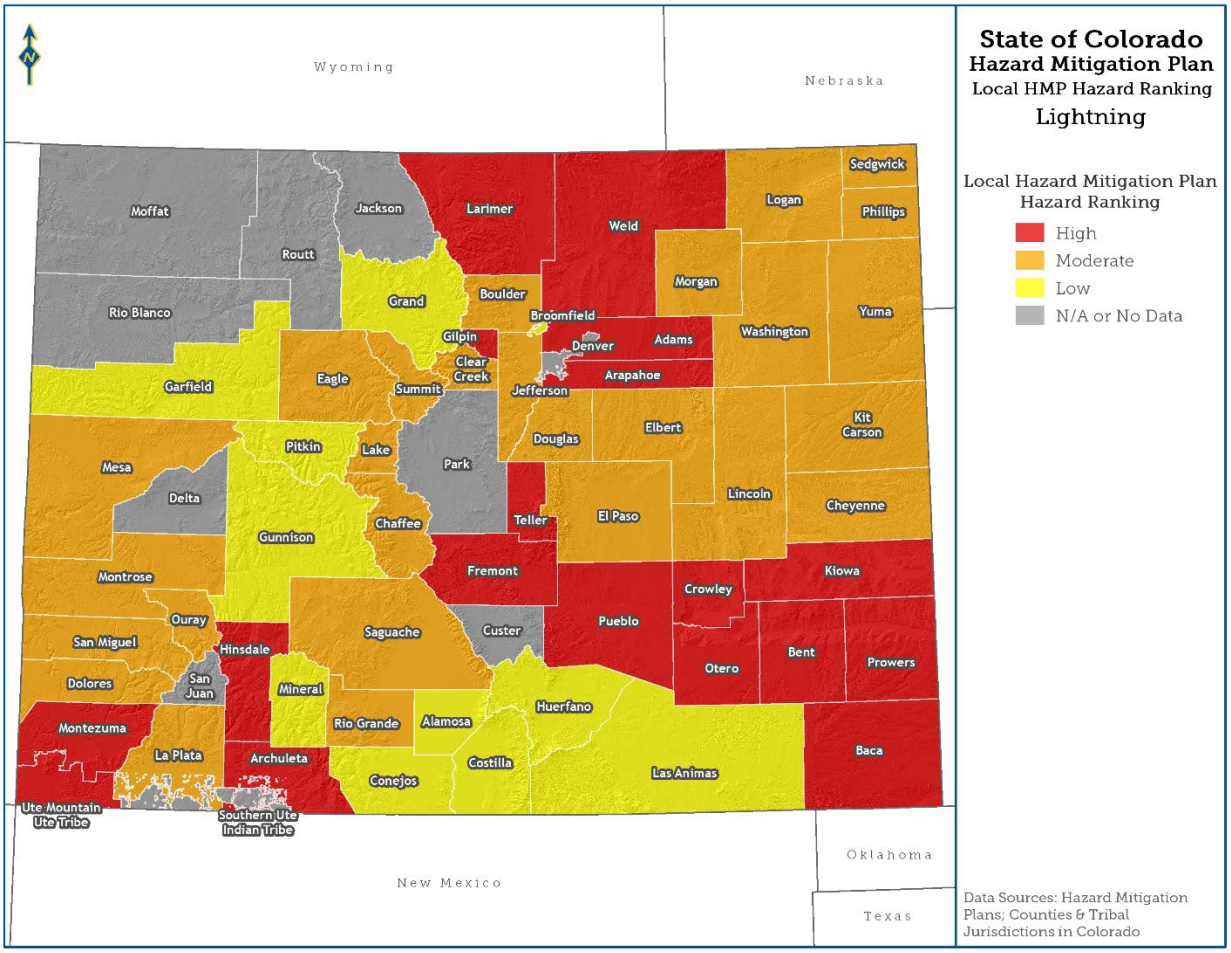
Figure 146 shows that both the Ute Mountain Ute and Southern Ute Indian Tribes ranked thunderstorm as high risk, in addition to many of the northern Front Range and southeastern counties.

FIGURE 146 LOCAL HAZARD RISK RANKINGS - THUNDERSTORMS



The rankings of high, medium, and low risk for the lightning hazard are split relatively equally across the state, shown in Figure 147. Many of the counties that ranked thunderstorm as high risk did the same for lightning and some who ranked thunderstorm as moderate consider the risk for lightning to be high.

FIGURE 147 LOCAL HAZARD RISK RANKINGS - LIGHTNING



Exposure

All counties are exposed to the hazards of thunderstorm and lightning, although some geographies see a much higher frequency and therefore a higher exposure. This is shown in the large number of events occurring along the Front Range and northeastern plains. See previous Figures in this section.

Local-level analysis of thunderstorm / lightning risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Thunderstorms are caused or worsened by hail, severe wind, and tornadoes. Thunderstorm and lightning can cause or exacerbate the hazards of expansive soils, flood, hail, severe wind, tornado, and wildfire.

Recent and Future Development

Exposure to thunderstorms and lightning will increase as Colorado's population grows.

Of those counties experiencing the state's largest percentage of growth (Figure 7), El Paso and Weld County have been identified as being at the highest risk from thunderstorm / lightning events (Figure 143).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of thunderstorm / lightning.

Consequence Analysis

TABLE 56 – EMAP IMPACT SUMMARY

Consideration	Description
Public	Outdoor workers, outdoor recreationists, outdoor sporting participants; population of the counties determined most at risk.
Responders	Some exposure exists to personnel performing routine duties when an event occurs; otherwise storm-related duties are typically post-event.

Consideration	Description
Continuity of Operations (Govt. & Services)	None, or limited loss of facilities or infrastructure function or accessibility, or ability to provide services. May have limited power interruption if not adequately equipped with backup generation.
Property, Facilities, & Infrastructure	Instances of property losses due to trees or roof tops being struck. Power outages may occur if utility lines are downed by lightning or wind. Buildings and equipment are exposed to lightning as well as utility infrastructure. Assets in areas with higher flash counts are at greater risk.
Environment	Downed trees and branches. Some potential for flooding or flash flooding. Lightning strikes may cause wildfires under certain conditions.
Economic	Extended power outages may cause delays in work, particularly in rural areas where problems are more widespread, but have fewer people responding to repair them.
Public Confidence in Govt.	Characteristics of lightning flashes such as duration and speed of onset result in limited response and recovery functions for government beyond first responders.

Tornado - Moderate Risk

Definition

A tornado is a violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. Tornadoes are generated by severe thunderstorms and characterized by a long, funnel shaped cloud. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets.

Tornadoes in Colorado are most frequent in the spring and early summer when warm, moist air from the Gulf of Mexico collides with cold air from the Polar Regions to generate severe thunderstorms. These thunderstorms often produce violently rotating columns of wind, known as funnel clouds which do not extend to the ground. Tornadoes often begin as funnel clouds, however not all funnel clouds evolve into tornadoes.

Location

Colorado lies at the western edge of the nation's primary tornado belt, which extends from Texas and Oklahoma through Kansas and Nebraska. In Colorado, the primary threat of tornadoes is east of the Continental Divide along the Front Range and across the Eastern Plains, although they have occurred statewide.

Contributing Factors

Tornado intensity is measured on the Enhanced Fujita Scale (Table 57), which examines the post-event damage caused by a tornado to homes, commercial buildings, and other human-constructed structures. The Enhanced Fujita Scale rates the intensity of a tornado based on damage caused, not by its size. The size of a tornado is not necessarily an indication of its intensity.

Tornadoes form rapidly and typically last only a few minutes, although rare instances of tornadoes lasting for hours have been reported. NOAA reports that lead times for tornado warnings vary between 10 and 15 minutes, but in some instances there may be little to no time to deliver a warning to a community.

While tornadoes are always dangerous, those that occur when people are sleeping are some of the most hazardous. Overnight tornadoes are more likely to be deadly, in part because the public are less likely to receive warnings. Those inside vulnerable housing and building structures, such as mobile homes, are at even greater risk.

The greatest exposure and impacts would be felt if an EF3 or higher tornado were to touch down in a densely populated area, especially a large town or city. Substantial infrastructure damage could be incurred by state, local, and federal facilities, with far reaching effects from power loss, impacts to utilities and water services, transportation disruption, and communication failure.

TABLE 57 ENHANCED FUJITA SCALE OF TORNADO INTENSITY

EF-Scale Number	Wind Speed (MPH)	Type of Damage Possible
EF0	65-85	Minor damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	Moderate damage: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	Severe damage: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy

EF-Scale Number	Wind Speed (MPH)	Type of Damage Possible
		cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	Devastating damage: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	Extreme damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structures badly damaged; high-rise buildings have significant structural deformation.

Past Occurrences

Historical Events

Colorado has experienced over 2,000 reported tornadoes and some counties have been the location of hundreds of these events. Figure 148 illustrates the ratings, locations, and paths traveled, if available, of tornadoes in the state since 1950. In reviewing the event reporting, it clearly shows that many reported tornadoes were near population centers, shown in the groupings around cities and towns.

FIGURE 148 HISTORICAL TORNADO EVENTS

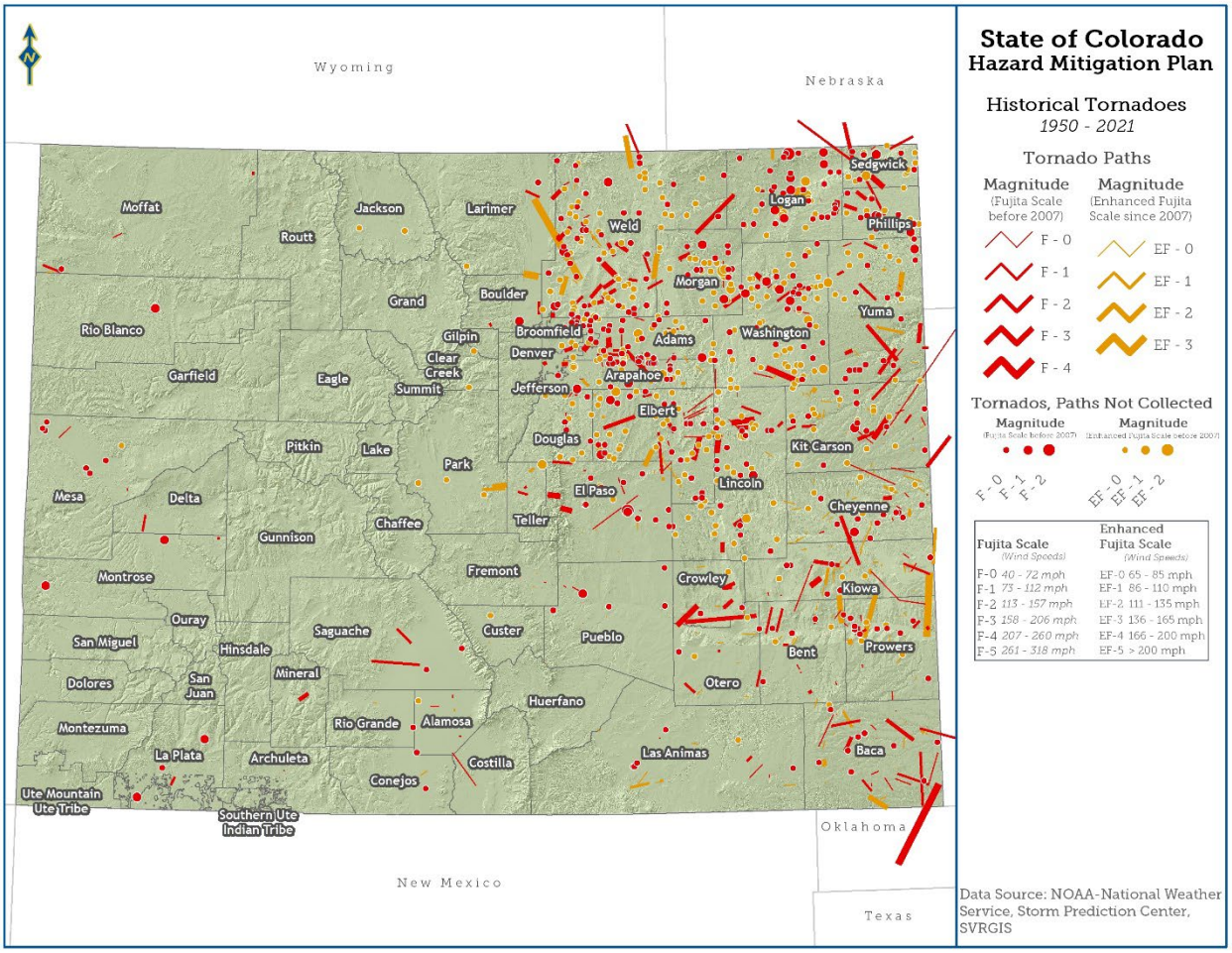
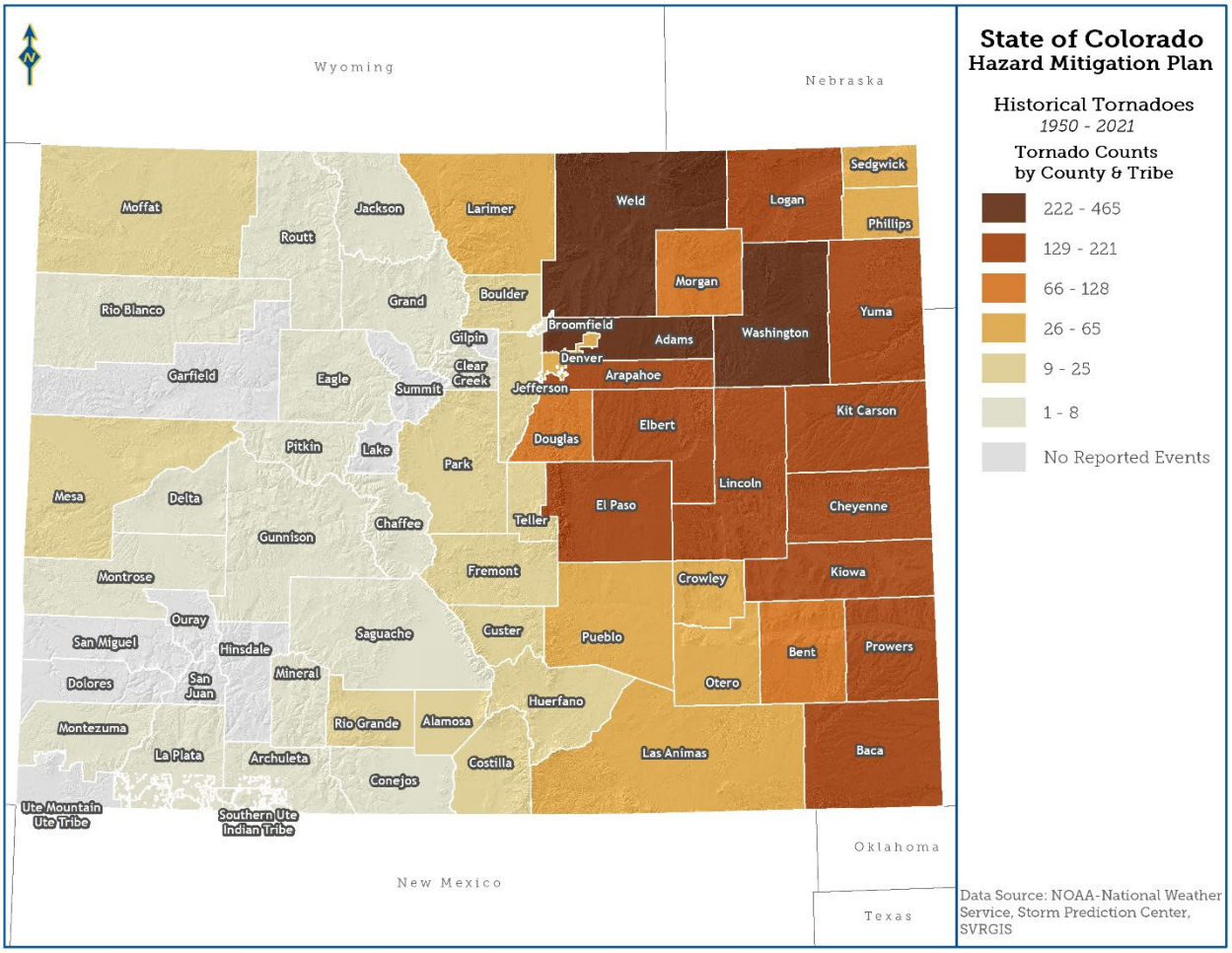


Figure 149 present the overall count per county and tribal area of this tornado data. It is notable that in the northeast area of the state some counties have experienced such high numbers (222-465 reported events) of tornadoes.

FIGURE 149 HISTORICAL TORNADOES BY COUNTY AND TRIBAL AREA



Prior to using the Enhanced Fujita (EF) scale, the Fujita scale was the tornado intensity rating system. In looking at the history of tornadoes in Colorado, distinguishing the overall count by ratings helps to better understand the risk tornadoes carry. Below tables, for both scales, detail the count and rating of tornadoes that have occurred in the state. “UK” and “EFU” include events with an unknown scale.

Tornado Events by Rating [44]

Fujita Scale Counts 1950-2006

UK	F0	F1	F2	F3	F4
55	931	504	110	17	1

Enhanced Fujita Scale 2007-2022

EFU	EF0	EF1	EF2	EF3
58	503	60	22	4

Previous Losses

There have been significant losses over the years with the greatest property losses in 2000-2009, due primarily to the 2008 Windsor tornado. Crop losses in 1990-1999 are the highest the state has seen and were a result of the 1996 Strasburg tornado. The total losses are separated by decade in Table 58.

TABLE 58 REPORTED TORNADO EVENTS, DEATHS, INJURIES, AND DAMAGE BY DECADE [44]

Years	Count	Deaths	Injuries	Property Damage	Crop Damage	Total Damage
1950-1959	111	0	16	$ 1,102,570	$ 0	$ 1,102,570
1960-1969	137	2	20	$ 1,261,520	$ 0	$ 1,261,520
1970-1979	204	0	25	$ 10,677,280	$ 0	$ 10,677,280
1980-1989	340	0	62	$ 68,991,570	$ 0	$ 68,991,570
1990-1999	525	0	27	$ 34,310,500	$ 6,502,500	$ 40,813,000
2000-2009	443	3	111	$ 170,596,000	$ 2,000	$ 170,598,000

[44] NOAA National Centers for Environmental Information (NCEI), Storm Events Database

Years	Count	Deaths	Injuries	Property Damage	Crop Damage	Total Damage
2010-2019	420	0	15	$ 2,638,000	$ 115,000	$ 2,753,000
2020-2022	84	0	0	$ 550,500	$ 0	$ 550,500
Total	**2,264**	**5**	**276**	**$ 290,127,940**	**$ 6,619,500**	**$ 293,994,440**

Based on information collected from communities across the state and the National Centers for Environmental Information (NCEI) Storm Events Database, Table 59 details events that resulted in deaths and / or multiple injuries over the last century.

TABLE 59 TORNADOES CAUSING DEATH OR 6 OR MORE INJURIES, 1915-2022 [44]

Date	Deaths and Injuries	Description
June 30, 1915	1 dead, 5 injured	Three homes were destroyed on ranches and farms 20 miles southwest of Lamar, Bent County.
Aug. 10, 1917	1 dead, 7 injured	A man was killed when he took shelter in a dry goods store that was destroyed at Two Buttes, Baca County.
Nov. 4, 1922	4 dead, 25 injured	Unusual for the season, this tornado hit a farmhouse in Lincoln County, 20 miles north of Sugar City.
Nov. 4, 1922	1 dead, 3 injured	At the Pleasant Valley School 11 miles ESE of Holyoke a teacher was killed in her "teacherage" home.
Aug. 10, 1924	10 dead, 8 injured	Nine children and one woman died in a farmhouse near Thurman, Washington County.
June 14, 1925	1 dead, 2 injured	A small tornado destroyed a poultry house and killed a child in Pueblo.
Aug. 10, 1926	1 dead, 2 injured	Two homes were destroyed on farms north of Padroni, Logan County. A child was killed.

Date	Deaths and Injuries	Description
June 8, 1928	2 dead, 4 injured	Seven farms were devastated near the Colorado/Oklahoma border. Deaths were in Baca County.
June 29, 1928	2 dead, 50 injured	Women died in each of two farmhouses that were completely leveled. This tornado passed just west of Johnstown.
Oct. 2, 1930	3 dead, 4 injured	Three people left their car and sought shelter in a farmhouse 14 miles NW of Fowler; the home and car were destroyed.
April 30, 1942	4 dead, 12 injured	Near McClave, Bent County, and Eads, Kiowa County, people were killed in the destruction of four different homes.
June 27, 1960	2 dead, 4 injured	Ten miles north of Holyoke, Phillips County a massive tornado threw two cars a quarter mile.
Oct. 17, 1971	9 injured	A tornado struck a mobile home park in the main street business district of Wray, Yuma County.
June 3, 1981	42 injured	Nearly 800 homes suffered damage as a tornado cut a swath through the heart of Thornton, a suburb of Denver.
June 15, 1988	7 injured	Moving to the northeast then southeast and then to the south, a tornado cut an erratic path across south Denver.
June 6, 1990	14 injured	A tornado destroyed 80% of the business district of Limon, Lincoln County, as well as 228 of the town's 750 homes.
July 7, 1993	8 injured	The injuries were on farms that were torn apart near Bethune and Burlington, Kit Carson County.

Date	Deaths and Injuries	Description
October 11, 1997	6 injured	A tornado touched down in Bent and Kiowa Counties, eyewitnesses said the tornado remained intact for most of the 35 mile track northeast to just south of Highway 96 in Kiowa county.
May 28, 2001	13 injured	Three tornadoes occurred in El Paso County. One, rated F2, struck the junior-senior high school building, destroying nearly one half of the structure.
March 28, 2007	2 dead, 9 injured	Over 200 residences and other buildings were affected or destroyed near the town of Holly, Prowers County and extending into Kiowa County. Two people were killed and nine others were injured. The damage path was around 28 miles long.
May 22, 2008	1 dead, 78 injured	A powerful tornado swept north-northwestward across Weld County and into Larimer County, carving a path of destruction, nearly 39 miles in length.
April 27, 2012	8 injured	Five separate tornadoes occurred across Bent, Prowers, and Kiowa Counties causing EF0 to EF2 damage. Tornado touched down near Lamar, Prowers County at around 2 am.

Notable Events

On July 13, 1996, a fast moving F2 tornado ripped a 12-mile path of destruction near Strasburg, in eastern Adams County. The tornado caused extensive structural damage to several galvanized metal grain silos, farm buildings, and sheds in the area. The roof of a two-story log home was torn off. Several homes in the area sustained roof damage and a number of power poles were downed along Highway 36. Crop damages were reported at $6.5 million.

On March 28, 2007, with a maximum rating of EF3 and a maximum damage path width of 900 yards, the tornado raced through the Town of Holly, causing two fatalities and nine injuries. Over 200 residences and other buildings were affected or destroyed. The damage path was around 28 miles long, extending into Kiowa County. The last substantial damage with the tornado was in northeast Prowers County, where a ranch sustained high end EF3 damage.

On May 22, 2008, a powerful tornado swept north-northwestward across Weld County and into Larimer County, carving a path of destruction, nearly 39 miles in length. The tornado, up to one-mile wide at times, initially touched down northeast of Platteville and finally lifted six miles west-northwest of Wellington. An assessment in the aftermath of the tornado revealed extensive areas of damage. On the enhanced Fujita Scale there were pockets of EF3 damage, mainly near the Missile Silo Park Campground, and to businesses and homes in eastern Windsor. There was one fatality and 78 injuries. One man was killed when he tried to escape the trailer park in his motor home. Preliminary estimates from FEMA indicated 850 homes were damaged, and nearly 300 homes were significantly damaged or destroyed. Privately insured damages totaled $147 million, and the Poudre Valley Rural Electric Association reported $1 million of damage to electric transmission lines.

On June 8, 2014 an upper level weather disturbance and its associated cold front moved across northern Colorado during the late morning and afternoon; spawning several tornadoes. Nine tornadoes touched down across northeast Colorado. Three of these tornadoes occurred in Park County, at elevations of 8,000-10,000 feet. The first, an EF1, occurred 8 miles south-southwest of Fairplay and damaged the roof of a residence. Another tornado developed 6 miles southeast of Fairplay in open country and an EF2 tornado developed 4 miles west of Lake George. The last tornado caused damage to some homes, overturned several recreational vehicles at an RV park, downed several power lines damaged buildings, and snapped trees from their bases. In Aurora, another EF1 tornado touched down near the Blackstone Country Club, it lifted golf carts and flipped an empty construction trailer. One of the carts was

thrown on top of a caddy walking nearby who sustained minor injuries. Five other tornadoes developed over open country across Douglas, Elbert and Weld Counties with little additional damage reported.

On July 27, 2018 five tornadoes touched down, three produced damage of EF-1 scale. In Arapahoe County, south of Byers, a tornado flipped a UPS truck end over end and injured the driver. It also took the roof off a manufactured home and partially destroyed an outbuilding. The second tornado near Ponderosa Park uprooted several trees. The third tornado near Deer Trail tossed a cattle feeder approximately one-quarter of a mile, blew over some farm equipment, and blew out the windows of a home.

During the summer of 2023, Colorado experienced its busiest tornado season since at least 2000. Through August, NOAA has reported 76 events, with two categorized as EF-3. This is the first time since 1993 that two or more EF-3 tornadoes have occurred in a year across the state.

One of these large events (8/8/2023 in Yuma County near the City of Yuma), coupled with severe storms and flooding, resulted in a Presidential Disaster Declaration (DR-4731). This tornado damaged irrigation pivots, trees, power poles, and grain bins, and caused significant damage to one home. As of August 2023, total event damages are estimated at $43 million. The other EF-3 occurred near the Town of Grenada in Prowers County and did destroy one home, in addition to a some outbuildings and vehicles.

Probability

Tornadoes are an annual occurrence in Colorado (100% chance). On average, most tornadoes in Colorado occur in June, followed by July and May, mainly during afternoon or evening hours. With expanded coverage of Doppler radar, population growth, and greater attention to storm chasing, the number of tornado reports over the past several decades has increased. This can create the appearance of an

increasing trend in tornado frequency when the heightened numbers can be attributed to advances in technology and reporting.

Since 1950, 2,264 reports of tornadoes across Colorado have been collected by the NCEI Storms Database. Based on this period of 72 years, there is an average of 31 tornadoes occurring in the state in a given year.

This count may be higher. It is likely some tornadoes occurring in rural areas are not counted. These events may not be caught by Doppler radar, are not reported, or are not witnessed. Urban Observation Bias can contribute to this as events are reported more often in more populated areas. Patterns of report grouping for tornadoes, as well as hail storms, illustrate this effect.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change on tornado events in Colorado remain highly uncertain. The areas currently vulnerable to tornadoes, especially eastern Colorado, will remain vulnerable to tornadoes in the future.

Risk & Vulnerability

Populations at Risk

While all populations are at risk of a tornado event, there are specific populations who are more vulnerable to the impacts. There are a variety of diverse reasons a person or group may be disproportionately affected by a tornado event. These populations include, but are not limited to:

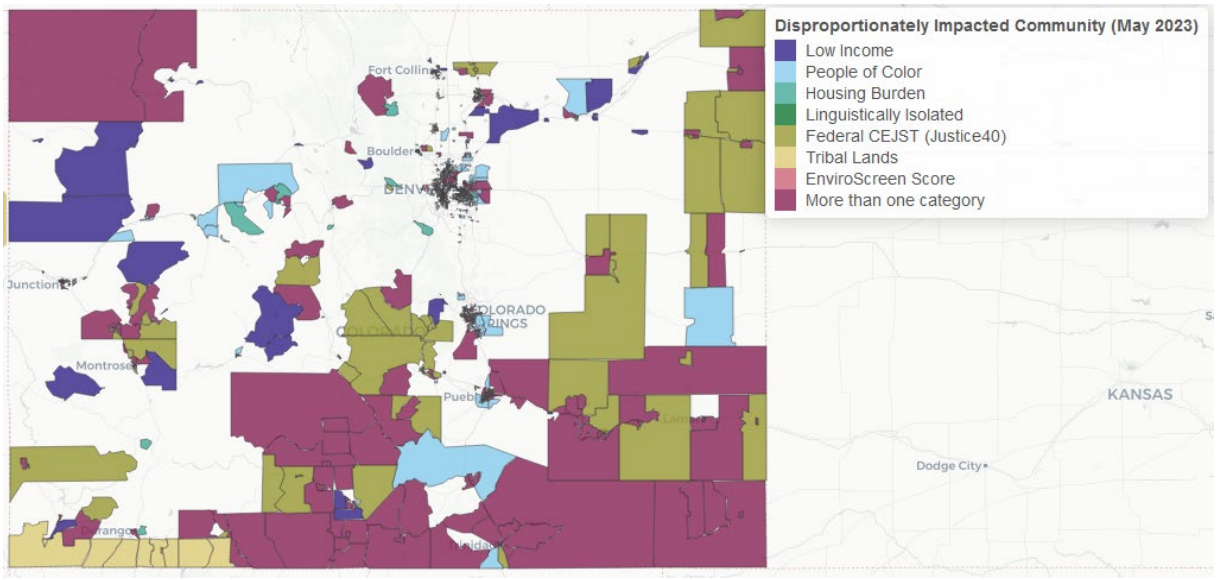
- Elders and the youngest in communities
- Minorities and those with Limited English who might not receive timely alerts
- Those identifying as having Access and Functional Needs
- Those living in crowded situations, group quarters, single parents, or living alone

- Those with a socioeconomic status such as poverty, unemployment, and lack of transportation
- Those living in mobile homes
- Those with limited access to information and healthcare

Tornadoes are unpredictable and anticipating the efforts needed to respond and recover successfully from an event involves recognition of these populations across the state and collaborative planning.

The State of Colorado recently defined what it terms "disproportionately impacted communities" (DIC). Further assessments utilizing this statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as "more than one category" are the most vulnerable across the state, as shown in Figure 150. When comparing these communities to those counties with the highest thunderstorm/ lightning risk (Figure 149), Adams and Weld County each contain Census Block Groups that are the most vulnerable in Colorado.

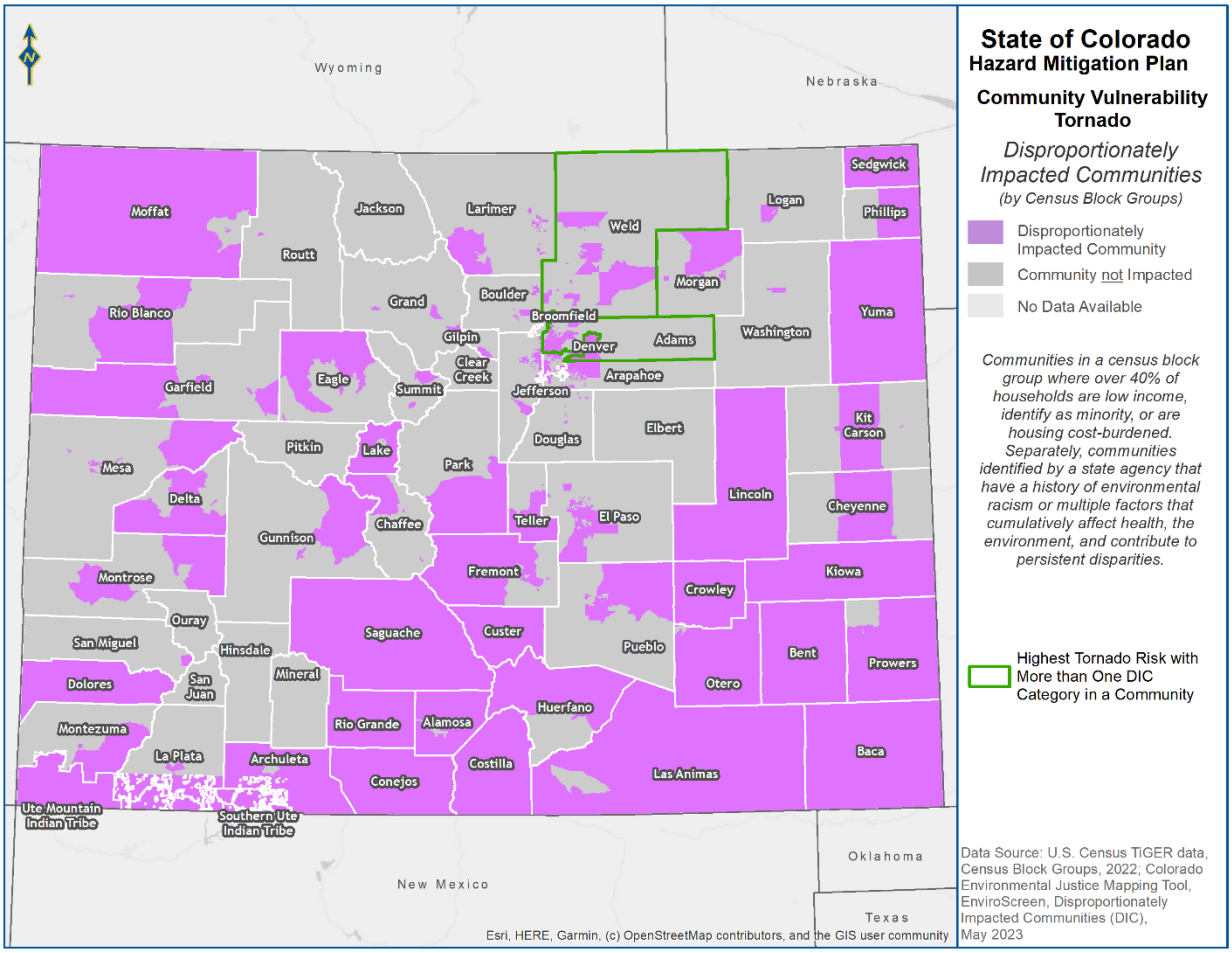
FIGURE 150 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to tornadoes include: low income, housing burdened, people of color, EnviroScreen

identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 151 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “High” (Adams) and “Medium-High” (Weld).

FIGURE 151 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008, there has only been one state asset real property loss attributable to a tornado, resulting in $422,189 in losses.

Exposure

The majority of state asset value is located along Colorado's Front Range. State assets located in this area and across the Eastern Plains are at risk from tornadoes. State facilities are the most vulnerable state asset type exposed to tornadoes. The largest risk is to un-reinforced and older structures that may not have been constructed to modern seismic building codes, located in the eastern portion of the state. The largest potential impacts resulting from an event could include structural collapse and damage to building inventories.

Of those counties at the highest risk from tornado events (Figure 149), Adams and Weld County have the most state assets exposed (as shown in Figure 13). Adams County has the highest amount of asset valuations exposed (as shown in Figure 14).

It should be noted that the statewide asset database utilized in this E-SHMP does not contain any "structure type" data that would allow for a more detailed evaluation of specific risk to those counties experiencing the highest risk from this hazard.

Lifelines

All community lifelines across Colorado are vulnerable to the impacts from a tornado event. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

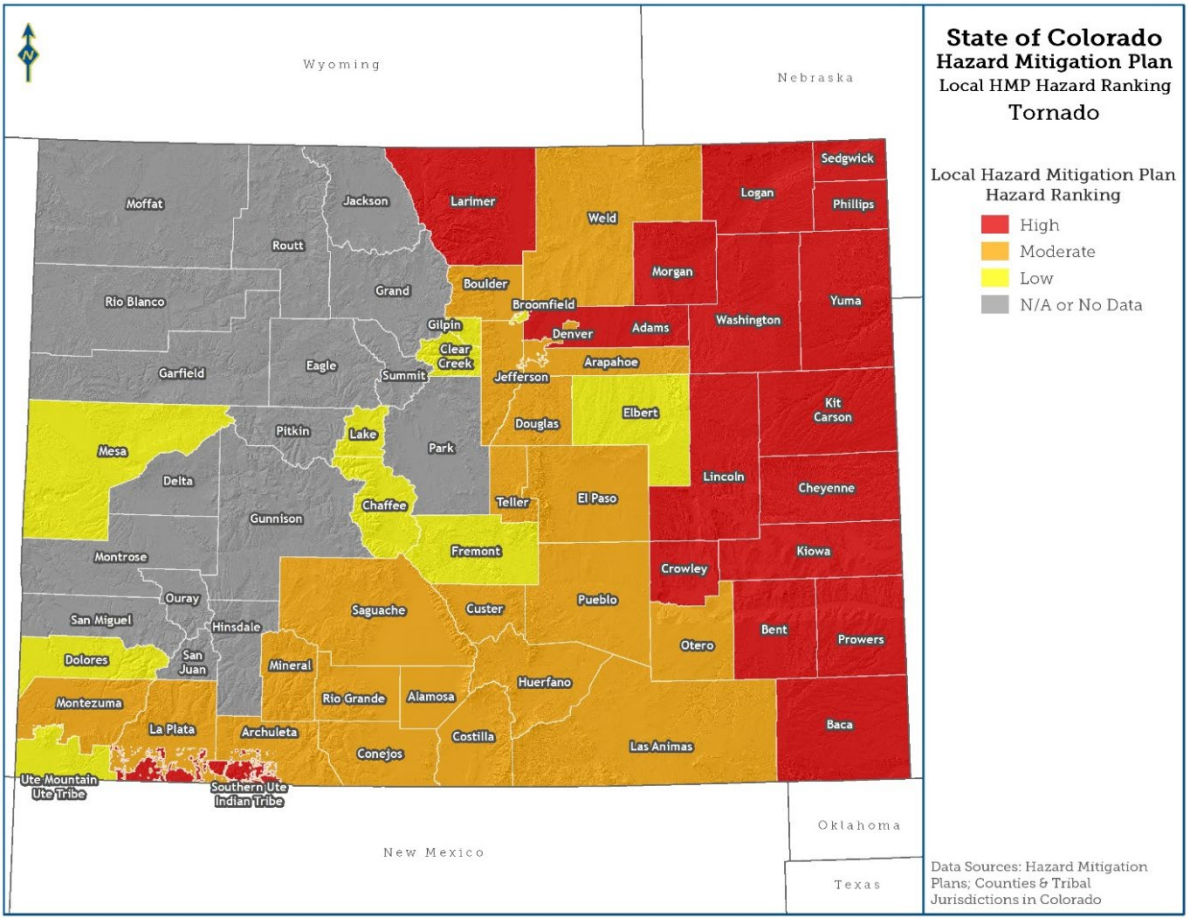
Tornado							

Local County / Tribe

Hazard Rankings

The counties and tribes that profiled and ranked Tornado as a hazard in their Local Hazard Mitigation Plan are primarily located in the east and central areas of the state. The risk rankings, shown in Figure 152, are overall consistent when taking history, previous losses, and community priorities into account.

FIGURE 152 LOCAL HAZARD MITIGATION PLAN TORNADO RISK RANKING



Exposure

All counties and tribes are at risk of tornado events, although the eastern and front range counties are most vulnerable. See previous Figures in this section.

Local-level analysis of tornado risk to structures is not provided in any of the state's HMPs. In many cases, a statement is made that vulnerability to this hazard is equally spread across the entire community. If this data is available in the future, the E-SHMP will utilize that information accordingly.

Interconnected Hazards

Tornadoes are caused or exacerbated by thunderstorm / lightning and severe wind events.

Tornadoes can also impact and influence damages resulting from hail, thunderstorm / lightning, and severe wind events.

Recent and Future Development

Counties that expect considerable growth in housing and have a history of tornado events are most at risk for future exposure. An increased building stock means that there are more homes and buildings threatened by tornadoes.

Development in the eastern counties, where most of the tornadoes are recorded, will notably increase vulnerability. Continuing development along the Front Range will also result in greater vulnerability.

Of those counties experiencing the state's largest percentage of growth (Figure 7), Adams and Weld County have been identified as being at the highest risk from tornado events (Figure 149).

Any population change (growth or decline, in addition to changes in local land use policies and shifts in the needs of underserved communities) will result in changes to hazard exposure. A planning assumption is that population growth will lead to an increased number of buildings, roads, utilities, and other infrastructure that will be exposed to natural hazards. Another assumption is that population decline will also change vulnerability as some buildings and infrastructure fall into a state of disrepair or become underutilized. These are important factors to note for the state's fastest growing counties that currently have the highest risk for the hazard of tornado.

Consequence Analysis

TABLE 60 EMAP IMPACT SUMMARY

Consideration	Description
Public	Anyone without adequate shelter during an event; population of the counties determined most at risk. High risk of injury and death.

Consideration	Description
Responders	Exposure exists to personnel performing routine duties when event occurs; storm-related duties are primarily post-event, however unsafe structural or environmental conditions may persist during the response period.
Continuity of Operations (Govt. & Services)	Loss of facilities or infrastructure function or accessibility, or ability to provide services. Power interruption is likely if not adequately equipped with backup generation.
Property, Facilities, & Infrastructure	Buildings, vehicles, signage, and/or any unsecured property may be affected during an event. Property may be destroyed or have significant damage. Buildings, equipment, and utility infrastructure are exposed to tornadoes.
Environment	Significant impact related to tree damage. Possible cascading water quality issues from damaged water treatment facilities.
Economic	Potential loss of facilities or infrastructure function or accessibility and uninsured damages. Impact to transportation sector and movement of goods. Historic events in Colorado have impacted community business districts where a majority of businesses are lost.
Public Confidence in Govt.	Public holds high expectations of government capabilities for warning, public information, and response and recovery activities related to a tornado. High expectations for rapid restoration of critical lifelines.

Wildfire – Extremely High Risk

Definition

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Wildfires can start from natural causes, such as lightning, but most are caused by humans, either accidentally or intentionally, including escaped prescribed burns. Prescribed fires, also known as prescribed burns, refer to the controlled application of fire by a team of fire experts under specified weather conditions to restore health to ecosystems that depend on fire. Wildfires can damage natural resources, destroy homes, and threaten human lives and safety.

Fire effects are the physical, chemical, and biological impacts of fire on ecosystem resources and the environment. The abiotic, or physical, effects of fire include its role in changing air quality, water quality, soil properties, and nutrient cycling. Biotic, or ecological, effects include altering vegetation and related impacts on wildlife. Fire effects are the result of an interaction between the heat regime created by fire and ecosystem properties and will vary according to site characteristics and fire behavior.

Location

The threat of wildfires is statewide in Colorado with the forests, grasslands, and wildland urban interface areas all at risk. The wildland urban interface (WUI) is the area where houses meet or intermingle with undeveloped wildland or vegetation fuels. This makes the WUI a focal area for human-environment conflicts, such as the destruction of homes by wildfires.

The Colorado State Forest Service (CSFS) updated its Colorado Forest Atlas in 2023. The Wildfire Risk Viewer (Public) tool allows users to see an area's specific risk. One category of risk is termed "wildland urban interface risk" (located in Wildfire Effects Themes), which is a measure of the potential impact on people and their homes from wildfire.

Figure 153 presents the WUI risk statewide. The largest collections of highest risk areas are mainly located along the Front Range. There are also pockets of highest risk scattered across much of the western side of the state. These areas mainly correlate with the more densely populated municipalities.

FIGURE 153 WUI RISK AREAS

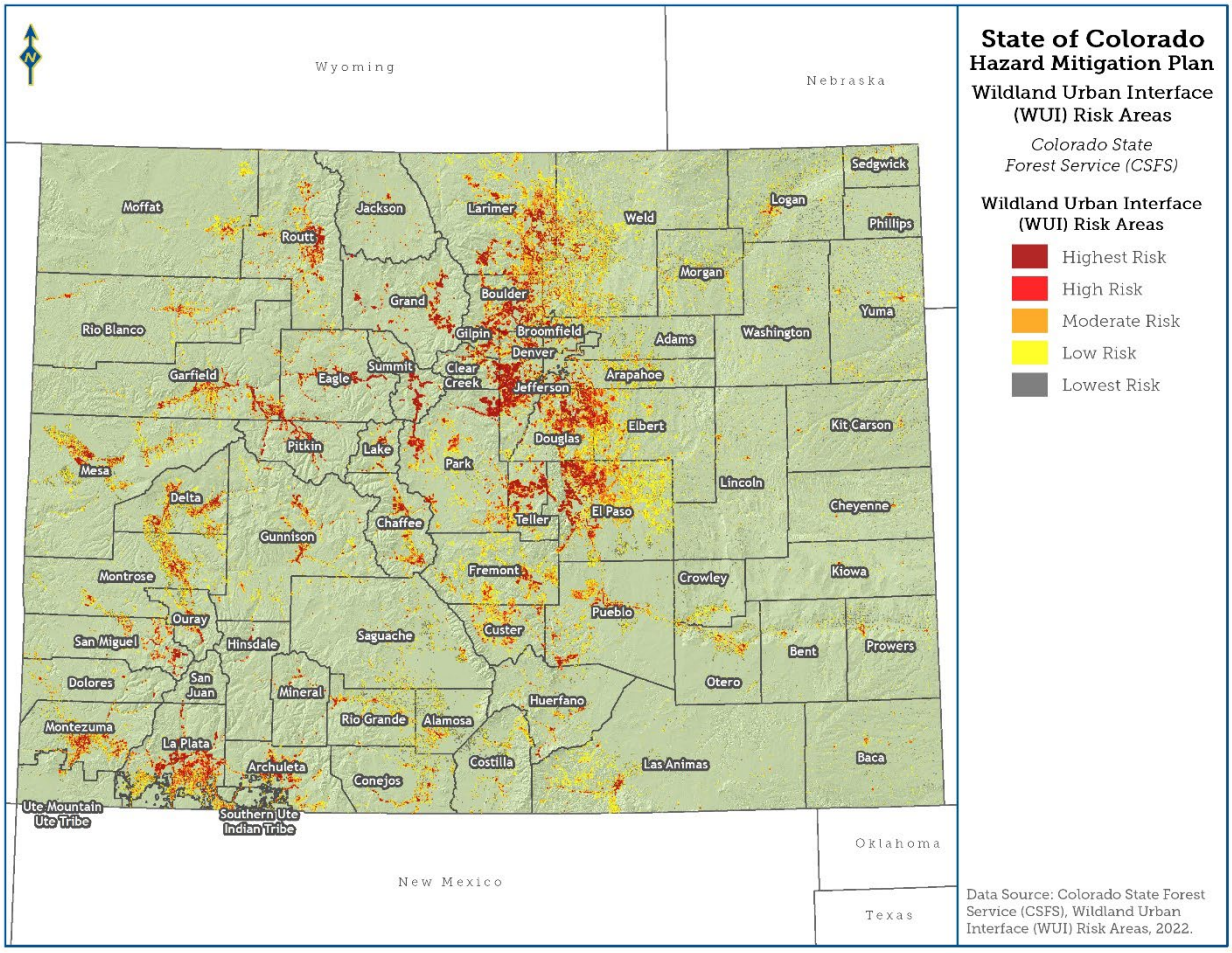
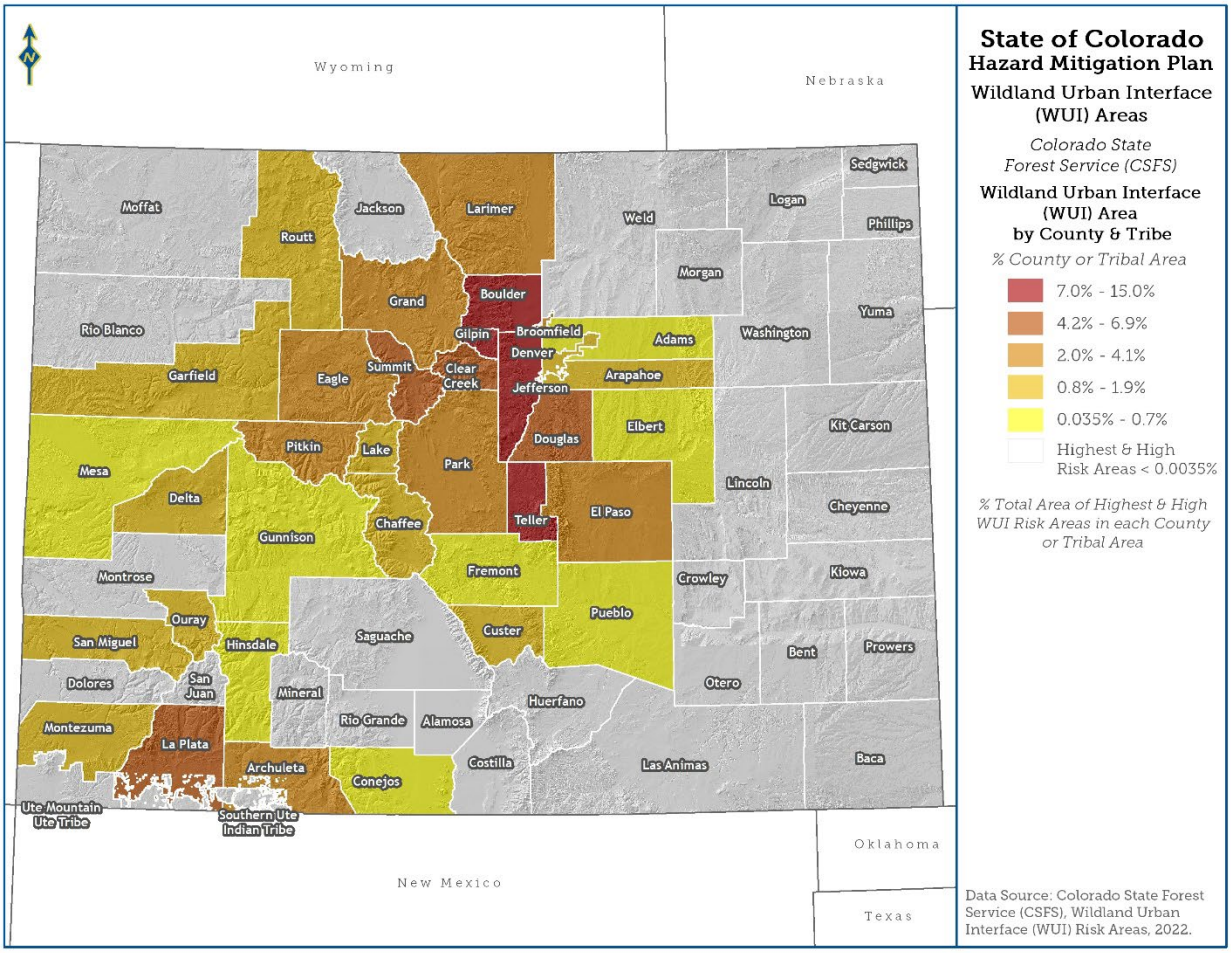


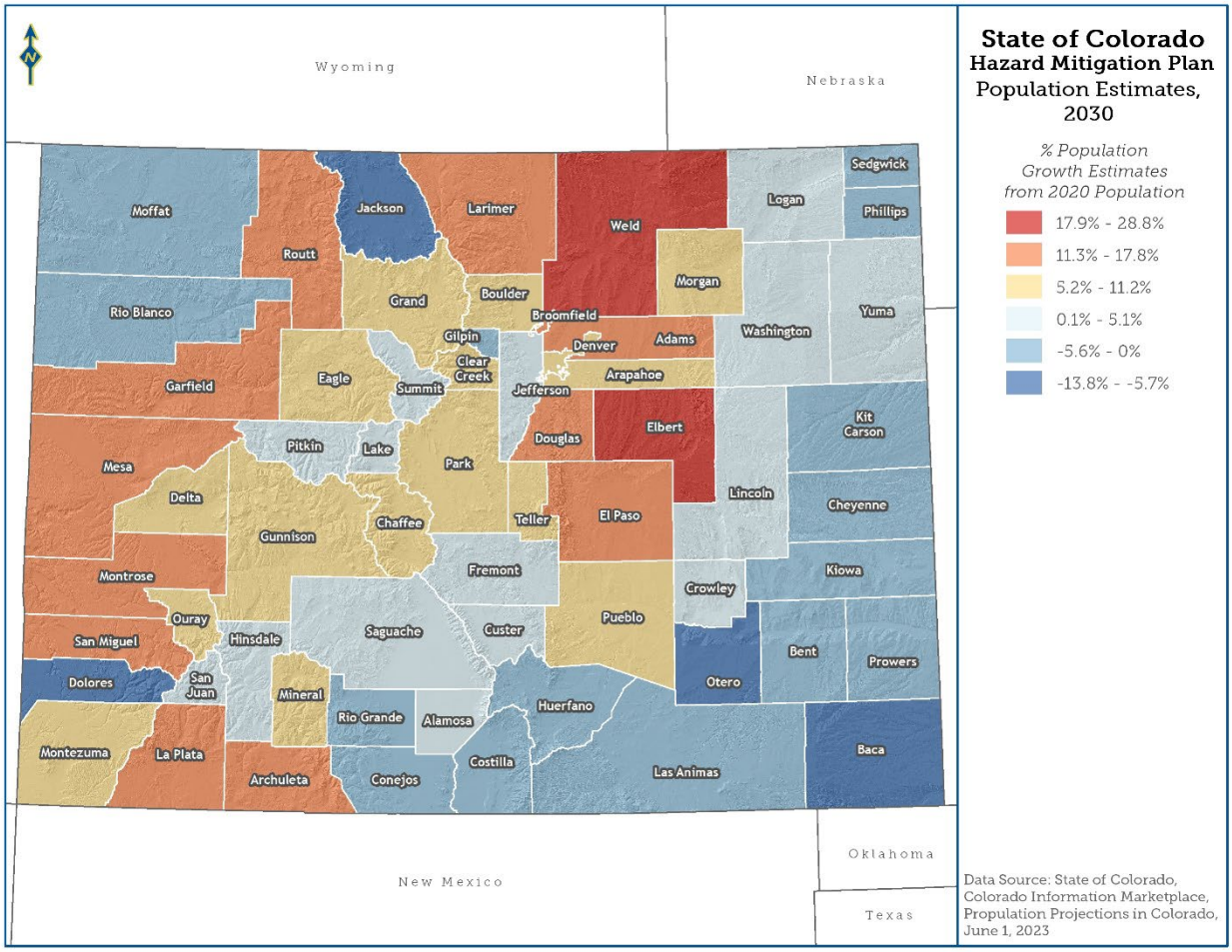
Figure 154 summarizes this data at a county and tribal area level, for those areas of high or highest statewide risk. Those counties with the most high and highest risk areas are clustered along the front range from Boulder County south to Teller County.

FIGURE 154 HIGH/HIGHEST WUI RISK AREAS BY COUNTY AND TRIBAL AREA



For comparison, Figure 155 presents the estimated population growth across the state through 2030.

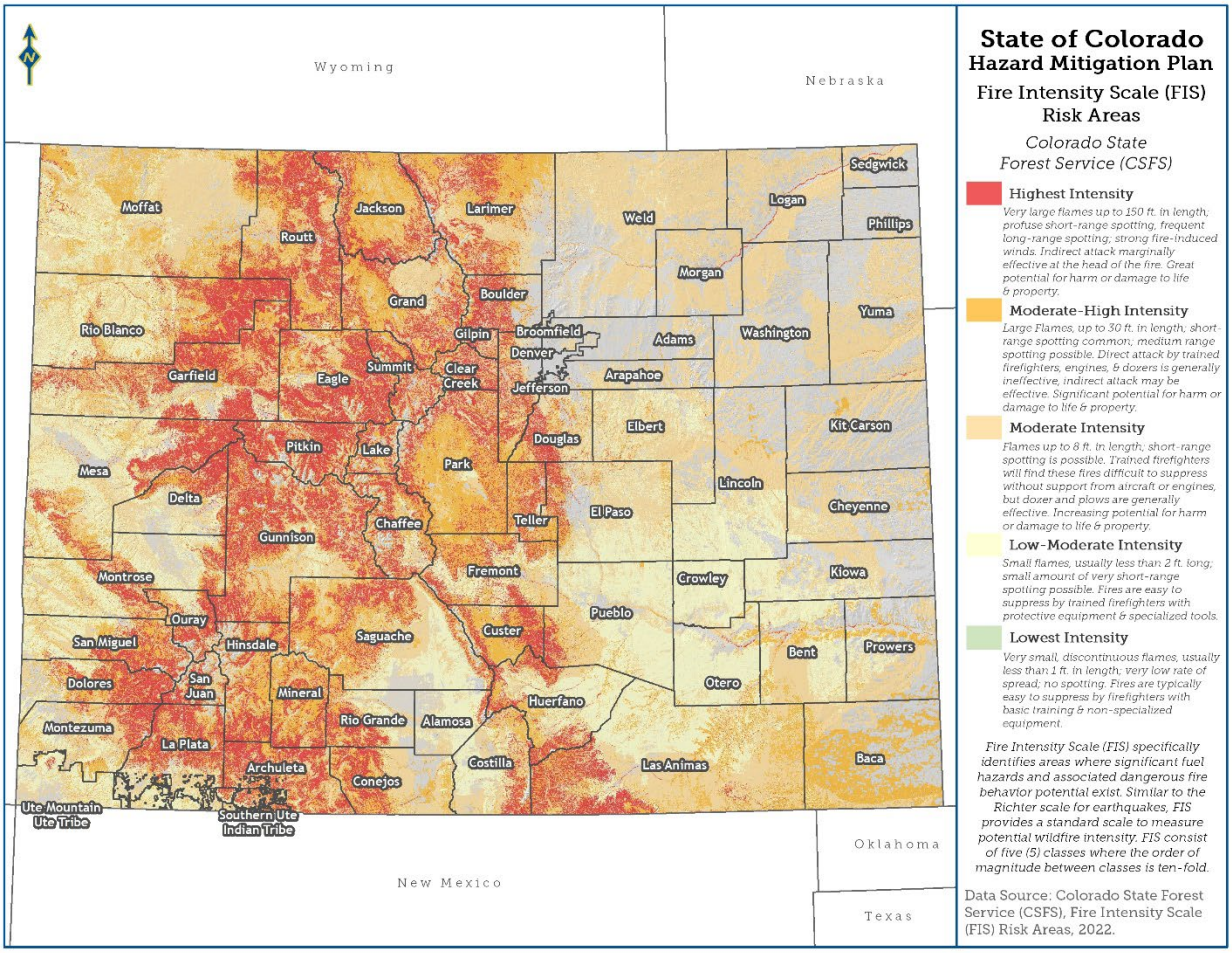
FIGURE 155 COLORADO 2030 ESTIMATED POPULATION GROWTH



Contributing Factors

Wildfire risk is determined by the chance of a fire occurring (likelihood), the associated fire behavior when a fire occurs (intensity), and the effects of the fire (susceptibility) on highly valued resources and assets. The range of fire intensities across Colorado are presented in Figure 156.

FIGURE 156 FIRE INTENSITY



Wildfire extent is variable and depends on many factors, including vegetation type, forest health and density, and topography, as well as atmospheric conditions such as wind, fuel moisture levels, day and nighttime temperatures, and air moisture. Every year, thousands of small wildfires ignite across the state with some growing to be large and extremely dangerous.

Over the last decade, Colorado has experienced an upswing in multiple large and erratic wildfires. These wildfires are in part a consequence of prolonged drought that has resulted in extremely dry and volatile fuels. The combination of dry fuels and ample availability of those fuels has created conditions where wildfires are burning faster and hotter than under more historically natural conditions. According to the

Colorado Climate Plan, several forest types, such as low-elevation Ponderosa Pine, have historically maintained a low tree density due to frequent, low intensity wildfires. However, over the past century it has been common forest management practice to suppress all wildfires, creating more dense forests and more fuel to burn.

Forest insect epidemics and forest parasites contribute to wildfire potential by killing trees, thereby increasing fuel loading. Over the past two decades, Colorado has experienced an increase in insect infestations that have left vast areas of forest vulnerable to wildfire. These infestations, coupled with growth in the WUI, increase wildfire risk and the potential for catastrophic wildland fires in the state.

Wildfire is one of the most detrimental hazards to air quality and has long lasting health effects. Smoke inhalation has been shown to cause premature deaths. Wildfire smoke impacts the entire population but is especially dangerous to underserved communities and vulnerable populations. Chronic health conditions, most notably respiratory conditions, are exacerbated by the Fine Particulate Matter, also known as PM2.5, which is produced as a result of wildfires. PM2.5 has been linked to several thousand premature deaths each year and wildfire is one of the predominant sources. This same level of particulate matter is also created by coal power plants.

Wildfires have post-fire impacts that may contribute to the susceptibility of debris flows, mudslides, landslides, and floods in areas where fire has burned off vegetation. Roads, residential structures, and outbuildings can suffer prolonged damaging impacts from these post-fire hazards, including costly siltation of municipal water sources in areas scarred by wildfires. Large fire incidents can leave critical watersheds in need of emergency and long-term rehabilitation.

Past Occurrences

Historical Events

According to the National Interagency Fire Centers (NIFC) database[45] approximately 9,500 reported wildfires have occurred across the state since 2009. Figure 157 presents wildfires tracked by the NIFC from 1992-2020 which exceeded 100 acres.

The CSFS Colorado Forest Atlas Wildfire Risk Viewer (Public) tool also allows users to review historical wildfire events. These events are located in the "historical wildfire occurrences" Wildfire Risk Themes section of the viewer.

The Colorado Division of Fire Prevention and Control (DFPC) Historical Wildfire Information webpage presents some additional highlights on past events. These include an emphasis that all the state's 20 largest historical wildfires have occurred in the last 20 years, more than half of these occurring since 2016.

[45] https://data-nifc.opendata.arcgis.com/datasets/nifc::wildland-fire-incident-locations/explore

FIGURE 157 HISTORICAL WILDFIRE EVENTS (> 100 ACRES)

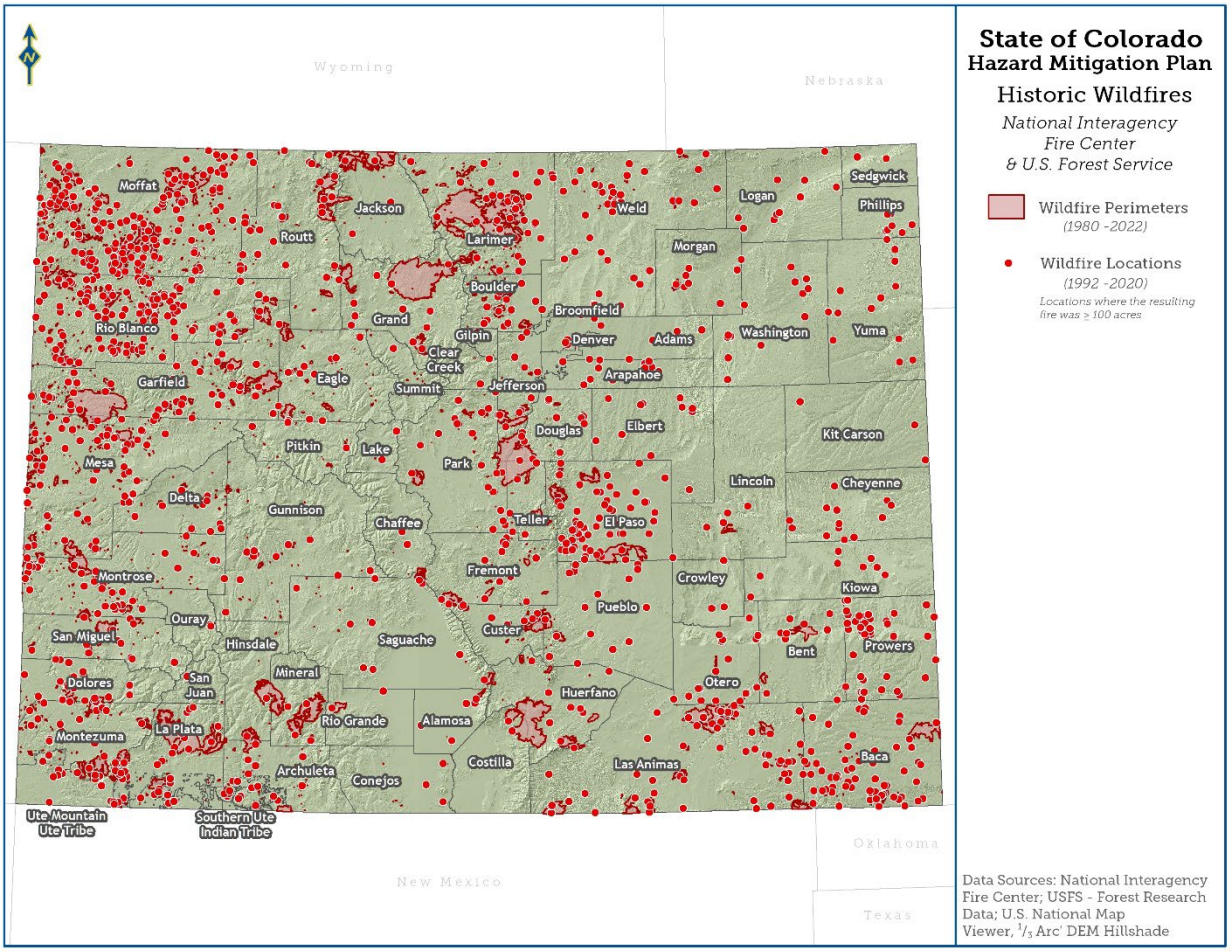


Figure 158 summarizes this data at a county and tribal area level. This shows where the higher counts of past wildfire events have occurred. In general, the most wildfires larger than 100 acres occur in the northwest corner of the state. A high number of these sized events also occur in the southeast, west central, and northern central areas.

FIGURE 158 WILDFIRE EVENT (> 100 ACRES) COUNTS BY COUNTY

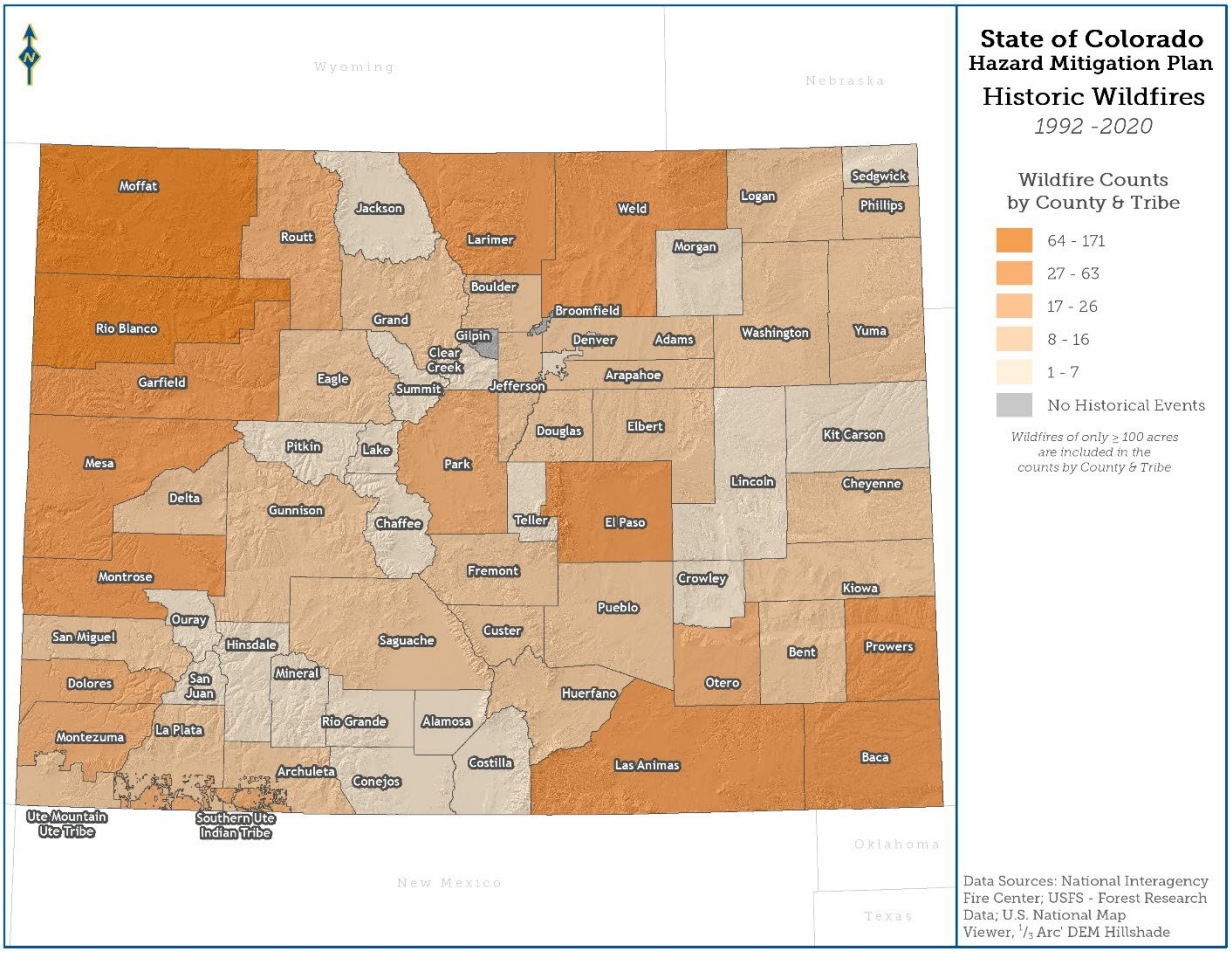
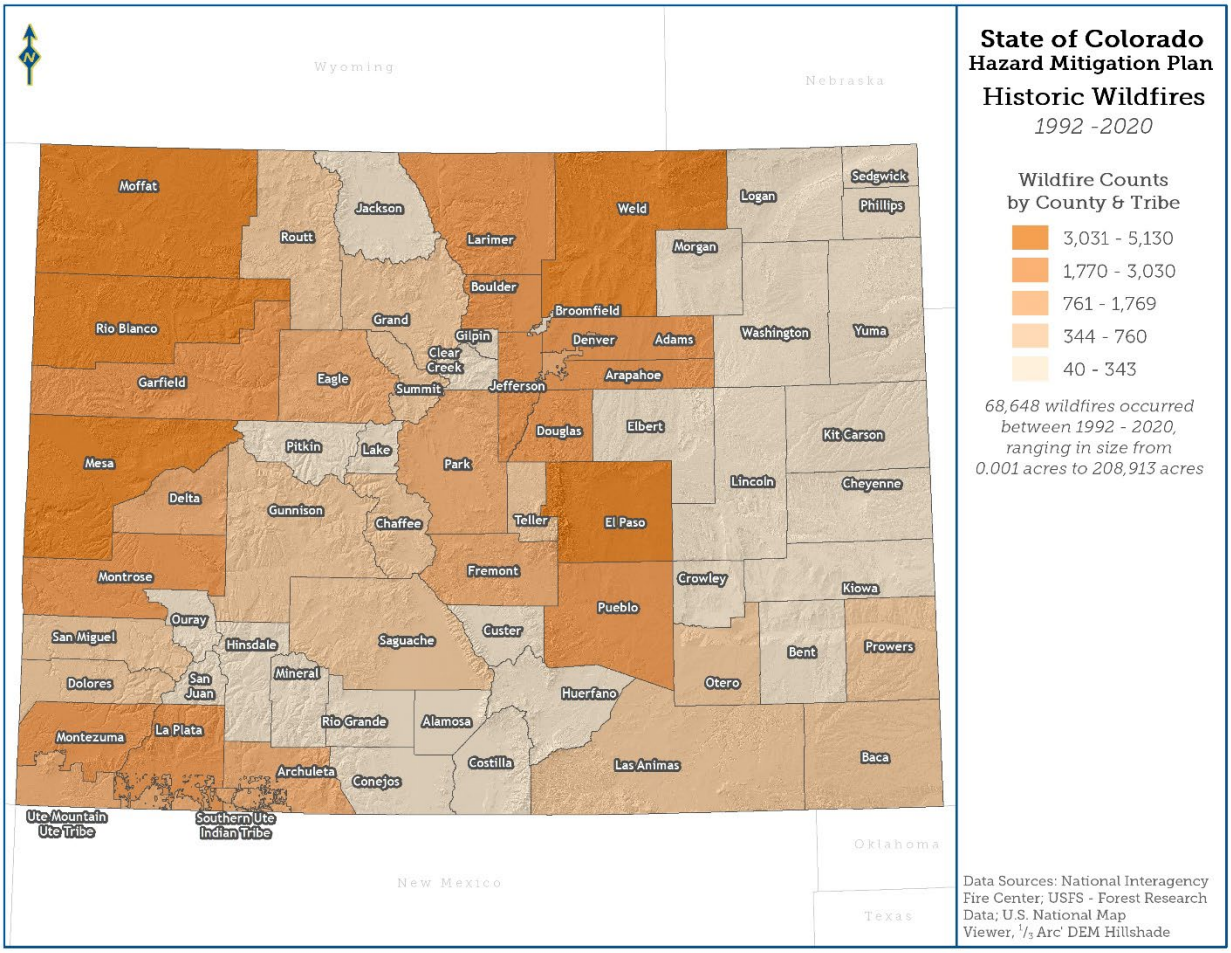


Figure 159 presents a summary of all (any sized) wildfires across counties and tribal lands. Those areas experiencing the largest number of wildfires differ slightly from the previous Figure. This shows that the southeast part of the state experiences less wildfires than most, but the wildfires that do occur burn over 100 acres.

FIGURE 159 ALL WILDFIRE EVENT COUNTS BY COUNTY



Previous Losses

Based on NIFC data, Table 61 includes the largest wildfires since 2018. Each of these events burnt over 100,000 acres and include four of the state's five largest fires in Colorado history (The 2002 Hayman Fire burnt 137,760 acres). In addition to these four, there have been 77 reported fires that burned over 1,500 acres with almost one-quarter burning over 10,000 acres since 2018.

TABLE 61 LARGEST WILDFIRES SINCE 2018

Discovery Date	Fire Name	County	Acres	Estimated Incident Cost
6/27/2018	Spring Creek	Costilla	108,045	$32,000,000
7/31/2020	Pine Gulch	Mesa	138,799	$35,000,000

Discovery Date	Fire Name	County	Acres	Estimated Incident Cost
8/13/2020	Cameron Peak	Larimer	208,726	$133,300,000
10/14/2020	East Troublesome	Grand	193,812	$15,682,681

The highest estimated incident costs from a wildfire are $200 million and $133 million for the Lightner Creek fire in La Plata County and the Cameron Peak fire in Larimer County, respectively. Data from the NIFC includes these reported estimated incident costs, which total $896,560,000 since 2014. This equates to approximately $99 million in fire incident costs across the state annually.

These figures include the costs of the fire incident itself, not necessarily the losses of structures or homes. For example, the reported incident costs for the 2021 Marshall Fire is $2.3 million. However, the fire destroyed over one thousand homes along with damaging commercial facilities, which resulted in losses of over $2 billion.

There have been 51 deaths reported as related to wildfire since 1937. Colorado prepares heavily for these types of events and has been fortunate to have the tools and teams available, especially through strong mutual aid agreements, to keep residents safe during wildfire events. Table 62 shows the details of the events in Colorado which resulted in fatality.

TABLE 62 WILDFIRE RELATED DEATHS

Year	Fire Name	County	Number of Deaths
1937	Roosevelt National Forest		1
1976	Battlement Mesa	Garfield	3
1985	Columbia		1
1986	Montrose	Montrose	4

Year	Fire Name	County	Number of Deaths
1991	Routt National Forest	Routt	1
1992	Glenwood Springs	Garfield	1
1994	South Canyon (Storm King Mountain)	Garfield	14
2001	Larkspur	Douglas	1
2002	Cuerno Verde	Custer	2
2002	Hayman	Douglas, Jefferson, Park, and Teller	5
2002	Missionary Ridge	La Plata	1
2002	Big Elk	Larimer	3
2008	Ordway	Crowley	3
2012	Waldo Canyon	El Paso	2
2012	High Park	Larimer	2
2012	Black Forest	El Paso	2
2020	East Troublesome	Boulder	2
2021	Kruger Rock	Larimer	1
2021	Marshall	Boulder	2

The highest insured wildfire losses are shown in Table 63, as reported by the Rocky Mountain Insurance Information Association. The Marshall Fire itself nearly equals the insured losses of the other top nine loss events combined (in 2022 dollars).

TABLE 63 LARGEST INSURED WILDFIRE LOSSES

Year	Fire Name	Insured Loss ($ Millions)	2022 Dollars ($ Millions)
2021	Marshall	$2 Billion	$2.1 Billion
2020	East Troublesome	$543	$603
2012	Waldo Canyon	$453.70	$568
2013	Black Forest	$420.5	$518
2010	Fourmile Canyon	$217.0	$286
2012	High Park	$113.7	$142
2020	Cameron Peak	$71	$78
2002	Hayman	$38.7	$61
2002	Missionary Ridge	$17.7	$28

Notable Events

Fires in Colorado can be notable for multiple factors including size, intensity, duration, number of structures destroyed, cost of damages, number of people displaced and injured, or deaths. Each fire is remembered by the impacted communities for different reasons. Specific details of these notable events can be found in Table 64.

TABLE 64 NOTABLE WILDFIRES

Year	Fire Name	County	Costs / Losses
1937	Roosevelt National Forest		1 death
1976	Battlement Mesa	Garfield	3 deaths, 880 acres
1985	Columbia		1 death
1986	Montrose	Montrose	4 deaths

Year	Fire Name	County	Costs / Losses
1989	Black Tiger	Boulder	$10,000,000, 44 structures, 1,778 acres
1990	Olde Stage	Boulder	10 structures, 3,000 acres
1991	Routt National Forest	Routt	1 death
1992	Glenwood Springs	Garfield	1 death
1994	Hourglass (Pingree Park)	Larimer	13 structures, $2,200,000
1994	Wake	Delta	$2,675,000, 3 structures, 4,000 acres
1994	South Canyon (Storm King Mountain)	Garfield	14 wildland firefighters died during response efforts, 2,115 acres
1996	Buffalo Creek	Jefferson	$3,835,000, 10 structures, 12,000 acres
1999	Battlement Mesa	Garfield	9 structures
2000	Bobcat	Larimer	18 structures, 10,600 acres
2000	Hi Meadow	Jefferson	51 structures, 10,800 acres
2000	Pony	Montezuma	4 structures, 5,240 acres
2001	Larkspur	Douglas	1 death
2002	Snaking	Park	2,590 acres, 2 structures
2002	Cuerno Verde	Custer	388 acres, 2 structures, 2 deaths
2002	Schoonover	Douglas	3,862 acres, 12 structures, 1 bridge, 2 injuries

Year	Fire Name	County	Costs / Losses
2002	Iron Mountain	Fremont	4,440 acres, 200+ structures, 3 injuries
2002	Coal Seam	Garfield	12,209 acres, 99 structures & 14 outbuildings
2002	Hayman	Douglas, Jefferson, Park, & Teller Counties	137,760 acres, 5 deaths, 16 injuries, 600 structures, $39 M insured losses
2002	Missionary Ridge	La Plata	70,485 acres, $17.7 M insured losses, 56 structures, 52 injuries, 1 death
2002	Million	Rio Grande	9,346 acres, 11 structures
2002	Valley	La Plata	400 acres, 6 homes
2002	Big Elk	Larimer	4,413 acres, 1 air tanker, 3 deaths
2002	Big Fish	Garfield	17,056 acres, 1 lodge, 7 cabins
2002	Long Mesa	Montezuma	2,601 acres, 3 homes
2002	Panorama	Garfield	1,700 acres, 4 homes
2003	Overland	Boulder	3,439 acres, 12 homes
2003	Cherokee	Douglas	1,200 acres, 2 homes
2004	Picnic Rock	Larimer	8,908 acres, 1 home
2007	Bear	Moffat	1,526 acres, 1 home, 2 structures

Year	Fire Name	County	Costs / Losses
2008	Ordway	Crowley	8,900 acres, 14 homes, 10 structures, 3 Deaths
2008	Nash Ranch	Park	1,115 acres, 2 structures
2009	Olde Stage	Boulder	1,300 acres, 3 homes, 2 structures
2010	Parkdale	Fremont	628 acres, 1 home, 1 structure
2010	Fourmile Canyon	Boulder	6,280 acres, 169 homes, $230 M insured losses, 5+ structures
2010	Reservoir Road	Larimer	710 acres, 2 homes, 3 structures
2012	Lower North Fork	Jefferson	4,140 23, homes, 3 deaths
2012	Waldo Canyon	El Paso	15,364 acres, 346 homes, $460 M insured losses, 2 deaths
2012	High Park	Larimer	87,250 acres, 259 homes, 2 deaths
2013	Black Forest	El Paso	14,280 acres, 498 homes, 2 deaths
2013	Royal Gorge	Fremont	3,218 acres, 48 of 52 park structures
2016	Cold Springs	Boulder	528 acres, 8 homes
2016	Junkins	Custer & Pueblo	18,403 acres, 9 homes
2018	Spring Creek	Costilla & Huerfano	108,045 acres, 141 homes

Year	Fire Name	County	Costs / Losses
2020	Pine Gulch	Mesa	138,799 acres
2020	Cameron Peak	Larimer	208,726 acres, 469 structures (including 220 outbuildings and 42 primary residences)
2020	East Troublesome	Grand	193,812 acres, 366 homes, 555 structures
2021	Kruger Rock	Larimer	1 death
2021	Marshall	Boulder	2 deaths, 1,084 homes, $2 B insured losses

Probability

Wildfire is an annual occurrence in Colorado (100% chance) and it is expected that extreme events may become more common. Longer fire seasons and more uncharacteristic wildfires are also anticipated, according to the CSFS 2020 Colorado Forest Action Plan[46].

Uncharacteristic wildland fire is an increase in wildfire size, severity, and resistance to control, as compared to that which occurred historically, in addition to occurrences in unexpected areas.

The CSFS Colorado Forest Atlas Wildfire Risk Viewer (Public) tool allows users to see an area's specific risk. One category of risk is termed "burn probability" (located in Wildfire Risk Themes section of the viewer), which is the annual probability of any location burning due to a wildfire.

[46] CSFS 2020 Colorado Forest Action Plan

Climate Change Impacts

Climate change has impacted the hazard of wildfire in Colorado. Table 65 details the impacts from climate change on location, extent/intensity, frequency, and duration. The effects of climate change make the state increasingly susceptible to large-scale fires, occurring more often, that threaten human lives, communities, power lines, roads, domestic water supplies, wildlife habitat, and other important resources.

TABLE 65 CLIMATE CHANGE IMPACTS

Impact	Projected Change
Location	Areas at risk to wildfires in Colorado include forested areas, grasslands on the eastern plains, and the wildland-urban interface. The area at risk to wildfires is likely to expand into higher elevation forests, with increasing temperatures and evaporative demand in the warm season.
Extent/Intensity	Wildfire intensity is projected to increase due to additional dry vegetation that can fuel wildfires. Extent is projected to increase. Total area burned per year is projected to increase substantially into the 21st century in the Rocky Mountain West, including Colorado.
Frequency	Droughts are projected to occur more frequently, increasing the frequency of wildfires.
Duration	The length of the fire season in Colorado is projected to increase by several weeks. Long-duration wildfires are expected to increase in frequency.

Future Costs

The Future Avoided Cost Explorer (FACE) tool was developed by the state to understand the economic impacts of flood, drought, and wildfire looking forward to 2050. It estimates the expected cost impacts of these three hazards on a selection of economic sectors, under future climate and population scenarios. These costs are

expressed in expected annual damages, which are a function of the hazard magnitude, probability, and exposed assets.

For modeling wildfire scenarios two economic sectors were analyzed, buildings and suppression. Damages are conceptually represented as the intersection of wildfire hazard (burn probability and intensity) and asset vulnerability (building replacement costs). The cost of suppression, which is the amount the state spends to fight and extinguish ongoing fires, was also modeled.

Figure 160 presents the state's estimated expected annual damages from wildfire, based on climate and population change scenarios. These scenarios show that high population growth (with current climate conditions) would nearly double the expected annual damages. Conversely, severe climate change (with the state's current population) increases expected annual damages by roughly 60%.

FIGURE 160 WILDFIRE EXPECTED ANNUAL DAMAGES BY POPULATION AND CLIMATE CHANGE SCENARIO

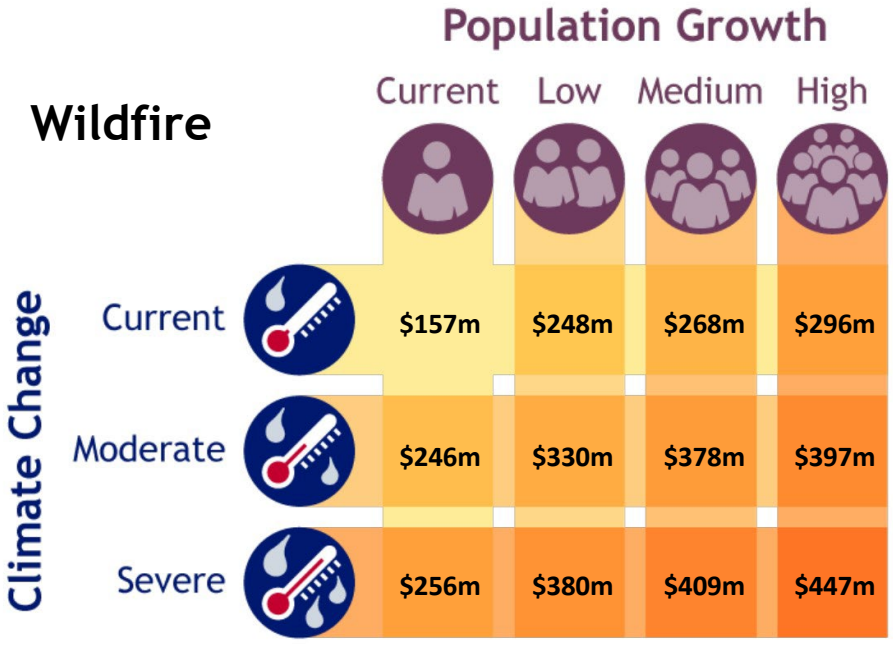


Figure 161 and Figure 162 present this same information, broken down for the buildings and bridges sectors, respectively.

FIGURE 161 WILDFIRE EXPECTED ANNUAL BUILDING DAMAGES

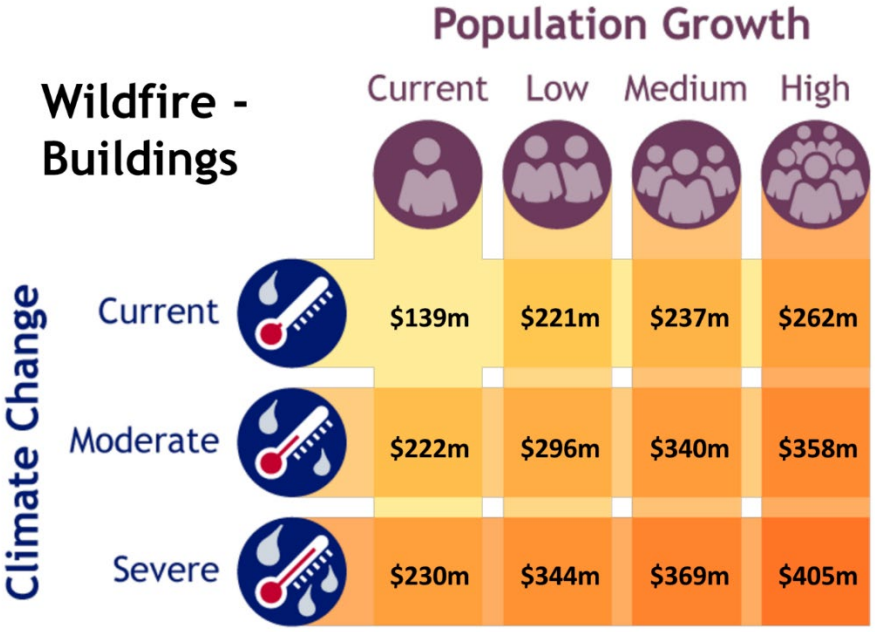
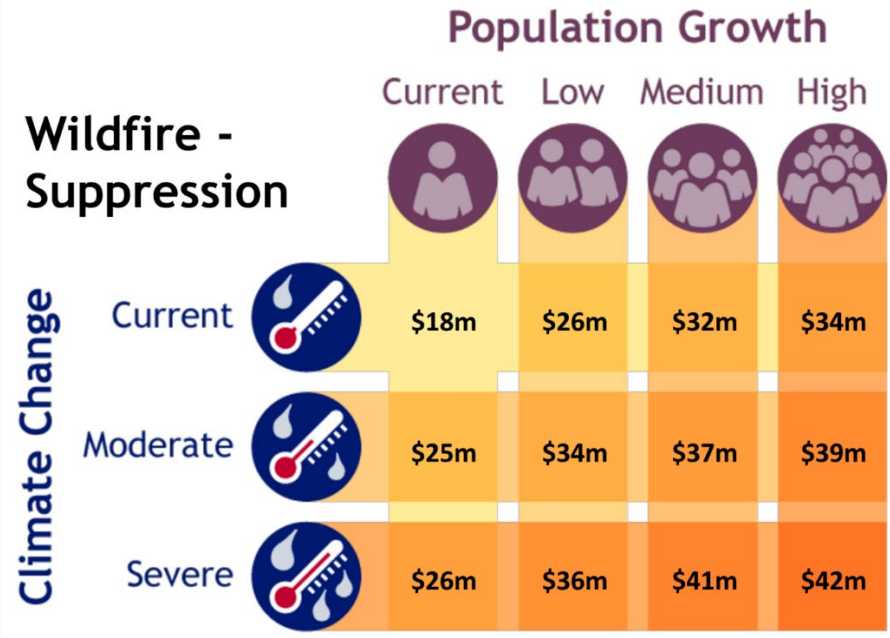


FIGURE 162 WILDFIRE EXPECTED ANNUAL SUPPRESSION COSTS



Risk & Vulnerability

Populations at Risk

All populations living within wildfire risk areas can potentially be impacted. Populations with low-income, no transportation, chronic health conditions, children and the elderly, and those with language and technology barriers are some of the populations that are likely to be the most negatively affected due to a wildfire event.

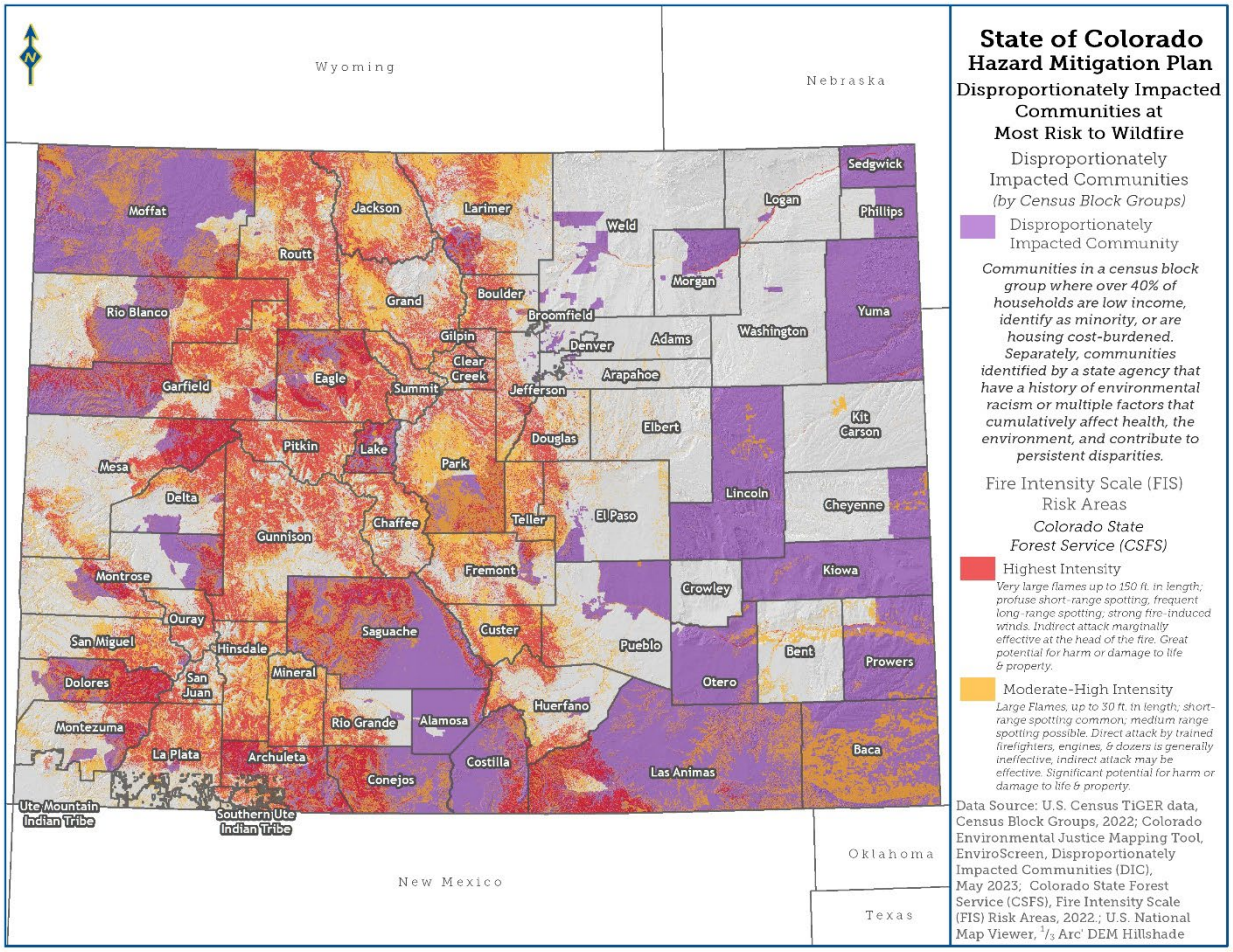
The ability to safely evacuate is an important factor in determining wildfire risk. There are many communities in the state with only one road in (ingress) and out (egress) which can result in dangerous evacuation and response conditions. In some cases, this leaves residents unable to drive out of the community and exposed to approaching wildfire.

The state government does not have sufficient information on the extent and conditions around this problem and is attempting to scope this critical issue. As part of the E-SHMP update, a mapping tool survey was sent to all county emergency managers providing the opportunity to identify areas of concern for ingress and egress in their communities. Responses were received from nine counties with input including a combination of points and polygon areas. This is an ongoing effort across the state to identify populations with increased wildfire risk due to lack of safe evacuation routes.

The CSFS Colorado Forest Atlas Wildfire Risk Viewer (Public) tool allows users to see an area's evacuation potential utilizing the "ingress / egress with social vulnerability" (located in the Community Characteristics section of the viewer).

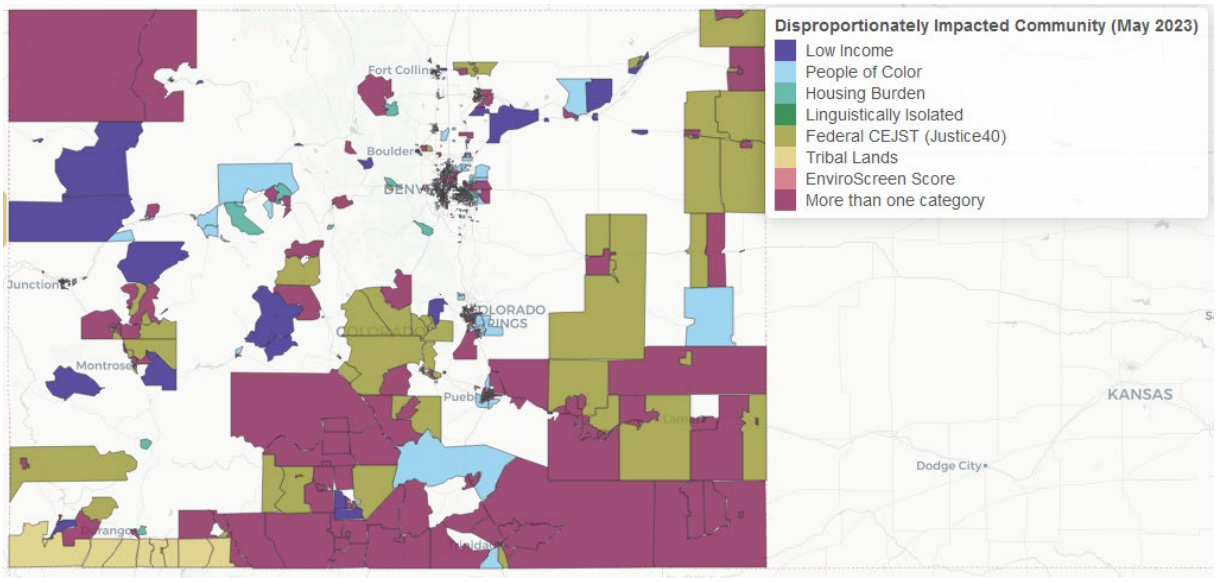
The State of Colorado recently defined what it terms "disproportionately impacted communities" (DIC). Figure 163 identifies those DIC communities, at a Census Block Group level, that have moderate-high and high wildfire intensity.

FIGURE 163 DISPROPORTIONATELY IMPACTED COMMUNITIES AT RISK



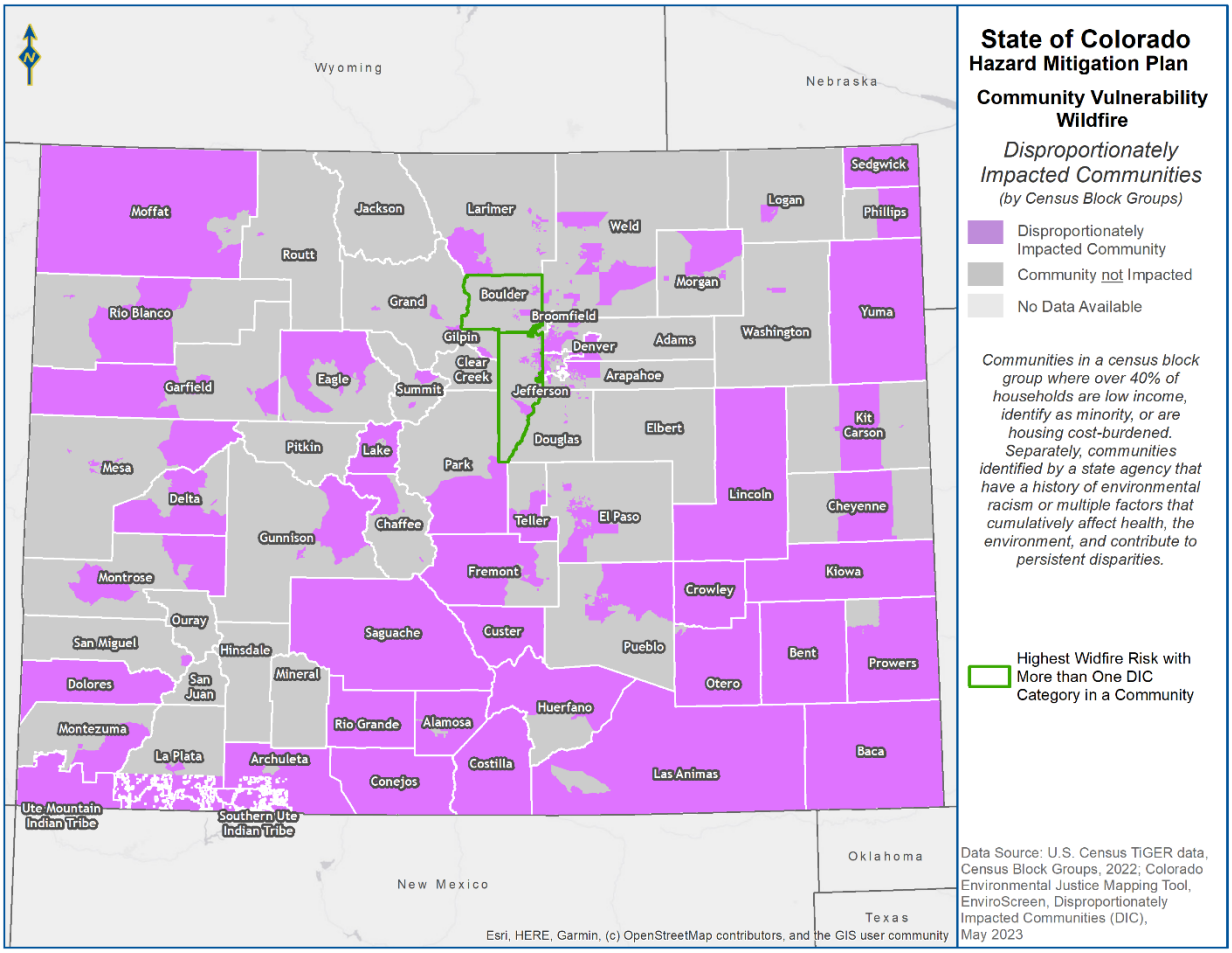
Further assessments utilizing the statewide DIC dataset permitted the identification of those communities experiencing multiple disproportionate impacts. These communities identified as “more than one category” are the most vulnerable across the state, as shown in Figure 164. When comparing these communities to those counties with the highest percentage of high hazard WUI areas (Figure 154), Boulder and Jefferson County each contain Census Block Groups that are the most vulnerable in Colorado.

FIGURE 164 DISPROPORTIONATELY IMPACTED COMMUNITIES



The disproportionately impacted communities in these counties at a higher risk to wildfire include: low income, housing burdened, people of color, EnviroScreen identified, and Climate and Economic Justice Screening Tool (CEJST) identified. Figure 165 highlights these counties. These counties have the following statewide cumulative SVI scores assessing their vulnerability: “Low-Medium” (Boulder), and “Low” (Jefferson).

FIGURE 165 COMMUNITY VULNERABILITY



State Assets

Previous Losses

Since 2008, there have been 20 property losses reported on state assets due to wildfire, resulting in over $2.5 million in losses. Reported property damage includes damage to property signs, fences, irrigation wells, and wood posts. The largest reported expense, close to $1 million, was a result of the Marshall Fire destroying outdoor landscaping. The next highest loss was $577,660 due to a lightning strike-caused wildfire that damaged Colorado Parks and Wildlife property in Yuma County.

Exposure

Communication towers are the most vulnerable state asset type exposed to wildfire hazard. Specific towers include the La Veta Pass tower site (Costilla and Huerfano

Counties), Denver DTB transmitter site (Denver, Jefferson, Arapahoe, Douglas, and Boulder Counties), and the Grand Junction SOB (Mesa, Garfield, Pitkin, Eagle, Rio Blanco, and Routt Counties). The largest potential impacts resulting from an event includes limited, or no first responder communications in the coverage area.

State-owned dams are another highly vulnerable state asset type. Of the 22 in total, 21 (all except Garnet Mesa) are identified as being located in moderate-high and highest intensity wildfire burn areas.

State assets are exposed to wildfires across the state, as seen in Figure 166, which shows the count of structures exposed to areas modeled to have the moderate-high or highest fire intensity statewide. Counties with the highest exposure by structure count are scattered over all parts of the state.

FIGURE 166 STATE ASSET BUILDINGS EXPOSED TO MODERATE-HIGH / HIGHEST FIRE INTENSITY

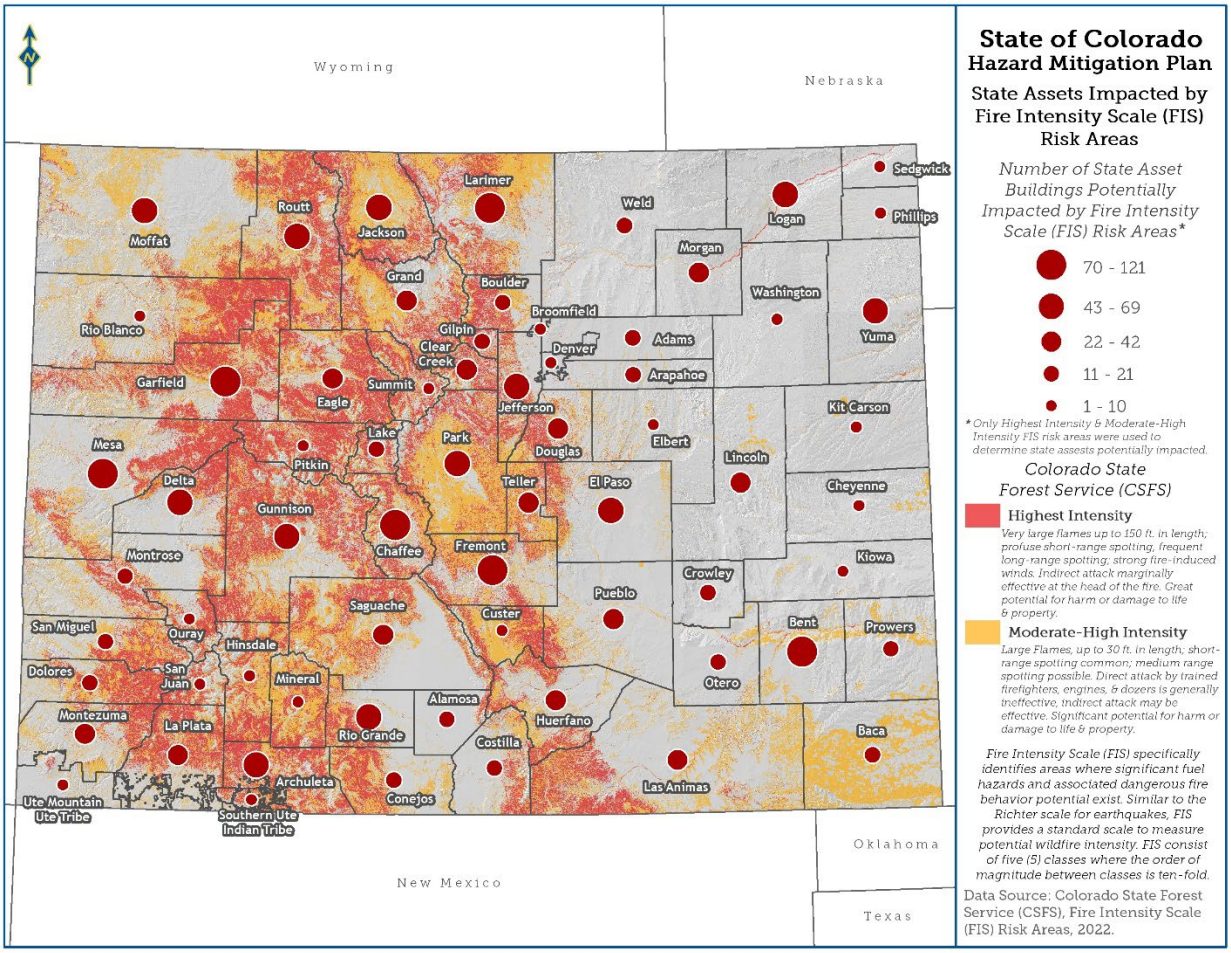
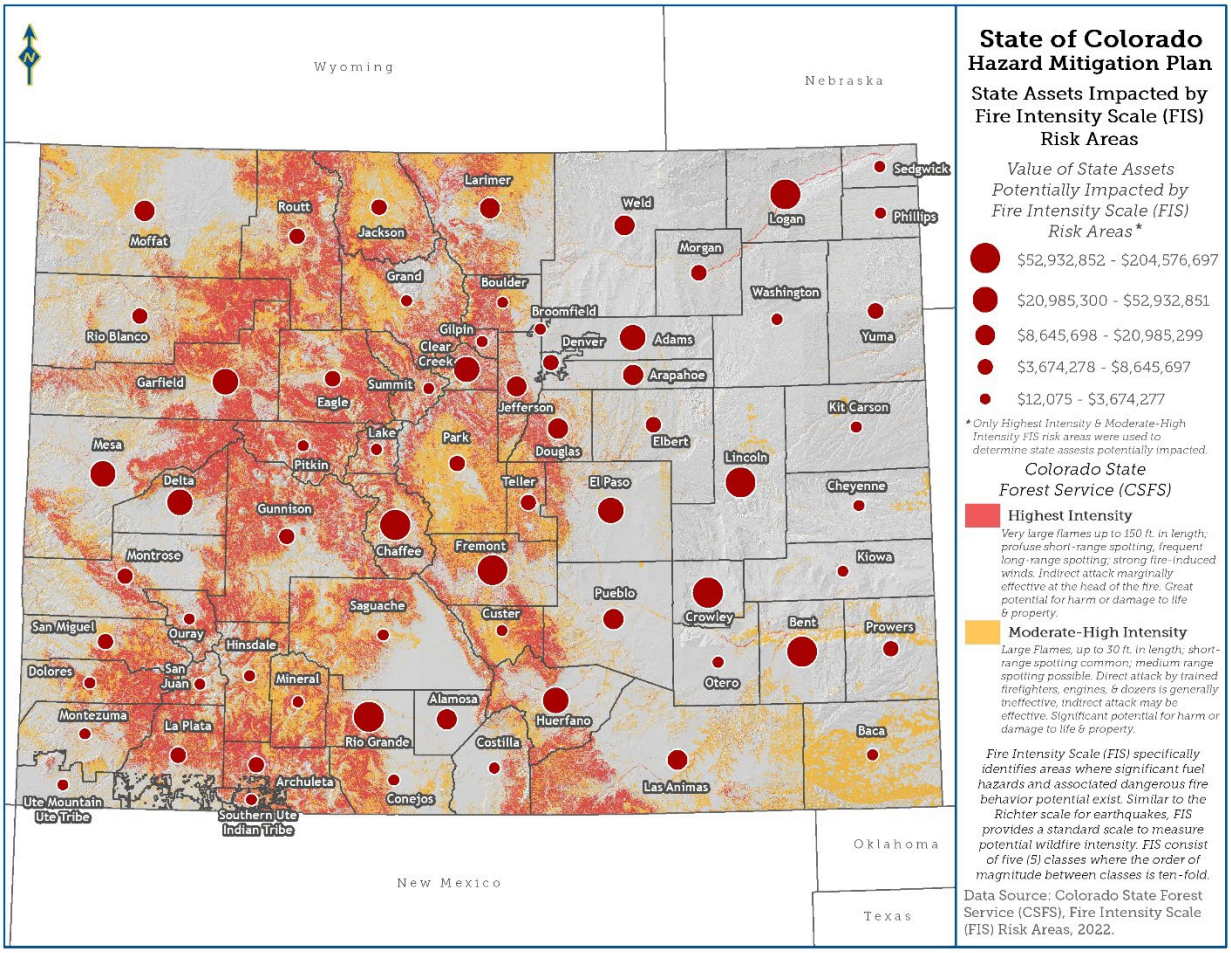


Figure 167 similarly illustrates that the exposed asset values are also spread across much of the state.

FIGURE 167 VALUES OF STATE ASSET BUILDINGS EXPOSED TO HIGH/HIGHEST FIRE INTENSITY



Lifelines

All community lifelines across Colorado are vulnerable to the impacts from wildfire events. All sectors could be affected, straining resources, and potentially having long-term effects on recovery and resilience.

Wildfire	Communications	Energy (Power & Fuel)	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation

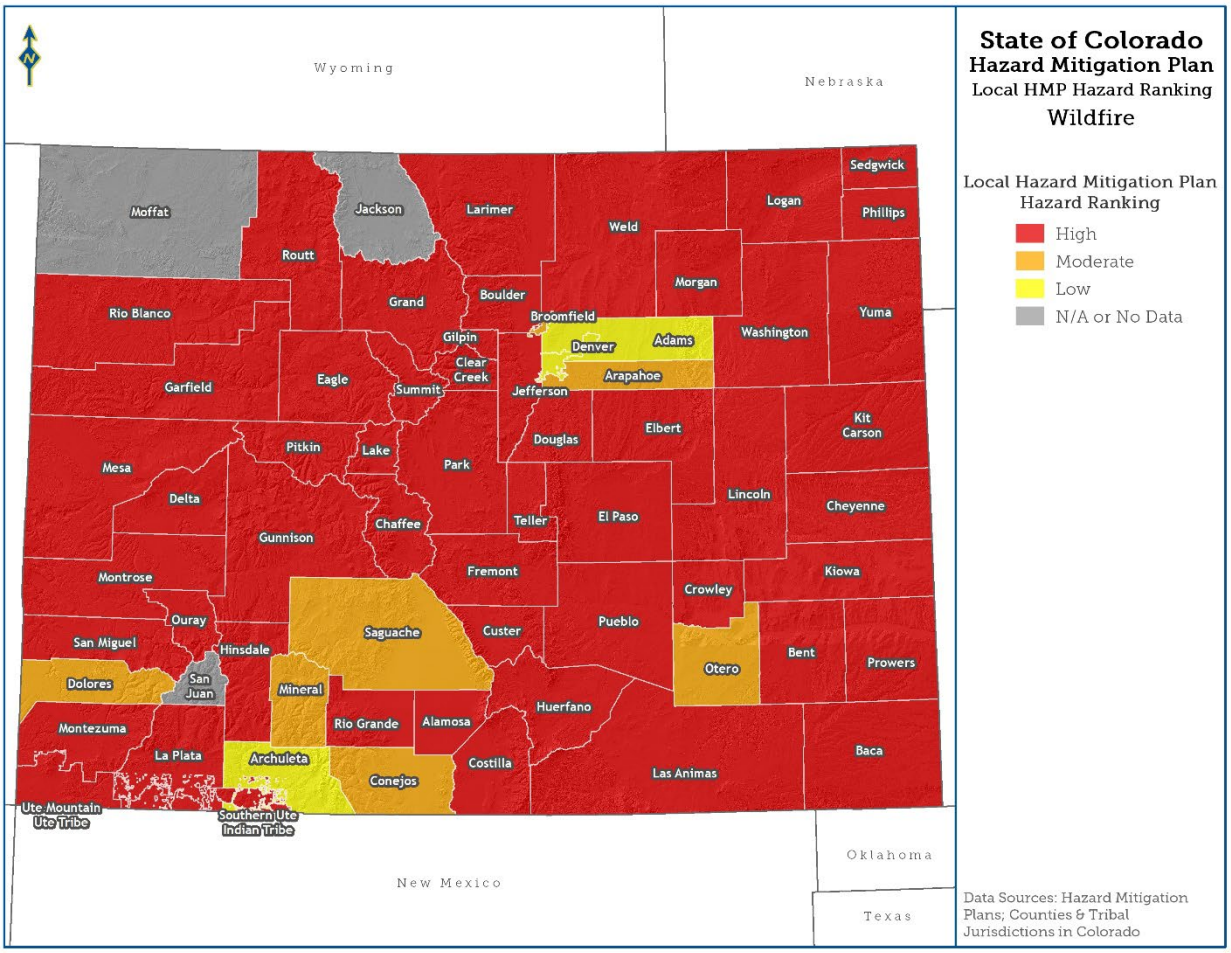
Local County / Tribe

Hazard Rankings

Figure 168 shows the local hazard risk rankings for wildfire. Approximately three-quarters of local hazard mitigation plans ranked the risk of wildfire as high. There is

potential for some of the medium and low risk rankings to be increased as plans are updated with more and larger fires occurring closer to developed areas. This is related to Boulder County's Marshall Fire, which destroyed over 1,000 homes in December 2021 and illustrated the wide reach a wildfire could have and that the WUI has a broader definition than previously thought by many.

FIGURE 168 LOCAL HAZARD RISK RANKING

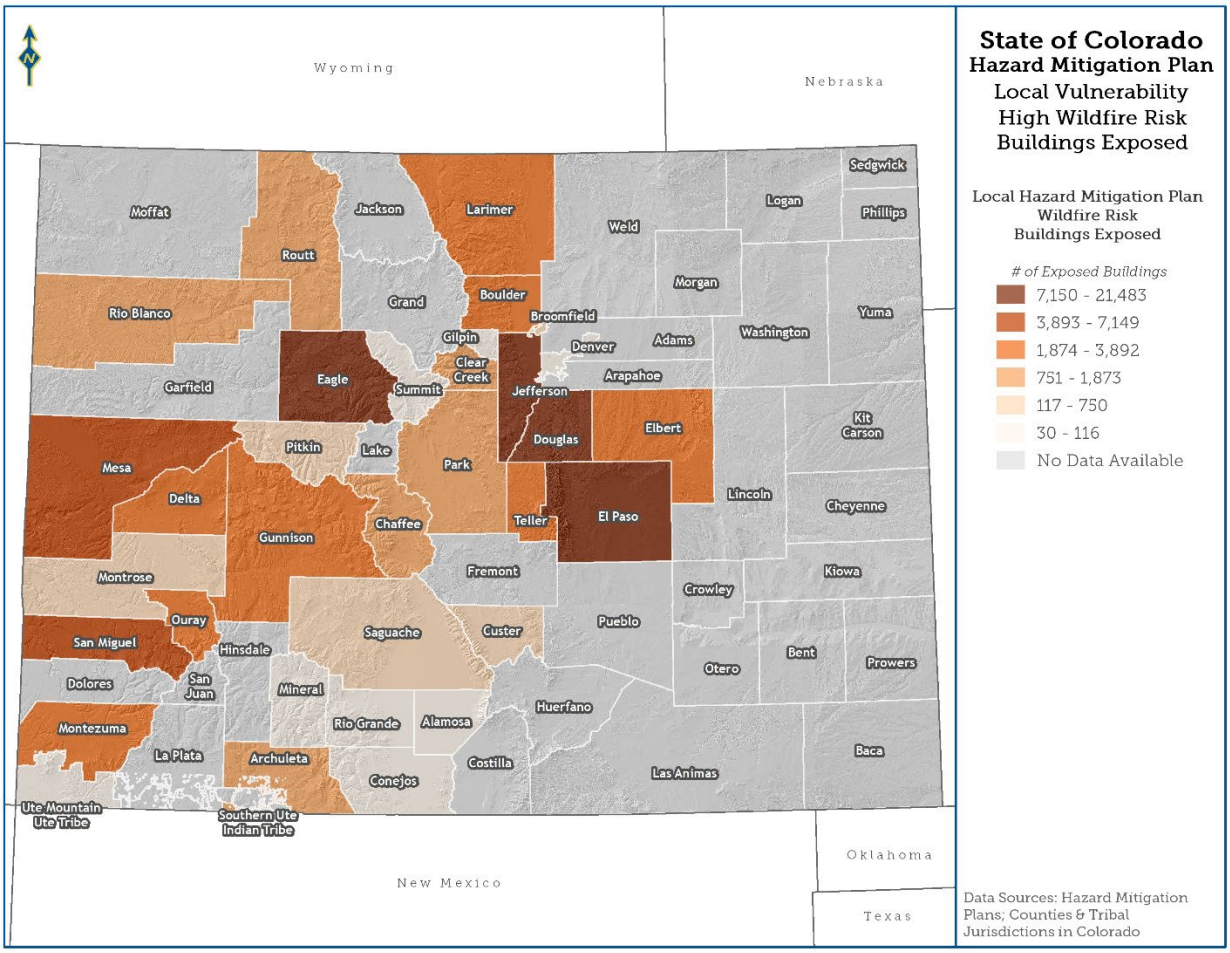


Exposure

The range of buildings exposed to areas with a high risk of wildfire are shown by county and tribal area in Figure 169. The counties with the most exposed buildings are located from the Front Range to the western border, with varied counts throughout. The highest range of exposed buildings are found in Teller, Jefferson,

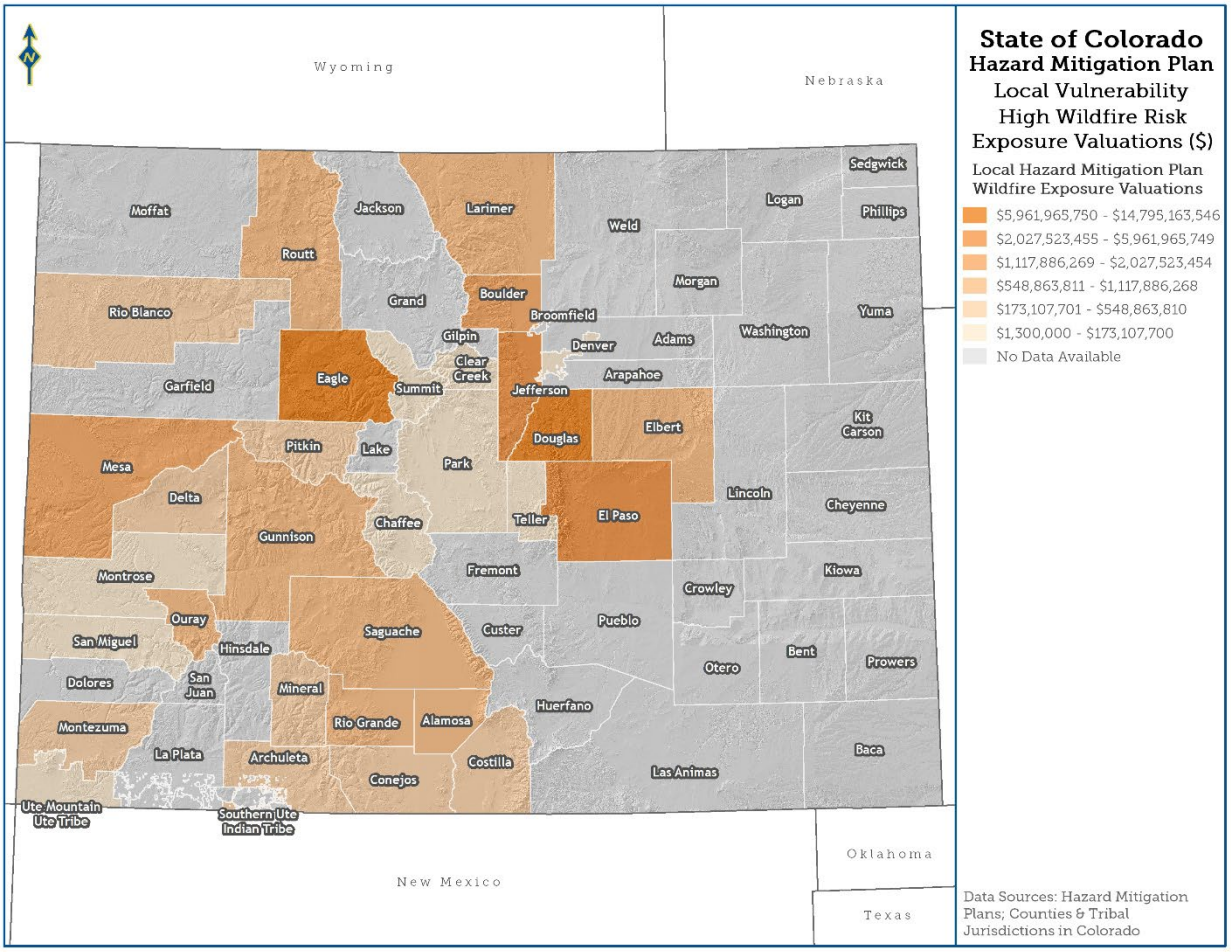
Douglas, and El Paso counties. Mesa and San Miguel in the west have the next highest exposure across the state.

FIGURE 169 LOCAL BUILDING COUNT EXPOSED TO HIGH WILDFIRE RISK AREAS



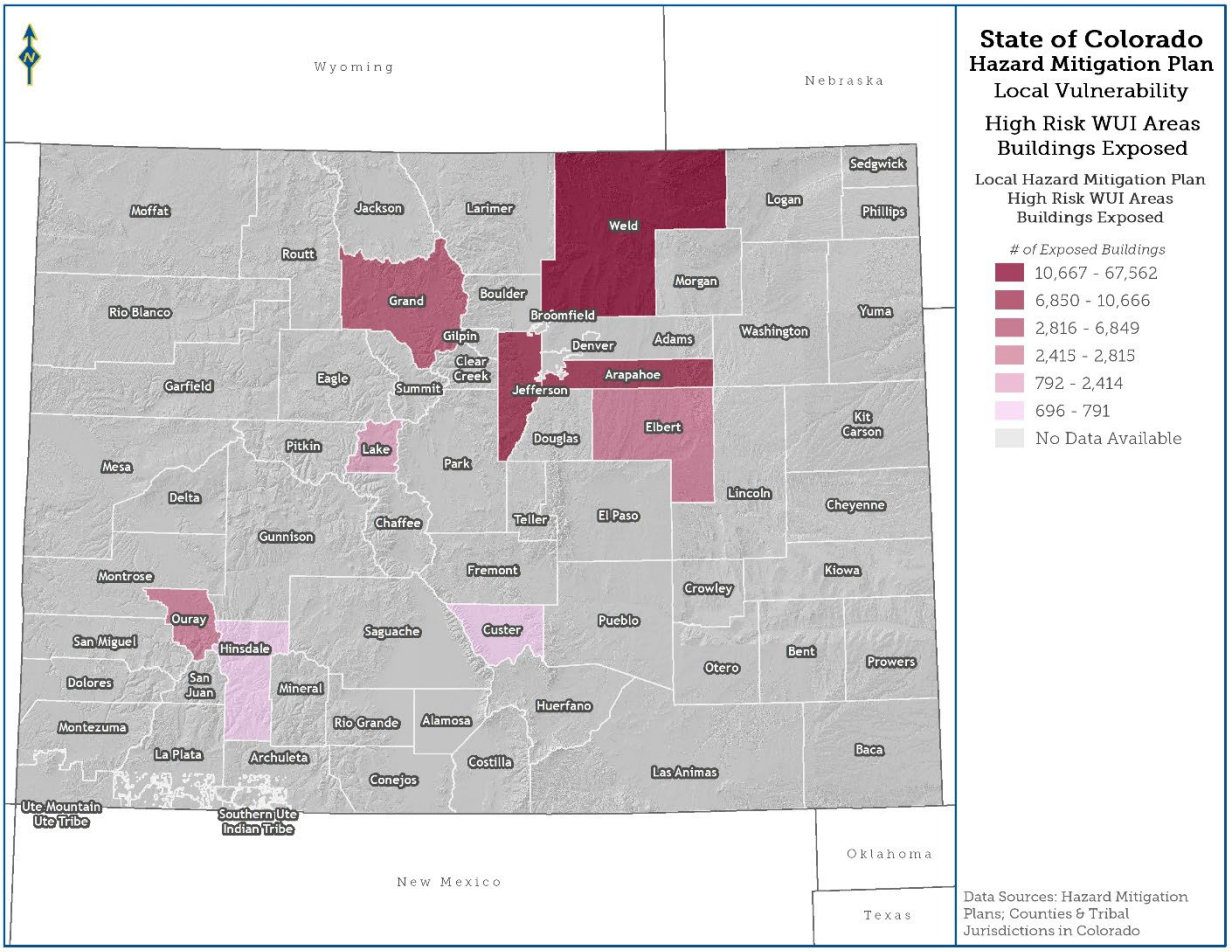
The highest value for buildings exposed to areas at risk of wildfire are closely aligned with the counties with the highest building counts, as seen in Figure 170.

FIGURE 170 LOCAL VALUE OF BUILDINGS EXPOSED TO HIGH WILDFIRE RISK AREAS



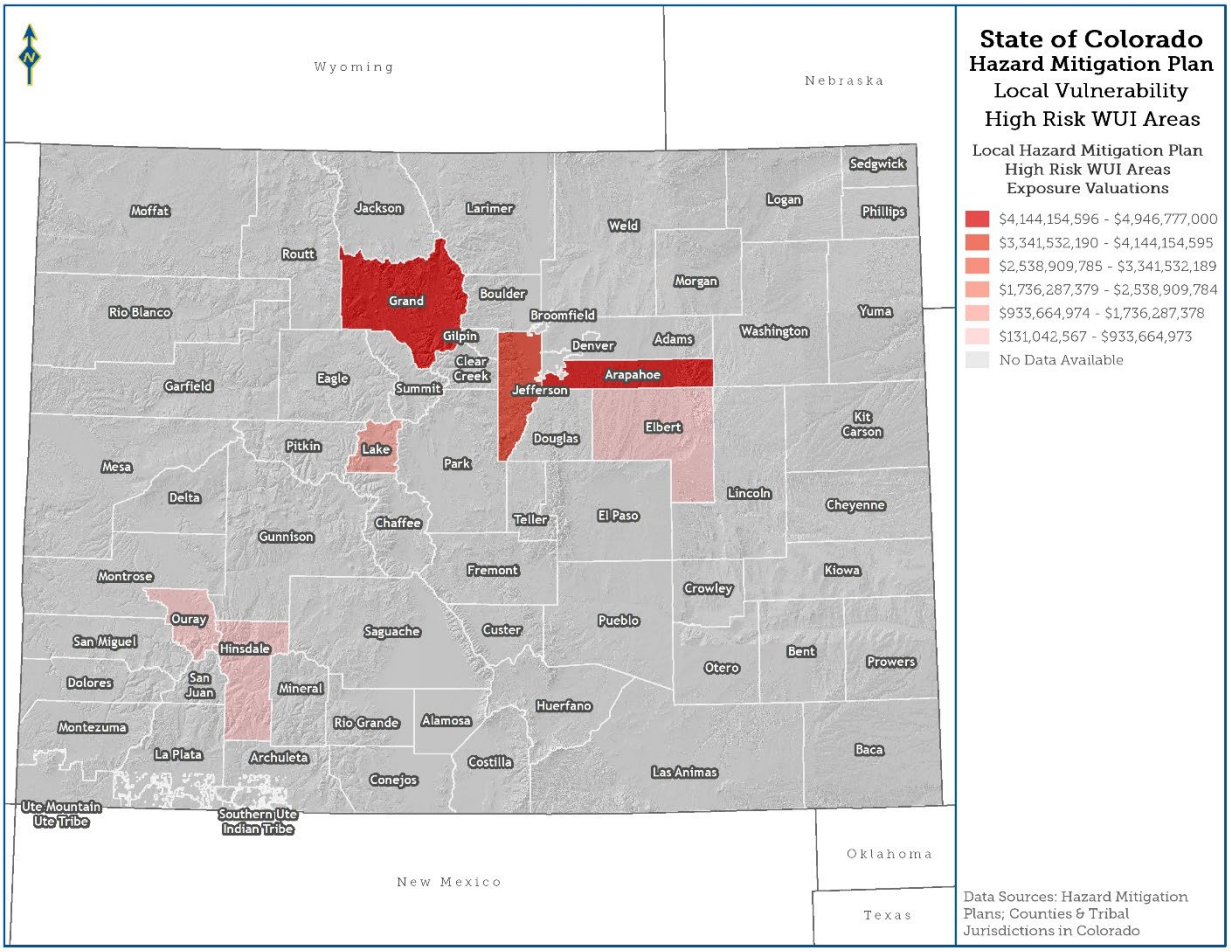
Building exposure in the WUI, shown in Figure 171, is not commonly profiled in local hazard mitigation plans. Of those counties with figures, Weld County holds the highest counts while Custer and Hinsdale hold the lowest.

FIGURE 171 LOCAL BUILDING COUNT EXPOSED TO HIGH RISK WUI AREAS



In Figure 172, values of the buildings exposed to WUI areas range from $131 million to $4.9 billion. Grand and Arapahoe counties fall within the highest value range. The lowest exposure values are found in Elbert, Ouray, and Hinsdale with values below $933 million.

FIGURE 172 LOCAL VALUE OF BUILDINGS EXPOSED TO HIGH RISK WUI AREAS



Interconnected Hazards

Hazards that cause or contribute to wildfire are drought, extreme heat, severe wind, and thunderstorm / lightning. Wildfire can cause or worsen erosion / deposition, flood, and landslide / debris flow / rockfall.

Recent and Future Development

Colorado State University (CSU) researchers estimate that by the year 2030, the size of Colorado's WUI will have increased to 720,000 homes (from an estimated 313,000 in 2010). Based on projections, the areas at greatest risk of wildfires are correlated with continuing population growth.

In review of local HMPs, the following information was provided regarding recent development. This information was taken from those counties experiencing the most relative growth (%) from 2010-2021, as detailed in the Risk Assessment Overview.

- During the past few decades, population growth in the Weld County WUI has increased greatly. Subdivisions and other high-density developments have created a situation where wildland fires can involve more buildings than any amount of fire equipment can possibly protect.

- The high potential for wildfire is fairly uniform across the planning area. Residential and commercial properties are concentrated along the U.S. 160 and 550 corridors and in valleys along the county's many rivers and creeks. The county's landscapes and recreation opportunities consistently attract newcomers and much of the recent growth has resulted in home building in vegetation which, in most parts of this county, is at high risk for catastrophic wildfire.

- La Plata County continues to see an increase in dispersed residential suburbs being built in the WUI. This rising number of people in the WUI as well as the projected population increase will greatly increase the risk of wildfire in these areas. In recent years, the risk of wildfires has increased throughout the County due to significant development in forested areas along with the buildup of tree densities and underbrush in most forests.

- The City and County of Broomfield has experienced rapid growth for the past ten years as people move to the Denver Metropolitan area. Much of this growth has occurred in the WUI, where developing lands are adjacent to undeveloped land. While the risk of wildfire on undeveloped land is generally understood, much of the adjacent developing land is equally at risk. As development in WUI areas continues to increase, the risk to lives, property, and resources correspondingly increases.

- During the past few decades, population growth in the Larimer County WUI has increased greatly. Subdivisions and other high-density developments have created a situation where wildland fires can involve more buildings than any amount of fire equipment can possibly protect.
- According the 2020 CWPP, 135 subdivision filings have been added to Chaffee County, including 12 with more than 10 lots. In addition, 227 filings are in the CWPP's top two Treatment Priority Areas.
- Across Routt County forest growth, housing developments, drought, and insect epidemics have contributed to the ever-increasing risk of a catastrophic wildfire event.
- Much of the development in the County is located in the lower elevation zones of sagebrush, Gambel oak, and pinyon-juniper woodlands. The development of homes and other structures is encroaching into the forest wildland and natural areas and is expanding the Wildland-Urban Interface. Specific areas of concern identified in the Community Wildfire Protection Plan (CWPP) included Missouri Heights, Spring Valley, Puma Paw, and Four- Mile Corridor.

In review of local HMPs, the following information was provided regarding future development. This information was taken from those counties projected to experience the most relative growth (%) through 2050, as detailed in the Risk Assessment Overview.

- As development in Weld County expands into wildland areas, people and property are increasingly at risk.
- The continued migration of residents to remote areas of Routt County increases the probability of human-caused ignitions from vehicles, grills, campfires, and electrical devices.

- The potential for wildfire-caused damage to structures in Eagle County is increasing as wildland fuels accumulate and greater numbers of people choose to build homes in wildfire-prone areas. As climate warming leads to longer, more intense periods of drought, the risks and impacts of wildfires are expected to grow.

- People living in or near wildland settings in Garfield County are vulnerable to the threat of wildfire. The development of homes and other structures is encroaching into the forest wildland and natural areas and is expanding the Wildland-Urban Interface.

- Many areas in Mesa County now have an increased wildfire threat in areas where fire was not a problem in the past. This is due to a combination of irrigation and the introduction of nonnative plants.

- Wildfire continues to be a significant threat to the county and its residents. Growth pressures, increasing cost of living and the desire to live in forested areas are continuing growth in WUI in eastern San Miguel County. In the West End, limited application of building codes and resulting lack of insurance puts new housing at higher risk. In the East End, some homeowner's association covenants do not allow for the creation of defensible space.

- La Plata County continues to see an increase in dispersed residential suburbs being built in the WUI. This rising number of people in the WUI as well as the projected population increase will greatly increase the risk of wildfire in these areas.

- Future growth into interface areas and changing climatic conditions could increase wildfire risk. The FACE tool predicts $7.5 million in future annual losses in Archuleta County in high population growth/severe climate conditions. Additional development in many current subdivisions will increase exposure to High Wildfire Risk Areas.

Consequence Analysis

TABLE 66 - EMAP IMPACT SUMMARY

Consideration	Description
Public	Deaths and injuries have occurred in past events. Staff, recreationists, campers, property owners in remote areas or the wildland urban interface areas, and persons with breathing difficulties may all be impacted. Secondary impacts may negatively affect water quality and downstream water users.
Responders	Exposure exists to response personnel performing routine duties when an event occurs; fire event-related duties may cause significant danger to response personnel including evacuation, suppression, law enforcement, and damage assessment.
Continuity of Operations (Govt. & Services)	Potential loss of facilities, infrastructure function or accessibility, or ability to provide services. Power interruption is likely if not adequately equipped with backup generation. Potential decrease in property tax collection by local government and special districts due to loss of structure or land value may impact service provision.
Property, Facilities, & Infrastructure	Buildings, landscaping, vehicles, signage, and/or any unsecured property may be affected during an event. Property may be destroyed, have significant structural damage, or be affected by smoke. State historical, recreational, natural, and wildlife properties/facilities are at risk. Buildings, equipment, vehicles, and communications and utility infrastructure are exposed and lost to wildfires every year in Colorado.

Consideration	Description
Environment	Significant impact related to loss of forest or grasslands, impacts to water quality, erosion, and sedimentation may affect critical infrastructure and natural waterways. Loss of ground vegetation may encourage debris flows, landslides, mudslides, or other geologic movement of land. Dead or damaged trees are at risk of falling.
Economic	Potential loss of facilities or infrastructure function or accessibility and uninsured damages. Potential impact to tourism and land development activities depending on severity of the fire season and location of events. Depending on the nature of the fire occurrence area, many home-based businesses will be impacted by evacuation, lack of utility service, or through destruction of property.
Public Confidence in Govt.	Public holds high expectations of government capabilities for warning, public information, and response and recovery activities related to wildfires. Recent and past events indicated a high expectation from evacuees for the provision of real-time property-level damage assessments (e.g., what properties are confirmed destroyed, damaged, or unaffected).

Wildlife-Vehicle Collision - Low Risk

Definition

Wildlife-Vehicle Collisions (WVCs) occur thousands of times each year in Colorado. Affected species include bear, beaver, bighorn sheep, bobcat, cow, coyote, deer, dog, elk, fox, moose, pronghorn, raccoon, and skunk. Most reported WVCs involve deer and elk although bears are also often involved. These incidents are common and extremely costly to life safety and property.

Location

WVCs can happen nearly anywhere in Colorado, but Colorado Parks and Wildlife (CPW) cautions drivers to be especially wary when driving through the following areas: Interstate 70 (Floyd Hill, Mt. Vernon, and Eagle), Highway 285 (Morrison), Highway 160 (Durango to Pagosa Springs and Durango to Mancos), Highway 550 (north of Durango and from Montrose to Ouray), Interstate 25 (Castle Rock to Larkspur), Highway 82 (Glenwood Springs to Aspen), Highway 36 (Boulder to Lyons), and Highway 93 (Golden to Boulder).

Contributing Factors

Motorists across Colorado regularly face the potential for vehicle collisions with wildlife. Individual WVCs typically only directly impact a small geographic area and only a few people at once. Collisions can lead to serious injury or death and can cause extensive vehicle damage. A larger area and number of people may be indirectly impacted by traffic jams caused by WVCs.

Additional factors for motorists include driving speed, visibility, time of day, road conditions, and familiarity with Colorado animal behavior and movement patterns.

Several federal, state, and local agencies have been working with communities to reduce losses from WVCs over several decades. This has included fencing and an increase in construction of wildlife crossings. These crossings are overpasses or underpasses for animals to bypass transportation corridors safely.

Past Occurrences

Historical Events

With any historical data the information is only as accurate as the best available data and WVC may be underreported for multiple reasons. Often WVC is most associated with large animal wildlife collisions, such as deer, antelope, and elk, however CDOT data is far more extensive including a wide variety of animals.

Lighter sections on the mapped routes, in Figure 173,indicate a larger number of reported collisions. This aligns with the more traveled transportation corridors including Interstates, State Routes, and areas with larger wildlife populations, especially near hunting and recreation areas.

The eastern portion of the state, while still significant, sees lower numbers of collisions along most routes throughout the region overall. The larger transportation corridors show extensive numbers of collisions across the state and the western portion shows a web of routes with immense numbers of collisions.

FIGURE 173 HISTORICAL WILDLIFE VEHICLE COLLISION EVENTS

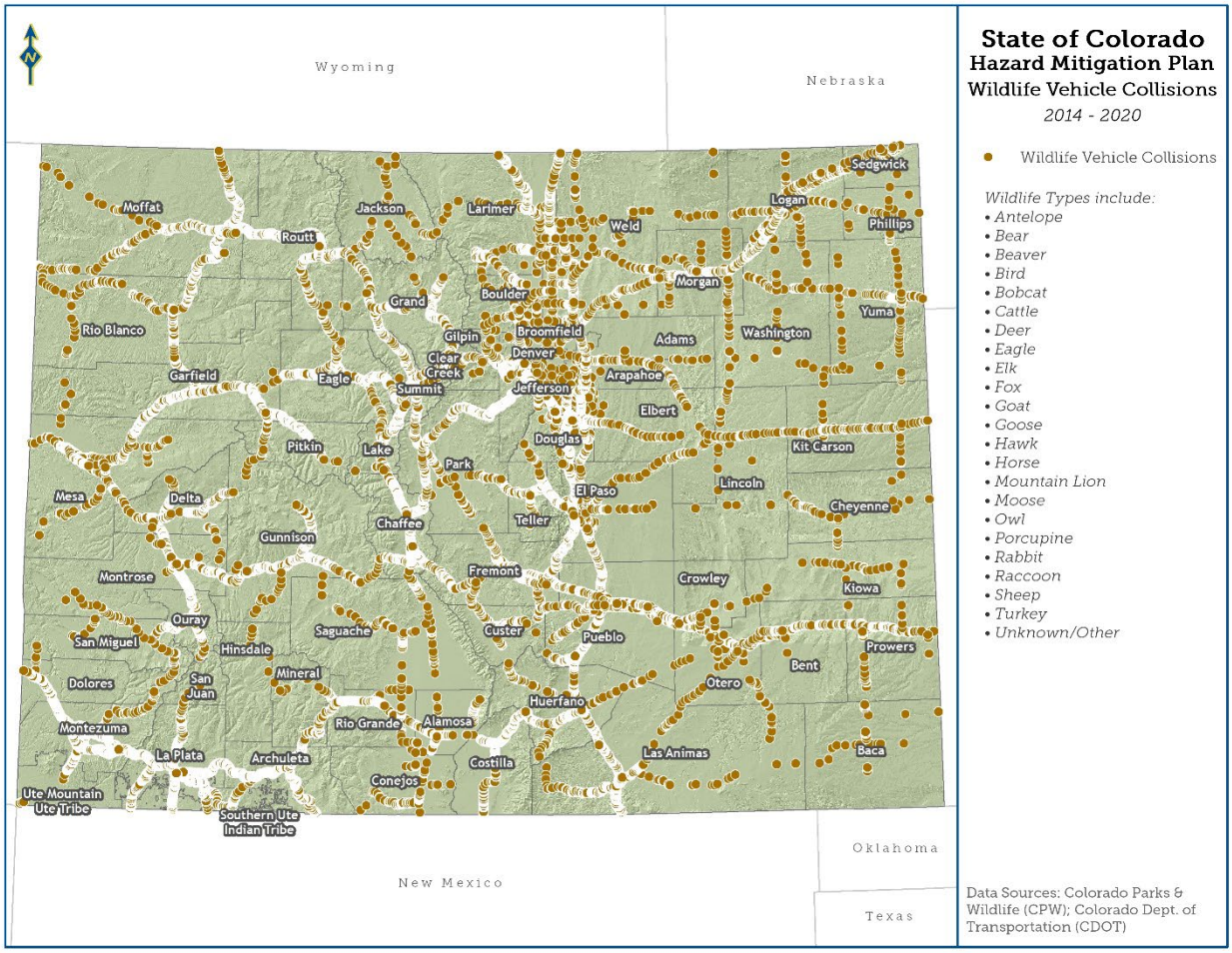
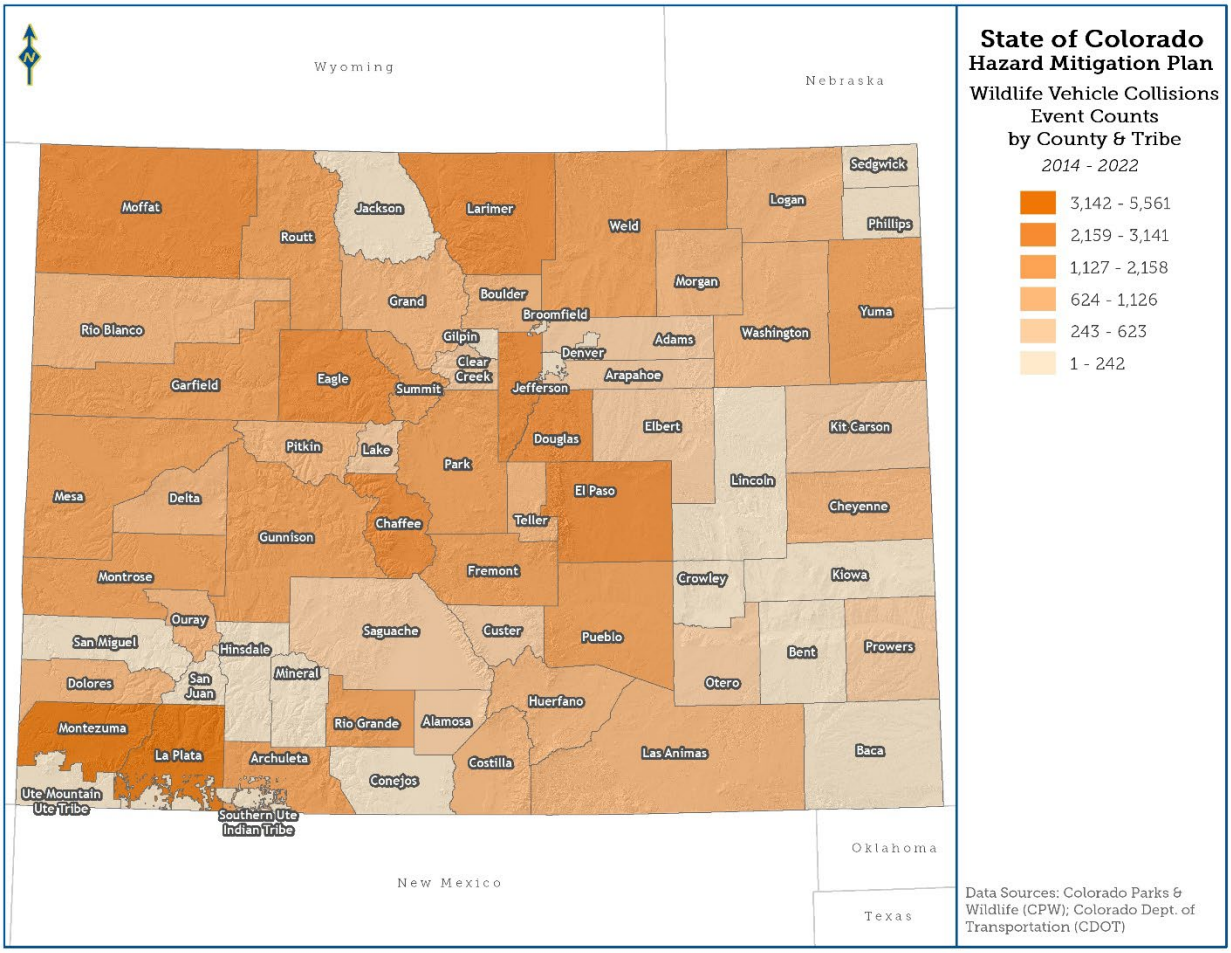


Figure 174 summarizes the WVC event count by county and tribal area to further illustrate locations across the state most impacted by the hazard. In the southwest region, Montezuma and La Plata counties have the highest event counts with approximately 3,000 to 5,500 each between 2014 and 2020. Notably, five nearby counties and both Tribal lands had less than 243 collisions each in the same period. The counties in the southeast have similarly low counts, while the I-25 corridor shows increasing counts among counties as it travels north, excluding the Denver Metro area.

Overall, the state's western counties fall within higher event count ranges, which correlates to the WVC locations in the historical map.

FIGURE 174 WILDLIFE VEHICLE COLLISIONS EVENT COUNTS PER COUNTY



Previous Losses

Between 2010 and 2019, CDOT reported 37,802 wildlife-vehicle collisions, 2,945 injuries, and 34 fatalities caused by WVCs in Colorado. Over 91% of these crashes were classified as property damage only. Annually approximately 2,000 to 4,000 incidents are reported, however unreported incidents may increase the total significantly.

Average costs of each incident vary from year to year and are often not reported outside of the insurance industry. In addition to private property damages, these costs may include the value of the animal involved if it poses a loss for a public agency or a rancher/farmer.

Notable Events

CDOT identified collision hotspot areas across the state regions and has worked to reduce the number of WVCs. The resulting recently built wildlife crossings[47] have drastically reduced the number of WVC and animal deaths.

Probability

Thousands of WVCs are certain to happen every year in Colorado and are most likely to occur during migration season, particularly between dusk and dawn. Deer and elk will move from higher elevations to lower elevations as fall shifts to winter, and then move back to higher elevations as winter gives way to spring. Because the days are shorter at these times of year motorists may be commuting around dawn and dusk, putting people and animals at greater risk of a collision.

Climate Change Impacts

According to the best data available at the time of this plan update, the future impacts of climate change are expected to influence future WVC events, but the extent of these impacts is as yet unknown. Additional research is needed to determine the effects of climate change on the location, extent/intensity, frequency, and high-season duration of WVCs.

Risk & Vulnerability

Populations at Risk

All Colorado residents who drive, or ride, in vehicles are at risk of WVCs. Those who travel in areas with high animal populations are more vulnerable than those in urban areas, especially to large animal collisions. A collision can cause extensive injury and damages which may be more difficult for some to recover from financially than others. Those living in isolated areas may be unable to get assistance, first responders, or CDOT response for extended periods.

[47] Colorado Wildlife Crossings

Populations most vulnerable to the impacts from a WVC could be those lacking health insurance or individuals whose household relies on a single vehicle.

State Assets

Previous Losses

There are no reported losses to state building assets due to WVC. Wildlife prioritization studies[48] done for CDOT have estimated the value of each animal to the state's economy. Examples of some of these values include: deer ($2,178), pronghorn ($2,106), and big horn sheep ($7,533).

Exposure

Vehicles are the most vulnerable state asset type exposed to WVC. The largest risk is to those vehicles traveling at times of increased animal movement. The largest potential impacts resulting from an event could include damaged or totaled vehicles. The impact of WVCs on most critical infrastructure/key resource sectors is limited and would likely be the result of the vehicle hitting a nearby structure. WVCs primarily impact public safety and personal property.

Lifelines

Transportation would be the only impacted community lifeline from a wildlife vehicle collision event. It would likely be for a short duration while the safety and health of those involved were assessed and the road was cleared. There is no expected strain on resources or long-term effects on recovery and resilience.

Wildlife-Vehicle Collision							Transportation

[48] https://www.codot.gov/programs/research/pdfs/2022/wildlife-prioritization

Local County / Tribe

Hazard Rankings

The majority of local hazard mitigation plans did not profile WVC. However, historical data is often a reliable indicator for overall future trends in risk.

Exposure

Those who drive, or ride, in a vehicle are exposed to WVCs, although this exposure is significantly lower in urban areas. The more wildlife present in an area the exposure increases to an event, especially driving at dawn or dusk, and during migration seasons.

Interconnected Hazards

WVCs increased during the COVID-19 pandemic due to less people on the roads. Drivers tended to speed more and animals became less cautious of roadways.

Recent and Future Development

The highest risk areas for WVCs do not necessarily coincide with the highest population growth projections. However, the expected overall population increase in Colorado will put more people at risk of a collision with wildlife. Residents of the most at-risk counties or tourists passing through these areas are also more exposed.

Land use planning for future development, including multi-jurisdictional planning, must consider the location of wildlife habitat to minimize disruption to wildlife migration corridors. Federal, state, and local governments should continue working with communities to identify priorities for mitigation, migration patterns, and crossing structure feasibility.

Consequence Analysis

TABLE 67 EMAP IMPACT SUMMARY

Consideration	Description
Public	There are roughly three fatalities and 294 injuries annually[49].
Responders	First responders face the same level of exposure as the general public. They may also face additional risk from traffic when responding to WVCs and from wildlife due to response conditions (travel speed and decreased visibility).
Continuity of Operations (Govt. & Services)	Loss of facilities or infrastructure for the provision of government services is expected to be non-existent or negligible.
Property, Facilities, & Infrastructure	Thousands of personal vehicles will be damaged in any given year. Buildings are generally not impacted. WVCs may damage road infrastructure if vehicles or animals collide with guardrails, barriers, etc. These impacts are typically short-term.
Environment	Environmental damage may occur when vehicles leave the roadways. Engine fluids may also leak onto the ground, though likely not in large enough quantities to cause extensive or long-term environmental damage. Wildlife populations are negatively impacted, intensely in some areas.
Economic	Possible short-term blockage of roadways that prevent travel and access to local businesses by residents, recreationists, and tourists.
Public Confidence in Govt.	WVCs are not expected to impact confidence in government. However, installation of additional wildlife crossings,

[49] Colorado Department of Transportation Wildlife Vehicle Crash Data (2010-2019)

Consideration	Description
	underpasses, and overpasses may improve the public's sense that the government is working to address the hazard.

HAZARD MITIGATION CAPABILITIES

The assessment of mitigation capabilities is the next step after assessing hazard risk. The combination of these two elements provides the foundation for developing a comprehensive action strategy to mitigate risks in Colorado. An understanding of state government and local authorities and capabilities is necessary in order to develop a comprehensive and feasible mitigation strategy.

This section provides a discussion of Colorado state government's financial, legal, and programmatic ability to carry out mitigation actions in the pre-and post-disaster setting to achieve its mitigation goals and objectives. The mitigation capabilities are addressed by evaluating how a program, policy, regulation, or practice contributes to the statewide mitigation program, but also address areas in which the state needs to strengthen its capabilities by providing applicable limitations. Additionally, the discussion of state capabilities is extended to provide an overview of how they address development in hazard-prone areas and to highlight general changes in capabilities since approval of the previous plan.

Additional discussion on state government capabilities includes what funding mechanisms are in place to improve or sustain capabilities and implement the mitigation strategy. This discussion includes the assessment of funding capabilities for hazard mitigation projects to include their limitations and where additional funding is necessary.

Acronyms

Table 68 provides a key for the acronyms contained within this chapter of the E-SHMP.

TABLE 68 - ACRONYM KEY

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
BCEGS	Building Code Effectiveness Grading Schedule	CWPP	Community Wildfire Protection Plan	HMGP	Hazard Mitigation Grant Program
BOCC	Board of County Commissioners	CWRPDA	Colorado Water Resources & Power Development Authority	HMGP-PF	Hazard Mitigation Grant Program - Post Fire
BRIC	Building Resilient Infrastructure and Communities	DEF	Disaster Emergency Fund	HMP	Hazard Mitigation Plan
C.R.S.	Colorado Revised Statues	DFIRM	Digital Flood Insurance Rate Map	HUD	US Department of Housing and Urban Development
CAFA	Community Assistance Funds Adjacent to National Forest Lands	DFPC	Division of Fire Prevention & Control	IA	Individual Assistance
CAIC	Colorado Avalanche Information Center	DHE	Colorado Department of Higher Education	IPAWS	Integrated Public Alert & Warning System

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CAP	Community Assistance Program	DHS	US Department of Homeland Security	MHFD	Mile High Flood District
CCC	Colorado Climate Center	DHSEM	Division of Homeland Security and Emergency Management	MSI	Mountain Studies Institute
CCCD	Colorado Center for Community Development	DLG	Division of Local Government	NEHRP	National Earthquake Hazards Reduction Program
CDA	Colorado Department of Agriculture	DNR	Colorado Department of Natural Resources	NFIP	National Flood Insurance Program
CDBG	Community Development Block Grant	DOLA	Colorado Department of Local Affairs	NFPA	National Fire Protection Association
CDBG-DR	Community Development Block Grant – Disaster Recovery	DWR	Division of Water Resources	NFS	US National Forest Service

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CDOT	Colorado Department of Transportation	EAP	Emergency Action Plan	NHRAIC	Natural Hazards Research & Applications Information Center
CDPS	Colorado Department of Public Safety	EIAF	Energy / Mineral Impact Assistance Fund	NIFC	National Interagency Fire Center
CDOR	Colorado Department of Revenue	EM	Emergency Manager	NRCS	Natural Resources Conservation Service
CEHMC	Colorado Earthquake Hazard Mitigation Council	EOP	Emergency Operations Plan	OEM	Office of Emergency Management
CEPA	Colorado Emergency Preparedness Assessment	EQIP	Environ-mental Quality Incentives Program	PA	Public Assistance
CERT	Community Emergency Response Team	E-SHMP	Enhanced State Hazard Mitigation Plan	PDM	Pre-Disaster Mitigation Grant Program

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CGS	Colorado Geological Survey	FACO	Fire Adapted Communities	RiskMAP	Risk Mapping, Assessment, & Planning
CHPHE	Colorado Department of Public Health & Environment	FEMA	Federal Emergency Management Agency	SB	Colorado Senate Bill
CIP	Capital Improvements Program	FIRM	Flood Insurance Rate Map	SBA	US Small Business Administration
CoAgMet	Colorado Agricultural Meteorological Network	FIS	Flood Insurance Study	SFA	State Fire Assistance
CoCoRaHS	Colorado Community Collaborative Rain, Hail, & Snow Network	FMA	Flood Mitigation Assistance	SFHA	Special Flood Hazard Area
COOP	Continuity of Operations	FMAG	Fire Management Assistance Grant	SHMT	Colorado State Hazard Mitigation Team
COSWAP	Colorado Strategic Wildfire Action Program	FRWRM	Forest Restoration and Wildfire Risk	SME	Subject Matter Expert

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
			Mitigation Grant		
CO-WRAP	Colorado Wildfire Risk Assessment Portal	FTAP	Flood Technical Assistance Partnership	TABOR	Colorado's Taxpayer Bill of Rights
CPW	Division of Parks & Wildlife	FTE	Full-Time Employee	USACE	US Army Corps of Engineers
CRO	Colorado Resiliency Office	FTF	Governor's Flood Task Force	USBR	US Bureau of Reclamation
CRWG	Colorado Resiliency Working Group	GIS	Geographic Information Systems	USDA	US Department of Agriculture
CSFS	Colorado State Forest Service	GO	General Obligation	WATF	Governor's Water Availability Task Force
CSU	Colorado State University	HB	Colorado House Bill	WESTFIRE	Western Forest Fire Research Center
CTP	Cooperating Technical Partner	HHPD	High Hazard Potential Dam	WRRG	Wildfire Risk Reduction Grant
CU	University of Colorado	HIRA	Hazard Identification and Risk Assessment	WUI	Wildland Urban Interface

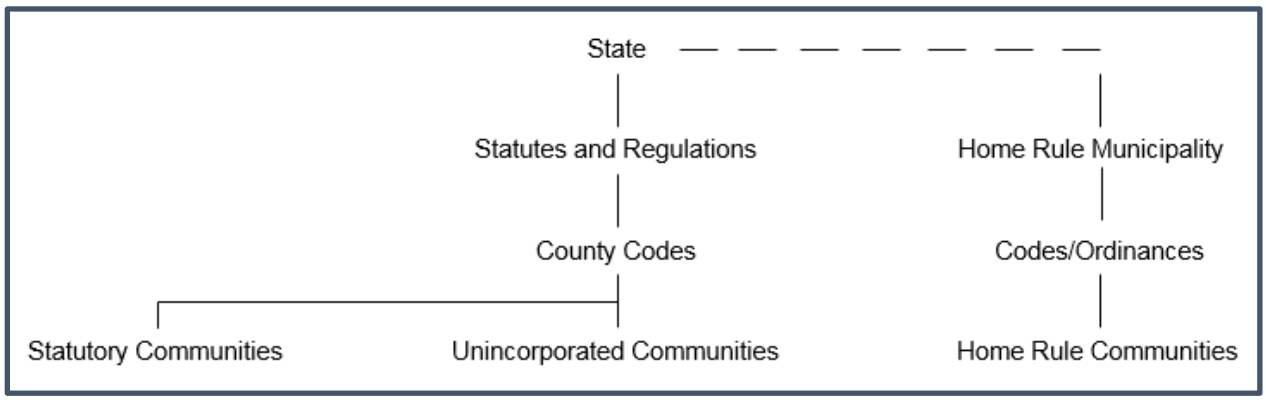
Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CWCB	Colorado Water Conservation Board	HMA	Hazard Mitigation Assistance	WWA	Wildfire and Watershed Assessment
CWDG	Community Wildfire Defense Grant				

Government Mitigation Responsibility

It is important to understand where responsibilities lie across the state and local jurisdictions for implementing hazard mitigation strategies and actions. When looking at the responsibilities of the state and local government in relation to hazard mitigation, relevant legislation can be divided roughly into state statutes and regulations at the state level, and county and municipal codes and ordinances at the local level. According to the legal dictionary, a statute can be defined as "an act of legislature that declares, proscribes, or commands something; a specific law, expressed in writing passed by a legislature on the state or federal level." In contrast, local government codes and ordinances are the rules and regulations enacted into law by the local government.

Figure 175 is a depiction of the organization of structure of state statutes and regulations in comparison to statutory county and municipal and home rule governments local land use and mitigation powers.

FIGURE 175 – STRUCTURE OF STATE STATUTES AND REGULATIONS



Home Rule

It is important to highlight Colorado's distinction as a "Home Rule" state. Home rule is the power of a local jurisdiction to set up its own system of self-government without receiving a charter from the state. Home rule is allowed under some state constitutions. The authority to act in local affairs is transferred from state law to a local charter, adopted and, as needed, amended by the voters through referendum. Home rule shifts much of the responsibility for local government from the state legislature to the local community. While they command a large amount of power delegated to them by the state, home rule cities and counties can still be subjected to restrictions found in the United States Constitution and state constitutions. Home rule counties can do anything not specifically forbidden by state or federal law.

Unincorporated / Statutory

In Colorado, communities that are not home rule, fall under statutory designation of powers. According to the Colorado Municipal League, statutory cities and towns are limited to exercising powers that are granted by the state and are subject to provisions and limitations imposed by the state. Lands and communities that are not within an incorporated municipality are under the jurisdiction of a county and are subject primarily to state legislation.

State, County, & Local Government Responsibility

Both state and local governments have specifically defined responsibilities as they relate to hazard mitigation. In regard to state level responsibilities, C.R.S. 24-65.1

302 describes the functions of state agencies in relation to hazard mitigation. State agencies are tasked with:

- Sending recommendations to local governments relating to designation of matters of state interest on the basis of current and developing information; and
- Providing technical assistance to local governments concerning designation of and guidelines for matters of state interest.

Major state agencies that are responsible for these duties include: The Colorado Water Conservation Board (flood hazards), Colorado State Forest Service (wildfire hazards), and the Colorado Geological Survey (geological hazards).

Local level responsibilities vary by jurisdiction. A common section of Colorado State legislation referenced throughout the municipal codes is Title 29, Article 20. This section of legislation contains statutes that grant municipalities the authority to regulate land use. Statute 29-20-104, for example, allows municipalities to regulate development in hazardous areas. Many of the municipal codes can also contain statements of purpose which provide the intent of the code. For example, in Sterling's Municipal Code, under the Flood Prevention and Protection's statement of purpose it reads "It is the purpose of this chapter to promote public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas."

It is important to note that even though a statement of purpose is provided, the code also contains a liability clause that states "this chapter shall not create liability on the part of the community or any official or employee thereof for any flood damages that result from reliance on this chapter or any administrative decision lawfully made thereunder." Therefore, while many of the codes contain a statement of purpose that entails how the code is meant to ensure public safety and wellbeing, it is by no means a guarantee. The codes contain liability clauses to maintain legal protection in cases that the code is not sufficient during and after disaster events.

Much like with municipalities, the two types of county designations in the State of Colorado include home rule counties and statutory counties. Home rule counties do not have as much independence and separation from state legislation as home rule municipalities. There are only two home rule counties in Colorado, those being Weld County and Pitkin County. The remainder of the counties in Colorado are statutory counties. Counties are tasked with providing mandatory services, explicitly conferred to them by state law, as well as, discretionary powers for the provision of certain services or control of certain activities.

County discretionary powers include mitigation tactics, such as, providing water and sewer services (storm drainage) and wildfire planning and response services. Much like their municipal counterparts, Colorado counties contain regulations in the form of codes and ordinances that help incorporate hazard mitigation strategies into areas that are outside of municipal boundaries. These types of areas are often unincorporated sections of the county.

Because counties have discretionary powers, each county goes about implementing hazard mitigation in different ways. Some counties contain comprehensive county codes which include direction on land use, zoning, and building codes. Other counties have mitigation strategies in several different documents, such as flood mitigation addressed in the county building code and a county land use plan. A commonality amongst all counties however, is the emphasis put on regulating hazard mitigation policy through land use and building codes.

Per analysis conducted during the 2018 E-SHMP update, it is also important to acknowledge the discrepancy between state population and land area. The State of Colorado had a total population of approximately 5,538,180 people in 2018. Of that total, approximately 5,142,955, roughly 93%, lived in incorporated areas (home rule and statutory municipalities). This is a stark contrast when comparing the land area of these incorporated areas to non-incorporated land. Of the 104,177 square miles that make up Colorado, only 1.8% of that land consists of incorporated areas. Putting these

two statistics together reveals that 93% of the state's population lives in only 1.8% of the state's land area.

This population to land area dynamic can create challenges for a state. Municipal governments, particularly home rule, possess the power granted to them by the state to implement hazard mitigation practices they deem appropriate. Municipalities and their populations also cover less land, so the hazards they address can be prioritized and specific to the area. Conversely, even though unincorporated areas contain much less of the state's population, they cannot be forgotten about. County and state level governments still have an obligation to ensure residents are provided with the necessary regulations to help mitigate any number of hazards.

State Level (Statues and Regulations)

State departments are responsible, within their statutory authorities, to perform direct activities and/or provide assistance and support to local jurisdictions in identifying and mitigating risks to hazards. This assistance includes developing and running programs to provide technical assistance and funding to develop and implement mitigation actions.

Statutes

Statutes are defined as a law enacted by a legislative body of government at either the state or federal level. For the most part, the Colorado State statutes relating to hazard mitigation fall into the following categories: legislative declarations, creation of specialized hazard mitigation committees and positions, creation of dedicated mitigation funds, and the expansion of duties for already established hazard mitigation committees. The specialized hazard mitigation committees generally address one hazard, for example wildfire, and are composed of subject matter experts. They serve as policy advisory committees and sometimes possess power to distribute mitigation funds.

Statute organization generally consists of a title section followed by a purpose and introduction, what department or committee is responsible for oversight and

implementation, and then a detailed body entailing the various components of the statute.

Table 70 provides a summary of the statutes identified and how they relate to mitigation. Many of the statutes detail responsibilities of specific committees, mitigation strategies, and specific funds dedicated to wildfire mitigation. The remainder of the statutes focus on general mitigation topics, funding, and some specific to drought and flood.

TABLE 69 – SUMMARY OF STATE STATUTES RELEVANT TO MITIGATION

General	Funding	Wildfire	Drought	Flood
10	9	28	4	7

Table 70 through Table 74 provide details for each statute. Additional details about these statutes can be found at the Colorado Legal Resources Public Access Website.

TABLE 70 –STATE STATUTES RELEVANT TO GENERAL MITIGATION

C.R.S. Number	Title
24-33.5-710.	Disaster prevention, mitigation, and recovery.
24-33.5-702.	Purposes and limitations.
24-33.5-1606.5.	Office of preparedness - creation - duties - posting of notice of NIMS classes - definition.
24-65.1-103.	Definitions pertaining to natural hazards.
24-38.5-102.6.	Climate change mitigation and adaptation fund - creation - use.
24-33.5-1213.4.	School all-hazard emergency planning and response.
24-38.8-103.	Development of statewide climate preparedness roadmap.
10-4-114.	Requirements on hazard insurance coverage for loans secured by real property.

C.R.S. Number	Title
24-65.1-302.	Functions of other state agencies.

TABLE 71 –STATE STATUTES RELEVANT TO MITIGATION FUNDING

C.R.S. Number	Title
24-38.5-102.6.	Climate change mitigation and adaptation fund - creation - use.
24-33.5-706.5.	Hazard mitigation fund - established - financing - legislative intent.
24-33.5-1619.	Natural disaster mitigation enterprise - fund - goals - grant program - gifts, grants, or donations - legislative declaration - definitions.
24-33.5-1227.	Wildfire preparedness fund - creation - gifts, grants, and donations authorized - wildfire preparedness plan - report.
37-60-123.2.	Flood and drought response fund - created.
24-33-117.	Wildfire mitigation capacity development fund - established - financing - legislative intent.
23-31-318.	Wildfire mitigation incentives for local governments - grant awards - fund - reporting - definitions.
23-31-310.	Forest restoration and wildfire risk mitigation grant program - technical advisory panel - legislative declaration - definitions.
35-1-114.	Agricultural drought and climate resilience office - creation - grants for agrivoltaic demonstration and research projects - rules - definitions.

TABLE 72 –STATE STATUTES RELEVANT TO WILDFIRE MITIGATION

C.R.S. Number	Title
24-65.1-302.	Functions of other state agencies.
37-92-602.	Exemptions - presumptions - stream restoration projects - report - legislative declaration - definitions.
24-33.5-1227.	Wildfire preparedness fund - creation - gifts, grants, and donations authorized - wildfire preparedness plan - report.
24-33-117.	Wildfire mitigation capacity development fund - established - financing - legislative intent.
23-31-318.	Wildfire mitigation incentives for local governments - grant awards - fund - reporting - definitions.
23-31-310.	Forest restoration and wildfire risk mitigation grant program - technical advisory panel - legislative declaration - definitions.
39-22-543.	Credit for wildfire hazard mitigation expenses - legislative declaration - definitions.
24-33.5-1233.	Colorado fire commission - creation - powers and duties - report - legislative declaration.
24-33.5-1236.	Wildfire resiliency code board - powers and duties - rules - cash fund - legislative declaration - definitions.
29-20-105.5.	Intergovernmental cooperation - intergovernmental agreements to address wildland fire mitigation - land owned by municipality for utility purposes - legislative declaration.
23-31-313.	Healthy forests - vibrant communities - funds created - outreach working group - legislative declaration - definition.
29-22.5-101.	Legislative declaration.

C.R.S. Number	Title
23-31-320.	Timber, forest health, and wildfire mitigation industries workforce development program - creation - policies and procedures - legislative declaration - definitions.
23-31-316.	Colorado forest health council - legislative declaration.
23-81-102.	Recruitment of wildland fire prevention and mitigation educators program - report - definition.
32-18-109.	Wildfire mitigation measures - private land - reimbursement.
30-15-401.7.	Determination of fire hazard area - community wildfire protection plans - adoption - legislative declaration - definitions.
24-33.5-1221.	State responsibility - determination by the director - intergovernmental agreements required - terms included - definitions - legislative declaration.
23-31-317.	Biomass utilization study - legislative declaration - report - definitions.
2-3-1602.	Wildfire matters review committee - creation.
23-1-142.	Commission directive - expansion of forestry and wildfire mitigation degree and certificate programs - simulator - legislative declaration - definitions.
23-31-312.	Community wildfire protection plans - biomass utilization plans - county governments - guidelines and criteria - legislative declaration - definitions.
2-3-1601.	Legislative declaration.
24-33.5-1203.	Duties of division.
24-33.5-1225.	Emergencies.

C.R.S. Number	Title
24-65.1-302.	Functions of other state agencies.
37-92-602.	Exemptions - presumptions - stream restoration projects - report - legislative declaration - definitions.
24-33.5-1227.	Wildfire preparedness fund - creation - gifts, grants, and donations authorized - wildfire preparedness plan - report.

TABLE 73 –STATE STATUTES RELEVANT TO DROUGHT MITIGATION

C.R.S. Number	Title
37-60-123.2.	Flood and drought response fund - created.
35-1-114.	Agricultural drought and climate resilience office - creation - grants for agrivoltaic demonstration and research projects - rules - definitions.
37-60-124.	Office of water conservation and drought planning - creation - powers and duties.
37-60-126.5.	Drought mitigation planning - programs - relationship to state assistance.

TABLE 74 –STATE STATUTES RELEVANT TO FLOOD MITIGATION

C.R.S. Number	Title
37-60-123.2.	Flood and drought response fund - created.
24-65.1-302.	Functions of other state agencies.
37-60-121.	Colorado water conservation board construction fund - creation - nature of fund - funds for investigations - contributions - use for augmenting the general fund - funds created - rules.
30-30-102.	Authority to remove obstructions in streams.

C.R.S. Number	Title
32-11.5-102.	Legislative declaration.
37-92-602.	Exemptions - presumptions - stream restoration projects - report - legislative declaration - definitions.
37-60-106.	Duties of the board - legislative declaration.

Regulations

State regulations are the means by which state executive agencies enforce state laws. The regulations themselves are typically authorized by specific statutes. Colorado's state regulations are rather limited with regards to hazard mitigation. The only two relevant regulations pertain to flood and wildfire.

The lone flood regulation is 2 CCR 408-1, updated in 2022, which contains the rules and regulations for regulatory floodplains in Colorado. The regulation contains 20 subdivisions which entails parties involved, responsibilities, rules, and enforcement of the regulation. This regulation is promulgated and overseen by CWCB.

Regulation 8 CCR 1507-32 details prescribed burning in Colorado and the Division of Fire Prevention and Control (DFPC) is responsible for oversight and compliance. The regulation dictates the rules and regulations that constitute the minimum standards for all prescribed burning conducted in the state.

Programs, Policies, Regulations, & Practices

Table 75 summarizes all pre- and post-disaster hazard mitigation-related programs, policies, regulations, and practices across the State of Colorado's government. As applicable, this Table identifies state regulations and authorities, providing information on the legal foundation for the state government's role in hazard mitigation. Specific details relating to these capabilities are also provided, in addition to identified limitations relating to the capability's effectiveness in facilitating risk reduction. Lastly, the Table provides details on changes to these capabilities since 2018 as provided by the SHMT.

TABLE 75 - HAZARD MITIGATION STATE CAPABILITIES

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CCC	Colorado Agricultural Meteorological Network (CoAgMet)	Program	• Automated weather stations mainly used for agricultural monitoring. • Hourly datasets for temperature, relative humidity, wind speed/direction, solar radiation, soil temperature, precipitation, soil moisture (most CoAgMET stations now update every five minutes). • Monitoring evapotranspiration for drought monitoring. • Potential data source during severe weather.	Precipitation is seasonal (tipping bucket gage not good for snow). Not all sites have soil moisture; hourly, not real-time data.	X	X	Network has expanded to 90 stations, with support from the Colorado Water Conservation Board, the National Mesonet Program, and local station sponsors. Enhancements to the network, including 10-m wind towers and all-weather precipitation gauges are planned for a limited number of stations in the coming years

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CCC	Colorado Community Collaborative Rain, Hail, & Snow Network (CoCoRaHS)	Program	• High spatial coverage of precipitation reports. • One of the most comprehensive datasets for hail measurements and characterization in the country. • Educational outreach opportunities for reaching citizens.	Inconsistency in reporting; not all stations report all the time.	X	X	CoCoRaHS is primarily supported by data users and by donations from volunteers. Some support for operation and maintenance is also provided by the National Mesonet Program. Interactive maps (maps.cocorahs.org) have been added since 2018, along with other new features
CCC	Colorado Climate Center (CCC)	Practice	• Routine monitoring of statewide climate conditions, including drought and high-impact weather • Regular updates including monthly climate summaries, webinars, presentations to the state Water			X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			Availability Task Force, and engagement with organizations and the public statewide • Wide-ranging climate services activities, providing data and expertise to diverse stakeholders				
CDA > Animal Health Division	Protection of Livestock from All Hazards Emergencies CRS § 35-50-101-114	Regulation	• Animal Health & Disease Control • Oversees livestock movement into the state to prevent disease in Colorado. • Control disease, mitigate losses, and recovery from disaster or disease. • Proper carcass disposal to prevent disease and protect public and environment.	Limited by compliance of livestock owners with import and testing rules. Limited by level of biosecurity or disease prevention practices on livestock operations. Limited by disease transmission (vectors) and susceptibility of animals.	X	X	Increased State funding. The legislature approved the funding for the hiring of the Agriculture Emergency Coordinator in 2022.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CDA > Animal Health Division	State Emergency Preparedness & Response Plans CRS § 35-50-105	Regulation	• Establishment of emergency preparedness plans • Protect livestock health and ranchers/farmers agricultural operations. • Plan, prepare, train, and exercise CDA staff, emergency response partners, and livestock producers.	Limited by small number of staff to prepare for Ag emergencies. Limited by time spent in other livestock disease control efforts. Limited by lack of understanding of the importance of Ag by most citizens.	X	X	Increased State funding. The legislature approved the funding for the hiring of the Agriculture Emergency Coordinator in 2022.
CDA > Animal Health Division	USAHerds Animal Health Emergency Reporting Diagnostic System CRS § 35-57.9-101-104	Regulation	• Colorado Livestock Information Security Act • Database has livestock premises, movement, and animal ID data. • Capable of mapping locations and movements of livestock to mitigate losses of disasters and disease. Mapping of livestock premises aids in	Limited by data that is entered into the system through electronic documents that are migrated into system and through CDA data entry staff. Limited by availability to server and	X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			protecting animal and public health during wildfires, flooding, blizzards.	application – remote areas may not have internet capabilities. Limited by staff availability during emergencies.			
CDA > Animal Health Division	Secure Food Supply Plans CRS § 35-50-105	Regulation	• To protect livestock in disease or other livestock emergencies • Use of movement controls, permitting, biosecurity, and surveillance to keep livestock and products moving in the face of disease outbreak. • Working with livestock industry to develop best COOP plans.	Limited by livestock industry willingness to cooperate and collaborate in planning. Limited by lack of current livestock industry's contingency plans and resources for response.	X	X	No change.
CDA > Animal Health Division	AgAlert System CRS § 35-50-108	Regulation	• Mandatory reporting & Quarantine to prevent spread of disease • Use of the DHS FEMA IPAWS system for alert notification of Ag emergencies	Limited by livestock owners and transporters to receive alerts via Wireless	X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			when livestock are in danger of disaster or disease. • Capability to reach more people to restrict movement of livestock.	Emergency Alerts (WEA). Limited by compliance of livestock owners to call the CDA for special permits to move livestock and livestock products.			
CDA > Conservation Services Division	Colorado Weed Management Grant Program	Program	• Organized private interests, conservation districts, and municipalities are eligible to apply for assistance from the Colorado Noxious Weed Management Fund to enhance weed management efforts within the State of Colorado. Additionally, the Noxious Weed Program continues to administer federal noxious weed management funds from the U.S. Forest Service's State and Private Forestry program.		X	X	Increased with Federal Funding (pass-thru).

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CDA > Conservation Services Division	Request-A-Bug Program	Program	• Biological pest control agents are seasonally available to help suppress weed and insect pests in Colorado. They can be requested by private landowners in the state or other governmental agencies concerned with controlling the spread of exotic invaders. Approximately 30 weed predators are being cultured, released, and established on weed infestations throughout the state. In addition to the biological weed control programs, this section conducts control programs for the alfalfa weevil and Oriental fruit moth, with a total of twelve beneficial species.		X		Participation in the program is increasing, so revenue (funding) is increasing. CDA is currently trying to get spending authority to actually use the increased revenue to help expand the program.
CDOT > Materials & Geotechnical Services	Geohazards Services Program	Program	• Provides internal mitigation design and review for projects funded by geohazards mitigation budget; performs site inspections during project	Scope of the Program is limited to reducing hazard impacts on state and interstate	X	X	Budget has remained fixed since 2018. This has had the effect of reducing funding

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			construction; provides personnel designated as first responders during geologic hazard related emergencies; installs mitigation devices on slopes for prevention and/or protection; posts falling rock signs on highways. Maintains existing mitigation devices in a state of good repair • Evaluates and prioritizes mitigation locations; combines geologic and climate information with traffic and slope data to rank geologic hazards according to severity of risk. • Program evaluates post-event safety conditions and appropriate mitigation.	transportation facilities.			capabilities due to inflation in construction costs over the 5-year period between 2018 and 2023
CDPS	State Public Safety Entity Reorganization HB 12-1283	Regulation	• Consolidates homeland security functions into the Colorado Department of Public Safety (CDPS). • Transfers wildfire command and control responsibilities from Colorado		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			State Forest Service (CSFS) to CDPS/DFPC. • Places Office of Emergency Management (OEM) under CDPS and creates Division of Homeland Security & Emergency Management (DHSEM). • Defines OEM role. • Purpose is efficiencies in pre- and post-disaster related operations and communications.				
CDPS > DFPC	Colorado Wildfire Preparedness Plan and Fund SB 06-96, CRS § 24-30-310 (2)(3)	Regulation	• Use as state match for FEMA HMA grants to local governments to mitigate wildfire hazards		X		No change.
CDPS > DFPC	Training Directors of Fire Protection Districts in Wildland Urban	Program	• Provide local governments eligible for FEMA HMA grants with wildfire strategic planning assistance		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Interface (WUI) SB 08-039						
CDPS > DFPC	County Open Burning Slash Permit Program SB 11-110	Regulation	• Requires counties with 44% forest cover to maintain open burning permit system for unincorporated areas. • Exempts prescribed burns following federal and state guidelines, and preserves existing rights of agricultural producers to conduct burning on their property.		X		No change.
CDPS > DFPC	Fire Suppression Program Rules CRS § 24-33.5-1205(1)(a)	Regulation	• Creation of Fire Suppression Program. • Establishes minimum standards of performance to ensure fire suppression systems are installed with nationally recognized standards.		X		No change.
CDPS > DFPC	Prescribed Burn Program SB 13-083	Program	• Requires DFPC to implement a prescribed burning program. • Bill reassigns to Director of DFPC certain permitting and planning		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			activities related to prescribed fire, previously the responsibility of the State Forester.				
CDPS > DFPC	Prescribed Fire Certification Standard SB 10-102	Regulation	• Requires DFPC to establish standards for training and for certification of prescribed fire users.		X		No change.
CDPS > DFPC	Wildfire Resilient Homes Grant Program HB 23-1273	Program	• The act creates the wildfire resilient homes grant program within the DFPC. The program allows homeowners to apply to receive a grant for retrofitting or improving a house or other structure on the homeowner's property with strategies and technologies for structure hardening in order to make the house or structure more resilient to the risk of wildfire.	Initially allocated for $100,000	X		New capability.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CDPS > DHSEM > OEM / Mitigation	Building Resilient Infrastructure and Communities Program (BRIC)	Program	• Administration of FEMA BRIC Grant Program. • Provides funding on a competitive basis for [C&CB] and projects including studies, construction, wildfire mitigation, and property acquisition.	This program is extremely competitive. Colorado does not have a mandatory statewide building code, which is one of the program's Technical Evaluation Criteria. Colorado sub-applications must deliberately address all of the other criteria to be competitive.	X		New capability.
CDPS > DHSEM > OEM / Mitigation	Flood Mitigation Assistance (FMA)	Program	• Administration of FEMA FMA Grant Program. • The FMA Program offers grants for developing a local flood hazard mitigation plan and for completing flood mitigation projects to reduce flood risk in communities.	Prioritized funding is for NFIP insured and repetitive loss properties, of which Colorado has less of than many other states, but still has		X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Prioritizes mitigation funding on insured properties with post-event repetitive losses.	high need for flood protection infrastructure projects.			
CDPS > DHSEM > OEM / Mitigation	Hazard Mitigation Grant Program (HMGP)	Program	• Administration of FEMA HMGP, which provides post-disaster mitigation funding in the event of a Presidential Disaster Declaration. • Also included the HMGP Post-Fire program following a FEMA Fire Management Assistance Grant declaration.	The timeline on these programs, immediately following either declaration type, challenges the impacted communities to fully utilize the available funding. The regular HMGP application period overlaps the first year of recovery and communities may lack the capacity to fully commit to both HMGP and Public Assistance.		X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
				The application period for HMGP Post-Fire can also be as short as six months, exacerbating that challenge.			
CDPS > DHSEM > OEM / Mitigation	Local Hazard Mitigation Plans (HMPs)	Practice	• Local hazard mitigation plans are a critical input in developing the statewide mitigation strategy. These plans are reviewed and incorporated into the state plan, directing a portion of the statewide mitigation strategy and prioritization of local assistance.	Implementation of the plans has been limited in many jurisdictions due to funding and staffing limitations, other priorities, et cetera.	X		No change.
CDPS > DHSEM > OEM / Mitigation	Mitigation Trainings and Workshops	Practice	• Educates mitigation partners on how to develop local hazard mitigation plans. • Provides a common base of information to mitigation partners and builds state and local capability.	Logistics and delivery state-wide can be prohibitive; not all part-time EMs are available to attend.	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CDPS > DHSEM > OEM / Mitigation	State & Local Hazard Mitigation Planning Program	Program	• DHSEM / OEM Mitigation Team has two dedicated positions to provide technical assistance in the development of the SHMP as well as local hazard mitigation plans (HMPs). These positions facilitate and/or attend planning process meetings such as kick-off and mitigation strategy development, and also support public meetings and presentations to state agencies and local elected or appointed officials throughout the plan's approval process, implementation & maintenance, and five-year eligibility cycle. • Beginning with Disaster 4581, DHSEM has expanded the scope of this program to include other planning-related activities.		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CDPS > DHSEM > OEM / Mitigation	State Hazard Mitigation Team (SHMT)	Practice	• Comprised of SMEs representing state agencies, state agency partners, associated FEMA and CRO sectors, and the greater statewide mitigation community.		X		No change.
CDPS > DHSEM > OEM / Mitigation	Wildfire Preparedness Fund SB 21-054	Program	Provided DHSEM with $3,000,000.00 to: - Use as state match for FEMA HMA grants to local governments to mitigate wildfire hazards - Provide local governments eligible for FEMA HMA grants with wildfire strategic planning assistance	This is a one-time program and use is limited to local governments with a FEMA-approved hazard mitigation plan.	X		New capability.
CDOR	Wildfire Mitigation Measures Tax Subtraction HB 13-1012 CRS § 39-22-104	Regulation	• Allows landowners completing wildfire reduction measures on lands in the WUI to deduct a maximum of $2,500 from federal taxable income; deduction is available until 2024.	The cost of performing fuels mitigation in WUI areas is high due to difficulty of treatments and lack of vibrant forest products market. Taxpayer must own	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
				the property; property must be located in the WUI; total amount of the subtraction cannot exceed 50% of the landowner's out of pocket expense or $2500, whichever is less; available through 2024.			
CGS	CGS Land Use Review Program Subdivision Law 1972 SB 35-3, CRS § 30-28-101, et seq.	Program	• Several state statutes and/or state agency regulations specify requirements for the submission of geologic suitability reports in conjunction with land-use applications. • Review geologic reports for new developments in unincorporated areas of the state with lot sizes less than 35 acres. Reports must include information on soils suitability and geologic	Land use review is not required in incorporated areas or in divisions of land where lots are greater than 35 acres. Geologic hazard mapping is only available for limited areas.	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			conditions. • Provide a report to counties stating whether geologic hazards present on a site have been properly identified and if the proposed plan of mitigation is adequate. • Consult with counties and private geologists to produce geologic hazard maps that should be regarded as a starting point for any site-specific geologic-suitability investigation. A particular county's HB 1041 maps should be available for inspection at the county planning department, as well as at the CGS. • Charges CGS with evaluating geologic factors that would have significant impact on the proposed use of the land for subdivision purposes by reviewing preliminary plat applications.	Enforcement - not all counties follow the statute.			

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Requires subdividers to submit reports concerning geologic characteristics, potential radiation hazards, soil suitability, storm drainage plans, on-lot sewage disposal, and any soil or topographic conditions that present hazards or require special precautions. • Directs county planning agencies to refer a copy of the preliminary plan submittal to the CGS for review.				
CGS	STATEMAP and Geologic Hazards Mapping Program	Program	Competitive, matching-funds grant program between state geological surveys and the United States mapping program. • Develops geologic map information for incorporation into decision-making on a wide variety of local and countywide issues. • Focuses maps on high-growth areas throughout Colorado.	Continuation of program is dependent on awards from competitive federal grant program and matching funds from the state.	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Informs Colorado Geologic Mapping Advisory Committee stakeholder group that prioritizes the areas for mapping.				
CGS	Building Codes – Zoning – Planning 1984 HB 1045, CRS § 22-32-124 (1)	Regulation	• Requires that, prior to the acquisition of land for school building sites or construction of any buildings thereon, the Board of Education must consult with the Colorado Geological Survey regarding potentially swelling soils, mine subsidence, and other geologic hazards and determine the geologic suitability of the site for its proposed use.	There is no enforcement provision in statute and some school districts do not comply with the law.	X		No change.
CGS	Colorado Geological Survey 1969 HB 1282, CRS § 34-1-101 and 103	Regulation	• Establishes CGS to collect, analyze, and disseminate geologic information and provide technical assistance to local governments. • Authorizes CGS to determine areas of natural geologic hazards that could affect the safety of or economic loss to	CGS was transferred to the Colorado School of Mines. The statutory mission of CGS remains the same; however, funding and staff were reduced. This impacts	X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			the citizens of Colorado. • Directs CGS to assist, consult with, and advise existing state and local government agencies on geologic problems; for instance, after significant rain event causes instability due to soil saturation, or after a hazard event to determine additional instability and risk.	the ability of CGS to help local governments identify and plan for natural hazards.			
CGS	Soils and Hazard Analyses of Residential Construction Act 1984 SB 13, CRS § 6-6.5-101	Regulation	• Requires all residential developers to analyze and disclose any potentially hazardous conditions to prospective home buyers.	Geologic hazard mapping is only available for limited areas.	X		No change.
CGS	National Earthquake	Program	• Administration of FEMA NEHRP State Earthquake Program. • Supports enhanced earthquake risk	This is a non-construction project grant. Mitigation	X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Hazards Reduction Program (NEHRP)		assessments in local hazard mitigation plans (HMPs). • Provides funding for earthquake modeling and loss estimation. • Provides funding for partnership building, planning, and training activities. • Provides funding for prevention materials and activities. • Provides support for limited post-event inspection and reporting.	activities such as structural retrofit are not allowed under program guidance.			
CGS	State Planning and Interest (1041 Regulations) CRS § 24-65.1-201 and 202	Regulation	• Areas of state interest as determined by local governments. • Natural hazard areas and mineral resource areas are two of four areas of state interest. Criteria for administration of areas of state interest to minimize hazards (i.e., floodplains, wildfire, and geologic hazard areas). • Defines natural hazards as wildfire	Municipalities and counties are not required to adopt 1041 regulations. Geologic hazard mapping is not available in all areas. CGS does not have sufficient funding and staff to provide	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			hazards, flood hazards, and geological hazards. A geological hazard is defined as "...a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property." The term includes, but is not limited to avalanches, landslides, rock falls, mudflows, unstable or potentially unstable slopes, seismic effects, radioactivity, and ground subsidence. • Requires that all developments in areas designated by counties as geological hazard areas shall be engineered and administered in a manner that will minimize significant hazards to public health and safety or to property.	technical assistance to all municipalities and counties using or considering adoption of 1041 regulations.			

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Instructs local governments to administer such areas in a manner that is consistent with model guidelines for land use in each type of natural hazard area. • Directs counties to create geologic-hazard maps to establish areas of state interest (natural hazard areas) and to serve as planning tools. Colorado Geological Survey (CGS) provides technical assistance on the identification of geologic hazards, and the review of geologic reports.				
Colorado State House	Creating a Permanent Interim Committee of the General Assembly on Wildfire Matters	Regulation	• Creates permanent Interim Committee (Wildfire Matters Review Committee) to review and propose legislation related to wildfire prevention and mitigation in the state. • Committee will meet at least once		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	SB 13-082		during the interim, and consult with experts, including CDPS and CSFS.				
CSFS	Colorado Healthy Forest and Vibrant Communities Act of 2009 HB 09-1199 CRS § 23-31-313 HB 16-1255 SB 17-050 SB 17-259 SB 21-05	Regulation	• Improved technical capacity for CSFS to implement forest management/fuel reduction projects; reduces wildfire risk to life, property, and watersheds; assists communities and others with CWPP development; offers spatially based wildfire risk analysis through enhancements to CO-WRAP; expands outreach/education activities related to wildfire risk reduction and healthy, resilient forests. • Supports utilization and marketing of wood products by providing loans to businesses. • Outlines CSFS responsibilities with CWPPs and community wildfire risk mitigation. • Leverages other funding sources		X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			through the use of state funds. • Annual transfer of ~$1 million to the Healthy Forests & Vibrant Communities Fund through 2023.				
CSFS	Colorado Wildfire Risk Assessment (web applications hosted in CO Forest Atlas)	Program	• Web mapping tool providing access to statewide wildfire risk assessment information. • Provides a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in Colorado.• Creates public awareness about wildfire risk and informs decision-making at local and state levels. • Provides state and local planners with information to support mitigation and prevention efforts. • Identifies areas that may require additional planning related to wildfire mitigation projects.	Funding for enhancements to system as data layers are updated.	X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Assists in the development of Community Wildfire Protection Plans (CWPPs).				
CSFS	Community Assistance Funds Adjacent to National Forest Lands (CAFA) Grants – Stevens Hazardous Fuels Grant	Program	• Competitive program makes federal funds available to communities to treat adjacent non-federal lands to protect communities when hazard reduction activities are planned on NFS lands. • Funds hazardous fuels reduction. Projects affiliated with approved Community Wildfire Protection Plans (CWPPs), demonstrating interagency collaboration, and incorporating a landscape scale approach are more competitive.	Limited funding is available; demand for funds far exceeds availability.	X		No major changes.
CSFS	Community Wildfire Protection Planning	Regulation	• Requires the CSFS to establish guidelines and criteria for counties to consider in preparing Community Wildfire Protection Plans (CWPPs) to address wildfires in fire hazard areas	CWPPs must meet the minimum standards required by the CSFS. Level of specificity may be a factor in	X		SB22-007 provided $800,000 for outreach campaign about wildfire risk and mitigation

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	SB 09-001 CRS § 23-31-312 CRS § 30-15-401.7		within the unincorporated portion of a county. • Supports development, revision, and implementation of Community Wildfire Protection Plans (CWPPs) by providing technical assistance ultimately resulting in implementation. • Provide technical assistance to communities, local government, and land managers regarding wildfire hazard areas. • Provide educational materials and information to communities developing CWPPs. • Maintains database of completed CWPPs in Colorado on CSFS website (currently 225 CWPPs exist in Colorado; 47 are county-level plans).	completing implementation. County-wide plans often aren't specific enough to provide necessary guidance for community project implementation.			

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CSFS	Fire Adapted Communities (FAC)	Program	• Works closely with homeowners and communities to provide guidance on reducing fuels and increasing community safety. • FAC is an umbrella concept that includes all programs and activities to reduce wildfire risk. • Maintains consistent wildfire messaging from national to local partners. • Includes Colorado's Are You Firewise? Program	Consistent understanding and messaging amongst partners.	X		No major changes.
CSFS	Forest Improvement Districts HB 07-1168	Regulation	• Authorizes a municipality or county to propose to its voters the formation of a Forest Improvement District through which the municipality or county could tax itself to raise money for priority forest improvement projects.		X		Using HFVC Sec. 6 for COWRA update to be released in 2023.
CSFS	Forest Restoration and Wildfire Risk	Regulation	• Consolidation of two grant programs, Colorado Forest Restoration Grant and	Demand for CSFS services under this	X		Severance tax no longer funds the HFVC. As of

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Mitigation Grant (FRWRM) SB 17-050 SB 17-259 CRS § 23-31-313		DNR Wildfire Risk Reduction Grant, into one program administered by the CSFS. • Assists with funding community-level actions across the state that are implemented to protect populations and property in the wildland-urban interface and to promote forest health and the utilization of woody material. Includes funding for capacity building. • Pre/post treatment monitoring of select projects to determine treatment effectiveness and gather information to assist with adaptive management. • Annual appropriation of $8 million from the General Fund via SB21-205.	program currently exceed available resources.			2021, funding comes from an annual appropriation of $8 million from the General Fund via SB21-205.
CSFS	Forestry Collaboratives and Partnerships	Practice	• Delivery of information and education through the Colorado Collaboratives Network • Development and implementation of cooperative programs to implement	Capacity to engage with the number of groups throughout Colorado.	X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			community protection and wildfire hazard reduction projects across ownerships • Partner to develop policy to drive effective fuels reduction and watershed health through the Rocky Mountain Restoration Initiative. • Partner with federal, state and local agencies in planning, funding and implementing multi-jurisdictional projects.				
CSFS	Forestry Programs for Homeowners and Landowners CRS § 23-31-202 CRS § 23-31-201	Program	• CSFS foresters provide forestry-related technical assistance to homeowners and landowners to help them manage property and meet overall stewardship/management objectives, which includes wildfire risk reduction activities. • Home assessments offer landowners recommendations on how to reduce	• The Colorado wildland-urban interface (WUI) is predicted to grow exponentially, and more resources are needed to reduce risk and protect critical infrastructure.	X		Severance tax no longer funds the Program. As of 2021, funding comes from an annual appropriation of $8 million from the General Fund via SB21-205.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			wildfire risk and manage for healthy forests, depending on landowner objectives. • A vibrant forest products industry will help offset some costs of fuels management implementation projects in the wildland-urban interface (WUI).	• Costs to implement fuels reduction projects are prohibitive to some landowners. • Lack of public acceptance of forest management practices can prohibit landowners from taking necessary actions to reduce wildfire risk.			
CSFS	Interagency Coordination	Practice	• Planning and implementation with local, state, and federal partners on forest health, fuels reduction, post-fire rehabilitation, and Good Neighbor Authority projects. • Allocation of federal and state funds. • Delivering coordinated interagency	Efficiencies in prioritizing mitigation projects across boundaries; leveraging of federal funds.	X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			messages to homeowners, landowners, and land management agencies.				
CSFS	Inter-governmental Cooperation to address Wildfire Mitigation HB 09-1162	Regulation	• Requires local governments that own any land area for any reason other than utility purposes that is located entirely or partially outside its own territorial boundaries and inside the boundaries of a county that contains at least 50% forest land or land that constitutes a wildland area, to enter into an IGA with the county or CSFS for the purpose of mitigating forest land. • Purpose of agreement is to mitigate forest land/wildland fires that affect contiguous land areas of the local government and county.	Limited funding to implement fuels mitigation projects at the county level.	X		No major changes.
CSFS	Mitigating the Effects of the Pine Beetle Infestation	Program	• Established a beetle mitigation fund allowing the public to make voluntary donations used to treat beetle-infested state-owned lands.	Fund availability dependent on donations	X		Additional $2,000,000 for Wildfire Risk Mitigation Loan Program.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	HB 08-1318 CRS § 23-31-303						
CSFS	NFPA's Firewise Communities USA™ Program	Program	• Supports communities working toward national Firewise Community (FWC) USA™ designation. • Supports communities renewing their Firewise USA™ designation each year. • Maintains database of communities participating in the program; 169 Firewise USA™ communities currently exist in Colorado. • Results in fuels reduction implementation reducing risk to lives, property, communities, and other values at risk.	There are five requirements communities must meet to complete and receive the Firewise USA™ designation: 1) complete a community wildfire risk assessment, 2) complete an action plan, 3) spend minimum of $22.14/dwelling unit on Firewise™ wildfire risk reduction activities, 4) create a Firewise™ board/committee, and	X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
				5) hold an annual education event or activity and complete application for designation.			
CSFS	Outreach and Educational Campaigns	Practice	• State, federal and grant funds. • State support of HB 1199. • Encourage and directly develop professional outreach and information campaigns to targeted audiences within the state. • Educational workshops, events and programs to youth and adult audiences that focus on wildfire mitigation and fire ecology. • Informed decision-making at the individual landowner and local level resulting in action towards hazard mitigation in wildland areas. • Production and distribution of print	Colorado's WUI is not fully developed, so demand for wildfire mitigation education will continue to increase.	X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			and online publications and guidance to inform landowners and professionals about best practices for wildfire mitigation.				
CSFS	Renewable Energy Forest Biomass Incentives SB 13-273 and SB21-258	Program	• Provides variety of incentives for use of forest biomass within “red zones.” • Defines red zone as a wildland-urban interface (WUI) area of high wildfire risk in Colorado, identified by the CSFS updated red zone map. • Directs CSFS to collaborate with federal agencies to facilitate use of forest biomass as feedstock for timber mills, and authorizes CSFS to assist communities in high risk areas with Community Wildfire Protection Plans (CWPPs).	High percentage of lands under federal ownership makes it difficult to implement landscape-scale forest management projects. Appropriate management of available lands at landscape level would provide a continuing source of forest products sustaining a wide array of market opportunities.	X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
CSFS	State Fire Assistance - Wildland Urban Interface Grant (SFA-WUI)	Program	• Competitive program makes federal funds available to homeowner & property owner associations, subdivisions, fire departments, counties, and other groups to implement projects that mitigate wildfire hazards in the wildland-urban interface (WUI). • Funds hazardous fuels reduction, fire information and education, and community and homeowner action. Projects affiliated with approved Community Wildfire Protection Plans (CWPPs), demonstrating interagency collaboration, incorporating a landscape scale approach, and a documented maintenance schedule are more competitive.	Requires a minimum one-to-one match from recipients. Additional recipient match may make the proposal more competitive. Limited funding is available; demand for funds far exceeds availability.	X		No major changes.
CSFS	State Leadership in Wildfire	Practice	• Allocation of federal and state funds. • Delivery of coordinated interagency messages to homeowners, landowners,		X		Consistent state funding available for this purpose (HFVC).

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Mitigation and Forest Health		and land management agencies. • Potential awareness leads to informed decision making and action to mitigate wildfire threats.				
CSFS	Watershed Bonding for Forest Health SB 08-221 CRS § 37-95-112.5	Regulation	• Allows Colorado Water Resources & Power Development Authority (CWRPDA) to issue up to $50 million in bonds; proceeds can be used to help CSFS, in partnership with another governmental agency, identify and complete watershed protection and forest health projects. • With proper authority and agreement, bonds can be issued for forest health and watershed protection projects.		X	X	No major changes.
CSFS	Wildfire and Watershed Assessments (WWAs)	Program	• Uses template for assessing individual 6th-level watersheds, developed by Front Range Watershed Wildfire Protection Working Group, 15 initial (i.e., Phase 1) WWAs have been	Assessments are still being completed, and much of the state is in need of detailed assessments to	X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			completed. Eleven of the 15 WWAs have entered Phase 2 level with stakeholder involvement process and specific "zones of concern" identified on the ground. • Four primary components integral in evaluating zones of concern are: wildfire hazard, flooding or debris flow risk, soil erodibility, and water uses ranking. • Individual WWAs have been completed identifying critical zones of concern within watersheds. Zones of concern identify areas in need of forest management and fuels mitigation. • Provides post-wildfire assessments to minimize impact to critical watersheds.	determine risk of wildfires to important watersheds.			
CSFS	Wildfire Mitigation Incentives for Local Governments	Program	• Assists with funding local governments across the state that dedicate revenue for local forest management and wildfire mitigation efforts. Includes	• Limited (one-time) funding available • Local Governments are required to match	X		New as of 2022 when the Colorado General Assembly passed HB22-1011. A one-time

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	HB22-1011		funding for capacity building. • Created during the 2022 legislative session when the Colorado General Assembly passed HB22-1011, a one-time allocation of $10,000,000 to the Incentives for Local Government Grant Program Fund, administered by the CSFS.	grant funds with revenue raised from a dedicated revenue source (tax imposed by the local government, approved mill levy approved, etc.) or to expand existing programs administered by the local government on a long-term basis. • Lack of Local Government ability to create required dedicated fund on a long term basis			allocation of $10,000,000 to the Incentives for Local Government Grant Program Fund, administered by the CSFS.
DHE	Center for Colorado Policy	Program	• Located at UC-Colorado Springs; applies the latest research in land use and environmental economics, along		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Studies: Program on Growth Issues		with public finance and basic economic theory, to growth issues facing Colorado.				
DHE	Center for the American West	Program	• Located at UC-Boulder, a creative and innovative organization identifying and addressing multiculturalism, community building, fire policy, and land, water, and energy use. • Operates on premise that exploration of minds of residents of the American West is an important inquiry into the workings of cultures and ecosystems. • Helps citizens of the West become agents of sustainability; illuminates challenges and opportunities facing Colorado's complicated geographic and cultural area.		X		No change.
DHE	Education Studies and Programs	Program	• University activities around the state support and facilitate education opportunities and studies. These		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			programs are very successful in promoting and forwarding mitigation activities.				
DHE	Natural Hazards Research & Applications Information Center (NHRAIC) (aka “Natural Hazards Center”)	Program	• Located at the University of Colorado Boulder (CU Boulder); serves as a national and international clearinghouse of knowledge concerning social science and policy aspects of disasters. • Collects and shares research and experience related to preparedness for, response to, recovery from, and mitigation of disasters, emphasizing link between hazard mitigation and sustainability to both producers and users of research and knowledge on extreme events. • Strengthens communication among researchers, individuals, organizations, and agencies concerned with reducing damages caused by disasters.		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Promotes all-hazards approach for addressing environmental extremes and is a leading proponent of cooperative partnerships among varying disciplines.				
DHE	Western Forest Fire Research Center (WESTFIRE)	Program	• Interdisciplinary research facility based at Colorado State University (CSU) Fort Collins, College of Natural Resources associated with the Forest, Rangeland, and Watershed Stewardship programs.		X		No change.
DHE	Colorado Center for Community Development (CCCD)	Program	• Located at the University of Colorado Denver (CU Denver), community development focused center which provides students opportunities to support community development and design, preservation, and other projects in communities. • Partners with DOLA (University TA program) to provide conceptual design and related work for communities; can				No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			provide assistance, using students, pre- and post-disaster. DOLA funds projects matched by the communities.				
DNR	Wildfire Risk Reduction Grant (WRRG) Program SB 13-269	Program	• Funds focused on reducing hazardous forest fuels in the wildland-urban interface. CSFS collaborates with the DNR and provides technical assistance to grant applicants. • Wildfire Risk Reduction Grant Program Advisory Committee consists of eight members appointed by the Executive Director of the DNR to represent various interests involved in, or concerned with, the mitigation of catastrophic wildfires such as federal land management, local government, and the forest products industry. • Creates Wildfire Risk Reduction Grant (WRRG) Program, including new cash fund established to provide funding for	Additional recipient match may make the proposal more competitive. Limited funding is available; demand for funds far exceeds availability. In 2017, this program was consolidated with the Forest Restoration Grant in SB-70 and is under the responsibility of the CSFS.	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			grants (Wildfire Risk Reduction Fund). • Directed the State Treasurer to transfer $9,800,000 from the General Fund to the Wildfire Risk Reduction Fund on July 1, 2013.				
DNR	Flood Control Planning & Zoning 1966 HB 1007	Regulation	• State approval and designation of storm runoff channels and basins.		X		No change.
DNR > CAIC	Colorado Avalanche Information Center (CAIC)	Program	• Issues backcountry avalanche forecasts. • Issues forecasts for State Transportation System. • Provides education tools and avalanche safety classes. • Maintains automated and manual measurement sites in high-elevation areas. • Documents human involvement in	Cash-funded largely from donations, contributions, and Severance Tax fund.	X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			avalanches. • Assists in avalanche search and rescue activities. • Assists with determining post-avalanche safety conditions and appropriate mitigation. • Assists in hazard mapping and land-use planning.				
DNR > CAIC	Avalanche Mitigation Program	Program	Provides Avalanche Management Program and staff training in awareness, survival, and rescue techniques; provides forecasting to monitor snow conditions, issue hazard assessments, recommend road closures, and suggest avalanche hazard mitigation operations; performs active avalanche hazard mitigation operations using helicopters, avalaunchers, artillery, fixed installations, and hand-placed explosives.		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
DNR > CWCB > Finance	Emergency Dam Repair Cash Fund CRS § 37-60-122.5	Regulation	• Created Emergency Dam Repair Cash Fund. • As determined by CWCB, money transferred from CWCB Construction Fund as needed.		X		No major changes.
DNR > CWCB > Planning / Watershed and Flood Protection	Flood and Drought Response Fund CRS § 37-60-123.2	Regulation	• Created and appropriated funding to the Flood Response Fund, administered by CWCB.		X		No major changes.
DNR > CWCB > Water Supply Planning	Drought Mitigation Planning CRS § 37-60-126.5	Program	• Drought mitigation planning programs in relationship to state assistance; scarcity, shortages, supply, demand. • Develops programs and provides technical assistance. • Recommends appropriation and expenditures as necessary (5% share of Operational Severance Tax Trust Fund) for purpose of assisting covered entities and other state and local governments		X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			to develop drought mitigation plans. • Guidelines for review and evaluation of drought mitigation plans and prioritization of funds distribution.				
DNR > CWCB > Watershed and Flood Protection	Risk Mapping, Assessment, and Planning (RiskMAP)	Program	• Administers program; funding sources from DHS/FEMA, state, and local funds. • Information regarding Colorado RiskMAP program can be found at: http://coloradohazardmapping.com • Projects may be prioritized pre- and post-disaster to assist with immediate mapping needs or mitigation technical assistance.		X	X	Funding capabilities expanded to include additional mitigation-focused and high resolution topographic (LiDAR) data projects.
DNR > CWCB > Watershed and Flood Protection	National Flood Insurance Program (NFIP)	Program	• Provides technical assistance on floodplain issues through FEMA's Community Assistance Program (CAP) administered by CWCB. • Funding provided to state for technical assistance to local governments through DHS/FEMA, with	Funding cannot be expended for hazard identification (i.e. floodplain mapping).	X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			match funds from the state. • Provides funds for mitigation prioritized on repetitive post-event flood losses.				
DNR > CWCB > Watershed and Flood Protection	Colorado Flood Hazard Evaluation for Land Use Considerations 1977 Executive Order 8491	Regulation	• Evaluation of flood hazard in locating state buildings, roads, and other facilities, and in approving sewage and water facilities and subdivisions.		X		No major changes.
DNR > CWCB > Watershed and Flood Protection	Colorado Floodplain Management Authority 1977 SB 126, CRS § 24-65.1-403(1), 1973, as amended	Regulation	• Authorizes the CWCB to coordinate all activities relating to the designation of floodplains in the state in connection with land use planning. • Floodplain authority; refer to State Flood Mitigation Plan for additional information.		X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
DNR > CWCB > Watershed and Flood Protection	Colorado Water Conservation Board 1937	Regulation	• Creation of Colorado Water Conservation Board (CWCB).		X		No major changes.
DNR > DWR	Colorado NFIP Participation 1977 Executive Order 8504	Regulation	• Requirements and criteria for state participation in the National Flood Insurance Program (NFIP).		X		No major changes.
DNR > DWR	Rules & Regulations for Dam Safety and Construction, authority granted to State Engineer 1973 CRS § 24-4-103, 2 CCR 402-1, Sections 37-87-102	Regulation	• Requirements for construction or enlargement of dams or reservoirs; alteration, modification or repair; general maintenance; emergency action; safety inspections; owner's responsibilities; restriction of recreational facilities; and Emergency Action Plans (EAPs). • All High and Significant Hazard dams must have EAPs.		X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	and 37-87-105 and 37-80-102(11K)						
DNR > DWR > Office of the State Engineer - Dam Safety	National Dam Safety Program State Assistance Grants	Program	• DHS/FEMA grant assistance to State Dam Safety programs to reduce risks to life and property associated with dams, increase awareness of the benefits and risks related to dams, and advance the state in the practice of dam risk management.		X		Have been awarded CWCB Project Bill and FEMA HMGP Grant Funding to complete Risk Assessments on High Hazard Dams for Owners using outside consulting engineers to more aggressively complete these vital assessment on all our high hazard dams that have population at risk below the dam.
DOLA	Colorado Demography Office (located in the DOLA	Program	• Provides technical assistance and information on population, housing and households, economy, labor force, census data, profiles, GIS; data can be		X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	Executive Director's Office)		accessed via internet. • Users include, but are not limited to, local governments including special districts.				
DOLA	Watershed Resilience Pilot Program	Program	The program is a holistic, strategic initiative designed to provide watershed restoration, risk mitigation and community and economic development using a collaborative, coalition-of-partners approach.		X	X	
DOLA > DLG	Land Use, Climate Change, and Resilience Training and Webinars	Practice	• Planning for Hazards: Land Use Solutions for Colorado webinars and website. • "Mitigating Hazards through Land Use Solutions" workshops with DHSEM and FEMA. • Climate Change Webinar Series (2020-2021 & 2023) • "Resilient Leadership" Webinars on Pre- and Post-Disaster Recovery		X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			Planning in partnership with FEMA, CCI, CML (2022)				
DOLA > DLG	Community Development Block Grant (CDBG)	Program	• Coordination and overall administration of federally funded "Small Cities" Community Development Block Grant (CDBG) program. • Funds have been used for pre- and post-disaster mitigation purposes.		X	X	No major changes.
DOLA > DLG	Energy / Mineral Impact Assistance Fund (EIAF)	Program	• Assists communities affected by the growth and decline of energy and mineral industries in the state. • Funded projects include water and sewer improvements, road improvements, construction/improvements to recreation centers, senior centers, and other public facilities, fire protection buildings and equipment, and local government planning.		X	X	No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			• Funds have been used for pre- and post-disaster mitigation purposes.				
DOLA > DLG	Office of Smart Growth - Community Development Office CRS § 24-32-3201, et. seq.	Program	• Created within DOLA during 2000 legislative session to assist local governments in addressing unique public impacts of growth. • Provides direct technical and financial assistance to local governments in the areas of land use planning and growth management.	Still in statute but no longer funded.	X	X	No major changes.
DOLA > DLG > CRO	Microgrids for Community Resilience	Program	• Created within DOLA during 2022 legislative session (HB22-1013) to assist rural communities that are at significant risk of experiencing severe weather or natural disaster events and has at least one "anchor institution" located within the community (i.e., community resilience hub, government, emergency protective services, etc.)	Bolstered by funding to CEO through IIJA funding, but funding amount limited and must be allocated by 2024	X		No major changes.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
DOLA > DLG > CRO	COVID-19 Regional Resiliency & Recovery Roadmaps	Program	• Funded through the EDA, program brings together 16 regional teams to develop a strategic roadmap that will result in regionally aligned and actionable strategies that will help rural communities recover from COVID-19 and be more resilient to future shocks and stressors (including mitigation strategies)	2-year funding limitation, ending mid-2023, loss of 4.5 term-limited staff	X	X	No major changes.
DOLA > DLG > CRO	Colorado Resiliency Framework	Program, Policy	• Coordinates efforts to help communities reduce risks from hazards and recover from disasters and build resiliency throughout the state. • Established formal Colorado Resiliency Working Group as ongoing coordination and steering committee for state's resiliency efforts. • Incorporates mitigation into post-disaster recovery.	Capabilities could be expanded with additional permanent staff.	X	X	HB19-1292 provided permanent funding through the General Fund for 3 FTE.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
Governor's Office	State Fire Ban Authority CRS § 24-30-308	Law	• Authorization by Governor of bans on open burning in designated areas.		X		No change.
Governor's Office	Hazard Awareness Weeks	Practice	• Educates public on the dangers of severe weather. Winter weather, severe weather, lightning, wildfire, and general preparedness are the primary topics. • Local governments and the National Weather Service (NWS) provide weather spotter training. • Support materials are provided by all agencies. • Press releases and a Governor's proclamation are issued. ReadyColorado regularly disseminates preparedness information, including promoting Hazard Awareness Weeks and National Preparedness Month.		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
Local Government	Master Plan Wildfire Hazard Area Locations CRS § 30-28-106 CRS § 31-23-206	Regulation	• CSFS provides assistance to counties in locating wildfire hazards for master plan efforts.		X		No change.
Local Government	County Preliminary Plan Referral Reviews CRS § 30-28-136	Regulation	• For wildfire hazards: Board of County Commissioners (BOCC) distribute copies of prints of the preliminary plan to the CSFS. CSFS provides feedback on wildfire hazards.		X		No change.
Local Government	County Building Codes Title 30, Article 28, Part 2 30-28-201	Regulation	• Enabling authority for counties to adopt a building code (and if they do, that code must meet or exceed the standards in the 2003 version of the international energy conservation code [20-28-211]).		X		No change.
Local Government	County Fire Planning Authority	Regulation	• County Powers & Functions: fire planning authority.		X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
	CRS, Title 30, Article 11, Part 1: 30-11-124						
Local Government	Removal of Statutory Limit on the Amount that may be Raised for the Purpose of Fighting Fires SB 09-105	Regulation	• Removed statutory limit on amount that can be raised in a year by a special property tax levied by a Board of County Commissioners (BOCC) for purpose of fighting specified types of fires in a county.		X		No change.
Local Government	Local Government Land Use Control Enabling Act 1974 HB 1034, CRS § 29-20-101, et seq	Regulation	• Gives broad enabling authority to local governments to plan and regulate the use of land within their jurisdictions, including regulating development and activities in hazardous areas. • Allows counties and municipalities to regulate development and activities in hazardous areas. • General purpose of guiding and		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			accomplishing a coordinated, adjusted, and harmonious development of the municipality and its environs. • Promote health, safety…and general welfare in the process of development, including among other things…the promotion of safety from fire, and other dangers.				
Local Government > CGS	County Master Plan CRS, Title 30, Article 28, Part 1: 30-28-106	Regulation	• County Planning: Referral and review requirements. • 30-28-136(1)(i) CGS evaluation of geologic factors.		X		No change.
Local Government > CGS	Professional Geologist Standard 1973 HB 1574, CRS § 34-1-201, et seq	Regulation	• Requires all geologic reports required by law be prepared by a “professional” geologist.	There is no enforcement provision in statute.	X		No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
MHFD	Urban Drainage & Flood Control District (UDFCD) 2007 Series, Resolution No. 10 (District Levee Policy)	Policy	• Levee policy to discourage local governments within MHFD authorizing or permitting use of levees in new development of flood hazard areas; ineligible for District maintenance assistance. • MHFD will consider levees to protect existing development as last resort only, when no other mitigation option is feasible.			X	No change.
MSI	Mountain Studies Institute (MSI)	Program	• The MSI collaborates among researchers, educators and policy makers with an interest in the San Juan Mountains and other mountain systems worldwide can provide increased knowledge and understanding of mountain environments and communities and the issues that affect them. • The MSI has many established		X	X	No change.

Organization	Description	Type	Capabilities	Limitations	Pre-Disaster	Post-Disaster	Changes Since 2018
			programs focusing on issues such as climate, history, land use, water and snow, air quality, and ecosystems in the San Juan mountains in southwest Colorado. • Provides pre and post-fire education and research for communities, as well as post-fire ecosystem monitoring.				
State Government	State Planning and Interest CRS § 24-65.1-203	Regulation	• Functions of state agencies to provide technical assistance to local governments for matters of state interest (i.e., CWCB, State Conservation Board and Districts, CSFS, CGS, Division of Mines, DPW, DNR).		X	X	No change.
State Government	Amendment to the Colorado Disaster Emergency Act HB-18-1394	Regulation	• Includes provisions related specifically to recovery, mitigation, and resiliency and to establish the roles and responsibilities of state and local agencies at all stages of emergency management.		X	X	No change.

Land Use / Zoning

The State of Colorado has a two-fold process for encouraging the incorporation of hazard mitigation into land use planning. The Division of Homeland Security & Emergency Management - Office of Emergency Management (DHSEM/OEM) is charged with working with communities to foster the development and adoption of FEMA-approved local hazard mitigation plans (HMPs). These HMPs present an opportunity for local governments to evaluate their use of land use planning and zoning, and to consider if the addition of, or enhancements to, these capabilities would be beneficial. At present (8/29/2023), greater than 95% of the state's population live in a county, municipality, or Tribe with a FEMA-approved HMP.

The Colorado Department of Local Affairs (DOLA) also plays a key role in advancing hazard mitigation considerations in land use planning. DOLA's Division of Local Government (DLG) developed a program to help communities plan for and implement strategies for hazard avoidance and mitigation. In the spring of 2016, DLG launched the Planning for Hazards: Land Use Solutions for Colorado guide and website to help local communities, particularly those impacted by disaster, implement hazard mitigation into their land use planning process. The guide includes information on how to conduct a local hazard identification and risk assessment (HIRA) and identifies over 20 land use strategies specific to Colorado communities that can be used to further hazard planning. A key goal of this ongoing project is to assist communities in the development of land use strategies to reduce the risk of damage or destruction due to known hazards. Additionally, as the state's largest funder of comprehensive plans, DLG requires such plans to assess, address, and work to mitigate hazards and points to the Planning for Hazards guide as a tool.

A key issue Colorado continues to address is how elected officials obtain information regarding known and potential hazards during the land use decision-making process. Local elected officials are charged with making decisions regarding the location and types of development allowed in their communities. Three key sources of data

typically convey information to decision-makers regarding the land use review process to include:

- Local community planners with knowledge provided via a local hazard mitigation planning process;
- Expert referral agency consultations as required by state law; and
- The general public and other local referral bodies as may be required in local codes.

Land use planners play a key role in the conveyance of hazard and mitigation information. They typically have responsibility for gathering and evaluating local hazard information, other local government comments, and state agency referrals for decision-maker review. Most significant land use decisions in Colorado are quasi-judicial, requiring a public process and the presentation of issues at public meetings and hearings. The format of the public process is determined by local officials and may include potential developer presentations, public workshops, and formal hearings before planning commissioners and/or local elected officials.

Community Planning Elements in Hazard Mitigation

Local planners typically consult with other local governments, community and regional experts, and community advocates. The key information sources regarding natural hazards at the local level include a local planning commission, engineering and public works officials, emergency managers, and the Local Emergency Planning Committee (LEPC). Advisory plans may include a comprehensive land use plan, a local HMP, and/or an emergency operations plan (EOP).

Colorado counties are an arm of state government and are therefore required to develop comprehensive land use plans pursuant to state statute. Municipalities may have similar requirements under a Home Rule Charter or are otherwise bound by state planning laws. While the nature and extent of comprehensive land use plans vary across the state, the fundamental components of many plans include information on

natural and technological constraints on various types of land uses. Information contained in a comprehensive land use plan is typically a key element in the land use decision process.

Local zoning and subdivision codes may also contain hazard information and avoidance requirements. They may require that site-specific mitigation plans be developed for consideration by officials during the review process. Hazard information required in local codes typically includes flood and floodplain information, geologic hazards, and wildland fire risks. Other hazard data may be also required based upon local conditions such as mining hazards in mountain communities.

Certified land use planners have a duty to make aspects of a potential project a part of the public review process. They also have a responsibility to address the long-term consequences of present actions. Planners typically have a commitment to educate the public about planning issues and their relevance to the lives of residents in their communities. Knowledge regarding local natural and technological hazards are key to the success of communities. There is a natural partnership between planners and emergency managers that is fostered through information sharing and technology transfer. The State of Colorado recognizes this critical relationship and has tasked DHSEM/OEM and DOLA to assist in this work.

Referral Process

The Colorado General Assembly recognizes that local land use bodies can benefit from information known by a number of local, regional, and state agencies. Key issues of concern include water supply availability, geologic hazard conditions, wildland fire potential, and flood hazards.

The statutory referral process takes place upon receipt of a complete preliminary subdivision plan submission. Planners or the development applicant then submit the proposed plan for review by referral agencies according to their local process and/or state law and agency rules. Referral agencies consist of state agencies that specialize in specific areas of regulation or policy.

The Colorado state referral process is entailed in the Colorado Revised Statutes Title 30 Government County § 30-28-136 "Referral and review requirements." The statutes call for a review of any preliminary plan submission to a county. Municipalities often follow a referral process that is dictated in their local standards or charter. The purpose of the referral process is to transfer key information to local decision-makers for their consideration. In having referral agencies review a proposed development plan, the referral agency can help inform the planning process to assist in identifying issues and hazards that may affect the proposal and current or future residents.

Issues addressed by referral agencies typically include the availability of critical services and infrastructure, geological conditions and hazards, water supply availability, and the availability of adequate school capacity. The goal is often to ensure that new development does not negatively impact the community or place residents at risk.

Statutory Referral Agencies

Colorado law requires that counties consult with several state, regional, and local agencies during the development review process. These statutory referral agencies include the following three state agencies:

- The Colorado State Forest Service (CSFS) [Colorado State University] for issues related to forest stewardship, wildland fire prevention, mitigation, and preparedness.
- The Colorado State Engineer [Colorado Department of Natural Resources (DNR) – Division of Water Resources (DWR)] for an opinion regarding material injury likely to occur to decreed water rights by virtue of diversion of water necessary or proposed to be used to supply a proposed subdivision of land. The State Engineer also evaluates the adequacy of a proposed water supply to meet requirements of a proposed subdivision.

- The Colorado Geological Survey (CGS) [Colorado School of Mines] for an evaluation of those geologic factors that may have a significant impact on a proposed use of the land. The State Geologist works with the Colorado Avalanche Information Center (CAIC) to help make avalanche conditions known.

Mandatory local referral agencies include:

- Appropriate school districts for an evaluation of potential impacts on local or regional education services.
- Each county or municipality within a two-mile radius of any portion of the proposed plan for the consideration of issues related to the proposed development.
- Any utility, local improvement and service district, or ditch company when applicable for critical infrastructure or service considerations.
- The local conservation district board within the county for explicit review and recommendations regarding soil suitability, floodwater problems, and watershed protection, even if the project does not fall into a conservation district. Local conservation districts are assisted in this work by the U.S. Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS). The Colorado Department of Agriculture (CDA) – Colorado State Conservation Board provides the local conservation district with guidance regarding this referral process.
- The county or district public health agency or the Colorado Department of Public Health and Environment (CDPHE) for review of the on-lot sewage disposal reports, review of the adequacy of existing or proposed sewage treatment works to handle the estimated effluent, and for a report on the water quality of the proposed water supply to serve the subdivision. In instances where a local land use authority does not have applicable water and

wastewater review capacity, the CDPHE has both regulatory and technical assistance responsibilities.

Many local jurisdictions have referral and consultation processes that extend beyond the basic statutory requirements. Home and property owner associations, fire and law enforcement service providers, and historic preservation groups are often consulted as development proposals move through the land use review process.

Effectiveness of the Referral Process

Colorado's local land use referral review process is partially effective in conveying local hazard information. State agency concerns with the referral process include limited review time periods, a lack of uniform funding for the review process, and the effectiveness of information transfer procedures for what are often technical and complex issues.

A secondary concern is that the statutory referral processes specified in state law have not kept pace with changes in state agency responsibilities. As an example, the Colorado Water Conservation Board (CWCB) is the principal planning and regulatory agency for flood planning and floodplain rulemaking. Local conservation districts have a duty to comment on flood related issues; their referral comments could be more effective if made in consultation with the CWCB and its community flood mitigation team.

It is also important to note that referral comments to local officials are advisory in nature. Land use approval bodies may, in many instances, choose to overlook referral recommendations. While they may request that mitigation measures be incorporated into a development approval, referral agencies typically are not required to review or approve those measures.

Colorado lawmakers amended the state's Disaster-Emergency Act (HB18-1394) in 2018 which requires that all phases of emergency management include hazard mitigation consideration and be incorporated into local EOPs. The bill updates the Colorado

Disaster-Emergency Act to include provisions related specifically to recovery, mitigation, and resiliency and to establish the roles and responsibilities of state and local agencies at all stages of emergency management. This is a positive step forward for mitigation planning.

Building Codes

Local building codes are sound tools to consider when evaluating local policies related to hazard mitigation. The intention is to increase structural integrity and fire prevention; however, increased benefits can also be seen in natural hazard avoidance. Given Colorado's strong home rule tradition, building codes are typically implemented at the local level. It should be noted that the application of home rule limits the state's ability to control certain land use and planning regulations that could result in safer growth and development.

Adoption and adherence to building codes create stronger and safer buildings, increases sustainability, improves environmental friendliness, decreases recovery efforts following a natural disaster, complies with guidelines for government assistance, and saves money over the life of a building. In 2000 the International Code Council (ICC) published its first set of codes. Since then it has continued to update codes every three years, in order to provide guidance on best practices and standards for new construction and updates. The International Building Code (IBC), International Residential Code (IRC), and International Existing Building Code (IEBC) all provide guidance for development to create communities that are built to keep residents safer in the event of disaster.

Currently, many jurisdictions in Colorado have adopted some versions of the ICC codes, although many have not regularly updated these codes in alignment with ICC. There is not a statewide building code for either residential or commercial structures in Colorado. At this time, there is also not a centralized, updated database of Colorado jurisdictions with building codes available. Having this information would

allow the state to perform analysis on local adoption and enforcement, but currently there is no state entity tasked with maintaining any such information.

BCEGS

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a community and how well the community enforces these codes. The grading system is focused on mitigating hazards and looks at the administration of building codes, including adoption and enforcement. This system also analyzes data on plan review, including processes in place to promote plan review accuracy, completeness, and consistency as well as adequate staffing for this work. The BCEGS finally considers field inspection and if a community enforces its codes. BCEGS classifications range from 1, lowest scoring, to 10, the highest scoring. BCEGS most recently completed a review of Colorado communities in 2019. As a state, Colorado received a 5 for both residential and commercial codes grading.

Resources for Building Codes

There are several entities that manage and monitor building codes statewide for structures under their purview, or provide information and resources to jurisdictions as shown in Table 76.

TABLE 76 - ENTITIES THAT MONITOR BUILDING CODES STATEWIDE

Entity	Description of Building Code Connection	Additional Information
Office of the State Architect	This office is responsible for establishing minimum building codes for all state agency construction (state facilities) on state-owned or state lease-purchased properties of facilities.	https://osa.colorado.gov/state-buildings/building-codes

Entity	Description of Building Code Connection	Additional Information
Division of Fire Prevention & Control	All public schools and junior colleges and licensed healthcare facilities.	https://dfpc.colorado.gov/FLSconstruction
Colorado Examining Board of Plumbers	This board is responsible for the State Minimum Plumbing Code.	https://dpo.colorado.gov/Plumbing
DOLA > Community Development Office > Division of Housing	If a county or municipality does not have a building code, factory-built structures and buildings constructed on-site intended for multiple occupancy are subject to building standards set by the division.	https://cdola.colorado.gov/office-of-regulatory-oversight/building-codes-and-standards
DNR > CWCB	CWCB does require certain building codes to be followed for any critical facilities being sited in a 100-year floodplain.	https://cwcb.colorado.gov/sites/cwcb/files/Rules%20and%20%20Regulations%20for%20Regulatory%20Floodplains%20in%20Colorado%202%20CCR%20408-1.pdf

Mitigation Funding

Table 77 provides a summary of all state and federal funding programs related to hazard mitigation efforts. It identifies which programs are state funded and which are federally funded but managed by the state. State agencies continually work to identify new strategies for implementing mitigation projects, including new funding sources. As an example, DOLA has recently provided this resource (Local Community Funding Guide), which summarizes funding sources available through a variety of

federal and state programs to local government entities and community based organizations, some directly or indirectly related to hazard mitigation.

Although state agencies are continually developing capability and processes to maximize the availability and efficient use of mitigation resources, demand for mitigation dollars typically exceeds supply. As such, the State Disaster Emergency Fund (DEF) has been used to continue and expand support for statewide mitigation and recovery activities. In the past these funds have been used post-disaster to support portions of the non-federal share on Hazard Mitigation Grant Program (HMGP) projects and Public Assistance (PA) 406 projects for state and local entities.

Additionally, local jurisdictions invest in mitigation activities across the state. These investments may be fully funded and locally directed, or as cash or in-kind matching funds for federal and state mitigation programs. Nonprofit organizations may have various programs or opportunities for public and private sector entities, including private property owners, to receive and apply funding or services to natural hazard mitigation. In addition, other opportunities for mitigation funding exist in the private sector through various foundations.

TABLE 77 – HAZARD MITIGATION FUNDING PROGRAMS

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
CDA		X	Environmental Quality Incentives Program -Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.	This is a USDA program. The National Resources Conservation Service (NRCS) has seen an increase in funding to EQIP in Colorado.
CDA		X	Rural Development Grants - Provides grants and loans for infrastructure and public safety development and enhancement in rural areas.	No major changes.
CDOT > Materials & Geotechnical Services	X		Geohazard mitigation is funded through the Transportation Asset Management Program. Budget in a typical year ranges from $9M - $10M	The CDOT Resilience Program is an additional potential source of mitigation funding; however, there is no dedicated minimum amount for

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
				geologic hazard mitigation.
CDPHE		X	Clean Water Act Section 319 Grants - Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.	No change.
CDPS > DFPC		X	Fire Management Assistance Grants (FMAG) - Provides fire suppression support to states when loss of life and property are imminent. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.	No major changes.
CDPS > DFPC		X	Rural Fire Assistance Grant - Funds fire mitigation activities in rural communities. (Managing agency - community applicants, Source agency NIFC)	No major changes.
CDPS > DFPC	X		The program allows homeowners to apply to receive a grant for retrofitting or improving a house or other structure on the homeowner's property with strategies and technologies for structure hardening in order to make the house or structure more resilient to the risk of wildfire.	New program.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
CDPS > DHSEM	X		State Disaster Emergency Fund	No change.
CDPS > DHSEM		X	Flood Mitigation Assistance (FMA) Program - Repetitive flood loss property reduction. Since many homeowners are not interested in these project opportunities, often the funds go unused.	No change.
CDPS > DHSEM		X	Hazard Mitigation Grant Program (HMGP) and HMGP Post Fire (HMGP-PF)- Post-disaster multi-hazard and wildfire mitigation funding.	HMGP Post-Fire grants began in October 2018.
CDPS > DHSEM		X	Individual Assistance (IA) - Following a disaster, funds can be used to mitigate hazards when repairing individual and family homes.	No change.
CDPS > DHSEM		X	Public Assistance (PA) - Following a disaster, funds can be used to mitigate hazards when repairing damages to a public structure or infrastructure. Wildfire mitigation is also eligible for emergency protective measures for threatened facilities.	No change.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
CDPS > DHSEM		X	Pre-Disaster Mitigation Program (PDM) - Grants for specific multi-hazard mitigation projects, including planning.	Grant is now part of the Congressionally Directed Spending portfolio and its availability relies on annual appropriations.
CDPS > DHSEM		X	Small Business Administration (SBA) Pre-Disaster Mitigation Loan Program - Provides low-interest loans to small businesses for mitigation projects. (Applicant coordinated through DHSEM)	No change.
CDPS > DHSEM		x	Building Resilient Infrastructure and Communities Program (BRIC)	New program.
CGS		X	National Earthquake Hazards Reduction Program (NEHRP) - Provides money to support enhanced earthquake risk assessments in local hazard mitigation plans and other earthquake hazard mitigation and preparedness activities.	No major changes.
CSFS		X	Community Assistance Funding Adjacent to National Forest System Lands Grant (CAFA)	No major changes.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
CSFS		X	Community Wildfire Defense Grants (CWDG)	New program.
CSFS		X	Congressionally Designated Spending - Colorado Wildfire Risk Reduction and Resilient Forests Project	Federal program established in 2022. Annual opportunity to opt-in or out of management. Partial opt-in selected for initial year to support programmatic outreach & education.
CSFS		X	Disaster Supplemental Funding - Crystal Mountain Post-Wildfire Recovery and Mitigation Project	No major changes.
CSFS		X	Forest Land Enhancement Program - Provides educational, technical, and financial assistance to help landowners implement sustainable forestry management objectives	No major changes.
CSFS		X	Forest Legacy Program - Program providing funding to protect private forest lands that are environmentally,	Competitive grant program created in

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			economically, and socially critical. This program reduces development in the wildland-urban interface.	2017 via SB17- 050. Severance tax no longer funds the Program. As of 2021, funding comes from an annual appropriation of $8 million from the General Fund via SB21-205.
CSFS	X		Forest Restoration and Wildfire Risk Mitigation Grant (FRWRM) program- annual state-funded grant program to reduce fuels and conduct forest restoration projects and capacity building projects	State-funded program created under HB22-1011.
CSFS	X		Live Wildfire Ready public outreach campaign - one-time funding from SB22-007 for public campaign with potential for additional funding	No major changes.
CSFS		X	National Fire Plan - Provides pre-disaster funding for primarily wildland fire mitigation, but also planning for all hazards.	No major changes.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
CSFS		X	State Fire Assistance WUI Competitive Grants	No major changes.
CSFS	X		State tax break for property owners who perform wildfire mitigation https://tax.colorado.gov/sites/tax/files/Income65.pdf	Campaign to run in 2023 and 2024
CSFS	X		Wildfire Mitigation Financial Incentive for private property owners	Funding awarded to CSFS in FY 2022 and 2023 (Senator Bennet)
CSFS	X		Wildfire Mitigation Incentives for Local Governments - one-time funding allocated for a grant program to incentivize local governments to develop and conduct forest mitigation activities	USFS grant to CSFS for post-fire work in the Cameron Peak Fire footprint
CWRPDA	X		Water Revenue Bonds Program - Water and wastewater treatment plants, pump stations, dams/reservoirs, water rights, pipelines, hydro-electric projects, wells, meters, reuse, storage tanks, et cetera.	No change.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
DNR		X	Community Assistance Program (CAP) - Product-oriented financial assistance program directly related to the flood loss reduction objectives of the NFIP.	No change.
DNR	X		The Colorado Strategic Wildfire Action Program (COSWAP) was created after the devastating 2020 fire season by the Colorado legislature through the bi-partisan supported SB21-258 in the summer of 2021. COSWAP is designed to quickly move $17.5 million state stimulus dollars to start on-the-ground work on fuels reduction projects and increase Colorado's capacity to conduct critical forest restoration and wildfire mitigation work that will increase community resilience and protect life, property and infrastructure.	New program as of the 2021 legislative session.
DNR		X	RiskMAP Program - Establishes or updates floodplain mapping and multi risk products	No change.
DNR	X		Colorado Healthy Rivers Fund - For projects that promote improvement and/or protection of the	No change.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			condition of the watershed including flood protection and channel stability.	
DNR	X		Colorado Watershed Restoration Protection - Provides funds for watershed and stream master planning in flood affected watersheds. Master plans should guide communities towards prioritization and implementation of stream rehabilitation and restoration projects that protect life and property from flood hazards.	No change.
DNR	X		Fish and Wildlife Resources Fund - River restoration feasibility studies and construction projects designed to directly mitigate or significantly improve the environmental impacts of existing water facilities.	No change.
DNR	X		Non-Point Source Pollution Grants - Applicants can include governmental and non-governmental organizations.	No change.
DNR	X		Watershed Restoration Grants - Watershed/stream restoration and flood mitigation projects. These grants	No change.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			were utilized in response to the 2012 High Park and Waldo Canyon Fires.	
DNR	X		Wildfire Risk Reduction Grant Program (WRRG) - Provides funding to reduce the risk of wildfire in areas where human development and forested lands overlap, areas often called the wildland-urban interface (WUI).	No change.
DNR > CPW		X	National Wildlife Wetland Refuge System - Provides funding for the acquisition of lands into the federal wildlife refuge system.	No change.
DNR > CPW		X	North American Wetland Conservation Fund - Provides funding for wetland conservation projects.	No change.
DNR > CPW		X	Partners for Fish and Wildlife - Provides financial and technical assistance to landowners for wetland restoration projects in “Focus Areas” of the state.	No change.
DNR > CWCB (USACE)		X	Planning Assistance to States - Provides assistance to States in planning for the development, utilization, and conservation of water and related land resources.	No major changes.
DNR > CWCB (USACE)		X	Silver Jackets - Can provide funding for flood related studies, public awareness, risk analysis, and flood	No major changes.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			response plans. Construction of small flood control projects. (Also managed by local applicants)	
DNR > CWCB > Finance	X		Construction Fund & Severance Tax Trust Fund - Provides funding for raw water projects (e.g., dams, pipelines, ditches, wells, new projects or restorations).	No major changes.
DNR > CWCB > Finance	X		Water Project Loan Program - Provides funding for raw water projects (e.g., dams, pipelines, ditches, wells, new projects or rehabilitation).	No major changes.
DNR > CWCB > Water Supply Planning	X		Drought Mitigation Planning Grant Program - Water conservation planning, drought mitigation planning, and project implementation.	Consolidated with current CO Water Plan Grant program (Conservation and Land Use Planning category).
DNR > CWCB > Water Supply Planning	X		Water Efficiency Grant Program - For aid in achieving goals in Water Conservation Plans; to promote the benefits of water resource conservation for education	Consolidated with current CO Water Plan Grant program (Conservation and

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			and outreach aimed at demonstrating the benefits of water efficiency.	Land Use Planning category).
DNR > CWCB > Water Supply Planning	X		Water Supply Reserve Program - Provides grants to assist Colorado water users in addressing their critical water supply issues and interests.	Updated criteria.
DNR > CWCB > Water Supply Planning	X		Agriculture Emergency Drought Response Fund - For emergency drought-related water augmentation purposes to agriculture water users.	No major changes.
DNR > CWCB > Water Supply Planning / Watershed & Flood Protection	X		Colorado Flood and Drought Response Fund - The fund can be used for flood and drought preparedness, and for response and recovery activities following flood or drought events and disasters.	No major changes.
DNR > CWCB > Watershed and Flood Protection	X		Severance Tax Multi-Objective Watershed Protection - The account exists primarily to provide grants for regional water resource planning studies and associated demonstration projects.	Consolidated with current CO Water Plan Grant program (Watershed Health

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
				and Recreation category).
DNR > DWR > Dam Safety Branch		X	Dam Safety Program - Promotes dam safety through Emergency Action Plans (EAPs), risk assessments, and exercises.	Have been awarded CWCB Project Bill (and FEMA HMGP funding) to complete Risk Assessments on High Hazard Dams for owners using outside consulting engineers to more aggressively complete these vital assessment on all our high hazard dams that have population at risk below the dam.
DOLA	X		Drinking Water Revolving Fund - Low-interest loans for drinking water treatment system needs. (Managing agencies DOLA/ CDPHE/ CWRPDA)	No major changes.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
DOLA	X		Water Pollution Control Revolving Fund - Low-interest loans for public wastewater treatment system needs and watershed nonpoint source control projects. (Managing agencies DOLA/ CDPHE/ CWRPDA)	No major changes.
DOLA	X		Revolving Loan Fund (Managing agencies DOLA/ CDPHE/ CWRPDA)	IIJA expanded SRLF funding to Colorado
DOLA	X		Energy/Mineral Impact Assistance Fund (EIAF) Grants - Funded projects include water and sewer improvements, road improvements, construction/improvements to public facilities, fire protection buildings and local government planning.	No major changes.
DOLA		X	Community Development Block Grant – Disaster Recovery (CDBG-DR) - Often following a disaster, the state may receive a CDBG Supplement intended for mitigation projects in the affected areas. Funding also supports public facilities including water and wastewater	No major changes.
DOLA	X		Microgrids for Community Resilience Program - provides grants to rural communities to bolster their	New program as of the 2022 legislative

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			grid resiliency and reduce impacts from extreme weather events	session (to launch in February 2023 and run through mid-2026); DOLA is partnering with CEO to seek additional funding from the IIJA through the Dept of Energy to expand this program for up to 10 years.
DOLA	X		Strong Communities Program (HB22-1304) - incentivizes infill development and fiscally and environmentally sustainable development patterns and avoiding sprawl into hazardous areas. Co-benefit of air pollution reduction by incentivizing sustainable development patterns to put people near transit and jobs.	New program as of the 2022 legislative session (to launch in January 2023 and run through 2026)
DOLA	X		Disaster Resilience Rebuilding Program - This grant and loan program established by the 2022 legislative	New program as of the 2022 legislative

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			session (SB22-206) is currently focused primarily on resilient rebuilding of homes impacted by disasters from 2018 on, including energy efficiency and fire and wind mitigation. (Note: pending funding availability, the DRR program, could expand to include local government and neighborhood recovery and economic recovery)	session, limited funding source that could have broader impact for mitigation if ongoing funding source were to be identified
DOLA	X		Watershed Resilience Pilot Program - The program is a holistic, strategic initiative designed to provide watershed restoration, risk mitigation and community and economic development using a collaborative, coalition-of-partners approach.	New program.
DOLA	X		IIJA Local Match Program (LOMA) - This program was established by SB22-215 and is a collaboration between DOLA, OEDIT, and the Governor's Office. This program is available to local governments to support their non-federal match requirement when applying directly to the federal government for an IIJA program	New program as of the 2022 legislative session. Limited funding that is available until funds run out, unless additional allocations

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			(which includes BRIC and FMA that both received allocations from IIJA).	were to be made in future legislative sessions.
DOLA		X	Housing and Urban Development (HUD) Grants - Provides a number of grants related to safe housing initiatives.	No major changes.
Governor's Office		X	Americorps - Provides funding for volunteers to serve communities, including disaster prevention. AmeriCorps/Vista has assisted local communities with wildfire mitigation projects. Managing Agency - Office of Lt. Governor	No change.
Governor's Office		X	Economic Development Administration Grants and Investments - Invests and provides grants for community construction projects, including mitigation activities.	No change.
USACE		X	In-Lieu Fee Program Mitigation Projects - Restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources	No change.

Organization	State Funding Program	Federal Funding Program Mgmt.	Mitigation Funding Program	Changes Since 2018
			management entity to satisfy compensatory mitigation requirements for Department of the Army permits.	
USACE		X	Mitigation Banks - Mitigation Banks are sites approved by the Corps to sell compensatory mitigation credits for projects resulting in unavoidable impacts to waters of the U.S. When a permit is issued that requires compensatory mitigation, the permit will specify how many credits are required to be purchased at an approved mitigation bank.	No change.
USACE		X	Small Flood Control Projects - Authority of USACE to construct small flood control projects. (Managing by local applicants)	No change.
USBR		X	WaterSMART – Drought Response Program - Provides for contingency planning, resiliency projects, and emergency response actions.	No change.
USDA > NRCS		X	NRCS Conservation Programs - Provides funding through a number of programs for the conservation of natural resources. Managing agency - applicant.	No change.

Local Mitigation Capabilities

All Colorado local HMPs must include an assessment of local capabilities, providing insight into how mitigation is and could be implemented at the local level. However, tracking all local mitigation related capabilities can be difficult. In many cases, these capabilities are integrated into everyday operations and as such they are not paid special attention in relation to their impact on an overall mitigation program. That being said, numerous communities in the state have implemented mitigation practices of some kind. This section is intended to summarize those mitigation capabilities.

Local capabilities serve as the cornerstone to successful implementation of mitigation strategies. These capabilities vary widely across Colorado's local and tribal governments. Variation in capabilities can be the result of many factors, including where the jurisdiction is located - in relation to hazard extent, regional economies impacting local tax base, political support, home rule or statutory authorities, full-time or part-time personnel, regular maintenance of and adherence to community and operational plans, and strength of regulation enforcement.

The E-SHMP update provided an opportunity to again assess these local capabilities, through analysis and data roll-up from 49 local HMPs. This information helped to guide updates to the state's mitigation strategy, ensuring it is closely integrated with local and tribal planning efforts.

The capability assessment divides local capabilities into four categories as described by FEMA: Planning & Regulatory, Administrative & Technical, Financial, and Education & Outreach. The following sections provide a compilation of and overview of these capabilities including a description as well as the limitations of each.

Planning & Regulatory Capabilities

The planning and regulatory category includes plans, codes, ordinances, and planning mechanisms a local jurisdiction may possess that would give support to implementing mitigation action strategies. The types of planning and regulatory capabilities are explained in Table 78 through Table 80.

TABLE 78 - BUILDING CODE, PERMITTING, AND INSPECTION CAPABILITIES

Capability	Description	Limitations
Building Codes	A set of rules and standards established and enforced by local governments for the structural safety of buildings; minimum acceptable level of safety for constructed objects. The main purpose of building codes are to protect public health, safety, and general welfare as they relate to the construction and occupancy of buildings and structures.	Jurisdictions may adopt codes but poor enforcement can exist; not all jurisdictions enact detailed building codes nor re-adopt the most recent version.
Building Code Effectiveness Grading Schedule (BCEGS) Rating	A program through the International Organization for Standardization (ISO) which performs an assessment of local building codes and how a community enforces these. The assessment has an emphasis on natural hazards mitigation. BCEGS program assigns each municipality a BCEGS rating of 1-10, with a rating of 1 being exemplary commitment to building code enforcement. Participation in the BCEGS can help to lower a community's insurances rates.	Optional participation in the program. Local ratings are not directly accessible.
Site Plan Review Requirements	Written requirements and standards that define how a site should be developed in terms of traffic and pedestrian	Jurisdictions may adopt but poor enforcement

Capability	Description	Limitations
	circulation, landscaping, drainage, lighting, and other similar items.	can exist; not all jurisdictions enact detailed site plan review requirements.

Figure 176 presents the results of the local capability assessment of building code, permitting and inspection. While almost three-quarters of local plans report having adopted building codes and having site plan review requirements, many of these building codes are not aligned with the most recent versions available, which are those recommended to ensure mitigation. Additionally, having review requirements is only beneficial if there is adequate enforcement.

FIGURE 176 - BUILDING CODE, PERMITTING, AND INSPECTION CAPABILITY SUMMARY

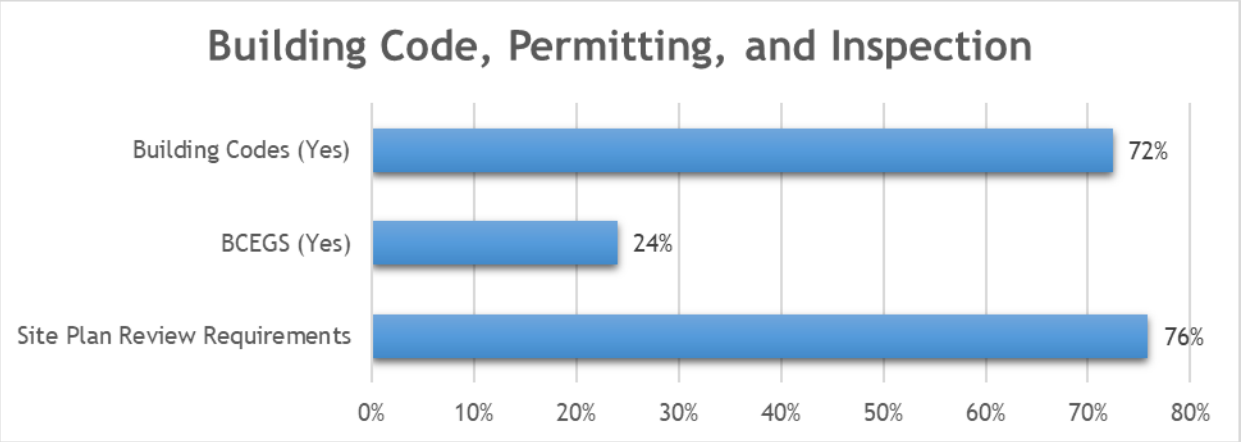


TABLE 79 - PLAN CAPABILITIES

Capability	Description	Limitations
Comprehensive Plan (Comp Plan), Master Plan, General Plan	Process and Plan used to determine community goals and aspirations in terms of community development; dictates public policy in terms of transportation,	These plans typically do not have a standalone

Capability	Description	Limitations
	utilities, land use, recreation, and housing; typically encompass large geographical areas, broad range of topics, and covers a long-term time horizon.	natural hazard element. If natural hazards are addressed, they do not tend to be integrated within the plan. The plans sometimes cross-reference a local HMP.
Capital Improvements Program (CIP)	A short-range plan, usually four to ten years, identifying capital projects and equipment purchases, providing a planning, and identifying financing options.	Variability of funding makes predictability of implementation difficult.
Floodplain Management Plan	Provides community strategies, projects, and measures with the objective to reduce risk and impacts of future flooding. It may take the form of a plan or ordinance.	Not utilized by most jurisdictions, needs to be updated.
Stormwater Program / Plan	A plan to provide recommendations for improvements to flooding, drainage, and stormwater systems.	Variability of funding makes predictability of

Capability	Description	Limitations
		implementation difficult.
Community Wildfire Protection Plan (CWPP)	A community based collaborative plan developed by local stakeholders that identifies and prioritizes areas for hazardous fuels reduction treatments to protect communities and infrastructure from wildfire.	Many of these local plan are outdated, need to be updated.
Erosion and Sediment Control Plan	A plan which provides measures for developers to prevent construction activities on-site from resulting in erosion or the movement of sediment off-site. The plan helps to identify potential problems posed by slope, drainage patterns, and soil types prior to beginning construction.	Not utilized by most jurisdictions.
Economic Development Plan	A strategic planning document and process that guides economic growth and development of a community or region. A plan that is rooted in resiliency. An economic development plan can inform hazard mitigation actions by identifying areas of economic growth and development and avoiding areas at risk of hazards.	These plans typically do not have a standalone natural hazard element.

Figure 177 summarizes the assessment results for plans. Most jurisdictions have comprehensive plans, but less than half utilize some of the other mitigation planning tools that are available.

FIGURE 177 - PLANS CAPABILITY SUMMARY

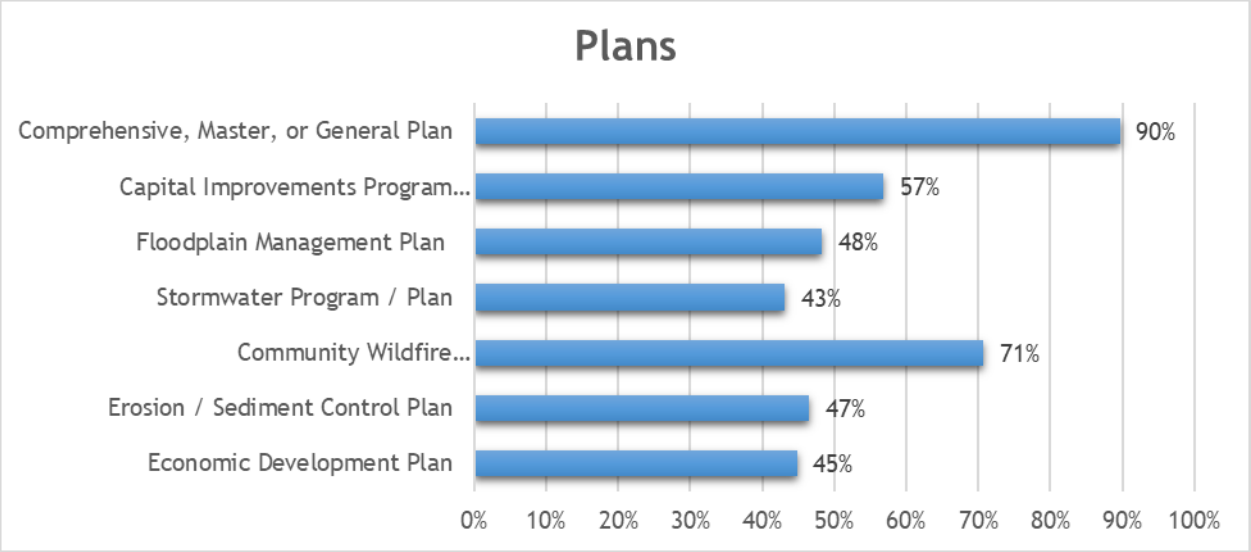


TABLE 80 - LAND USE AND ORDINANCE CAPABILITIES

Capability	Description	Limitations
Zoning Ordinance	Identifies multiple zones or districts, each with its own unique set of standards for land uses and development regulations.	Current land use requirements may be dated and/or may not factor in natural hazards.
Subdivision Ordinance	Establishes regulations for a subdivision and platting of land, providing for the preparation of plats and providing for the installation of utilities, streets and other improvements.	Not utilized by many jurisdictions.

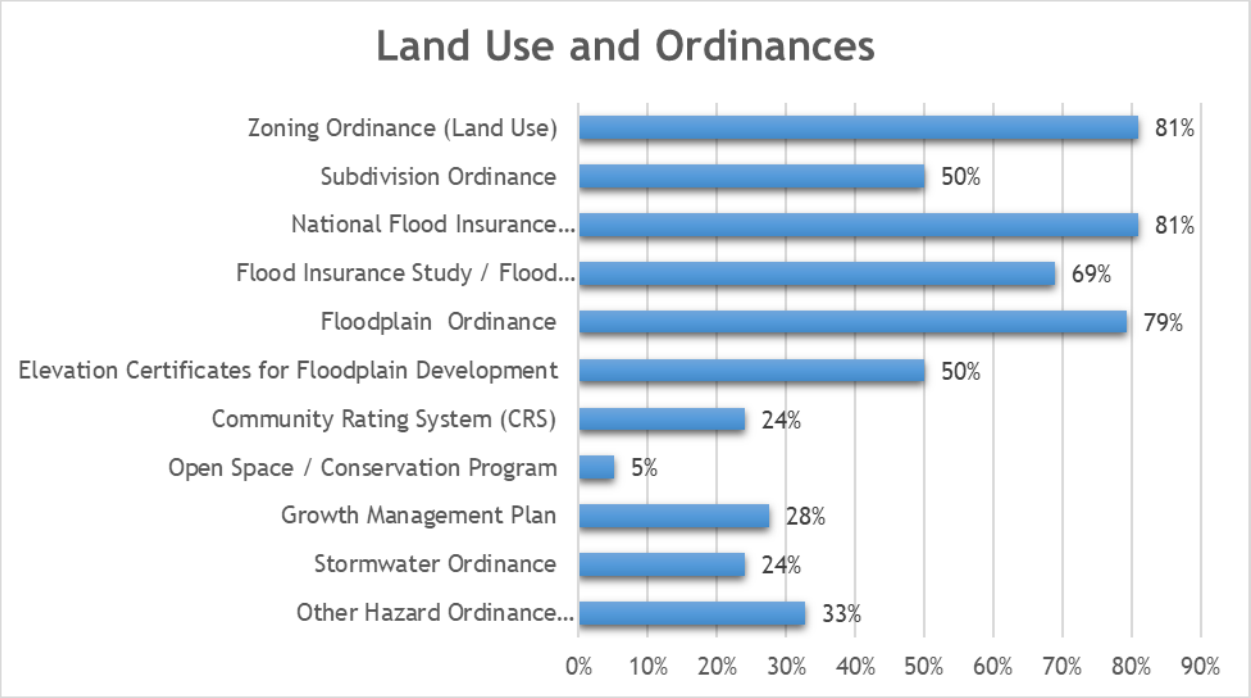
Capability	Description	Limitations
National Flood Insurance Program (NFIP) Participant	A program of flood insurance coverage and floodplain management ordinances created by Congress in 1968 through the National Flood Insurance Act of 1968 (P.L. 90-448) aimed to reduce future flood damage and provide protection for property owners; enables property owners in participating communities to purchase government insurance protection against losses from flooding; designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.	Local floodplain managers are typically tasked with this responsibility as an additional duty to other roles. Areas of the state are unmapped or maps need to be updated.
Flood Insurance Study (FIS) / Flood Insurance Rate Map (FIRM) / Digital FIRM (DFIRM)	A study that presents the risk of flooding within a community. A Flood Insurance Study report provides flood profiles that include flood elevation data. A Flood Insurance Study is often completed for the National Flood Insurance Program (NFIP). FIRMs and DFIRMs provide the mapped floodplains.	Many of these flood studies and floodplains are outdated, needs to be updated.
Floodplain Ordinance	Provides community strategies, projects, and measures with the objective to reduce risk and impacts of future flooding. It may take the form of a plan or ordinance.	Jurisdictions may adopt but poor enforcement can exist

Capability	Description	Limitations
Elevation Certificates for Floodplain Development	Elevation documentation of a building that helps to determine risk-based premium rate for flood insurance policies. An elevation certificate is compared to the building's Base Flood Elevation (BFE) to determine the cost of covering flood risk.	Floodplain and flood elevations must be known.
Community Rating System (CRS)	A program developed by FEMA to provide incentives for those communities in the NFIP that have gone beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.	Difficult for smaller jurisdictions to manage compliance.
Open Space / Conservation Program	A program to acquire and / or protect land as open space. Hazardous areas can be preserved as open space to eliminate development in these areas.	Not utilized by most jurisdictions.
Growth Management Plan	Promotes growth in a community and influences where and how growth occurs. Often designates specific areas where growth should occur in a community.	These plans typically do not have a stand-alone natural hazard element. If natural hazards are addressed, they do not tend to be integrated

Capability	Description	Limitations
		within the plan. Standalone plan that is only implemented through regulatory tools.
Stormwater Ordinance	A plan to provide recommendations for improvements to flooding, drainage, and stormwater systems.	Variability of funding makes predictability of implementation difficult.
Other Hazard Ordinance	Written regulations and laws that define hazard-prone areas and prevent or regulate development. (i.e. – steep slope, wildfire, snow load, etc.)	Jurisdictions may adopt but poor enforcement can exist; not all jurisdictions enact detailed hazard- specific zoning ordinances.

Presented in Figure 178 are the assessment results for land use and ordinances. Over half of these tools are utilized by over 50% of jurisdictions. Others have limited utilization.

FIGURE 178 - LAND USE AND ORDINANCE CAPABILITY SUMMARY



Administrative & Technical Capabilities

The administrative and technical category includes the staff and technical background necessary to implement the planning & regulatory capabilities or to implement mitigation action strategies. The types of planning and regulatory capabilities are explained in Table 81Table 78 through Table 83.

TABLE 81 - ADMINISTRATION CAPABILITIES

Capability	Description	Limitations
Planning Commission	A planning commission is an entity that objectively reviews and recommends sound and efficient planning regulations to the legislative body of the community. The Planning Commission is the primary entity responsible for long	Not utilized by most jurisdictions.

Capability	Description	Limitations
	term, comprehensive planning.	
Mitigation Planning Committee	A hazard mitigation planning committee is an entity that objectively reviews, Recommends, and potentially implements hazard mitigation. The committee is the primary entity responsible for hazard mitigation.	Not utilized by most jurisdictions.
Maintenance Programs	Maintenance programs, such as tree trimming, slash removal, drainage clearing, etc. that are performed by jurisdictions.	Not utilized or recognized by most jurisdictions.

Figure 179 presents the local reporting of the availability of administrative capabilities. The results may be underreported but are severely low across the entire state.

FIGURE 179 - ADMINISTRATION CAPABILITY SUMMARY

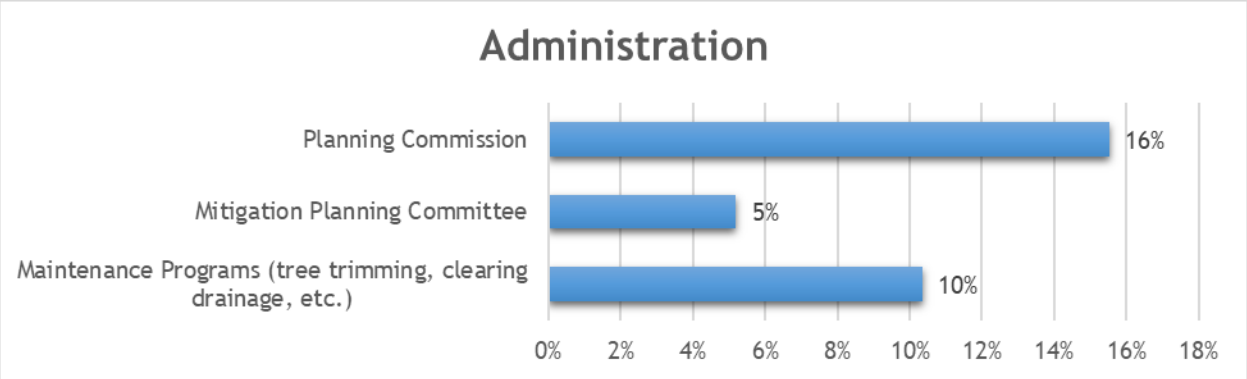


TABLE 82 - STAFFING CAPABILITIES

Capability	Description	Limitations
Emergency Manager (EM)	The managerial function charged with creating a framework within which	Many counties and

Capability	Description	Limitations
	jurisdictions reduce vulnerability to hazards and cope with disasters; local government personnel that coordinate all phases of disaster emergencies; responsibility is assigned to County BOCC Chair in Colorado, but generally is designated by BOCC to another individual or agency.	jurisdictions do not have a full-time EM; some are part-time, or the responsibility is included with other duties as assigned. Local jurisdictions that do not have an EM rely on their county. Many counties and jurisdictions do not have a designated back-up or deputy EM. The level of capability and depth within a local OEM across the state varies greatly.
Building Official	The community administrator charged with reviewing and enforcing local	Not every community has

Capability	Description	Limitations
	building codes. The administrator would be responsible for ensuring building codes are updated, and following the ICC three-year code updates.	the capacity to have a full-time building official. Many communities outsource building code enforcement.
Floodplain Administrator	The principal community administrator in the daily implementation of flood loss reduction activities including enforcing community flood damage prevention ordinances, updating flood maps, plans, and policies of the community, and any activities related to administration of National Flood Insurance Program (NFIP). The floodplain manager or administrator is responsible for overseeing a community's floodplain management program, and maintains education and experience requirements, certifications, licenses, or registrations.	This is a combined duty in many jurisdictions; it may also by necessity be contracted to another jurisdiction, authority, or private firm; can be difficult for jurisdiction personnel to maintain minimum education and experience requirements, certifications,

Capability	Description	Limitations
		licenses, or registrations.
Community Planner	Community planners are concerned with dynamics and interrelationships of basic physical, economic, political, and social elements in communities. Through study and analysis, planners project the influence of these elements on a variety of public and private decisions bearing on the future of an urban neighborhood, rural community, Indian reservation, city, or the orderly growth of a broad urban region. Planners work with physical, climatic, economic, social, political, and financial conditions in such communities, the process of change, and policy questions related to guiding that change.	Community planners must navigate the will of the public and elected leadership.
Transportation Planner	Transportation Planners examine current traffic and population trends in a community and determine the effectiveness of current and future planned roadways.	Not utilized by most jurisdictions.
Civil Engineer	Personnel with experience and understanding of the construction process.	Many communities outsource these duties to the private sector.

Capability	Description	Limitations
GIS Capability	Geographic Information Systems (GIS) Specialists work with related software to create and maintain data and/or maps. This is particularly useful in the assessment to understand risk of hazards to people and property and in identifying underserved communities. GIS software has the capacity to relate different types of data such as socioeconomic, demographic, administrative, or political boundaries, land use, land cover, environmental, infrastructure, and transportation networks.	Not all jurisdictions have trained GIS capabilities or funding to maintain full-time GIS personnel, equipment, and training; some jurisdictions contract GIS services through other jurisdictions or the private sector.
Resiliency Planner	Resilience is the ability for a community to prepare for and respond effectively to stress. A Resiliency Planner views the community holistically and considers ways to plan for a sustainable future and anticipate the possible disruption from inevitable natural hazard events.	Resilient communities in terms of natural hazard events is a concept that some members of a community may be skeptical of embracing

Figure 180 presents the results of the local capability assessment of staffing. Most all of these positions are available to a majority of jurisdictions.

FIGURE 180 - STAFF CAPABILITY SUMMARY

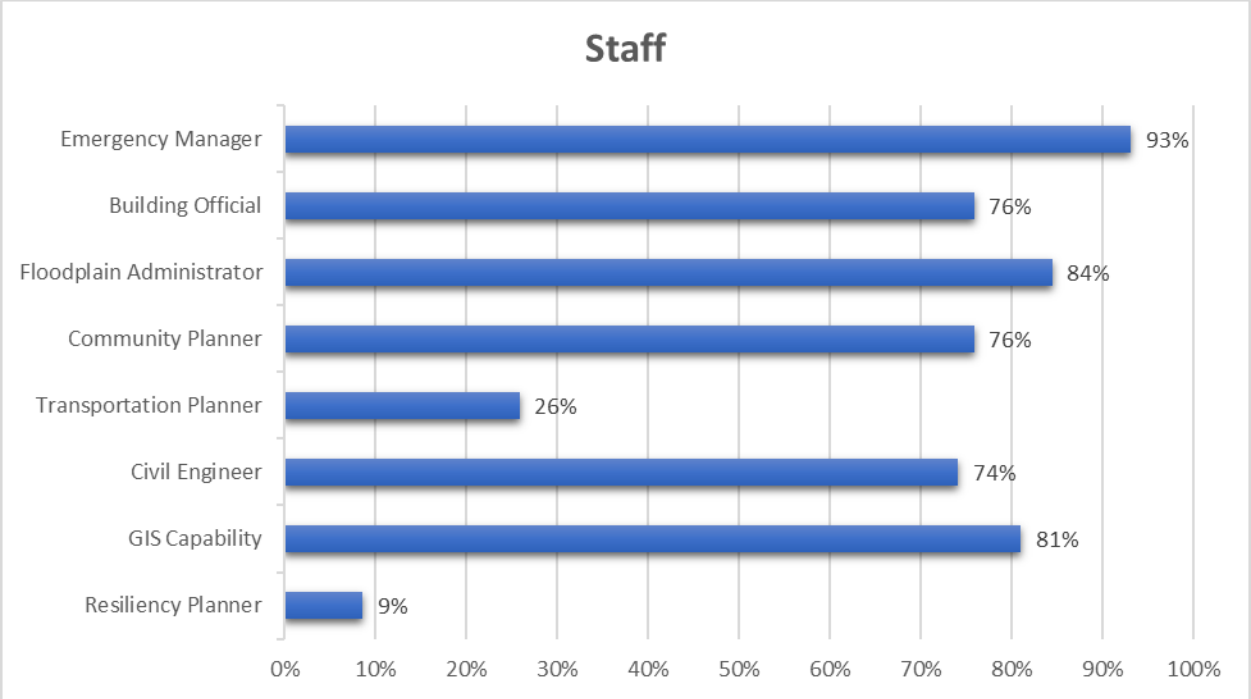


TABLE 83 - TECHNICAL CAPABILITIES

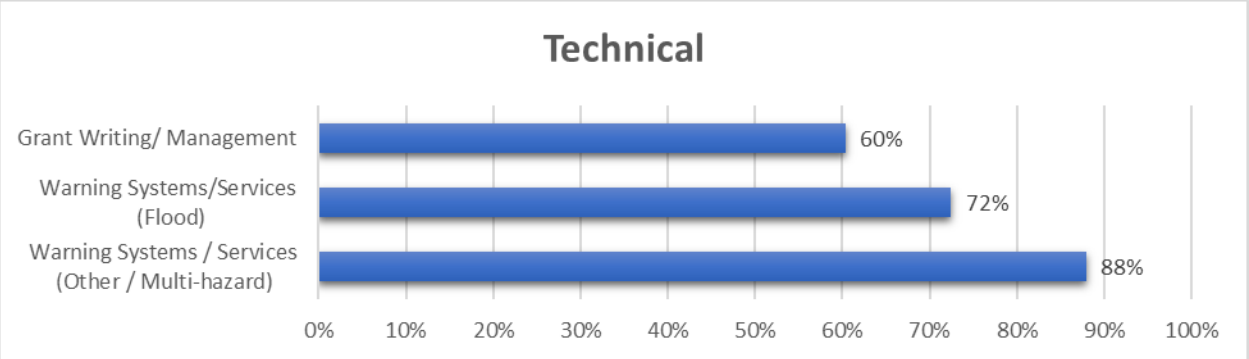
Capability	Description	Limitations
Grant Writing / Management	The position responsible for writing revenue proposals for projects and submitting timely, accurate reports for all existing grant funded projects; responsible for conducting full range of activities required to research, prepare, submit, and manage grant proposals; works with finance to comply with all grant reporting and maintains current records and grant tracking as necessary.	Not all jurisdictions have a dedicated grant writer, or funding for such an employee; many assign this duty as

Capability	Description	Limitations
		needed to various departments or hire and contract through the private sector.
Warning Systems / Services (Flood)	Warning systems specifically monitoring flood conditions, usually incorporates stream gauges and alert systems.	Most systems require contract support through the private sector, can be an expensive investment. Any technology has limitations and can fail.
Warning Systems / Services (Other Hazard)	Warning systems monitoring other hazard conditions including, wildfire, air quality, geologic risks, etc.	Most systems require contract support through the private sector, can be an expensive investment. Any technology

Capability	Description	Limitations
		has limitations and can fail.

The availability of technical capabilities is presented in Figure 181. A majority of jurisdictions utilize all of these capabilities.

FIGURE 181 - TECHNICAL CAPABILITY SUMMARY



Financial Capabilities

The financial category addresses the ability to fund mitigation actions. The types of financial capabilities are explained in Table 84. It should be noted the list is not exhaustive, as each local jurisdiction is unique and may have additional financial capabilities available.

TABLE 84 - FINANCIAL CAPABILITIES

Capability	Description	Limitations
Levy for Specific Purposes with Voter Approval	A tax approved by voters to generate additional tax revenue for a specific purpose.	Requires voter approval.
Utility Fees	Water or sewer utility fees that members of the community pay to convey utilities such as water, gas, or electricity to their	Entirely dependent on local utility providers.

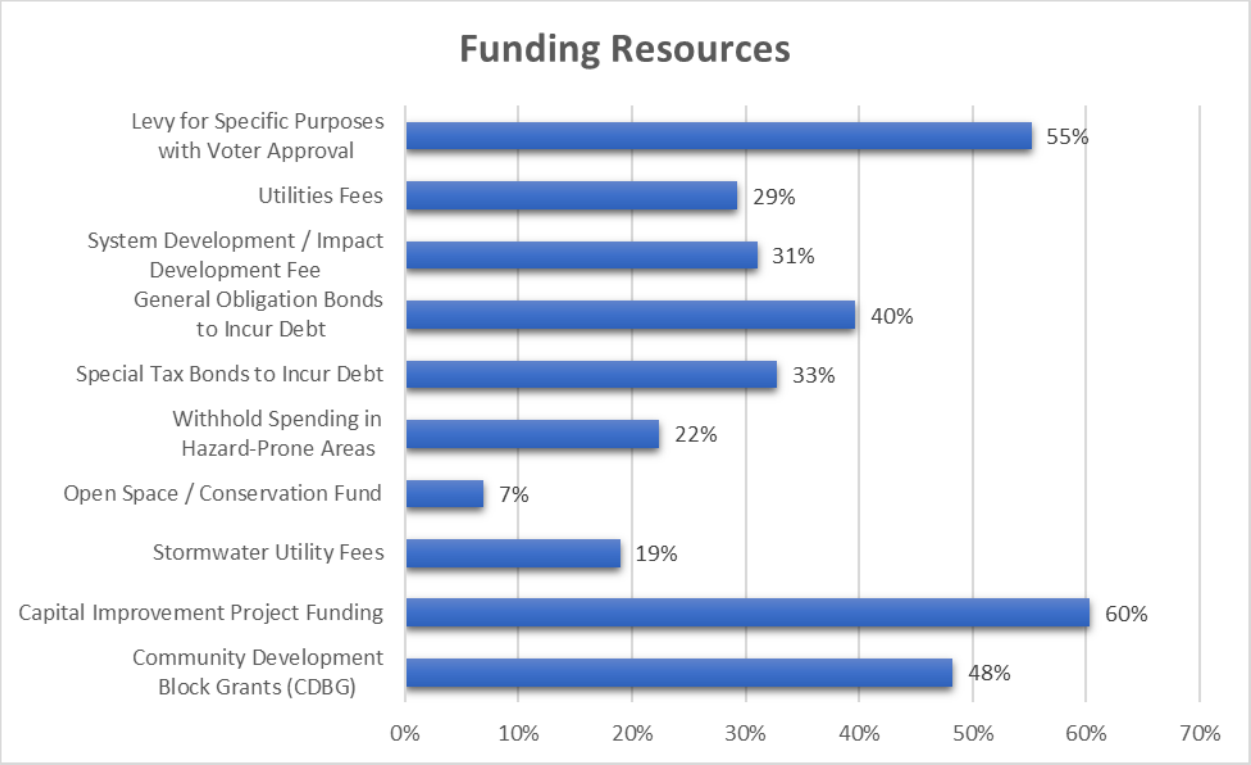
Capability	Description	Limitations
	properties and convey sewer away from their properties.	
System Development / Impact Development Fee	System development and impact development fees are one-time fees local governments place on new and proposed development as a way to pay for all or a portion of the costs it will take to bring new public services to the development.	Colorado state law denotes that local governments imposing an impact fee must show that the fee is reasonably related to the overall costs of extending the public service.
General Obligation (GO) Bonds to Incur Debt	A municipal bond that is issued by local governments to fund public projects with a pledge to use legally available sources such as tax revenues to repay bond holders. The bonds are backed by the full faith and credit of the municipality. GO bonds typically fund projects that will serve the entire community.	Some local municipalities limit general obligation bonded debt.
Special Tax Bonds to Incur Debt	A municipal bond that is repaid through revenues from a project or asset such as a tax on tobacco, gasoline, hotels, et cetera.	Colorado's Taxpayer Bill of Rights (TABOR) places a limit on how much a

Capability	Description	Limitations
		municipality may raise taxes without voter approval.
Withhold Spending in Hazard-Prone Areas	Some local governments have the ability to determine where government spending may be allocated. The local government may decide to restrict spending in areas determined to be at risk of natural hazards in order to limit development in that area.	Not utilized by most jurisdictions.
Open Space / Conservation Fund	A tax approved by voters to be used to purchase lands for open space conservation.	Not utilized by most jurisdictions.
Stormwater Utility Fees	Similar to a utility fee, a stormwater service fee is a charge for the service provided to convey stormwater off properties and control stormwater runoff through the construction, operation, and maintenance of the stormwater system.	Not utilized by most jurisdictions.
Capital Improvement Project (CIP) Funding	Funding specific to capital projects identified in a community's capital improvement plan or program. Capital improvement projects are generally short-term projects.	Colorado's TABOR places a limit on how much a municipality may raise taxes without voter approval.

Capability	Description	Limitations
Community Development Block Grants (CDBG)	A grant funded through HUD for community development activities such as construction of public facilities and economic development activities. DOLA administers the CDBG for municipalities and counties to fund community development activities.	Limited funding. Proposed projects must be consistent with the broad national priorities for the CDBG program including activities that benefit low- and moderate-income individuals, the prevention or elimination of blight, or community activities that address a threat to health or safety of the community.

The availability of funding capabilities is presented in Figure 182. The use of these funding resources is mixed across the state. Each jurisdiction is unique and may have additional financial capabilities available.

FIGURE 182 - FUNDING CAPABILITY SUMMARY



Educational & Outreach Capabilities

The education and outreach category includes tools to educate the public on hazards that pose a risk to their community and is an important part of enabling individuals to take mitigation actions related to personal property or safety. The types of educational and outreach capabilities are explained in Table 85.

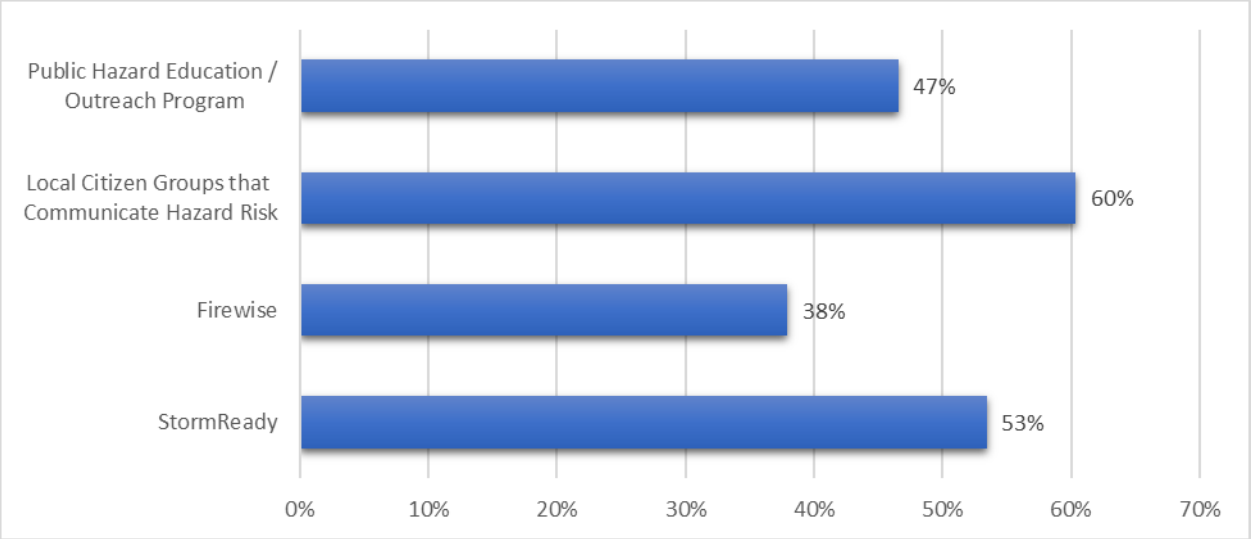
TABLE 85 - EDUCATION AND OUTREACH CAPABILITIES

Capability	Description	Limitations
Public Hazard Education / Outreach Programs	Examples of other types of education and outreach include but are not limited to distributing safety and preparedness	Requires a project champion.

Capability	Description	Limitations
	information, working with school districts on preparedness activities, establishing a Community Emergency Response Team (CERT) in communities, and various citizen academies.	
Local Citizen Groups That Communicate Hazard Risks	Local community groups often have a perspective and trust of people in a community that local governments may not. This allows for discussions and activities related to natural hazards to occur with peers in an environment that may be more comfortable for community members.	Requires a project champion.
Firewise™	Communities develop an action plan that guides their residential wildfire risk reduction activities, while engaging and encouraging their neighbors to become active participants in building a safer place in which to reside.	Requires a project champion. Focuses solely on wildfire hazard.
StormReady®	A nationwide program that helps communities better protect citizens during severe weather; encourages communities to take a proactive approach to improving local hazardous weather operations; provides EMs guidelines on how to improve hazardous weather operations.	Requires a project champion. Focuses solely on communication and safety skills.

The availability of education and outreach capabilities is presented in Figure 183. The utilization of these capabilities is mixed, but roughly half of jurisdictions report using each of these tools.

FIGURE 183 – EDUCATION & OUTREACH CAPABILITY SUMMARY



FEMA Core Capabilities

As part of the E-SHMP update, an evaluation of those FEMA Core Capabilities relating to hazard mitigation was conducted at both the state and local levels. This was the state's first attempt to identify individual and shared gaps across these capabilities.

Those Core Capabilities assessed include the following:

- *Threats & Hazards Identification*: Identify the threats and hazards that occur in the geographic area; determine the frequency and magnitude; and incorporate this into analysis and planning processes so as to clearly understand the needs of a community or entity.
- *Risk & Disaster Resilience Assessment*: Assess risk and disaster resilience so that decision makers, responders, and community members can take informed action to reduce their entity's risk and increase its resilience.

- *Community Resilience*: Enable the recognition, understanding, communication of, and planning for risk, and empower individuals and communities to make informed risk management decisions necessary to adapt to, withstand, and quickly recover from future incidents.
- *Long-Term Vulnerability Reduction*: Build and sustain resilient systems, communities, and critical infrastructure and key resources lifelines so as to reduce their vulnerability to natural, technological, and human-caused threats and hazards by lessening the likelihood, severity, and duration of the adverse consequences.

A total of nine state agency Core Capability self-assessments were conducted. These results are summarized in Table 86. Capabilities were rated on a scale of one (very low) to five (very high). The first row shows the highest rating across all state agencies, while the bottom row shows the state average.

TABLE 86 – STATE CORE CAPABILITY ASSESSMENT SUMMARY

Threats & Hazards Identification	Risk & Disaster Resilience Assessment	Community Resilience	Long-Term Vulnerability Reduction
Highest Rating Across State Agencies			
5	5	5	4
Average Rating Across State Agencies			
4.4	3.6	4.0	3.3

A total of 49 local Core Capability assessments were conducted by the state, in collaboration with counties, as part of the Colorado Emergency Preparedness Assessment (CEPA) process. These assessments were conducted between 2020 and 2023 and are summarized in Table 87. Capabilities were rated on a scale of one (very low) to five (very high). Additionally for the local assessments, grant reliance was also evaluated. Ratings followed a scale of one (not at all) to four (entirely).

TABLE 87 - LOCAL CORE CAPABILITY ASSESSMENT SUMMARY

Threats & Hazards Identification	Risk & Disaster Resilience Assessment	Community Resilience	Long-Term Vulnerability Reduction
Capability Assessment			
3.9	3.0	2.7	2.5
Grant Reliance			
2.6	2.4	1.9	1.9

Obstacles, Challenges, & Solutions

Throughout the planning process the SHMT identified obstacles and challenges relating to statewide mitigation capabilities. From those conversations came ideas for potential solutions to some of these challenges, resulting in some of the newly identified mitigation actions contained in this E-SHMP. Below is a summary of the major takeaways from these discussions.

- *Building Codes*: The main challenge is that Colorado is a home rule state, which means that building code adoption and enforcement are entirely determined by local governments. Many state agencies encourage building codes at the local level and/or are actively pursuing hazard-specific codes at the state level.

- *State / Federal Funding Timelines*: Differing funding timelines is a huge obstacle towards integrating state programs with federal programs. The fact that oftentimes these programs have differing timelines prevents program meshing. At this time there is no simple solution, though documenting this challenge in the E-SHMP will ensure that this is a topic of continued attention and to ensure that future awareness of this obstacle remains identified.

- *Programmatic Constraints*: Individual programmatic constraints will always be a challenge when utilizing any state or federal program. This is anticipated to always be an obstacle towards the integration of multiple programs, as each

program is developed to address a specific need. Awareness of this challenge and continued coordination across and between state and federal agencies is the first step towards finding potential solutions.

- *Local Match Capability*: A lack of available local match is an obstacle for many of the state's communities, especially for those that are rural and have limited funding resources. Local education about how many of these grant programs are reimbursable is one potential solution, to enable communities to plan ahead for these funding needs. Other solutions currently utilized by the state include: on-going coordination with partner agencies to identify additional funding resources, encouraging the development of regional (multi-county) plans or projects, and providing technical support relating to utilizing in-kind match. In the future, the state may also want to consider providing state funds to help cover some or all of these local match requirements.

- *Local Technical Expertise to Apply for Funding*: Local capacity and technical expertise for grant application development and management is a challenge for many communities. The state does provide technical support to assist communities in leveraging many of these programs, but the complexity and time requirements of many programs are an obstacle that many cannot overcome. This topic has recently been acknowledged by many different program leads and solutions are possible, but they must come at the program level.

- *Volume of New Programs*: The sheer volume of new programs available at both the state and federal levels is an obstacle for many local communities and state agencies. There is a great need for education across the board and only through close, on-going collaboration can this challenge be solved.

- *Local HMP Siloing:* HMP development is most always led by local emergency managers who may not have experience with community planning. This challenge can be exacerbated by the fact that many emergency managers

across the state are new to their positions and/or communities. This can result in a lack of institutional knowledge and relationships that are needed for the development of a successful HMP. Educating locals on the benefits of involving a broad range of community sectors is a solution, one that may be supported by the new FEMA planning policy that took effect in 2023.

- *Ingress / Egress Limitations*: A lack of redundant ingress /egress routes for many Colorado communities is an obstacle with no simple solution at this time. The state does not currently have a handle on the scale of this challenge and is attempting to scope this critical issue. Once this problem is better understood, solutions to these issues are expected to be a challenge, especially involving private property issues and challenging topological limitations in some locations.

- *Local Capacity and Capability*: The largest challenge to local implementation of mitigation policies, programs, and capabilities is adequate staffing and resources. This is especially true for rural communities with limited funding capital. Providing technical support and educating locals on available resources is the best solution that the state can provide. Specifically engaging underserved communities can also be an obstacle for communities who do not have existing networks and support organizations specific to these groups. Connecting locals to available state staff to help identify associated resources is a solution. A third related challenge involves providing communities with the best available data and resources relating to climate change and its impacts on hazard events. The E-SHMP, in addition to some of the other related state efforts on climate change documented in this E-SHMP, is the best solution.

- *High Hazard Potential Dam Program:* There are several challenges to reducing risk from HHPDs. The first is educating dam owners on the differences between rehabilitation projects and mitigation projects so that they apply to the correct funding source - HHPD or HMA, respectively. The second challenge is that many

dam owners of restricted HHPDs are small organizations that struggle to meet either the 25% HMA or 35% HHPD nonfederal share. Potential solutions for both include year-round coordination between DHSEM, Dam Safety, and dam owners as well as helping dam owners understand potential sources for match funds. Some examples are revolving loan funds (RLF), including the new Safeguarding Tomorrow RLF, and the State's new Natural Disaster Mitigation Enterprise. A third challenge with HHPDs is the extremely limited construction funding available in the HHPD grant program. The fiscal constraints of the program have, to date, limited the funding potential to about 10% of a single project's costs.

- *Local Challenges in Addressing the Needs of Underserved Communities:*

- Lack of Resources and Funding: Limited financial resources may hinder the implementation of targeted programs and initiatives for underserved communities. Difficulty in securing grants or funding specifically designated for addressing the needs of vulnerable populations.

- Limited Staff Capacity: Insufficient personnel or expertise to adequately assess and address the unique challenges faced by underserved communities. Overburdened staff may struggle to dedicate time and effort to comprehensive outreach and support initiatives.

- Communication Barriers: Language barriers or cultural differences may impede effective communication and engagement with underserved populations. A lack of culturally sensitive outreach materials or strategies can hinder the dissemination of critical information. Elderly and more rural populations may have limited access to digital communication resources.

- Community Engagement and Participation: Building trust and encouraging active participation from underserved communities can be challenging, impacting the success of mitigation initiatives. Ensuring the involvement of

community members in the planning process may require additional outreach efforts.

- Data and Information Gaps: Incomplete or inadequate data on the specific vulnerabilities and needs of underserved populations may hinder effective planning. Difficulty in accessing reliable data to inform decision-making and prioritize mitigation efforts for these communities.

- *Local Challenges in Addressing the Impacts of Climate Change:*

- Limited Awareness and Understanding: Lack of awareness and understanding of the local impacts of climate change may result in a lack of urgency or prioritization in mitigation efforts. Insufficient knowledge about the specific vulnerabilities of the community to climate change.

- Economic Disadvantages in Rural Communities: Economic constraints in rural areas may limit the ability to implement costly climate adaptation measures. Dependence on agriculture or other climate-sensitive industries may exacerbate the economic impacts of climate change.

- Lack of Infrastructure Resilience: Aging or inadequate infrastructure may be more vulnerable to climate-related events, increasing the community's overall susceptibility. Challenges in securing funding for infrastructure improvements to enhance resilience.

- Resistance to Change: Resistance or lack of buy-in from community members or local authorities may impede the adoption of climate-resilient practices and policies. Balancing short-term priorities with long-term climate mitigation goals can be challenging.

- Inadequate Planning and Regulatory Frameworks: Insufficient planning and regulatory frameworks may hinder the incorporation of climate considerations

into land use and development decisions. Lack of updated building codes and zoning regulations that account for climate change impacts.

HAZARD MITIGATION STRATEGY

The combination of information taken from the risk and mitigation capabilities assessments provides the foundation for developing a comprehensive mitigation strategy for the State of Colorado. The SHMT undertook three important tasks after examining these inputs.

- First, they evaluated the mitigation strategy goals and objectives from the 2018 E-SHMP for their effectiveness, continued relevance, and to identify any potential gaps.
- Secondly, state agencies that were responsible for mitigation actions identified in the 2018 E-SHMP were asked to review and report on the status, providing updates and indicating if the actions were complete, in progress, on-going, deferred, or no longer applicable.
- Finally, members of the SHMT identified new strategies to improve capabilities and mitigate risks identified in the statewide, as well as local, risk assessments.

Acronyms

Table 88 provides a key for the acronyms contained within this chapter of the E-SHMP.

TABLE 88 - ACRONYM KEY

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CAIC	Colorado Avalanche Information Center	CREA	Colorado Rural Electric Association	DOH	Division of Housing
CCC	Colorado Climate Center	CRO	Colorado Resiliency Office	DOLA	Colorado Department of Local Affairs

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CDA	Colorado Department of Agriculture	CRWG	Colorado Resiliency Working Group	DORA	Colorado Department of Regulatory Agencies
CDO	Community Development Office	CSFS	Colorado State Forest Service	DWR	Division of Water Resources
CDOT	Colorado Department of Transportation	CWCB	Colorado Water Conservation Board	E-SHMP	Enhanced State Hazard Mitigation Plan
CDPHE	Colorado Department of Public Health & Environment	DFPC	Division of Fire Prevention & Control	HHPD	High Hazard Potential Dam
CDPS	Colorado Department of Public Safety	DHE	Colorado Department of Higher Education	OEM	Office of Emergency Management
CEHMC	Colorado Earthquake Hazard Mitigation Council	DHSEM	Division of Homeland Security and Emergency Management	SHMT	Colorado State Hazard Mitigation Team
CEO	Colorado Energy Office	DLG	Division of Local Government	USGS	US Geological Survey

Acro-nym	Name	Acro-nym	Name	Acro-nym	Name
CGS	Colorado Geological Survey	DNR	Colorado Department of Natural Resources	WATF	Governor's Water Availability Task Force
CPW	Division of Parks & Wildlife				

Goals & Objectives

The State of Colorado's mitigation goals and objectives have been crafted over time, beginning with the original State Hazard Mitigation Plan that was first developed in 2001. The 2018 goals and objectives were reviewed by the SHMT as part of the E-SHMP update. No major changes have been made and the SHMT believes this mitigation strategy accurately identifies the broad mitigation needs of the state. One update to mention includes changing references from "all-hazards" to "natural hazards", as the E-SHMP no longer profiles many of the human-caused and technological hazards that were included in 2018.

In general, when specific hazard risks are unacceptable and certain mitigation actions may be achievable, the development of goals and objectives takes place. Initially, broad-based goals are developed, which are long-term general statements. From these goals, specific objectives are then defined to help guide the resulting mitigation actions that will accomplish the goals.

Table 89 presents the 2023 hazard mitigation goals for the State of Colorado. [Roman numerals after each goal are for identification purposes only – they are not ranked or prioritized.] Corresponding letters beneath each goal relate to mitigation objectives that are applicable to achieving that goal. A list of associated objectives follows.

TABLE 89 - STATE OF COLORADO MITIGATION GOALS & RELATED OBJECTIVES

State of Colorado Mitigation Goals & Related Objectives
Minimize the loss of life and personal injuries from natural hazard events (I)
Applicable Objectives: A, D, F, G, H
Reduce losses and damages to state, tribal, and local governments, as well as special districts and private assets, and support similar local efforts (II)
J, O
Reduce federal, state, tribal, local, and private costs of disaster response and recovery (III)
D, E, J, P, Q
Support mitigation initiatives and policies that promote disaster resiliency, nature-based solutions, cultural resources and historic preservation, and climate adaptation strategies (IV)
A, B, E, M, N
Minimize interruption of essential services and activities (V)
D, E, J, L, P, Q
Incorporate equity considerations into all mitigation strategies (VI)
A, E
Support improved coordination of risk mitigation between and among the public, private, and non-profit sectors (VII)
A, C, D, E, G, I, K, L, M, N, O, R

Create awareness and demand for mitigation as a standard of practice (VIII)
A, B, C, E, G, K, L, M, N, O

Following are the state's mitigation objectives identifying how the above goals will be accomplished, to help guide the resulting mitigation actions.

A. Support and empower local and regional mitigation strategies through statewide guiding principles, programs, and resources

B. Promote activities that are climate neutral and supportive of appropriate renewable and alternative energy

C. Strengthen hazard risk communication tools and procedures

D. Strengthen continuity of operations at the federal, state, regional, tribal, and local levels of government to ensure the delivery of essential services

E. Strengthen cross-sector connections across the state government

F. Identify specific areas at risk to natural hazards and zones of vulnerability

G. Expand public awareness, education, and information programs relating to hazards and mitigation methods and techniques

H. Develop mitigation projects focused on preventing loss of life, injuries, and negative impacts to natural resources and reliant community sectors from natural hazards

I. Assist local government officials with construction, non-construction, and regulatory hazard mitigation activities

J. Protect state critical, essential, and necessary assets located in natural hazard risk areas

K. Improve state, tribal, and local government mitigation project monitoring and decision-making tools

L. Strengthen connections between hazard mitigation activities and preparedness, response, and recovery activities

M. Improve coordination of state government mitigation resources with federal, tribal, and local government and private nonprofit resources

N. Increase state, tribal, and local government and private nonprofit participation in existing hazard mitigation programs

O. Partner with local and tribal governments to develop projects, initiatives, and public resources that protect private property from hazards

P. Reduce services interruptions and revenue losses, resulting from hazard events, to the state

Q. Reduce downtime and revenue losses, resulting from hazard events, for local and tribal governments and private nonprofit organizations

R. Through training, grants, and technical assistance, increase local government use of land use strategies that reduce risks to hazards

2018 Mitigation Actions

To evaluate the progress of state-level hazard mitigation efforts over the past five years, the SHMT was asked to report on the status of those mitigation actions identified in the 2018 E-SHMP. The following Table 90 presents this information. **The State of Colorado's commitment to hazard mitigation is apparent in the fact that close to 90% of the 2018 actions have been completed or are underway.** The lone 2018 action that was deferred, along with some of the on-going actions from 2018, are included in the 2023 mitigation action table later in this section.

TABLE 90 - 2018 MITIGATION ACTION STATUS

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Continued development of and improvements to hazards data relating to climate change.	Multiple	CCC	In progress	Y	The CCC is currently leading an updated to the CWCB-sponsored "Climate Change in Colorado" report. The updated report is scheduled for publication and release in summer 2023. This report will address climate change influences on some natural hazards.
Identify the best tool to disseminate the hazards data on an on-line viewer	Multiple	CCC	In progress	N	We have added some information to our website, such as the interactive severe storms climatology (https://climate.colostate.edu/severe_wx_climatology.html) and data about large wildfires (https://climate.colostate.edu/fire_climatology.html), but these are not comprehensive.
Continued coordination with producers on how to dispose of carcasses from mass animal casualty events	Animal Disease Outbreak	CDA > Animal Health Division	In progress	Y	1. On May 14, 2019, A cattle truck and a truck with goats collided 20 miles south of Pueblo near Colorado City. The cattle truck remained upright after the crash, but the other vehicle flipped over, killing some of the goats inside while others escaped. CDOT was called in to assist with carcasses disposal. 2. Staff participated in the Virus Elimination: Alternatives to Wet C & D and Vehicle Deacon Lessons Learned webinar February 11, 2020, sponsored by USDA / APHIS. Staff also participated in APHIS's Considerations for

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					Depopulation of Livestock webinar on June 4, 2020. Due to the COVID-19 incident and the possibility some livestock may be subjected to depopulation at the feedlots due to insufficient feed at those locations, discussions within CDA did take place regarding the depopulation operations. CDOT staff were part of that discussion.
Continue 'secure food supply' planning efforts to mitigate hazard's impacts on farming/ranching operations	Multiple	CDA > Animal Health Division	In progress	Y	The State Veterinarian's Office continues to update secure food supply plans and foreign animal disease (FAD) response plans. The FAD response plans are working documents last updated in March of 2022.
Continued evaluations of biosecurity practices to mitigate the risk posed by hazards	Multiple	CDA > Animal Health Division	In progress	Y	The Spring, Summer, and Winter 2022 Highly Pathogenic Avian Influenza (HPAI) (disease) response and recovery operations have supported this action. CDA is reviewing lessons-learned to use for other hazards, foreign animal disease (FAD) and biosecurity threats.
Continue to serve as a liaison between producers and	Multiple	CDA > Animal Health Division	In progress	Y	In December of 2021, the Unified Traffic Coordination Plan for Glenwood Canyon I-70 Closures was created while recovering from the Glenwood Canyon Mudslides. CDA worked with DHSEM and CDOT on Annex 8 of the plan to give

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
municipalities to integrate farmers and ranchers into disaster response planning (incident management plans)					livestock transportation prioritization and address the health and welfare of animals being transported on Colorado roadways. This plan is now a tool for the same region and other areas where producers need assistance. In October of 2022, CDA hired a full-time Agriculture Emergency Coordinator to continue and enhance this action. This emergency manager will build-out the Agriculture Emergency Liaison Program with all CDA Divisions, local emergency managers and the CSU Agriculture Extension Offices. The integration will be with counties and municipalities in Colorado's ag communities.
Continue coordination of 'Colorado Ag-Ready' program	Multiple	CDA > Animal Health Division	Complete	Y	The Colorado Ag-Ready Program is no longer active online, but it will be reinvented and a part of the new Agriculture Emergency Liaison Program with farmers, ranchers, producers, and associations in 2023.
Development of a geospatial historic properties database, to be integrated with the planned state asset and critical facility and	Multiple	History CO Office	No longer applicable	-	Staffing changes - no updates available

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
infrastructure geospatial database					
Continued development of GIS data identifying rockfall risk	Rockfall	CDOT	In progress	Y	The GIS rockfall risk evaluation effort has been expanded from rockfall to all geologic hazards, including landslides, rockslides, shallow embankment distress, and debris flows. Additionally, the identification effort is being expanded from listing areas with a documented history of a geohazard event to identifying all areas with a credible geohazard threat based on geologic conditions, slope, and highway configuration. The updated risk identification method will continue to evaluate risk to safety and mobility (user consequences), and existing transportation assets (owner consequences). Risk assessment will continue to be consistent with the current CDOT Risk-Based Asset Management Plan and Risk & Resilience Working Group efforts. Information is being organized using the statewide roadway linear referencing system (LRS) and roadway characteristics that represent the current status of the state's public road-way network for use by CDOT and other state staff, federal agencies, Metropolitan Planning Organization, local governments and the general public. The data is produced and analyzed for use as the basis for corridor planning, environmental analysis, long-range planning, asset

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					management, roadway maintenance, permitting and federal reporting requirements, such as bridges, roadway projects and traffic safety.
Identify the best tool to disseminate the rockfall risk on an on-line viewer	Rockfall	CDOT	In progress	Y	CDOT is updating an on-line viewer located on the Department GEOHub page. https://maps.codot.gov/portal/home/https://maps.codot.gov/portal/home/item.html?id=03c5d558c4d742ea8e7855df6bb974c1 . Continued maintenance and updates performed. As of 2023March 2023, the geohazard risk hazard map is a partial map of hazard sites located on transportation facilities across the state. Sites will be added as the inventory continues to be developed.
Formalize integration of community rating system (CRS) requirements into HMP updates	Flood	CDPS > DHSEM	No longer applicable	-	DHSEM continues to encourage this integration but does not require it.
Create opportunities to update county-level CWPPs as part of HMP updates.	Wildfire	CDPS > DHSEM	Complete	Y	DHSEM and CSFS implemented this opportunity during the PDM 2019 application period and continues to do so, with several counties taking advantage of it. DHSEM and counties will incorporate updated CSFS CWPP requirements into the HMP scope of work.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Complete spillway/outlets mapping for high hazard dams	Dam / Levee Failure	DNR > Dam Safety	Complete	N	Completed Screening Analysis of High Hazard Release - Downstream Floodplain Impacts Study database. The database is available to interested floodplain and emergency manager stakeholders through an access-controlled file. To be clear, this effort was intended to show NON-DAM FAILURE Scenarios. The modelling database was intended to begin screening which high hazard dams may have OUTLET & SPILLWAY release flows that exceed the downstream channel capacities. From a DAM SAFETY perspective, these would be considered that the dam is performing as designed. From a FLOODPLAIN management standpoint, the intent was for floodplain and emergency managers to be aware of the potential for these non-failure events that support within design standard operations to impact the downstream public during a high flow event.
Evaluate options for potential regulation and increase outreach to communities about the risk posed by dam release and	Flood	DNR Dam Safety, CDPS > DHSEM, DOLA > DLG	In progress	Y	From a regulatory standpoint, no progress has been made on a State or County level to limit development below dams. Given the rate of Colorado growth, dependency on tax revenues, etc., this seems like a daunting future that is unlikely to happen on a broad scale. We have completed routine outreach to communities by holding Regional Tabletop exercises. These events bring together stakeholders across multiple counties (dam owners, emergency

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
development below dams					responders, etc) and multiple jurisdictions (local, county, state, federal) and step through a dam failure scenario. This results in increased awareness and improvements to existing Emergency Action Plans. We intend to continue holding about 4 of these events per year, Statewide. Additionally, we attend RMAC meetings with DHSEM regional field managers quarterly and improve relationships with those emergency management stakeholders.
Require the integration of climate change considerations into local hazard mitigation plans	Multiple	CDPS > DHSEM	Complete	Y	DHSEM fully implemented this requirement during the BRIC 2020 application period and continues to do so.
Continued public education aimed at increasing avalanche awareness to recreational users	Avalanche	DNR > CAIC	In progress	Y	The CAIC has been progressive in implementing forecasting, education, and mitigation strategies across Colorado. Since 2018, they have conducted about 300 avalanche awareness classes for over 800 students and about 400 classes for state, local, federal governments, and private industry, with over 17,000 students in attendance. In 2021, the CAIC redesigned its warning platform for CDOT. In 2022, it rolled out a new public-facing website that allows the creation of avalanche forecasts for smaller geographic areas than was possible before. The CAIC has been working closely with county emergency managers,

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					including presenting a talk at the Colorado Emergency Management Association meeting in 2023. The CAIC is currently working with researchers at Simon Frasier University and the National Center for Atmospheric Research (NCAR) to understand how people use their products and help tailor their message in ways that reach more people across the state and are easier to consume and understand.
Continued expansion of avalanche mitigation installations	Avalanche	DNR > CAIC	In progress	N	1. Monarch Pass Gazex project completed. (Gazex is an avalanche control system that uses specially constructed “exploder” sites and tubes built at key locations in avalanche territory to set off avalanches at controlled times.) Completed the O’Bellx project around the I-70 Eisenhower-Johnson tunnel area (13 units installed). (O’Bellx is an upgraded version of Gazex.) Two Oblix units completed on Wolf Creek Pass. Avalanche guards being installed on Loveland Pass. A total of 15 devices are to be installed. Avalanche mitigation efforts with this system will prevent large accumulations of snow and decrease the risk of unexpected, natural avalanches and long delays due to cleanup and extended closures. This reduced avalauncher use in the corridor by 85% and increased operational efficiency. First use on Monarch Pass occurred 11/27/2019. Avalauncher, case charge, and hand charge refresher training

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					occurred on 12/10/2019 2. CDOT has installed five towers on the mountain and ridgeline above CO Highway 145 at Lizard Head Pass (located on the border between Dolores and San Miguel counties in southwest Colorado, rises to an elevation of 10,246 feet), about one mile north of Rico. The towers will be used for the preventative, controlled triggering of avalanches at known snow slide paths in this area. Installation began in early August and was completed in September. CO 145 and Lizard Head Pass is the alternate route for travelers heading north when the US 550 mountain corridor is closed for emergencies. 3. On 3/26/2021, CDOT releases video related to avalanche safety. https://www.facebook.com/coloradodot/videos/120654986642285/ 4. An Avalanche Guard system was installed above US Highway 6 to help control avalanches from the Professor and Widow slide paths. The paths are located across US 6 from the Arapahoe Basin ski area. The new system is safer and reduces road closures that affect heavy ski traffic in the area. Both were operational by November 2020. 5. No new systems have been installed since the last report. At the 20th Annual Colorado Snow and Avalanche Workshop, October 14 – 15, 2021, one of the sessions dealt with the "Measuring Explosive Overpressures from Remote Avalanche Control Systems." The session

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					discussed some of the science behind the placement and explosive power of charges associated with the remote-control mitigation systems. 6. Planned installation on Red Mountain Pass for summer of 2023.
Continued evaluations of avalanche risk to entire transportation system	Avalanche	DNR > CAIC	In progress	N	CDOT (partner agency) continues to work with the CAIC on data collection and avalanche studies.
Development of tools to help better predict wet avalanche activity on a sub-year scale.	Avalanche	DNR > CAIC	In progress	N	CAIC recently implemented a model, SNOWPACK, to help forecasters better understand the snow stratigraphy, especially the location of the wetting front, to help predict wet avalanche activity and conduct two studies about the formation and location of wet avalanche release in Colorado.
Continued development of GIS data identifying avalanche risk	Avalanche	DNR > CAIC	In progress	N	CAIC has developed and implemented a series of GIS tools to collect and display data for stakeholders to make real-time decisions. With their partners at CDOT, CAIC has helped determine the location of remote avalanche control systems (RACS) throughout the state, with plans for more installations over the coming years.
Identify the best tool to disseminate the	Avalanche	DNR > CAIC	In progress	N	CAIC hopes to launch a new system to communicate avalanche threat to the public in the fall of 2022.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
avalanche risk on an on-line viewer					
Institutionalize Resiliency into State of Colorado Investments and Operations' plan development	Multiple	DOLA > CRO	In progress	Y	The CRO is currently working on implementation of the Resiliency Playbook, which is a technical assistance program to assist State agencies in institutionalizing resilience into their programs. A priority for this initiative that will become widely available to State agencies is a module specifically supporting State agencies integration of resiliency criteria into community-facing grant programs.
Implement of 'Institutionalize Resiliency into State of Colorado Investments and Operations' plan actions	Multiple	DOLA > CRO	In progress	Y	The CRO is currently working on implementation of the Resiliency Playbook, which is a technical assistance program to assist State agencies in institutionalizing resilience into their programs. A priority for this initiative that will become widely available to State agencies is a module specifically supporting State agencies integration of resiliency criteria into community-facing grant programs.
Develop guidance for local jurisdictions to integrate climate	Multiple	DOLA > DLG	In progress	Y	DOLA: Planning for Hazards and coresiliency.com updated resources related to climate change. Underway new state climate website (part of interagency climate staff effort) CSFS (partner agency): 1. CSFS has continued to participate in the Planning for Hazards steering committee to ensure

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
change in local planning efforts					information is up to date and to provide updates on wildfire risk reduction programs and efforts. 2. CSFS personnel are involved in related efforts through the Colorado Fire Commission and associated subcommittees.
Develop future conditions models starting with flood, drought, and wildfire that will quantify baseline change in vulnerability and then baseline metrics in mitigation actions to reduce that risk.	Multiple	DOLA > CRO	Complete	N	FACE hazards study and viewer complete.
Enhance the current structure of the SHMT by creating formal working groups focused	Multiple	SHMT	No longer applicable	-	Delete. There are numerous standing partnerships and working groups, such as the Flood TAP and Colorado Resiliency Working Group. Hazard-specific working groups do exist on a more informal basis outside the SHMT framework as well.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
on specific hazards and mitigation projects.					
Promote integration of hazards into local government comprehensive plans and land use policies and regulations	Multiple	DOLA > DLG	Complete	N	Workshops completed; lead to creation of 8-hour Planning for Hazards FEMA course that will be offered in 2022 nationally. New Action - Offer FEMA course in CO.
Develop and facilitate a pilot day-long "Mitigating Hazards Through Land Use Solutions" workshop for local governments in partnership with DHSEM and FEMA	Multiple	DOLA > DLG	Complete	N	Two workshops were held with additional technical assistance provided to the municipalities and counties that participated. Details can be found on the Planning for Hazards website. This workshop was based on the Planning for Hazards: Land Use Solutions for Colorado and was the basis for the development of a current FEMA class offering (Mitigating Hazards with Land-Use Planning (MGT-474), from the National Disaster Preparedness Training Center)
Map and assess the vulnerabilities of	Multiple	CDPS > DHSEM	In progress	Y	The CIAC Infrastructure Protection team has been working with the Colorado National Guard and CISA to create the Whole of State Critical Infrastructure

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
individual nodes within the Critical Infrastructure Sectors, as defined by the US Department of Homeland Security, to natural, technological, and human-caused hazards in local, regional, and the state Threat and Hazard Identification and Risk Assessments (THIRAs).					program. The intention of this program is to map the locations of critical infrastructure throughout the state to ensure critical infrastructure nodes are properly secured and safeguarded against potential threats and hazards
Implement fuels reduction and forest health projects.	Wildfire	CSFS	In progress	Y	Actions continue to be ongoing. It may be worthwhile to consider augmenting this action or creating a new action that addresses the concept of promoting community wildfire adaptation in which CSFS is the state agency lead

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Complete hazard maps in areas where geologic mapping is complete.	Multiple	CGS	On-going	Y	Geologic hazard polygons have been generated from available 1:24k geologic maps and will be added to CGS's Geologic Hazards viewer once data review and QA have been completed. This is an ongoing project; hazard viewer data will be updated as new quadrangles are mapped at 1:24k.
Assess risks associated with the Flood/Wildfire nexus and develop mitigating actions and projects.	Flood	DNR > CWCB	In progress	Y	Currently working to develop the Wildfire Ready Watersheds program, funded by SB 21-240. This is a two-pronged effort aiming to develop mitigation actions in areas where wildfires would most affect water resources and public safety. The first action is to develop a state susceptibility analysis to identify where these impacts are most likely to occur. The second is to develop a framework for local stakeholders to implement mitigation projects and target state grant dollars. The susceptibility and framework analysis are anticipated to be complete by Dec. 30, 2022 with implementation beginning in 2023.
Improve statewide drought monitoring system to include additional stations and sensors, remote sensing, rangeland, groundwater	Drought	DNR > CWCB	In progress	Y	CWCB continues to finance annual project funds for the Colorado Mesonet through its Construction Fund. This funding goes to the Colorado Climate Center and builds on recent work that has improved the quality, accessibility, and usability of meteorological data collected by the Colorado Agricultural Meteorological Network, CoAgMET (also known as Colorado's Mesonet). CoAgMET is rapidly maturing as Colorado's Mesonet, providing high quality

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
and snowpack sublimation.					weather data targeted for use in water planning, management, conservation, and education. In recent years we have expanded the network (now with over 90 stations) and increased the number of stations reporting data every 5 minutes. We have also revamped the website and developed a new API that makes it even easier for data users to find what they need. The CoAgMET data are used for a broad range of applications, including irrigation planning, drought monitoring, water availability calculations, real-time weather monitoring, and much more.
Evaluate the threat of avalanches to future projects and developments.	Avalanche	DNR > CAIC	In progress	N	CDOT (partner agency) hired a new (internal) avalanche coordinator to assist with evaluations as well as a Winter Operations Meteorologist. On-going activity.
Update the floodplain and stormwater criteria manual.	Flood	DNR > CWCB	In progress	Y	Currently being updated. This has been divided into two phases. Phase I, which focuses on all aspects of floodplain mapping, is nearing completion in Q4 2022. Phase II, which encompasses all other aspects, including new sections since the last version, is expected to be complete in 2023. CWCB aims to update this manual every 5-7 years looking forward.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Complete the implementation of statewide floodplain rules and regulations.	Flood	DNR > CWCB	Complete	N	Completed recent update in 2022. All NFIP-participating communities have adopted state rules into their local ordinances.
Enhance data and information for analyzing drought vulnerability.	Drought	DNR > CWCB	Complete	N	FACE hazards study provides the best available and most accurate highlights of state vulnerabilities to drought.
Enhance the Colorado wildfire risk assessment (CO-WRAP) portal.	Wildfire	CSFS	In progress	Y	State-wide canopy and fuels layer updates have been completed as of 8/2022 with the support of DFPC, USFS, and CFRI. Other analysis and enhancements continue to be ongoing with final delivery expected in early 2023. The portal's title has changed to the Colorado Forest Atlas - Colorado State Forest Service (colostate.edu) so we will need to modify this language - CSFS staff to provide necessary information. Partnering agencies or working groups may need to be adjusted - the Water Availability Task Force is not involved in this work
Assist communities in implementing CWPPs.	Wildfire	CSFS	In progress	Y	1. Actions continue to be ongoing. 2. Change # of CWPPs from 225 to 243 and number of county plans from 47 to 50. 3. Partnering Agencies or Working

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					Groups may need to be adjusted. 4. Significant effort will be invested in plan development and revisions in coming months and years.
Add earthquake monitoring stations to evaluate seismicity activity.	Earth-quake	CGS	On-going	Y	CGS currently maintains and monitors nine permanent broadband seismometer stations. There are approximately 29 active stations in Colorado maintained by others, for a total of approximately 34 stations monitoring seismicity.
Integrate State Drought Plan within other statewide planning efforts.	Drought	DNR > CWCB	In progress	Y	The 2018 Colorado Drought Mitigation and Response Plan was reviewed in 2022/2023 in conjunction with updates to the Enhanced State Hazard Mitigation Plan update. At that time, the State Drought Plan was a standalone document that was managed and updated by CWCB. Over the course of the 2022-23 year, CWCB worked with DHSEM to dismantle the State Drought Plan and will be archiving it by the end of the calendar year of 2023. The content in the plan that addressed drought mitigation will be consolidated into the E-SHMP, and the content related to drought response that was found in Annex A of the State Drought Plan, will move into the State Emergency Operations Plan. The 2018 State Drought Plan will be archived by the end of this year and its contents will be fully integrated into other state planning documents. This will reduce duplication of efforts across multiple state agencies and allow

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					relevant drought response and mitigation content to be housed with other hazard response and hazard mitigation information for the entire state.
Participate in National Soil Moisture Network.	Drought	CCC	Deferred	Y	The Colorado Agricultural Meteorological Network (CoAgMET) has expanded soil moisture measurements to additional stations. These are not yet part of the NSMN, but efforts are ongoing to calibrate and disseminate these soil moisture observations through the CoAgMET website and data portal.
Analyze potential impacts of climate change.	All-Hazard	DNR > CWCB	In progress	Y	Action continues to be ongoing work in progress.
Enhance CCC website to include hazards and atmospheric risk information.	Atmo-spheric Hazards	CCC	Complete	N	An interactive severe storms climatology has been added to the CCC website, showing historical observations of hail, wind, and tornadoes. The CCC website also includes information about other hazards in Colorado.https://climate.colostate.edu/severe_wx_climatology.html
Increase participation in Fire-Adapted Communities and Firewise including education and outreach.	Wildfire	CSFS	In progress	Y	Actions continue to be ongoing. Update necessary to the action title.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Develop materials for, and participate in, awareness and outreach for atmospheric hazards.	Atmo-spheric Hazards	CCC	Complete	N	During presentations with a diverse set of audiences, information about atmospheric hazards is routinely shared. As one example, the presentation at the 2020 Colorado Emergency Management conference focused on severe hail in Colorado.
Minimize exposure to historic coal mine-related subsidence through evaluation and communication.	Sub-sidence	CGS	On-going	Y	CGS reviews proposed plats and development plans to help ensure that mine subsidence hazards are identified and avoided or mitigated and maintains an online GIS viewer showing undermined areas and shafts.
Increase inventory of historical avalanche data.	Avalanche	DNR > CAIC	In progress	Y	CDOT (partner agency). On-going activity. CAIC completed a review of historical records, pre-1950. Partnered with USGS on avalanche climatology study using dendrochronology
Improve methodology for estimating losses and identifying losses avoided for priority hazards.	All-Hazard	CDPS > DHSEM	In progress	Y	DHSEM partnered with CWCB, DOLA, FEMA Region 8, and CSFS to create the FACE Hazards Tool. This has provided a tool to estimate future losses from flood, drought, and wildfire in 2050 based on various levels of climate change and population change. The other methodologies listed in the 2018 E-SHMP remain in effect as well.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Strengthen coordination with the CRO Sectors as well as with technical assistance partnerships related to flood, drought, atmospheric, geologic and wildfire that contribute to the mitigation of statewide natural hazards.	All-Hazard	CDPS > DHSEM	In progress	Y	This has occurred primarily through the Flood TAP and the CRWG. COVID-19 and two other Presidential Disaster Declarations since the 2018 E-SHMP update have also led to increased coordination that began as response but grew to include mitigation. We also partnered with the Colorado Rural Electric Association to add a Rural Electric Cooperative-focused annex to the SHMP.
Improve emergency warning systems and encourage the installation of additional sensors and reporting devices to improve high flow measurement capabilities along flood	Flood	DNR > CWCB, CDPS > DHSEM, DNR > DWR, UDFCD	In progress	Y	DNR-DWR has an extensive network of measurement systems around the State online. https://dwr.state.co.us/tools/stations. Alerts can be set for all of these at levels identified by users to warn emergency managers/stakeholders of changing channel conditions.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
prone streams in high risk areas.					
Provide newsletter articles, other relevant information on flood hazard mitigation, and other forms of information exchange to professional organizations and local governments.	Flood	CDPS > DHSEM, DNR > CWCB	In progress	Y	Newsletters developed and sent to stakeholders periodically for both floodplain management and floodplain mapping programs. Newsletters are occasionally provided to professional organizations such as Colorado Association of Stormwater and Floodplain Management (CASFM) and Sustaining Colorado Watersheds (SCW) and others. Numerous program websites also exist to serve the public as needed - Fluvial Hazard Mapping Program, Floodplain Mapping Program, Colorado Emergency Watershed Protection Program, Wildfire Ready Watersheds, and Colorado Flood Threat Bulletin.
Continue to provide access to information, education, and tools on flood mitigation through Resiliency Resource Center and Planning for Hazards websites.	Flood	DOLA > DLG & CRO	Complete	Y	CRO continues to provide these resources on www.coresiliency.com

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Optimize potential state and federal funding sources to support mitigation initiatives which are part of the Colorado Flood Hazard Mitigation Plan to include additional coordination with Silver Jackets on State projects.	Flood	CDPS > DHSEM, DNR > CWCB	In progress	Y	Expanding partnership with agencies in Silver Jackets program.
Colorado Hazard Mapping Program (CHAMP)	Flood	DNR > CWCB	In progress	Y	Nearly complete.
Continued LiDAR acquisition and management of data for	Flood	DNR > CWCB	In progress	Y	Nearly complete with state coverage. Will then transition to ongoing maintenance collections.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
flood and other hazard mapping.					
Digitize existing 100-year floodplain maps.	Flood	DNR > CWCB	In progress	Y	Ongoing as part of the CHAMP effort.
Create a Dam Safety Inundation Map Database.	Flood	DNR > DWR	Complete	Y	Dam Safety has created the Dam safety Inundation Map shapefile and has shared that with E-SHMP contractors.
Promote land use solutions to reduce risk to flood hazards through information, education, and technical assistance.	Flood	DOLA > DLG, DNR > CWCB, UDFCD	Complete	Y	DOLA and the CRO developed the "Planning for Hazards: Land Use Solutions for Colorado" Guide that can be utilized by local communities in addition to providing technical assistance such as reviewing local hazard mitigation plans
Incorporate new State floodplain standards into local standards.	Flood	DNR > CWCB	Complete	N	Higher state floodplain standards have been incorporated into local ordinances for all NFIP-participating communities.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Promote a One Water approach and integrated water management into local water and land use planning.	Flood	DNR > CWCB	No longer applicable	-	Delete. Previous action champion no longer with CWCB.
Collect climatologic data at mid & lower elevations to fill existing gaps in the data collection network	Drought	DNR > CWCB, WATF	In progress	Y	CWCB annually funds the Colorado Mesonet to develop high quality weather data from 90 weather stations across Colorado for water resources application. It is a statewide effort benefiting many users from agricultural producers to municipal water providers and many others. Funding from CWCB in previous years has enabled the enhancement of some of these stations to fill critical monitoring gaps and improve evapotranspiration monitoring.
Continue to Support and Strengthen Intermountain West Drought Forecasting	Drought	CCC	In progress	Y	The CCC leads weekly drought monitoring activities for the state, making recommendations to the US Drought Monitor. Although forecasting remains challenging, the CCC has recently published research on crop-specific drought indicators, has submitted an article for publication on the sources of errors in streamflow forecasts, and regularly collaborates with researchers and stakeholders on the topic of drought early warning.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Evaluate, improve, and coordinate the role and relationship of the CWCB public information and education efforts with those being conducted by local water authorities, utilities, users, and suppliers.	Drought	DNR > CWCB	In progress	Y	CWCB facilitated 4 drought specific task forces during the 2020-2022 drought. These task forces coordinated with agricultural producers and municipal water providers using a variety of education and outreach tools including but not limited to a dedicated stakeholder outreach website called engagecwcb.org. These task forces disseminated crucial drought information to targeted stakeholder groups and developed interactive tools including ArcGIS StoryMaps and a local drought tour to educate policy makers and the public on the impacts of drought. These efforts have slowed due to the return of normal water supply conditions, but remain tools the CWCB has at its disposal to educate the public on drought issues.
Fund water system improvements for drought mitigation and resiliency.	Drought	DOLA, DNR > CWCB, WPA	Complete	Y	Through its grant and loan programs CWCB has funded both water system improvements and broader resiliency efforts aimed at drought mitigation. Additionally, CWCB restructured the funding in its WSRF program to dedicate $17M in funding for drought resiliency and aging infrastructure efforts across Colorado.
Make completion of local drought plans a priority; include	Drought	DNR > CWCB	In progress	N	This effort was included in Action 4.10 of the Colorado Water Plan which was released in 2023. The action calls for the development of a drought resiliency toolkit that can be used to support local planning for water security. While

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
vulnerability & risk assessments; incorporate info into next update.					CWCB also provides technical and funding support for local drought plans as well as supporting ongoing information sharing through the Water Availability Task Force, the CWCB will develop a drought resilience toolkit with several core components that can inform and ultimately support the creation of county-level "Water Security Roadmaps" as described in the Colorado Vision for Resilient Planning. The drought resilience toolkit. This effort will include a statewide susceptibility analysis to inform a drought-ready communities framework that communities can use to evaluate drought risk to life, safety, property, infrastructure, and water supplies at a county scale. This may include targeted data collection, data development, mapping, and reporting that will leverage ongoing statewide efforts, including CWCB watershed mapping for wildfires—recognizing the interconnects between fire and drought. It will also include a drought-ready communities framework that can guide local community discussions on how to use the drought toolkit to help communities prioritize drought planning and risk-mitigating projects. It will outline best practices for drought planning and recovery.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Integrate results, tools, and methods from the 2010 Statewide Drought Vulnerability Assessment to improve and standardize drought risk assessments in local hazard mitigation plans.	Drought	CDPS > DHSEM, DNR > CWCB	No longer applicable	-	DHSEM has required communities updating their HMPs to consult with the Colorado Climate Center and incorporate the FACE Hazards tool beginning with the BRIC 2020 application period. We do not require that they use the 2010 assessment to inform their drought hazard profiles.
Develop approaches and technology to help farmers adapt to drought.	Drought	CDA, State Conservation Board, USDA	In progress	Y	CDA is working with Colorado Water Conservation Board (CWCB), CSU Extension, Drought Advisors, and other partners to provide support to producers planning for and experiencing drought conditions. We are also working with research partners to continue to study drought-resistant crop types.
Continue development and the appropriate allocation of resources to the Office of Water Conservation and	Drought	DNR > CWCB	No longer applicable	-	Delete. The Office of Water Conservation and Drought Planning has been rolled into the Water Supply Planning Section within CWCB and its associated funding is now used as part of that groups annual budget. The funding is still applied to conservation and drought efforts, but is channeled through the Water Supply Planning Section of CWCB P68

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Drought Planning in providing technical assistance to covered entities, evaluating submitted water conservation and drought plans, administering fund programs, and disseminating information to the public.					
Encourage and provide incentives for more efficient municipal irrigation systems, including State-owned properties.	Drought	CWCB, NRCS CRC, GreenCO, Local Water Providers	In progress	N	CWCB is involved in efforts to review irrigation systems and landscape materials on state properties through the "Greening Government" initiative (Executive Order D 2019 016). These efforts will identify and pursue water efficiency improvements for State buildings that are cost effective. The improvements should meet the EPA's WaterSense criteria.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Encourage Qualified Water Efficient Landscaper (QWEL) Certification.	Drought	DNR > CWCB, City of Aspen, South Metro Water Authority	Complete	Y	South Metro Water Authority offers QWEL training in English and Spanish to landscapes in the Denver Metro region and has developed model ordinances for landscape standards.
Continue to pursue implementation funding for recommendations in this plan.	Drought	DNR > CWCB	Complete	Y	Drought mitigation initiatives, including many identified in this plan, were included in the CWCB's Colorado Water Plan. This sets forth both funding opportunities for stakeholders to take action on these issues, but also brings these goals to the forefront of CWCB's 10-year planning horizon, effectively prioritizing the near-term completion of these goals.
River restoration for streams that are most vulnerable to drought impacts.	Drought	DNR > CPW, DNR > CWCB	In progress	Y	In 2023 the Colorado legislature passed SB23-270, Projects to Restore Natural Stream Systems. This legislation helps to improve stream corridors that have been degraded by more than two centuries of hydrologic modification, agricultural land use practices, roads and development, channelization, mining, and climate-driven disasters. The final bill defines a set of minor stream restoration activities that are not subject to water rights administration. These include stabilizing the banks or substrate of a natural stream with bioengineered or natural materials, installing porous structures in

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					ephemeral or intermittent streams to stop degradation from erosional gullies and head cuts, and installing structures in stream systems to help recover from and mitigate the tremendous impacts that occur to water supplies from wildfires and floods. These actions are tied to drought resiliency because restoring the natural flow of stream allows for our headwaters to retain water later into the summer and maintain ecosystem function and health in the face of drier conditions.
Statewide Climate Change Initiatives	Drought	DNR > CWCB, USBR	Complete	N	CWCB funded the update to the Climate Change in Colorado report, in connection with Colorado Climate Center. This report offers Colorado-specific climate change information for Colorado communities to use as a decision support tool. Additionally, CWCB worked in conjunction with DHSEM to develop the FACE hazards tool, which stands for the Future Avoided Costs Explorer. This tool is designed to help communities understand the costs associated with doing nothing to adapt to the changing climate.
Vegetation Management, Pole Replacement, & Cross	Wildfire	Cooperative, USFS, County, State	On-going	Y	Cooperatives use weather and radar monitoring and apps to stay on top of impending storms. Cooperatives communicate the status of outages through social media, texts, and other platforms to inform members about outages.

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
Arm Enhancement, & Wildfire mitigation					Cooperatives have taken measures to educate members of what to do during outages.
Weather Monitoring	Atmo-spheric Hazards	Cooperative, County, State	On-going	Y	Cooperatives have individually assessed and implemented plans to reduce wildfire exposure. Cooperatives have implemented vegetation management plans, increased member education, and identified and replaced high priority poles. Some have replaced overhead lines with hardened insulated (tree) wire that will not arc or cause fires.
Hot Spot Identification	All-Hazard	Cooperative	On-going	Y	Cooperatives have individually assessed their systems to identify vulnerable or week spots in the system. Cooperative's patrol and inspect lines to identify areas for improvement. Cooperatives also test poles for integrity and safety.
Harden Communications, Facility Backup Generation, Remote Facility Control	All-Hazard	Cooperative	On-going	Y	Cooperatives have individually taken steps to improve outage duration. Cooperatives participate in mutual aid programs for times when the cooperatives resources are strained. CREA supports a disaster aid plan that all the cooperatives participate in. The plan includes a committee that meets regularly and conducts drills.
Strengthen lines, put lines underground where feasible	All-Hazard	Cooperative	On-going	Y	CREA has developed relationships with State Emergency resources and communicates and provides updates to these contacts regularly. CREA attends

Action Title	Hazard(s) Addressed	Responsible Lead Organization or Working Group	Action Status	On-going or Annual Effort?	Updates / Notes
					meetings and participates in exercises with emergency managers throughout the state.
Participation in Local and Emergency Management Exercises	All-Hazard	Cooperative, County, State	On-going	Y	CREA's disaster aid plan connects cooperatives and vendors to aid in response and recovery, sharing resources like labor, parts, and equipment. This includes a statewide communication plan for disaster assistance and disaster aid coordinators for each side of the state.
Maintenance Programs - Incorporate Equity Considerations into All Mitigation Strategies	All-Hazard	Cooperative	On-going	Y	Cooperatives have individually assessed their systems for ways to improve the reliability of service. Some cooperatives have placed overhead lines underground, some have replaced overhead lines with hardened insulated wire, and some have implemented the use of drones to identify areas of concern.

Mitigation Successes

The State of Colorado is proud of its accomplishments in mitigating natural hazards. By implementing various projects and improving capabilities, the state continues to meet the mitigation goals and objectives defined in this E-SHMP. Table 91 highlights some additional mitigation successes that the State of Colorado has implemented since the 2018 E-SHMP.

TABLE 91 – STATE MITIGATION SUCCESSES

Organization	Action	Details
CDOT	Asset Resiliency Mapping Application	CDOT's Risk and Resilience Program was created in response to Policy Directive (PD) 1905.0 "Building Resilience into Transportation Infrastructure and Operations", which directed CDOT to support state resilience goals by incorporating resilience in strategic decisions about transportation assets and operations. To support a standardization for calculating risk and resiliency on the state's transportation system, CDOT has produced this interactive map for users to assess risk as it relates to numerous different geohazards. Use these tools to explore criticality on different routes, find more information about individual events like landslides or fires, or search for a specific area of interest. CDOT Asset Resiliency Mapping Application (arcgis.com)
CDOT	State Highway 9 Animal Crossing	This research monitored the effectiveness of a wildlife mitigation project on State Highway 9 in Grand County, Colorado. The purpose of the

Organization	Action	Details
		mitigation was to reduce wildlife-vehicle collisions (WVC) while providing permeability for wildlife across the highway. This five-year study used motion activated cameras and analyses of WVC crash and carcass data to evaluate mitigation effectiveness. The research documented 112,678 mule deer successful passages and a success rate of 96% across the seven structures. In addition to mule deer, sixteen other wildlife species successfully used the crossing structures. The wildlife crossings and fencing mitigation helped decrease WVC crashes by 92% and carcasses by 90% relative to preconstruction levels.
CDOT	Geohazard Segment Risk Summary	The "CDOT Geohazard Segments" file has the risk data for landslides and other geologic hazards that we discussed at our initial meeting. Currently, this is an internal document and not published anywhere but I included it in case it's helpful for reporting the type of information we're tracking. The dollar values express annualized risk - user risk for the safety and mobility categories and CDOT/owner risk for the third category.
CDOT	I-70 Corridor Risk & Resilience Pilot	The I-70 Corridor Risk and Resilience Pilot demonstrated the benefits of examining a

Organization	Action	Details
		highway transportation network in terms of its capacity to serve demand in the event of physical hazards. This pilot provides a framework accommodating uncertainty, incorporating a probabilistic approach to assessing risk, and for making ensuing investment decisions to increase system resilience and reduce annual risk from physical hazards. It is a strategic approach, explicitly trading off the risk of failure against the cost of greater system resilience. This analysis can assist CDOT and other highway agencies to understand how its system will perform under a range of potential physical hazards, inform project selection and investment decisions, maintenance decisions, operational procedures, and the design process as to risk reducing investments and actions.
CGS	Develop and maintain a geologic hazards map viewer for Colorado emergency managers	The web map is a compilation of Colorado Geological Survey GIS products: mapped geologic hazards, 1:24,000 geologic mapping status polygons, undermined and mine subsidence hazard areas. Additional categories are added as needed and updates occur when derivative hazard mapping has completed review.
CGS	Outside referral agency for county	CGS has helped ensure that homes, schools, critical facilities, and other structures are

Organization	Action	Details
	and municipal planners	located and built such that exposure to geologic hazards is minimized. To do so, CGS utilizes land use review as a constant, ongoing activity and advises counties and municipalities about site-specific geologic hazards during the planning process, so hazards can be avoided or mitigated.
CGS	Technical Support	Since 2018, CGS continues to provide support to local governments related to hazard mapping, analysis, local regulations and land use, and hazard warning systems.
CSFS	FRWRM Grant Program	Since 2017, the FRWRM Grant Program has awarded just over $28 million to fund 206 Forest Restoration / Wildfire Risk Mitigation projects totaling ~21,000 acres of project work and 38 capacity building projects.
CSFS	Forest Health Reports	Forest Health Reports have documented the mitigation successes
CWCB	Dam Safety	Emergency Preparedness: Colorado High-Hazard Dam Release — Colorado Resiliency Office (Emergency Preparedness: Colorado High-Hazard Dam Release — Colorado Resiliency Office (coresiliency.com)) Have been awarded CWCB Project Bill (and FEMA HMGP funding) to complete Risk Assessments on High Hazard Dams for Owners using outside

Organization	Action	Details
		consulting engineers to more aggressively complete this vital assessment on all our high hazard dams that have population at risk below the dam. The focus is to use this grant funding to identify if there are risk driving (present unacceptable level of risk) potential failure modes on high hazard dams. To date, we have obtained funding to complete this assessment for about 15% of our nearly 450 High Hazard Dams in CO. If there are risk driving potential failure modes identified, this process clearly identifies what specific mitigation measures need to be designed, funded, and constructed to reduce the risk associated with the dam. This may open up more opportunities for dam owners to obtain construction funding through BRIC, HHPD, HMGP funding opportunities.
CWCB	Colorado Water Loss Initiative	Water Loss continues to be a major issue in Colorado. For specific cities where water loss is 30% or more, the investment in local infrastructure improvements are key. The CWCB is running the largest voluntary water loss training program in the country. The Colorado Water Loss Initiative (CWLI) trains water providers in the American Water Works Association M36 methodology for water loss control and management - the national industry

Organization	Action	Details
		standard. Phase I determined that for across 47 water loss audits for calendar year 2018, there were roughly ~5,500 af in apparent losses (metering, theft, etc. "paper water" or lost revenue) and ~16,600 af in real losses (leaks, etc.). Once audited, these leaks and losses are repaired and therefore the potential losses and actual losses are mitigated going forward. Phase II has about 70 going through it now and they will have findings soon.
CWCB	Ute Mountain Ute Tribal Farm and Ranch Enterprises	The Ute Mountain Ute Farm and Ranch Enterprise is a 7,700 acre agricultural operation in the southwest corner of Colorado. Owned and operated by the Ute Mountain Ute Tribe (UMUT), the Enterprise raises cattle, grows alfalfa and non-GMO corn, and runs an on-site mill. However, water supplies in southwest Colorado are highly stressed by drought and aridification: in 2021, the Enterprise laid off half of its workforce because it received 10% of its annual water supply. Only 8 of the 110 center pivots were operational, and over 6,000 acres of fields were left fallow. In 2022, heavy monsoons marginally improved the situation, allowing the Enterprise 25% of its annual water supply, but operations continue to be heavy-hit. The Ute Mountain Ute and the state of Colorado have

Organization	Action	Details
		partnered to build resilience and improve irrigation efficiencies. Efforts include a new innovative hydroelectric turbine project, which generates thousands of kilowatt hours to power irrigation pivots and the mill operations, and center pivot replacements to improve irrigation efficiency for the Enterprise. These adaptations provide options for the Enterprise's operations to respond in wet or dry years.
CWCB	Agricultural Drought Advisors program- Funded by Colorado Department of Agriculture and Colorado Water Conservation Board	Colorado Agricultural Drought Advisors is a multi-organization partnership. They offer webinars and trainings and provide one-on-one consulting on creating drought plans with farms or ranches. Their mission is to build short and long-term resilience to drought among Colorado Producers by working with farmers and ranchers to connect resources, identify/assess risk, and implement practices that lessen the impact of drought. We work with individuals to assess resources, identify risk, develop planning tools, and implement practices to lessen drought hardship and stress. They trained 822 attendees on drought planning and preparedness for agricultural producers and ranchers. This occurred over 6 training sessions. They also recently published a handbook on drought planning.

Organization	Action	Details
CWCB	Drought Management Planning: A Guide for Water Providers - Recently updated in June 2020	The CWCB developed this document as a means to assist water providers with local drought planning. The effort aims to recommend drought mitigation and response planning steps in developing local plans through a framework that is useful to statewide water providers that vary by geography, size, water supply sources, and financial and staff capacity resources. This is an update to the original document developed in 2010. Primary enhancements of the 2020 update include the refinement of planning steps based on lessons learned from both planning efforts and droughts since 2010, the addition of recent case studies, and improved usability. The guidance reflects current planning practices and resources and includes on integration of drought plans with other planning efforts to build community resiliency.
DOLA > DLG	Update to require County and Municipal Energy and Mineral Impact Assistance Fund to include all hazards in comprehensive plans	DLG has, for years, required county and municipal Energy and Mineral Impact Assistance Fund grantees to address natural hazards in their comprehensive plans. We just updated it this past quarter to include all of the hazards listed in their HMP: For comprehensive plan funding: "Risks of natural and human-caused hazards to life, property, and public resources, and consideration of their impact to vulnerable

Organization	Action	Details
		communities. Include goals, strategies, and/or actions to address and mitigate these hazards (must identify and address all potential hazards as described in the county's Hazard Mitigation Plan). Communities may find DOLA's Planning for Hazards guide helpful in this work."

2023 Mitigation Actions

The final piece of the state's updated mitigation strategy was the development of new or on-going mitigation actions for implementation over the next five years. Developing the 2023 mitigation actions was a collaborative effort across the entire SHMT. All of these projects were informed by the updated risk and mitigation capabilities assessments, in addition to local government strategies, and guided by the goals and objectives.

The overlap between state level and local risk rankings is the foundation for linking state and local mitigation strategies. Those linkages are also reflected in the similar mitigation goals found in this E-SHMP and local HMPs. SHMT agencies further strengthen those links while partnering with and mentoring local communities on plans or projects involving hazard mitigation.

As was the case in 2018, SHMT discussions regarding action prioritization made it clear that a one-size fits all approach would be difficult to implement across all state agencies / organizations. Therefore, it was again decided that the 2023 mitigation actions would not be prioritized as a group. Individual actions have been prioritized per agency / organization using the E-SHMP's "Guiding Principles" criteria (see E-SHMP Implementation chapter), in addition to individual agency / organization processes. Listed below are details pertaining to those individual methodologies being utilized by some agencies.

- CAIC: The CAIC prioritized actions based on the following. High priority actions will have believed immediate effects on safety. Medium priority actions are longer-term goals that are believed to have positive impacts, where a need is often to find funding to complete, or where CAIC is actively attempting to determine if the action will have beneficial results. Low-priority actions are research projects where the potential for positive results is seen over a longer period of time.

- CDPHE: As Colorado continues to experience impacts from extreme heat, CDPHE is initially looking at its impacts on those that have access and functional needs. These are the populations that are impacted the most by extreme heat, and have less resources to deal with it.

- CGS: The highest priority actions are focused on mitigating critical infrastructure and those projects that help to identify geologic risk for informing local development.

- CSFS: Highest priority actions are those that most directly inform or enable wildfire risk reduction implementation and includes funding distribution. Medium priority classification is reserved for outreach and education activities, including those that relate to ecological processes which, though important, are less so than more direct life safety actions.

- CWCB: Actions were prioritized by CWCB to align with our agency's missions and goals. Alignment with the Colorado Water Plan, our agency's overarching planning document was used to determine action priority. Additionally, funding programs/projects through our Grants & Loans programs is the way in which our agency most directly engages with hazard mitigation, alignment with this ideal also informed action prioritization.

- DHSEM: DHSEM prioritized its actions in this plan from the perspective of managing a statewide program that assists local communities to mitigate their

risks rather than as an agency that directly reduces risks through projects and other actions. The first priority is to those actions that will have the most widespread impact. The second priority is for those actions that address the state's three "Extremely High Risk" hazards- Drought, Flood, and Wildfire, either singly or as part of a multi-hazard solution.

- DHSEM / Dam Safety: The State of Colorado's Dam Safety Program has Rules, Guidelines, and Procedures that follow industry best-practices for Risk Informed Decision Making. Dams submitted for HHPD consideration in the state have gone through some form of Potential Failure Modes Analysis to define the deficiency at the structure that requires rehabilitation. The process for evaluating and prioritizing actions will primarily be associated with
    - 1. Construction Cost vs. Amount of Likelihood of Failure Reduction for Potential Failure Mode(s) of concern;
    - 2. Benefit of estimate Population at Risk Reduction through additional emergency action planning, inundation mapping, mock failure exercises;
    - 3. Evaluation of Social Vulnerability index and warning time to population centers within dam breach inundation zone;
    - 4. Evaluation of estimated cost for continued loss of reservoir restriction (i.e. water availability for population served), or estimated cost to replace dam if it were to fail.
    - 5. Evaluation of reservoir impact to community served through its water storage (i.e. large municipal vs. small recreational).
- DOLA: Actions identified for DOLA were assessed to determine alignment with executive priorities. If an identified action supported requirements outlined in state statute, was in alignment with Governor Polis' Administration Key Priorities (WIGs), or supported directives outlined in state executive orders or

legislative directives, the actions were automatically ranked as "High" priority. Actions were then assessed to determine if they supported core mission or identified priority goals and outcomes of the agency or offices, and if so, were also ranked as "High" priority. Actions identified as "Medium" priority were opportunities identified to advance risk reduction and/or resilience goals, but may not be directly tied to ongoing funding, policy directives, or program outcomes, but still are important for improving the resiliency of our communities. DOLA did not identify any actions as "Low" priority at this time.

Table 92 presents the new and ongoing 2023 mitigation actions. Additional actions as included in the Colorado Rural Electric Association (CREA) HMP are included in the Annex – Colorado Rural Electric Association HMP. State funding has been identified specifically relating to agency staff time, agency general fund, and specific program funding.

TABLE 92 - 2023 MITIGATION ACTIONS

Action ID	Action Title	Relevant Goal(s)	Relevant Objective(s)	Hazard(s) Addressed	Responsible Organization & Action Priority	Partnering Organization(s)	Potential Funding Source(s)	Estimated Completion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.01	Sustain or improve the local core capability of Community Resilience through programmatic and technical assistance through local HMP support	All	A, C, F, G, I, K, L, M, N, O, R	All hazards	DHSEM High	SHMT (Data)	BRIC, HMGP, FMA, DHSEM Staff Time	Ongoing	Multiple	Results of HIRAs in local HMPs are shared and understood more extensively by every member of a community.	New
2023.02	Sustain or improve the local core capability of Long-Term Vulnerability Reduction through programmatic and technical assistance through local HMP and project subapplication support	All	A, C, D, F, G, H, I, K, M, N, O, Q, R	All hazards	DHSEM High	SHMT	BRIC, HMGP, FMA, HHPD DHSEM Staff Time, DHSEM General Fund	Ongoing	Multiple	Communities implement mitigation actions that effectively reduce long-term risk.	New
2023.03	Sustain or improve the local core capability of Risk and Disaster Resilience Assessment through programmatic and technical assistance through local HMP support	All	A, C, F, G, I, L, M, N, R	All hazards	DHSEM High	SHMT (Data)	BRIC, HMGP, FMA, DHSEM Staff Time	Ongoing	Multiple	Community risk-related plans lead to the implementation of effective mitigation actions.	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.04	Sustain or improve the local core capability of Community Threats and Hazards Identification through programmatic and technical assistance through local HMP support	All	A, C, F, G, I, L, M, N, O, R	All hazards	DHSEM High	SHMT (Data)	BRIC, HMGP, FMA, DHSEM Staff Time	Ongoing	Multiple	Results of HIRAs in local HMPs are shared and understood more extensively by every member of a community.	New
2023.05	Integrate appropriate rural water and wastewater operators into local HMPs	2, 3, 5, 7, 8	A, C, E, F, L, N, R	All hazards	DHSEM Medium	CDPHE Water Quality Control Division; Local HMP leads	BRIC, HMGP, FMA, DHSEM Staff Time	Ongoing	Plans & Regulations	Create direct eligibility for some water and wastewater operators to be sub-applicants for HMGP.	New
2023.06	Implement relevant mitigation actions with rural water and wastewater operators that are stakeholders in local HMPs	2, 3, 5, 7, 8	A, G, H, I, L, M, N, Q	All hazards	DHSEM Medium	CDPHE Water Quality Control Division; Local HMP leads	BRIC, HMGP, DHSEM Staff Time	Ongoing	Structure & Infra-structure	Implement actions that prevent or dramatically reduce the loss of service for operators and their customers.	New
2023.07	Implement rehabilitation actions (pre-construction activities [scoping, permitting, design], repair, replacement, reconstruction, or	1, 2, 3, 5, 6	A, D, E, F, H, I, J, M, O, P, Q	Dam / Levee Incident	DHSEM Medium	DNR, Division of Water Resources, Dam Safety Branch	HHPD, DHSEM General Fund, DHSEM Staff Time	Ongoing	Structure & Infra-structure	Rehabilitating these High Hazard Potential Dams will restore full storage capacity, allowing them to completely meet their intended purposes (flood storage, recreation, water availability, etc.).	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	removal) to remove restrictions from High Hazard Potential Dams										
2023.08	Implement mitigation actions that increase the level of protection of dams, to reduce downstream risk	1, 2, 3, 4, 5, 6, 7	A, D, E, F, H, I, J, M, N, O, P, Q	Dam / Levee Incident	DHSEM Medium	DNR, Division of Water Resources, Dam Safety Branch	HHPD, DHSEM Staff Time	Ongoing	Structure & Infra-structure	Increasing the level of protection for dams will reduce the downstream risk to people, property, and infrastructure while also allowing the dams to fulfill their intended purposes.	New
2023.09	Institutionalize Resiliency into State of Colorado Agency Programs, Operations, and Investments	2, 3, 4, 5, 6	A, B, C, D, E	All hazards	DOLA (CRO) High	CRWG Agencies	DOLA Staff Time, Energy & Mineral Impact Fund	Ongoing	Multiple	The CRO has launched and made available a module for agencies to incorporate the resiliency criteria into community-facing grant programs. The CRO will continue to implement the Resiliency Playbook through an initial pilot process to identify improvements and gaps including those associated with risk due to natural hazards, and then as an ongoing technical assistance program to state agencies.	Ongoing
2023.10	Cultivate a Root Culture of Resilience and Risk Reduction in Local Governments Across Colorado by Maintaining and Curating Resiliency Resource Hub and	4, 6, 8	A, B, C, F, G, I, R	All hazards	DOLA High	FEMA, CSFS, DHSEM, DNR, Local Governments	BRIC, DOLA Staff Time, Energy & Mineral Impact Fund	Ongoing	Education, Awareness, & Outreach	CRO continues to maintain and curate the Resiliency Resource Hub and Planning for Hazards websites, which provides information, education, tools, and technical assistance. These include the promotion of land use solutions to reduce risk to natural hazards, as well as resources to strengthen the	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	Planning for Hazards websites.									resilience of communities to future natural hazards and to adapt to climate change impacts.	
2023.11	Build Resilient Colorado Communities Program to Include Disaster Recovery (including pre-disaster recovery) and Hazard Mitigation Module to Encourage Local Communities to Reduce Risk and Vulnerabilities	1, 2, 3, 4, 5, 6, 8	A, B, C, D, L, Q, R	All hazards	DOLA (CRO) High	CDPHE, DHSEM, FEMA	DOLA Staff Time, Energy & Mineral Impact Fund	Ongoing	Multiple	Initiatives can include supporting local communities in "resilient thinking" such as incorporating the resiliency criteria in mitigation projects, identifying and engaging vulnerable communities in reducing social vulnerabilities to hazards, and land use.	New
2023.12	Continue to prioritize securing ongoing and sustainable funding sources to expand flexible community resiliency funding and ongoing updates to the Colorado Resiliency Framework	4	A, B, H, N, O	All hazards	DOLA High	CRWG Agencies, State Recovery Office	Expansion of existing programs (i.e., creating the Climate Resilience Challenge through EIAF), IIJA, IRA, STORM Act Funding	Ongoing	Funding	Cross-agency collaborative strategy to draw down and effectively leverage funds during unprecedented time of funding availability at the federal level (IIJA, ARPA, IIJA, etc). Additionally, expansion of funding allows for more opportunity for state and local communities to pursue innovative mitigation and resiliency projects to reduce risk and be resilient to unknowns of the future.	New

Action ID	Action Title	Relevant Goal(s)	Relevant Objective (s)	Hazard(s) Addressed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Completion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.13	Extreme Heat Mitigation and Heat Management Solutions Framework, Plans, Programs, and Other Technical Assistance	1, 4, 6, 7	A, C, E, F, G, H, O, R	Extreme Heat	CDPHE High	DOLA (CRO, CDO), CEO, DHSEM, DNR, CSFS, Gov's Office (Office of Climate Prep & Recovery)	BRIC, CDPHE General Fund, CDPHE Staff Time, Governor's Office	2025	Technical Assistance	Craft a framework, plans, and other technical assistance for extreme heat actions and support local governments, health agencies, and other partners in prioritizing extreme heat mitigation and heat management solutions. Establishment of extreme heat resources and planning of next steps in collaboration with state and community partners	New
2023.14	Implementation of Microgrids for Community Resilience Grant Program and Development of Strategy for Microgrids in Colorado	4, 5, 6, 7, 8	B, F, H	All hazards	DOLA High	CEO, DORA	Funding allocation through 2026 established by HB22-1013, bolstered through IIJA funding in partnership with CEO	2026	Multiple	Through the development of a Microgrids Roadmap and partnership with utilities, the state will have a better understanding of statewide and local energy resilience needs, risks, and vulnerabilities. If long-term funding is secured for microgrids beyond the funding established by HB 22-1013, this will allow for the expansion and implementation of the Microgrids for Community Resilience Grant Program and Microgrids Roadmap, which will improve grid and energy reliability and resiliency for vulnerable populations and high-risk infrastructure through 2026.	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
										40101d US. Department of Energy amounting approximately $16,228,849.18, though there is the potential for future formula funding opportunities in coming years.	
2023.15	Enhance Mitigation Program as part of the Housing Recovery Program within the Disaster Resilience Rebuilding Program	1, 3, 4, 6, 7, 8	A, B, C, G, H, I, O, R	Wildfire	DOLA Medium	DHSEM, CEO	SB22-206 ($15m), limited funding source	Ongoing	Multiple	The current home hardening program that was launched as part of the Marshall Fire recovery efforts currently focuses primarily on outreach and education to homeowners. If funding is secured, this can provide the opportunity to assess current effectiveness of outreach efforts and additionally allow for expansion throughout the entire state, prioritizing communities with limited capacity (such as communities with low-income), as well as builders/vendors doing construction or rebuilding. Also have the opportunity to incorporate expanded outreach and education aspects if funding is secured as they relate to mitigation, such as landscaping mitigation education.	New
2023.16	State Programs and Investments that Support Housing	4, 6, 7, 8	A, B, F, I, R	All hazards	DOLA (CRO, CDO, & DOH) High	CEO	Funding currently	January 2024	Multiple	Currently a model through the Strong Communities program to encourage resilient affordable housing	New

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	Development and Related Costs Incorporate Guidance to Further Incentivize Resilient Building Design and Materials and Land Use Best Practices.						allocated by HB22-1304	(funds awarded)		developments through planning and infrastructure grants. This is currently funded by state stimulus funds through HB 22-1304, though there may be opportunities to build upon this existing model to continue to increase climate resilience and encourage participation by additional state and local partners.	
2023.17	Provide an Update of Current Mitigation Actions to Water and Land Use Planning Alliance Participants	4, 7	A, B, C, F, R	All hazards	DOLA (CDO) Medium	Water and Land Use Planning Alliance	DOLA Staff Time, Energy & Mineral Impact Fund	Ongoing	Multiple	Take the opportunity to engage participants in the Water and Land Use Planning Alliance and convene a discussion and utilize CRO resources when providing technical assistance related land use planning efforts that can increase resiliency and reduce risk, such as comprehensive plan or code updates.	
2023.18	Craft a framework, plans, and other technical assistance for extreme heat actions and support local governments, health agencies, and other partners in prioritizing extreme heat mitigation and	1, 4, 6, 7	A, C, E, F, G, H, O, R	Extreme Heat	CDPHE High	DOLA (CRO, CDO), DHSEM, DNR, CSFS	BRIC, CDPHE General Fund, CDPHE Staff Time, Governor's Office	2025	Technical Assistance	Establishment of extreme heat resources and planning of next steps in collaboration with state and community partners	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	heat management solutions.										
2023.19	Continue to fund and support the improvement of statewide drought monitoring system to include additional stations and sensors, remote sensing, rangeland, groundwater and snowpack sublimation.	4	R	Drought	DNR- CWCB Medium	CSU	NRI Grant Funds	Ongoing	Structure & Infra-structure	Data quality will improve and offer more predictive ability.	Ongoing
2023.20	Support the 2023 Colorado water Plan as a guiding document for drought and flood mitigation. Continue to integrate it with other statewide planning efforts.	4	L	Drought	DNR- CWCB High	CDA, DOLA, CDPHE, CPW	DNR General Fund, DNR Staff Time, Water Plan Grant	Ongoing	Plans & Regulations	Create common statewide vision for drought and flood mitigation.	New
2023.21	Incorporate drought mitigation actions within ESHMP and drought response framework within SEOP to support integration	4	L	Drought	DNR- CWCB Medium	DWR, CDA, DOLA, DHSEM	DNR Staff Time	2024	Plans & Regulations	Reduce duplication among plans and consolidate for ease of reference and consistency	Annual

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	of drought and broader water supply planning										
2023.22	Promote a One Water approach and integrated water management into local water and land use planning.	4	R	Drought	DNR- CWCB Medium		DNR General Fund, DNR Staff Time, Water Plan Grant, Water Supply Reserve Grant	Ongoing	Technical Assistance	Support holistic thinking about connections to land use and water.	Ongoing
2023.23	Working with partners like CSU and the Colorado Climate Center, collect climatologic data at mid & lower elevations to fill existing gaps in the data collection network	4	L	Drought	DNR- CWCB Medium	CSU, CCC	BRIC, DNR General Fund, DNR Staff Time, Water Plan Grant, Mesonet Funding	Ongoing	Structure & Infra-structure	Data quality will improve and offer more predictive ability.	Ongoing
2023.24	Evaluate, improve, and coordinate the role and relationship of the CWCB public information and education efforts with those being conducted	4	G	Drought	DNR- CWCB Medium		DNR General Fund, DNR Staff Time, Water Plan Grant, Water Supply	Ongoing	Education, Awareness, & Outreach	Improve messaging coordination to improve public awareness about drought risk.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	by local water authorities, utilities, users, and suppliers.						Reserve Grant, PEPO Grant				
2023.25	Fund water system improvements for drought mitigation and resiliency through CWCB grants and loan programs.	4	L	Drought	DNR- CWCB High		CWCB grant programs	Ongoing	Funding	Improve drought resilience and support the work of the 2023 Water Plan.	Ongoing
2023.26	Make completion of local drought plans a priority; include vulnerability & risk assessments; incorporate info into next update.	4	L	Drought	DNR- CWCB High		DNR General Fund, DNR Staff Time, NRI Grant Funds	Ongoing	Plans & Regulations	Improve local knowledge of drought risk and improve drought mitigation and response plans for local communities.	Ongoing
2023.27	Continue to provide technical assistance to covered entities, evaluating submitted water conservation and drought plans, administering fund programs, and disseminating information to the public.	4	R	Drought	DNR- CWCB Medium		NRI Grant Funds	Ongoing	Technical Assistance	Improve statewide system water loss and accelerate conservation water savings.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.28	Encourage and provide incentives for more efficient municipal irrigation systems, including State-owned properties.	4	A	Drought	DNR- CWCB Medium		DNR General Fund, DNR Staff Time, Water Plan Grant, Water Supply Reserve Grant	2033	Plans & Regulations	Water savings and demonstration of technology for water saving irrigation improvements.	Ongoing
2023.29	Encourage the development of landscaper certification programs.	4	R	Drought	DNR- CWCB Medium		DNR General Fund, DNR Staff Time, Water Plan Grant	2030	Plans & Regulations	Improve state's industrial capacity to manage drought-resilient landscapes effectively.	Annual
2023.30	Continue to pursue implementation funding for recommendations in this plan.	4	R	Drought	DNR- CWCB Low		BRIC, State legislature, Severance Tax	Ongoing	Funding	Funding for mitigation of drought and flood risk.	Ongoing
2023.31	River restoration for streams that are most vulnerable to drought impacts.	4	R	Drought	DNR- CWCB High		Water Plan Grant, CO Watershed Grant, NRI Funding, DNR Staff Time, DNR	Ongoing	Technical Assistance	Habitat improvement for riparian plants and animals and improved stream function.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
							General Fund				
2023.32	Support statewide Climate Change Initiatives included in the 2023 Colorado Water Plan.	4	R	Drought	DNR- CWCB High	Multiple	Water Plan Grant, NRI Funding, DNR Staff Time, DNR General Fund	2033	Multiple	Improve drought resilience.	Ongoing
2023.33	Implement the 50 agency actions in the 2023 Colorado Water Plan.	4	A	Drought	DNR- CWCB High	Multiple	Water Plan Grant, NRI Funding, DNR Staff Time, DNR General Fund	2033	Multiple	Improve drought resilience.	Ongoing
2023.34	Add earthquake monitoring stations to evaluate seismic activity.	1, 2	C, F, J	Earth-quake	CGS Medium		CGS General Fund, CGS Staff Time, USGS STATEMAP	Ongoing	Structure & Infra-structure Projects	Though Colorado had a large earthquake as recently as 1882, USGS lists the state as having a low to moderate seismic risk. However, it is difficult to determine Colorado's true risks because the state has a sparse network of earthquake monitoring stations and a short history of monitoring. By expanding the state's seismic array, CGS hopes to better understand Colorado's seismic risks,	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
										better educate the public about earthquakes, and work with state and local governments to mitigate these risks through planning and building codes.	
2023.35	Evaluate statewide mined areas for subsidence.	2	F	Ground Sub-sidence	CGS Low		CGS General Fund, CGS Staff Time, USGS STATEMAP	Ongoing	Data & Studies	Colorado has natural sinkholes, collapsing soil, and subsidence over mine workings. Each year, CGS maps about an additional 1-2% of the state for subsidence hazards along with other geologic hazards. We use the mapping to educate the public and local officials about subsidence hazards. CGS also uses the data to review proposed school and private developments for subsidence hazards for local governments. CGS will recommend that any safety hazards be avoided or mitigated. Hazard maps are also used to guide local comprehensive and disaster mitigation plans.	Ongoing
2023.36	Develop and maintain a geologic hazards map viewer for Colorado emergency managers.	All	F, G	All hazards	CGS Medium		CGS General Fund, CGS Staff Time, USGS STATEMAP	Ongoing	Data & Studies	State and local emergency managers, local officials, and the public cannot avoid geologic hazards or make informed decisions without good and accessible data about each hazard. The online map viewer is intended to	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
										provide people with the most current hazard information.	
2023.37	Participate in National Soil Moisture Network	1, 7	C, E	Drought	CCC High		National Mesonet Program, CWCB	Ongoing	Data & Studies	Broader inclusion of Colorado data for characterization of soil moisture and its influences on drought	Ongoing
2023.38	Coordination with the Water and Land Use Planning Alliance participants to Integrate Resilience into Water and Land Use Mitigation Actions	4, 7, 8	A, C, E, L, M, N, O, R	All hazards	DOLA (CDO) Medium	Water and Land Use Planning Alliance, CRO	DOLA Staff Time	Ongoing	Technical Assistance	Coordinate with Water and Land Use Planning alliance to continue to provide quarterly updates to the Water and Land Use Planning Alliance participants on identified mitigation actions and utilize CRO resources on an ongoing basis when providing technical assistance to land use planning efforts that can increase resilience and reduce risk. This potentially includes referencing the ESHMP and the Colorado Resiliency Framework in comprehensive plan or code updates and associated hazard mitigation strategies.	New
2023.39	Public risk communication study	1, 7, 8	C	Avalanche	CAIC High		BRIC, CAIC Staff Time, Energy & Mineral Impact	Ongoing	Data & Studies	Improve public communication and understanding.	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
							Assistance Fund				
2023.40	SNOWPACK modeling	1,5	C, F, P	Avalanche	CAIC Medium		CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Data & Studies	Implement snowpack modeling to supplement the avalanche forecast and make better mitigation decisions	New
2023.41	Webpage and Application improvements: Public Risk Communication	1, 5, 7	C, D, E, F	Avalanche	CAIC High		CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Structure & Infra-structure	Continue improving web and mobile applications for public and other agencies	New
2023.42	Avalanche mapping	1, 8	C, F, R	Avalanche	CAIC Medium		CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Structure & Infra-structure	Work on White Risk and ATES mapping models	New
2023.43	Avalanche Education	1, 8	C, E	Avalanche	CAIC High		CAIC Staff Time, Energy & Mineral	Ongoing	Education, Awareness, & Outreach	Continue education efforts for public, state, federal, local and private industries.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
							Impact Assistance Fund				
2023.44	Avalanche detection using infrasound pilot project	5	F, J, K, P	Avalanche	CAIC Low	CDOT	CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Structure & Infra-structure	Build and test infrasound for avalanche detection on US 160 Wolf Creek pass	New
2023.45	Continue to work with emergency managers to improve risk communication around unusual events.	1, 2, 4, 5, 7	A, C, D, E, J, K, M,	Avalanche	CAIC Medium		CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Education, Awareness, & Outreach	Continue our outreach efforts with emergency managers	Ongoing
2023.46	Review proposed subdivisions, schools, and other developments for potential geologic hazards and work with local governments, developers, and builders to avoid or mitigate hazards.	1, 2, 3, 4, 5, 7, 8	A, C, F, I, J, L, O, Q, R	Earth-quake, Erosion / Depo-sition, Expansive Soils, Ground Sub-sidence,	CGS High	CAIC	CGS Staff Time, USGS STATEMAP	Ongoing	Multiple	Identifying then avoiding or mitigating hazards during the planning process is an effective way to reduce deaths, injuries and economic losses from geologic hazards, including avalanche.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
				Landslide / Debris Flow / Rockfall							
2023.47	Improve local government compliance with state natural hazard land use regulations through education of planners and elected officials.	1, 2, 3, 4, 5, 7, 8	A, C, F, I, J, L, O, Q, R	Earth-quake, Erosion / Depo-sition, Expansive Soils, Ground Sub-sidence, Landslide / Debris Flow / Rockfall	CGS Medium	CAIC	CGS Staff Time, USGS STATEMAP	Ongoing	Multiple	Some cities, counties, school districts, and other local governments don't comply with state laws requiring identification, avoidance, and mitigation of geologic hazards. This is often due to rapid turnover of local planners and elected officials. Educational efforts will result in improved compliance and ultimately in a reduction of deaths, injuries, and economic losses.	Ongoing
2023.48	Work with local governments to use site plan, overlay zoning, and grading regulations, 1041 land use codes, and building codes to mitigate avalanche and debris flow risks.	1, 2, 3, 4, 5, 7, 8	A, C, F, I, J, L, O, Q, R	Ava-lanche, Debris Flow	CAIC Medium	CGS	CAIC Staff Time, Energy & Mineral Impact Assistance Fund	Ongoing	Multiple	Rising land and home prices means more building in areas with avalanche and geologic hazard risks. Colorado's subdivision laws don't apply to areas already platted or large lots (over 35 acres). CAIC and CGS will work with willing local planners and elected officials to implement building permit and other processes that ensure	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
										hazards are identified and mitigated on "exempt" lots.	
2023.49	Map geologic hazards in areas with greatest risks to people and infrastructure. Work with local governments to adopt maps.	1, 2, 3, 4, 5, 7, 8	A, C, D, E, F, G, H, I, J, K, L, N, O, Q, R	Earth-quake, Erosion / Depo-sition, Expansive Soils, Ground Sub-sidence, Landslide / Debris Flow / Rockfall	CGS High	CAIC	Federal funding (USGS), CGS Staff Time	Ongoing	Multiple	About 50% of Colorado has been mapped at the scale needed for land use planning. Some existing maps were completed without LiDAR and need to be updated. With hazards mapped at the appropriate scale, local officials can use this information to guide comprehensive planning, zoning, building codes, emergency management planning, and capital investments.	Ongoing
2023.50	Evaluate critical infrastructure for earthquake resiliency pilot project	1, 2, 3, 4, 5, 7, 8	A, C, D, F, G, H, I, J, L, M, N, O, P	Earth-quake	CEHMC High	CGS	BRIC	2024	Multiple	Identify earthquake risks to critical infrastructure and work with local governments to reduce such risks. Reduce injury, loss of life, and economic losses from earthquakes.	Ongoing
2023.51	Evaluate earthquake resiliency in building codes for K-12 public schools.	1, 2, 3, 4, 5, 7, 8	A, C, D, F, G, H, I, J, L, M, N, O, P	Earth-quake	CEHMC Low	CEHMC	BRIC	2024	Multiple	Identify earthquake risks to critical infrastructure and work with local governments to reduce such risks. Reduce injury, loss of life, and economic losses from earthquakes.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.52	Fund community-level actions (defensible space, fuels reduction/vegetation management, ignition-resistant building materials, fire suppression systems, post-wildfire flooding prevention, and sediment reduction measures) to reduce wildfire risk to people, property and infrastructure	1, 2, 4, 6, 7, 8	A, F, G, H, J, K, N	Wildfire	CSFS High		FRWRM & ILG Grants, Staff Time	Ongoing	Multiple	Provide grant funding to implement actions that reduce the risk if wildfire to people, property, and infrastructure	Ongoing
2023.53	Promote community fire adaptation	All	A, C, D, E, G, J, L, M, N, O, P, Q, R	Wildfire	CSFS High	Local governments, DNR, DFPC	CSFS General Fund, CSFS Staff Time, Healthy Forests Vibrant Communities, Forest Restoration & Wildfire Risk	Ongoing	Multiple	Develop action-oriented recognition of the reality of wildfire, reduce associated negative impacts, and decrease recovery times.	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
							Mitigation, Wildfire Ready Watersheds, Strategic Wildfire Action Program, USFS WUI Grants, BLM, CWGD, BRIC				
2023.54	Promote the role of fire in ecological processes to communities and the public at large through public education materials and events	4, 6, 8	G, H, J, L, O, R	Wildfire	CSFS Medium	DNR	CSFS General Fund, CSFS Staff Time, Project Learning Tree, USFS State Fire Assistance	Ongoing	Multiple	Improved ecosystem health resulting in protection of natural resources and human communities and greater resilience to future hazard conditions	Ongoing
2023.55	Provide online data and information access from the Colorado Wildfire Risk Assessment in the Wildfire Risk Viewer and Wildfire Risk	4, 6, 7, 8	A, E, F, G, K, M, N, O, R	Wildfire	CSFS High		CSFS General Fund, CSFS Staff Time, Healthly Forest Vibrant	Ongoing	Multiple	Increase in wildfire risk mitigation projects and awareness of wildfire hazards from the community to statewide level. Promote cross-agency collaboration in wildfire risk mitigation work, including local, state, federal,	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	Reduction web applications on the Colorado Forest Atlas website, as tools for wildfire risk reduction planning and landscape prioritization for fuels reduction. Include data on social vulnerability and egress/ingress routes. Provide online training and technical user support for these applications.						Communities, USFS State Fire Assistance			Tribal, non-governmental, academia, and more.	
2023.56	Raise awareness through a public outreach campaign, Live Wildfire Ready, of the need for Coloradans living in the wildland-urban interface to protect their lives, families, pets, homes and properties from wildfire and provide	1, 2, 7, 8	A, C, E, G, M	Wildfire	CSFS Medium	DFPC, USDA Forest Service, Colorado State Fire Chiefs	CSFS General Fund, CSFS Staff Time, Live Wildfire Ready Funding	Ongoing, but campaign will wrap at end of 2024 without more funding	Education, Awareness, & Outreach	Increase awareness of need to reduce wildfire risk and provide practical, simple, low-cost actions for people to take start living wildfire ready	Ongoing

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	actions they can take to lower their risk										
2023.57	Provide actions people can take to reduce wildfire risk to their home and property through a comprehensive Home Ignition Zone guide, available in English and Spanish	1, 2, 6, 8	A, C, G	Wildfire	CSFS Medium		CSFS General Fund, CSFS Staff Time, Healthly Forest Vibrant Communities	Ongoing	Education, Awareness, & Outreach	Provide critical steps for reducing wildfire risk to homes and properties, so state has one standard	Ongoing
2023.58	Assist local communities and other partners implement wildfire mitigation projects (defensible space, fuels reduction/vegetation management, ignition-resistant building materials, fire suppression systems, post-wildfire flooding prevention and sediment reduction measures) to reduce their risk and	All	A, D, F, H, I, J, K, M, N, O, Q	Wildfire	DHSEM High	Local governments, Eligible PNPs, CSFS, CDNR	BRIC, HMGP, CSFS General Fund, CSFS Staff Time	Ongoing	Structure & Infra-structure	Reduced risk from wildfire damages, build momentum for community wildfire projects, reduce post-fire flood damages, reduce/eliminate response & recovery costs.	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
	vulnerability to the hazard.										
2023.59	Support wildfire mitigation and workforce development through the Colorado Strategic Wildfire Action Program's Workforce Development Program's grant program.	All	A, E, F, H, I, M	Wildfire	DNR-EDO High	DOC, local governments, nonprofits, Colorado Youth Corps Association	CSFS Staff Time, COSWAP, Water Plan Grant	Ongoing	Funding	This program funds fuels reduction mitigation projects complete by conservation corps or State Wildland Inmate Fire Teams. This opportunity also funds mitigation training.	Ongoing
2023.60	Colorado Strategic Wildfire Action Program's Landscape Resilience Investment Program	All	A, F, H, I, M	Wildfire	DNR-EDO High	Local governments	CSFS General Fund, CSFS Staff Time, COSWAP, Water Plan Grant	Ongoing	Funding	The Landscape Resilience Investment Program reduces the risk of wildfire to life, property and infrastructure through landscape scale, collaboratively developed mitigation projects, as well as project planning and cost shares for defensible space in strategic focus areas.	Ongoing
2023.61	Implement a wildfire home-hardening grant program to assist property owners in lowering the potential for structure ignition during a wildfire event	1, 2, 3, 4, 6	A, C, F, G, H	Wildfire	DFPC High	CSFS	CSFS Staff Time, FEMA Fire Prevention & Safety	Ongoing	Structure & Infra-structure	To be used in ignition prevention projects (i.e., replacing roof or siding, replacing a deck, and installing appropriate screens, replacing attic and soffit vents, replacing vinyl gutters and window frames, etc.).	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
2023.62	Improve risk assessments in local HMPs by including potential structure losses to each natural hazard included in the plan.	All	A, C, D, F, G, I, M, N, O, P, Q, R	All Hazards	DHSEM	Local HMP Planning Groups / Committees	BRIC, HMGP, Staff Time (DHSEM & Local)	Ongoing	Technical Assistance	Local communities will develop a more complete risk assessment and communicate risk more effectively to inform officials' and the public's decision making.	New
2023.63	Improve risk assessments in local HMPs by ensuring that recent development (previous five years) and planned/future development (next 10-20 years) are specifically addressed in hazard profiles with respect to exposure, vulnerability, and potential losses.	All	A, C, D, F, G, I, M, N, O, P, Q, R	All Hazards	DHSEM	Local HMP Planning Groups / Committees	BRIC, HMGP, Staff Time (DHSEM & Local)	Ongoing	Technical Assistance	Local communities will develop a more complete risk assessment and communicate risk more effectively to inform officials' and the public's decision making.	New
2023.64	Improve the state government's risk assessment by creating or adding to existing data sets to include structure types.	All	A, C, D, E, F, H, J, K, M, N, P	All Hazards	DHSEM	SHMT (data)	BRIC & HMGP Grants; DHSEM Operating Budget; Staff Time	2026	Data & Studies	State agencies will have a better understanding of their exposure and potential losses by structure type, enabling better informed decision making for mitigation, response, and recovery.	New

Action ID	Action Title	Rele-vant Goal(s)	Relevant Objective (s)	Hazard(s) Address-ed	Responsible Organization & Action Priority	Partnering Organization (s)	Potential Funding Source(s)	Estimated Comple-tion Date	Mitigation Type	Potential Benefits	On-going or Annual Effort?
							(DHSEM & SHMT Partners)				

LOCAL COORDINATION

The State of Colorado is responsible for providing hazard mitigation planning support to local governments through training, technical assistance, and identifying available funding opportunities. This support, coordinated through the Division of Homeland Security and Emergency Management's (DHSEM) Mitigation Section, ensures that locals are informed of statewide mitigation priorities and are aware of the best available data and resources to implement mitigation planning. Additionally, the Colorado Enhanced State Hazard Mitigation Plan (E-SHMP) serves as a resource for local governments.

The state looks to local hazard mitigation plans (HMP) to inform the E-SHMP, specifically relating to local mitigation strategies, mitigation capabilities, and hazards data. This content is presented across this E-SHMP in those relevant chapters and was provided to the State Hazard Mitigation Team (SHMT) for their use and consideration during the plan update process.

Since 2018, the Planning Branch of DHSEM's Mitigation Section has worked in tandem with local partners to achieve many accomplishments. Those to highlight include:

- Involvement of local emergency managers in the E-SHMP planning process: A total of 15 local government representatives were invited to participate in all meetings and communications relating to the plan update. Additionally, all county and tribal emergency managers across the state were offered an opportunity during the E-SHMP planning process to provide their input through three separate surveys. These surveys were distributed through DHSEM's Regional Field Managers (RFM). A total of 24 counties participated in the first survey and nine counties provided input relating to the second. The third survey relating to local challenges in addressing the needs of underserved communities and impacts of climate change received 12 responses.

- Encouraged the development of Community Wildfire Protection Plans (CWPP): As there is much alignment between the development of an HMP and CWPP, the Mitigation Team has been encouraging locals to develop CWPPs following their HMP updates. A majority of CWPP-required elements can be met through the HMP planning and update process.

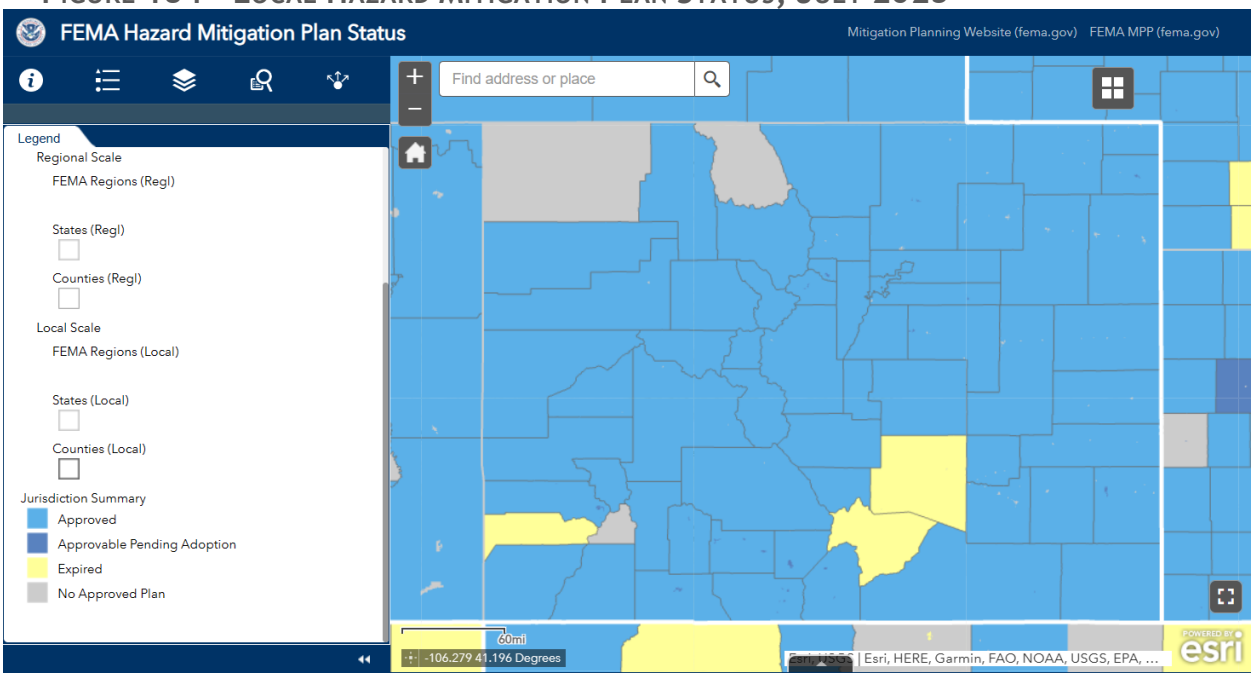
- Expansion of the Mitigation Section: In 2019 a seventh position was added to the Mitigation Section, enabling expanded technical assistance to Colorado communities as they apply for and implement mitigation projects.

Hazard Mitigation Plans

As of July 2023, 58 counties, four municipalities, and one Tribe have local HMPs that are FEMA approved. These 63 approved plans encompass over 95% of the state's total population. As of October 2023, over 80% of local jurisdictions, that have previously submitted a mitigation plan, are currently approved or updating their plans. An overwhelming majority of the county HMPs are multi-governmental and include most municipalities and many special districts.

The following Figure 184 presents the current status of local HMPs, as of July 2023. This information is updated regularly, so readers are encouraged to access FEMA's Local Hazard Mitigation Plan Status web map for updated information.

FIGURE 184 – LOCAL HAZARD MITIGATION PLAN STATUS, JULY 2023[50]



Review, Coordination, & Integration

The Planning Branch of DHSEM's Mitigation Section (i.e. - the "Mitigation Planning Team", or "Planning Team"), along with agency partners, provides technical assistance throughout the local and tribal hazard mitigation planning processes. In some cases, Mitigation Planning Team staff will review individual sections of local HMPs or provide feedback on specific passages, dependent upon community needs and requests. Once a plan is in final draft form, the Planning Team will review it for compliance with the applicable FEMA Mitigation Plan Review Tool and state mitigation planning requirements. The state review process will generally take 30 days or less.

If the plan has met FEMA's planning requirements, it will be forwarded to FEMA for review. If the Planning Team finds that a community needs to improve certain elements of their plan, it will provide detailed comments and suggested revisions. Once a community has addressed the suggested revisions, the Planning Team will then forward the plan to FEMA for official review. In cases where FEMA requires revisions

[50] FEMA Hazard Mitigation Plan Status (arcgis.com)

for final approval, the state will work closely with a community to identify potential solutions and make revisions.

All of Colorado's local and tribal HMPs currently approved by FEMA are available on the DHSEM website. Making these plans available benefits local communities who are engaged in the planning process, as a number of ideas and methodologies are available to review and incorporate. Information, content, data, and mapping from the E-SHMP is also available for locals to use. The Planning Team is able to provide any of this information whenever requests are made by local jurisdictions or tribes. Encouraging this content sharing helps to ensure that local plans are aligned and linked to the state plan.

The Planning Team continually reviews, catalogues, and tracks information from local and tribal HMPs for incorporation into the E-SHMP during regular plan updates. By constantly monitoring this information, the state is able to track changes and trends at the statewide and regional levels. This ensures that the state's risk assessment and mitigation strategy take into account, and link back to, these local HMPs.

Technical Assistance

The Mitigation Section works closely with both federal and local partners to ensure mitigation plans and projects meet the communities' needs and are completed successfully.

When FEMA releases Hazard Mitigation Assistance (HMA) program guidance, DHSEM advertises the availability of funds and encourages qualified communities to submit a Notice of Interest (NOI) for project applications. In general,

- The applying entity must have a FEMA approved hazard mitigation plan.
- The scope of the project must be comprehensive and meet all HMA guidance requirements.

- The project must be a long-term solution to a well-defined problem that is caused by a natural hazard.
- The project meets FEMA Benefit-Cost Analysis (BCA) minimum criteria.

Technical assistance and application development is available year-round via Colorado's EMGrants Pro system to position and prepare communities in advance of short NOI and application timelines. Since the last plan update, the Mitigation Section has again increased and enhanced the technical assistance it provides to local partners, promoting community resiliency and sustainability for residents of Colorado by fostering partnerships and maximizing the availability of mitigation resources.

For specific information related to funding provided through FEMA's HMA grant programs, refer to the Capabilities chapter of this E-SHMP.

Hazard Mitigation Planning

The Mitigation Planning Team focuses on planning efforts, while occasionally providing project-related support. Planning Team staff regularly attend local hazard mitigation planning committee meetings and provide on-site support both proactively and upon request. Soon after a sub grant award, Planning Team staff will meet with the local project manager and finance staff to review the grant management process, and will continue providing that assistance throughout plan development. The Planning Team also advises communities on maximizing local match funding sources.

The Planning Team has developed training materials, workshops, and presentations for communities interested in or engaged in the local mitigation planning process. For example, prior to the course's discontinuation in 2021, the Planning Team regularly conducted a one-day course – structured around FEMA's G-318 *Mitigation Planning Workshop for Local Government* - during the annual DHSEM Emergency Management Academy. This event is attended by local emergency managers, other state & county departments, city staff, law enforcement, regional council members, FEMA, and others. In addition to classroom trainings, the Planning Team partners with subject

matter experts to present information on pertinent mitigation topics at the annual Colorado Emergency Management Conference.

The Planning Team has developed additional materials like “best practices” guidance that enables plans to meet the FEMA Review Tool requirements, provides research resources related to conducting comprehensive risk assessments, and offers sample mitigation action strategies. The Planning Team has frequently supported local planning efforts to achieve StormReady® and Firewise™ designation, and also can provide adoption support at public hearings.

New information and resources regularly become available about natural hazard risks and the impacts of specific hazards in certain areas or on certain populations. Similarly, information about future conditions like population and development changes, climate change, or the cascading impacts or related hazards also become available. However, this new information’s value depends on a foundational understanding of a community’s assets (people; structures; systems; natural, historic, and cultural resources; and important community activities) and its hazards and risks. The DHSEM Mitigation Planning Team will guide and assist communities throughout their HMP update process to close gaps in that foundation of assets, hazards, and risks in their plans. One specific example is to address how recent development (previous five years) and future/planned development (next 10-20 years) will relate to the community’s natural hazards in terms of exposure, vulnerability, and potential losses.

Within the last year, the Planning Team has supported the planning process across more than 20 counties and municipalities. Outreach to more than 20 additional counties and tribes that require an updated mitigation plan is ongoing. The Planning Team reminds jurisdictions of needed HMP updates at least 18-24 months in advance of their expiration date and correspondence provides information on possible grant funds for supporting the planning process. The Mitigation Planning Team also works cooperatively with jurisdictions to obtain adoptions within six months of receiving FEMA Approval Pending Adoption (APA).

Advancing Local HMPs

Barriers to developing or updating local HMPs include the local government's staffing capacity and limited or lack mitigation funding. Several local communities have expressed the strain of providing funds to cover the cost of updating or developing their plan. Some counties simply don't have the staff to champion the planning update themselves. Political barriers can also arise in some jurisdictions as they attempt to adopt the plan.

To address these concerns of available funding, DHSEM regularly provides local governments with grant funding opportunities to reduce the overall costs of developing or updating their HMP. DHSEM assists communities in tracking staff time to increase their in-kind match for FEMA grant match requirements, which reduces the amount of cash that the local needs to provide. During the COVID-19 pandemic, the local cost share for some FEMA grants was reduced to 10% instead of 25% and the Planning Team ensured that locals leveraged the opportunity to update their HMPs, resulting in some counties' staff time alone covering the match. DHSEM is continuing to find opportunities to reduce the costs of plan updates which can include providing state funds to cover the local match requirements or combining plan updates under one grant so that the locals only have to provide a match once.

Where providing matching funds is a challenge for a county, DHSEM encourages development of regional (multi-county) plans, as these may both reduce the funding burden and encourage collaboration with surrounding jurisdictions.

DHSEM's Planning Team also provides support to local communities that run into political push back in adopting their HMPs.

Hazard Mitigation Projects

Working alongside the Planning Team is the Mitigation Project Team (the Projects Branch of the Mitigation Section), who assist local communities with identifying and implementing the mitigation solutions identified through the planning process to address natural hazard impacts. Much of the Project Team's focus is geared towards

FEMA HMA grant funding. For these projects, the Project Team assists communities throughout the application process (developing the scope of work, budgets, schedules, Benefit Cost Analysis, and other FEMA required application materials) through sub grant closeout. The Project Team often also consults on non-HMA funded projects, leveraging their knowledge and experience to enhance outcomes across all mitigation grant programs.

The Project Team has instituted many programmatic improvements since the previous E-SHMP update in 2018. Many of these improvements are direct outcomes of the numerous recent disaster declarations which challenged existing capabilities and required increased use of technological and other efficiencies to meet the demands of managing the large sum of funding made available through FEMA's Hazard Mitigation Grant Program (HMGP). Improvements include:

- Use of EMGrants - application development, quarterly reporting, reimbursement, and closeout processing.
- Improved technical assistance documents and checklists to ensure completeness.
- Greater knowledge and experience implementing and overseeing projects like acquisition and elevation, wildfire, generators, five percent projects, etc.
- Improvements to engagements with new partners for projects (i.e. – rural electric cooperatives)
- Updated review process for Requests for Reimbursements (RFR)
    - The Mitigation Section ensures work: was consistent with the approved scope of work, in accordance with Environmental and Historic Preservation (EHP) requirements; was performed within the approved Period of Performance (POP); and was properly procured, in addition to

reviewing documentation backup completeness (invoices, proof of payment, and other relevant documentation)

- The RFR is then submitted to the Office of Grants Management to review procurement including compliance with local and federal procurement requirements (44 CFR § 13.36 and 2 CFR § 200 as applicable), open and competitive practices, and appropriate support documentation has been submitted.

Additionally, the Project Team reviews quarterly reports to ensure ongoing progress and compliance with grant requirements, performs monitoring site visits, assists with closeout, and maintains ongoing and proactive engagement with all partners throughout a project.

Funding Opportunities

Throughout the year, the Mitigation Project Team communicates with state agency partners on FEMA funding opportunities, to ensure broad dispersal and awareness of these grants. Additionally, when a community is unable to obtain FEMA HMA grant funds, the Mitigation Section will evaluate other state-level funding opportunities or technical assistance through coordination with partner agencies. Partners regularly communicated with include the following:

- Colorado Water Conservation Board (CWCB)
- Colorado Department of Transportation (CDOT)
- Colorado Department of Local Affairs (DOLA)
- Colorado State Forest Service (CSFS)
- Colorado Department of Natural Resources (DNR)
- Colorado Division of Dam Safety
- Colorado Geologic Survey (CGS)

- Mile High Flood District (MHFD)
- Colorado Municipal League (CML)
- Colorado Counties, Inc. (CCI)
- Special Districts Association of Colorado

As the Mitigation Project Team is notified of mitigation needs at the local level, an initial outreach meeting is scheduled to determine needs and potential solutions. Eligibility under FEMA grant programs is discussed. In an effort to provide additional funding opportunities outside of FEMA, the DHSEM Mitigation Project Team is continually building knowledge of other federal and state mitigation and resilience programs. This requires ongoing engagement with other program representatives and subject matter experts from a myriad of local, state, and federal agencies, and non-profits.

Additionally, the Mitigation Project Team coordinates with appropriate partners when reviewing projects for funding. This allows for input from subject matter experts who are able to identify best practices and provide suggestions for improvements to a proposed project. This also has the added benefit of increasing our partners' awareness of mitigation efforts across the state.

Projects can then be prioritized after potential funding sources are identified for local projects. Local project prioritization follows the same process as for state projects, which is documented in the Plan Implementation chapter of this E-SHMP.

Other Agency Support

State floodplain administrators, state foresters, state geologists, state hydrologists, cooperative extension representatives, state mitigation planners, and state RFMs work with communities developing safety, preparedness, and mitigation plans.

Many state agencies provide technical assistance and funding for local mitigation plans and projects as resources become available. Each agency's criteria is dependent

on applicable agency rules and federal award requirements, and may be reliant on a competitive application process. Some grants may be based on need, others on demonstrated risks or development pressures. In all cases, any hazard related grant funding provided to a local community must be able to effectively and demonstrably show that the funding will help prepare a community for or mitigate against a potential risk. See the Capabilities chapter of this E-SHMP for additional details.

State agencies also financially and technically support hazard mapping and risk assessment efforts that can improve E-SHMP and local HMPs. Institutions of higher education have also historically developed tools to help communities complete more accurate risk assessments. The following Table 93 highlights this current support:

TABLE 93 - STATE AGENCY LOCAL HAZARD MITIGATION PLAN SUPPORT

Agency	Technical Assistance Provided
CO Avalanche Information Center	Data, information, and mapping have been used to inform the avalanche hazard profile and risk assessment in plan updates.
CO Climate Center	Data and information have been used to inform the climate change components of the plan and the drought and extreme heat profiles and risk assessments in plan updates.
CO Department of Agriculture	Data, information, and mapping have been used to inform the agricultural disease and pest infestation profiles and risk assessments in plan updates.
CO Department of Energy	Data and information have been used to inform plan updates.
CO Department of Public Health & Environment	Data, information, and mapping (including the EnviroScreen program) have been used to inform the wildfire hazard profile and risk assessment in plan updates.

Agency	Technical Assistance Provided
CDOT	Data and information have been used to inform the wildlife vehicle collision hazard profile and risk assessment in plan updates.
CGS	Data, studies, and mapping (including Hazus modeling) have been used to inform all "geologic" hazard profiles and risk assessments in plan updates.
CSFS	Data, information, and mapping (including the CO Wildfire Risk Assessment [CO-WRA] program) have been used to inform the wildfire hazard profile and risk assessment in plan updates.
CWCB	Data, information, and mapping (including the Risk Mapping, Assessment, and Planning (RiskMAP), CO Hazard Mapping (CHAMP), and Wildfire Ready Watershed [WRW] programs and Future Avoided Cost Explorer [FACE] tool) have been used to inform the flood and other related hazard profiles and risk assessments in plan updates.
DNR Division of Water Resources Office of the State Engineer – Dam Safety	Data, information, and mapping (including the High Hazard Dam Release program) have been used to inform the wildfire hazard profile and risk assessment in plan updates.
State Demography Office	Data and information have been used to inform the demographic components in plan updates.

The Mitigation Section reviews state agencies' documents and websites to identify programs and policies that promote or could potentially further mitigation initiatives around the state. The most current list is presented in detail in the Capabilities chapter of this E-SHMP.

E-SHMP IMPLEMENTATION

CFR § 201.2 states that the State Hazard Mitigation Officer (SHMO) is the official representative of state government who is the primary point of contact with FEMA, other Federal agencies, and local governments in mitigation planning and implementation of mitigation programs and activities required under the Stafford Act. The Colorado SHMO resides within DHSEM and is responsible for the implementation, maintenance, and review of the E-SHMP, along with the State Hazard Mitigation Team (SHMT). In the spirit of statewide cooperative integration, any potential future discussions related to modification or realignment of the current SHMT will be conducted during an annual meeting with all team members to ensure inclusion, integration, coordination, collaboration, participation, recommendations, and agreement from the established SHMT members are included.

Acronyms

Table 94 provides a key for the acronyms contained within this chapter of the E-SHMP.

TABLE 94 - ACRONYM KEY

Acronym	Name	Acronym	Name	Acronym	Name
AA	Advanced Assistance	DEF	State Disaster Emergency Fund	NEIC	National Earthquake Information Center
ASFPM	Association of State Floodplain Managers	DHS	US Department of Homeland Security	NEMIS	National Emergency Management Information System

Acronym	Name	Acronym	Name	Acronym	Name
BCA	Benefit Cost Analysis	DHSEM	Division of Homeland Security and Emergency Management	NFIP	National Flood Insurance Program
BRIC	Building Resilient Infrastructure and Communities	DLG	Division of Local Government	NFPA	National Fire Protection Association
CASFM	Colorado Association of Stormwater and Floodplain Managers	DNR DWR	Colorado Department of Natural Resources, Division of Water Resources	NRCS	National Resources Conservation Service
CCC	Colorado Climate Center	DOLA	Colorado Department of Local Affairs	NOFO	Notice of Funding Opportunity
CDA	Colorado Department of Agriculture	DORA	Department of Regulatory Agencies	NWS	National Weather Service
CDBG	Community Development Block Grant	DWR	Division of Water Resources	OEDIT	Colorado Office of Economic Development and

Acronym	Name	Acronym	Name	Acronym	Name
					International Trade
CDBG-DR	Community Development Block Grant – Disaster Recovery	EMAP	Emergency Management Accreditation Program	OGM	Office of Grants Management
CDOT	Colorado Department of Transportation	EPCRA	Emergency Planning and Community Right-To-Know Act	PA	Public Assistance
CDPS	Colorado Department of Public Safety	E-SHMP	Enhanced State Hazard Mitigation Plan	PDM	Pre-Disaster Mitigation Grant Program
CEAEP	Colorado Energy Assurance Emergency Plan	EWPP	Emergency Watershed Protection Program	PoP	Period of Performance
CEHMC	Colorado Earthquake Hazard Mitigation Council	FACO	Fire Adapted Communities	RiskMAP	Risk Mapping, Assessment, & Planning
CEO	Colorado Energy Office	FEMA	Federal Emergency Management Agency	RFI	Request for Information

Acronym	Name	Acronym	Name	Acronym	Name
CEPA	Colorado Emergency Preparedness Assessment	FEMA GO	FEMA Grants Outcomes	RL	Repetitive Loss
CEPC	Colorado Emergency Planning Committee	FHZ	Fluvial Hazard Zone	ROI	Return on Investment
CEPP	Colorado Emergency Preparedness Partnership	FIRM	Flood Insurance Rate Map	SB	Colorado Senate Bill
CERT	Community Emergency Response Team	FMA	Flood Mitigation Assistance	SBA	US Small Business Administration
CFM	Certified Floodplain Manager	FMAG	Fire Management Assistance Grant	SEOP	State Emergency Operations Plan
CGS	Colorado Geological Survey	FTAP	Flood Technical Assistance Partnership	SERC	State Emergency Response Commission
CHAMP	Colorado Hazard Mapping Program	FTF	Governor's Flood Task Force	SFHA	Special Flood Hazard Area

Acronym	Name	Acronym	Name	Acronym	Name
CHPHE	Colorado Department of Public Health & Environment	GIS	Geographic Information Systems	SHMO	State Hazard Mitigation Officer
CHR	Colorado Cultural and Historic Resources Task Force	HB	Colorado House Bill	SHMT	Colorado State Hazard Mitigation Team
CIAC	Colorado Information Analysis Center	HHPD	High Hazard Potential Dam	SME	Subject Matter Expert
CIP	Critical Infrastructure Protection	HIRA	Hazard Identification and Risk Assessment	SOW	Scope of Work
CRO	Colorado Resiliency Office	HMA	Hazard Mitigation Assistance	SRIA	Sandy Recovery Improvement Act
CRS	Community Rating System	HMGP	Hazard Mitigation Grant Program	SRL	Severe Repetitive Loss
CRWG	Colorado Resiliency Working Group	HMGP-PF	Hazard Mitigation Grant Program - Post Fire	TA	Technical Assistance

Acronym	Name	Acronym	Name	Acronym	Name
CSFS	Colorado State Forest Service	HMP	Hazard Mitigation Plan	TAP	Technical Assistance Partnership
CSU	Colorado State University	HSAC	Homeland Security and All-Hazards Senior Advisory Committee	THRA	Threat Hazard Identification and Risk Assessment
CTP	Cooperating Technical Partner	LEPC	Local Emergency Preparedness Coordinator	UDFCD	Urban Drainage & Flood Control District
CU	University of Colorado	MHFD	Mile High Flood District	USACE	US Army Corps of Engineers
CWCB	Colorado Water Conservation Board	NIST	National Institute of Standards and Technology	USBR	US Bureau of Reclamation
CTP	Cooperating Technical Partner	NSF	National Science Foundation	USDA	US Department of Agriculture
CU	University of Colorado	OEM	Office of Emergency Management	USFS	US Forest Service
CWCB	Colorado Water Conservation Board	OEDIT	Colorado Office of Economic Development and	USGS	United States Geological Survey

Acronym	Name	Acronym	Name	Acronym	Name
			International Trade		
CWDG	Community Wildfire Defense Grant Fund	NOAA	National Oceanic and Atmospheric Administration	VSL	Value of a Statistical Life
DR	Disaster (Presidential Disaster Declaration)	NEHRP	National Earthquake Hazards Reduction Program	WATF	Governor's Water Availability Task Force

Integration

The integration of the E-SHMP with other state planning initiatives occurs in part through regularly scheduled meetings and coordination of the SHMT. Coordination and integration of the hazard mitigation program and other state-wide efforts is vital for methodical, cohesive, and successful implementation of the mitigation strategy. This occurs throughout the mitigation planning process, through data-sharing between different state plans, and through participation on planning committees and policy commissions.

The 2023 SHMT roster includes more than 160 individuals representing state agencies, the academic community, SMEs, and local emergency managers. Through the SHMT, DHSEM planners are made aware of the data, programs, and priorities of other state agencies, and other agencies become more knowledgeable about mitigation policies and programs and how they can be integrated into their own plans. Outside of the E-SHMP update process, the state continues to coordinate with all mitigation program stakeholders, and will ensure that local, state, regional, and federal mitigation

efforts stay integrated with the E-SHMP. An accounting of regularly occurring interagency coordination opportunities is listed in Table 95.

TABLE 95 – INTERAGENCY COORDINATION WORKING GROUPS

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
Colorado State University Extension Emergency Preparedness Team	Identify hazards, opportunities for partnerships, and common resources. The CDA - CSU Extension partnership allows for training, planning, and staging of resources pre-disaster.	As needed	CDA
Agriculture Emergency Liaison Program	Works closely with producers and associations to recruit farmers and ranchers to identify mitigation projects and assist their local emergency managers when agriculture is threatened (all-hazards). Engages much needed SMEs before a disaster occurs.	Regional meetings and bi-monthly communication	CDA
CRO Colorado Resiliency Working Group (CRWG)	Coordinates interagency implementation of the CO Resiliency Framework and ongoing resiliency integration across state policies and programs.	Quarterly meetings	DOLA > DLG

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
Boulder Watershed Collective	CWCB provides technical and financial support towards enabling mitigation actions. The collective addresses forest watershed health, resiliency, and stewardship. Its mission is to cultivate partnerships, promote community stewardship, and revitalize social and ecological systems within the watershed.	Coordination as needed	DNR > CWCB
Left Hand Watershed Center	Assess, protect, and restore the watershed. Its focus is on: adaptively managing watersheds, finding balanced solutions for working rivers, engagement of the community, and to restore rivers & forests.	Coordination as needed	DNR > CWCB
Coalition for the Poudre River Watershed	Improve and maintain the ecological health of the watershed through community collaboration.	Coordination as needed	DNR > CWCB
Silver Jackets Program	Leverage federal and state partnerships to address small interagency projects that	Monthly coordination calls.	DNR > CWCB

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
	mitigate flood risk or improve outreach throughout Colorado	Quarterly coordination calls, often part of the Flood Technical Advisory Partnership meetings.	
Emergency Watershed Protection Program (EWPP)	Respond to flood and fire disasters, including on private property.	As needed	DNR > CWCB
Flood Task Force (FTF)	Discuss issues relating to general flooding, especially spring runoff flooding issues.	Formally meets once per year in March (coordinated with the Water Availability Task Force)	DNR > CWCB
Flood Technical Assistance Partnership (FTAP)	A flood-hazard-specific working group that addresses all aspects of disaster preparedness, including mitigation. Participation is based on a whole community	Quarterly meetings	CDPS >DHSEM

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
	approach with evolving membership.		
Water Availability Task Force (WATF)	Monitor conditions that affect Colorado's water supply, including snowpack, precipitation, reservoir storage, streamflow, and weather forecasts.	Monthly meetings	CCC
Colorado Earthquake Hazard Mitigation Council (CEHMC)	Evaluate and advise on earthquake hazards throughout Colorado	Meetings every two months	CGS
CSU - Center for Collaborative Conservation	Information and resource sharing. Develop opportunities for program and project leveraging	Monthly meetings and newsletter	CSFS
Rocky Mountain Restoration Initiative	Federal, state, and local planning to implement fuels reduction, forest health and watershed protection projects	Regular meetings	CSFS
Wildfire Collaboratives	Information and resource sharing. Develop opportunities for program and project leveraging. Coordination & collaboration on prescribed fire, grant management, and general	Regular meetings	CSFS

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
	wildfire risk reduction practices (West Region Wildfire Council, Wildfire Adapted Partnership, Grand County Wildfire Council, Routt County Wildfire Mitigation Council, Summit County Wildfire Council, Two Rivers Wildfire Council, Fire Adapted Bailey, Spanish Peaks Alliance for Wildfire Protection)		
Fire Adapted Colorado (FACO)	Network member host supporting community wildfire adaptation primarily before and after fires - Trainings, communication support, resource provision, facilitation	Regular meetings	CSFS
Colorado Prescribed Fire Council	Provides education and information for people interested in prescribed fire	Regular meetings	CSFS
Homeland Security and All-Hazards Senior Advisory	Established pursuant to Colorado Revised Statute §24-33.5-1614, they assist the state in the prevention, protection, mitigation,	Monthly meetings	CDPS

Interagency Collaboration Group	Goals	Coordination Frequency	Lead Agency/Department
Committee (HSAC)	response, and recovery from threats and hazards posing the greatest risk.		
Colorado Cultural and Historic Resources (CHR) Task Force	Improve the State of Colorado's mitigation, preparedness, response, and recovery efforts for cultural and historic resources.	As needed	Volunteer Steering Committee
Colorado Emergency Preparedness Partnership (CEPP)	A Nonprofit organization that promotes joint emergency planning between the public, private, and philanthropic sectors in Colorado, focused on planning, training, and information sharing.	As needed	CEPP

Other State Agency Mitigation Activities

Division of Homeland Security and Emergency Management (DHSEM)

DHSEM's Office of Emergency Management (OEM) is responsible for the state's comprehensive emergency management program, covering the five mission areas of emergency management including mitigation. The OEM Mitigation Section is the primary state entity responsible for coordinating mitigation efforts across the state for DHSEM. Further details pertaining to OEM's mitigation actions are detailed across this chapter of the E-SHMP.

Colorado Climate Center (CCC)

A key partner in Climate Resiliency is the Colorado Climate Center (CCC) at Colorado State University (CSU). The CCC collects and manages climate and weather data with

the purpose of monitoring the climate, placing individual events into historical perspective, disseminating climate information to the user community, and providing climate expertise as part of the decision-making process. The CCC is dedicated to the development of tools and methods to better communicate the climatology and climate variability of Colorado to scientists, educators, stakeholders, media, and the general public. CCC climate and weather data are key elements in identifying storm and climate change hazards in Colorado. In the past, CCC has been awarded HMGP funding to complete assessments of weather and climate information assets across the state.

Colorado Emergency Planning Committee (CEPC)

Created to implement the state elements of the Emergency Planning and Community Right-To-Know Act (EPCRA) for a State Emergency Response Commission (SERC). The CEPC is charged with the approval of Local Emergency Preparedness Coordinators (LEPCs), which are required to use their statutory authorities to support all-hazards planning efforts in their areas, create and maintain Right-To-Know procedures for official and public access to information, and monitor "Tier II" annual hazardous materials reporting requirements. The CEPC also coordinates an annual LEPC conference and training events in support of the state's program.

Colorado Geologic Survey (CGS)

Several state statutes require developers and builders to submit geologic suitability reports in conjunction with subdivision plats (lots sized less than 35 acres) and other types of land-use applications. The Colorado Geological Survey (CGS) leads a land-use review program to evaluate geologic suitability. These reports include information such as the identification of geologic hazards and constraints (potential radiation hazards, soil suitability, storm drainage plans, on-lot sewage disposal, and any soil or topographic conditions) that may require special precautions along with the appropriate mitigation measures. CGS provides recommendations to local governments to consider during land-use decisions.

House Bill 1041, in place for over 40 years, requires that all developments in areas designated by counties as geological hazard areas shall be engineered and administered in a manner that will minimize significant hazards to public health and safety or to property. Another state statute of note requires that, prior to the acquisition of land for school building sites or construction of any buildings thereon, the Board of Education must consult with the Colorado Geological Survey regarding potentially swelling soils, mine subsidence, and other geologic hazards and determine the geologic suitability of the site for its proposed use.

Colorado State Forest Service (CSFS)

CSFS serves as the lead state agency for providing forest stewardship and management, fuels reduction, and wildfire mitigation assistance to Colorado landowners. The agency also provides forestry education and outreach. Every year, the CSFS helps treat thousands of acres of forestland, assisting landowners and communities to help improve forest health and ensure related benefits. CSFS provides a wide range of forestry services through focused programs that deliver measurable, impactful results, using a non-regulatory approach, strategic partnerships, and personalized service. The agency grows and distributes seedling trees and shrubs from its nursery for conservation purposes. They also are the approval agency for Community Wildfire Protection Plans (CWPP), an important tool in mitigating wildfire risk.

Colorado Water Conservation Board (CWCB)

Colorado's most comprehensive water information resource, CSCB's responsibilities range from protecting the state's streams and lakes to water conservation, flood mitigation, watershed protection, stream restoration, drought planning, water supply planning, and water project financing. CWCB also works to protect the state's water apportionments in collaboration with other western states and federal agencies. The agency maintains expertise in a broad range of programs and provides technical assistance to further the utilization of Colorado's waters.

CWCB and CDOT jointly lead the Flood Technical Assistance Partnership (TAP) in coordination with FEMA. Their mission is to "Bring organizations together across multiple levels of government to… advise and comment on floodplain management issues, improve local and regional communication, and influence policy and change throughout Colorado." In the event of significant potential or actual flooding in Colorado, Flood TAP members provide technical assistance, resources, funding, and agency coordination for flood response, flood recovery, and hazard mitigation efforts. The Flood TAP is responsible for monitoring and reporting climate indicators and severe weather conditions, as well as exchanging information about local, state, and federal activities.

With enhancements developed by CWCB, Colorado continues to require higher regulatory floodplain standards above the minimum National Flood Insurance Program (NFIP) requirements. The Rules require an additional one foot of elevation above the base flood elevation as the standard in local flood ordinances. Additionally, as of 2022, critical facilities are required to elevate two feet above the base flood elevation. These requirements provide additional protection for structures during floods greater than the 1% annual chance flood and are an important and effective flood mitigation strategy across the state for future development. These floodplain standards also include additional protections when locating new critical facilities.

Per Executive Order 8491, the CWCB is also responsible for evaluating flood hazards when locating state buildings, roads, and other facilities, and in approving sewage facilities, water facilities, and subdivisions. In addition, Senate Bill 126 authorizes the CWCB to coordinate all activities relating to the designation of floodplains in the state in connection with land use planning.

Colorado Hazard Mapping Program

The Colorado Hazard Mapping Program (CHAMP) provides a mitigation and land use framework in areas likely to be affected by future flooding, erosion, and debris flow events. CHAMP is preparing updated hazard information for the streams most affected

by the September 2013 flooding. An additional phase of CHAMP is also focusing on counties and communities that are still utilizing paper FEMA Flood Insurance Rate Maps (FIRMs). This scope includes digitizing existing FIRM panels in select communities and jurisdictions and wherever topographic data is available, updating flood risk information to be provided as best available information for local communities to utilize. Community leaders can use this updated hazard and newly digitized information to assess risk and identify mitigation opportunities in their community.

Erosion Hazard and Debris Flow Identification Process

Much of the damage experienced during the September 2013 flooding occurred outside the mapped regulatory floodplain. CWCB in conjunction with the Colorado Geological Survey (CGS) supported by a multi-agency technical team developed a program for mapping riverine erosion hazard areas (fluvial hazard zones [FHZ]) and identifying debris flow areas. The program will reduce property loss and damage, promote watershed-scale river planning and management, reduce public expenditures for disaster response and recovery, protect riparian habitat, and encourage multiple uses of riparian areas. It will also help communities and citizens make informed decisions about where to locate future development, protect property and lives, and enhance water quality and river function.

Riverine erosion is a significant, but unstudied, flood risk for many Colorado communities. Relying only on FIRMs to manage floodplains and to reduce flood risk is insufficient to prevent future damages. Well elevated structures located above the regulatory surface water elevation and structures located outside of the regulatory floodplain were destroyed by riverine erosion from riverbanks migrating laterally in September 2013. Despite these very real, extreme hazards, riverine erosion hazard zones are currently not shown on the FIRMs. Furthermore, despite NFIP directives that communities should be managing erosion hazard areas, clear guidance from FEMA is not available on how such fluvial risks are to be managed. The state's FHZ mapping

efforts will provide technical standards, conduct studies for communities requesting mapping, and provide regulatory guidance.

Department of Local Affairs (DOLA)

DOLA works in partnership with local governments and communities statewide to provide funding for projects and disaster recovery relief. They provide state and federal funding to private housing developers, housing authorities, and local governments to increase the inventory of affordable housing, and work diligently to help Colorado's most vulnerable population to remove them from homelessness. DOLA also provides expertise through robust technical assistance programs to help with community planning, property taxation, and tax appeals. DOLA hosts a number of offices, programs, trainings, and initiatives focused on hazard mitigation and disaster resiliency through the CRO Colorado Resiliency Working Group (CRWG). Examples include:

Resilient Design Performance Standards

Through collaboration with Boulder County, DOLA developed program guidelines for the sub-allocation of CDBG-DR grant funds for public infrastructure and buyout/acquisition programs. Provides program and application overviews for minimum threshold projects, priority infrastructure projects, and buyout/acquisition of residential properties.

Local Government Financial Resiliency Education

Provides planning guidance to local governments for financial resilience, like revenue disruption, and was integrated into DOLA's Budget 101 workshops.

Economic Resiliency Study

In partnership with the Colorado Office of Economic Development and International Trade (OEDIT) and the Leeds School of Business at the University of Colorado Boulder, DOLA conducted an economic resiliency study to evaluate thriving and failing

Colorado communities, through population retention and sustained economic growth. The study informs possible economic development strategies for local communities.

Community Inclusion Mapping

Helps to identify health and social service strengths and vulnerabilities, including resources, assets, and populations. The maps can also be used to assess needed community programs and resources and encourage population analysis to ensure that health and social service outreach materials are available in all appropriate languages within each community. These maps are also useful to identify and prepare for community-unique vulnerabilities, providing an opportunity to incorporate vulnerable populations into risk mapping.

Planning for Hazards: Land Use Solutions for Colorado

Developed by DOLA and the University of Colorado Denver, this web-based guidebook provides detailed, Colorado-specific information about how to assess a community's hazard risk level and how to implement numerous land use planning tools and strategies to reduce that risk. DOLA also offers webinars on the guide and "Mitigating Hazards through Land Use Solutions" workshops in coordination with DHSEM and FEMA. These resources further promote the integration of hazard mitigation into land use planning and vice versa. Topics have included:

- Communicating Community Risk and Resilience
- Reducing Colorado's Risk to Geologic and Soil Hazards
- Climate Planning in Colorado
- Land Use Planning for Wildfire Resilience
- Integrating Hazards into the Comprehensive Plan
- Land Use Solutions for Colorado
- Land Acquisition Strategies for Building Flood Resilience

Colorado Disaster Housing Task Force

Assembled in 2010, the Task Force drafted a Disaster Housing Annex to the State Emergency Operations Plan and activated in 2013 to support flood response and recovery efforts and in 2022 to support Marshall Fire recovery efforts. The Task Force utilized the 2013 SHMP Risk Assessment to understand potential hazards that would require a disaster housing operation, and in turn, what disaster housing capabilities the state needs to develop or maintain. In 2018, the Task Force facilitated the addition of a Division of Housing representative to the SHMT.

Colorado Sustainable Main Streets Initiative

The DOLA DLG Office of Smart Growth leads the Main Street initiative with support from other state agencies and SHMT members including DHSEM's Mitigation Section. The mission is to coordinate partnerships and assistance to enhance community sustainability. Communities work to integrate issues of land use, transportation and mobility, affordable housing, public health and human services, natural resource conservation (including water supply), environmental quality, energy efficiency and renewable energy, hazards and mitigation, and sound fiscal planning.

Office of Dam Safety

The Dam Safety Branch of Colorado's Division of Water Resources (DWR), Department of Natural Resources (DNR) mitigates the potential risk of dam incidents through routine engineering assessments. The office conducts regular coordination with a number of entities including CDPS, CDOT, CWCB, USACE, NRCS, the National Guard, and FEMA. Regional emergency mock dam failure tabletop exercises are conducted two to four times annually.

Department of Regulatory Agencies (DORA)

The DORA's Division of Insurance is coordinating the understanding of the true value of structures at risk to hazards across the state. This on-going effort was discussed during the E-SHMP update, as obtaining this local-level assessor's data can be

challenging for a state agency. Through conversations with OEM, the division was informed that this type of data is oftentimes included in local HMP efforts. Integrating this HMP data into these DORA efforts is an example of integration efforts across the State of Colorado.

Governor's Office of Climate Preparedness and Disaster Recovery

The Governor's Office of Climate Preparedness and Disaster Recovery was created via SB22-206 to provide a proactive, focused and priority-setting approach to state climate adaptation efforts, and provide capacity within the Governor's Office to support the increased demand in recovery coordination from climate-driven disasters. The office was established following the record-breaking 2020 wildfire season, and devastating Marshall Fire, as an acknowledgment that in addition to the many valuable recovery efforts undertaken by the state, added capacity and proactive efforts were warranted with respect to climate preparedness and adaptation. The office is developing a Climate Preparedness Roadmap, as set forth in SB22-206. As part of the development, they are assembling a full catalog of current climate adaptation efforts undertaken across the state (programs, initiatives, regular activities, existing or upcoming reports, plans etc.), to seek to both identify potential gaps and avoid duplicate existing efforts or recommendations. The office has also sought to produce an aggregate analysis of future climate scenarios that brings together not only climate modeling but socioeconomic, population and demographic, natural systems and other data sets to gain a more comprehensive understanding of potential future climate impacts. The office's participation in the SHMT fostered collaboration for this effort, ensured E-SHMP awareness, and resulted in ongoing coordination efforts. The office will also use some parts of the E-SHMP process to align and inform recommendations and next-step action items to be advanced by the state.

Floodplain Management

CWCB is the Lead Agency for promoting NFIP participation and compliance, is responsible for the administration of the Community Assistance Program (CAP), and is

a Cooperating Technical Partner (CTP) for the NFIP. The state's commitment to providing technical assistance to local entities also includes verifying compliance with federal regulations and local floodplain ordinances.

CWCB works with local governments outside of the Denver Metro Area to develop new Flood Insurance Studies (FIS), FIRMs, and other non-regulatory products. Within the six county Denver Metro Area the Mile High Flood District (MHFD) is the CTP. FEMA operates the Risk Mapping, Assessment, and Planning Program (RiskMAP), which has been underway since 2010. RiskMAP combines flood hazard mapping, risk assessment tools, and hazard mitigation planning into one seamless program. The budget for RiskMAP is determined on an annual basis. Colorado continues to provide cost-sharing leverage for Digital Flood Insurance Rate Map (DFIRM) and future RiskMAP projects.

DHSEM's Mitigation Section continuously coordinates with CWCB staff on the integration of Community Rating System (CRS) planning and local hazard mitigation planning through the development of tools and direct outreach to communities. Through this cross-agency coordination, potential FEMA Hazard Mitigation Assistance (HMA) and, in particular Flood Mitigation Assistance (FMA) projects, are identified. Fifty-two jurisdictions across the state participate in the CRS program. DHSEM and CWCB are working to message how local HMPs can help to improve CRS ratings.

National Flood Insurance Program

For the period August 2018 through August 2023, the number of NFIP flood insurance policies in Colorado declined from 20,760 to 18,081 representing an approximately 13.8% overall drop in policies in force. These declines occurred in the 12-month periods of 2019-20, 2020-21, and 2021-2022 with the 2022-2023 period showing a 2.19% increase. The 3 years of decline correlates roughly to FEMA's change-over to the new premium pricing methodology, "Risk Rating 2.0".

The CWCB Community Assistance Program (CAP) staff support local communities and state agencies in substantial damage determinations for structures within the Special

Flood Hazard Area (SFHA) to ensure compliance with all NFIP requirements by providing written policy, workshops, and documentation templates/examples.

There are currently 52 Colorado communities participating in FEMA's Community Rating System (CRS) program with Crested Butte being the newest having joined in early April 2023. The CWCB NFIP CAP staff supports CRS communities and those interested in participating by being a resource for requirement and compliance information and guidance.

The NFIP tracks structures that experience repetitive flooding losses, with the intention to focus attention on these properties so that they can be bought out or relocated. A Repetitive Loss (RL) property is 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. As of August 2023, there are 143 RL properties across the state which have experienced a collective 337 losses. These losses equate to $6.7 million in building payments and $780,000 in content payments.

FEMA further defines a Severe Repetitive Loss (SRL) property as one that has: a) four or more flood insurance claims that each exceeded $5,000, with at least two of those payments occurring in a 10-year period, and with the total claims paid exceeding $20,000, or b) two or more flood insurance claim payments that together exceed the value of the property. There are six SRL properties in Colorado. These properties have received a combined $775,000 in building payments and almost $200,000 in content payments.

Actions taken to reduce the number of these structures include 35 mitigation projects. These projects focused on acquisitions/demolitions, flood control projects, floodproofing, and structural elevations.

Cooperating Technical Partners (CTP)

The CTP Program is an innovative approach creating partnerships between FEMA and participating NFIP communities, regional agencies, state agencies, tribes, and

universities. This allows those with the interest and capability to become more active participants in the FEMA flood hazard mapping program. The CWCB is a FEMA CTP and administers the Risk MAP program. The Mile High Flood District (MHFD), formerly known as the Urban Drainage & Flood Control District (UDFCD), serves as the CTP within the Denver Metropolitan Area.

Colorado Association of Stormwater and Floodplain Managers (CASFM)
CASFM is a nonprofit organization of professionals involved in floodplain and stormwater management, water quality, flood hazard mitigation, and flood preparedness. CASFM represents the interests of stormwater managers and flood hazard specialists from local and state government, the research community, the insurance industry, and consulting engineers. Members of CASFM in private industry and in public service work together toward a common cause: to reduce the loss of human life and property from flood and storm damage. CASFM manages a number of committees dedicated to mitigation educational and outreach:

Floodplain Management Committee

Monitors and influences state and federal policy developments in floodplain management that impact Colorado communities. The committee keeps members informed of changes to legislation and policy affecting floodplain regulations and insurance. They also manage the Colorado Chapter of the Association of State Floodplain Managers (ASFPM) Certified Floodplain Manager (CFM) Program.

Stormwater Quality Committee

Organizes and promotes stormwater-related education opportunities to maintain and improve the health of lakes, rivers, and streams through proper stormwater management. Opportunities include conference sessions, organizing speakers, short courses, and an annual day trip to local stormwater quality facilities.

Community Rating System (CRS) Committee

Promotes awareness of and participation in the CRS program through information sharing and training. The Committee provides opportunities for collaboration and awareness of resources.

Outreach and Training Committee

Supports the board and membership through dissemination of information, organizing training, and providing external outreach and support to a growing group of associated professional organizations and regional communities. This includes:

- Developing social media postings
- Identifying stormwater training opportunities
- Website and email distributions
- Establishment of a Junior Members Organization
- Internal communication between CASFM's Board and other stormwater committees and professional societies

Scholarship Committee

Awards three scholarships each year to eligible undergraduate, postgraduate, and students that have a CASFM member as their legal guardian.

Integration with Other Plans

The E-SHMP is a living document that is utilized through the five-year cycle to inform and guide the development of other state-wide plans. In addition, the 2023 update integrates both the previously stand-alone Colorado Flood Mitigation Plan and Colorado Drought Mitigation and Response Plan, streamlining the data and evaluation of these hazards. Below are additional plans that were influenced by the 2018 E-SHMP and were referenced for integration with the 2023 update. Relevant data and capabilities were incorporated to better understand areas where mutual

responsibilities and policies could be leveraged. The review also verified that these responsibilities and capabilities are in alignment with the Goals and Objectives of the mitigation program as described.

OEM Strategic Plan

The 2023-2026 OEM Strategic Plan provides a road map to achieving the OEM's vision and mission. This plan is built upon five Key Results, including one that is focused solely on reducing the impact of natural disasters and emergencies through mitigation. The Key Results are supported by six Strategic Objectives, including one that aims to reduce the impacts of incidents and disasters to Colorado communities through mitigation and long-term vulnerability reduction. Detailed hazard mitigation objectives that support the Strategic Objectives focus on aligning planning efforts, implementing regional support teams for preparedness and planning, and integrating whole community stakeholders.

Colorado Emergency Preparedness Assessment (CEPA)

The CEPA is Colorado's emergency preparedness program of record. Conducted at the county level every three years, CEPA analyzes a county's threats and hazards, the county's ability to deliver the core capabilities regardless of threat or hazard, the county's grant reliance, and the county's response capacity. CEPA uses the threats and hazards identified in the E-SHMP, specifically the Hazard Identification and Risk Assessment (HIRA), as the baseline for county threat and hazard assessment. Aggregated CEPA data is used to fulfill annual Threat and Hazard Identification & Risk Assessment (THIRA)/Stakeholder Preparedness Review (SPR) requirements. CEPA data is also used to validate the HIRA and to create actions for DHSEM in the mitigation strategy.

State Emergency Operations Plan (SEOP)

The 2023 Colorado State Emergency Operations Plan (SEOP) integrates the E-SHMP, specifically information found in the Hazard Identification and Risk Assessment (HIRA), into the Threat and Hazard Overview section of the Base Plan. Information from the HIRA helps SEOP planners and readers to understand the threats and hazards

Colorado faces in order to develop plans to respond and recover should those threats and hazards be realized. This plan was recently signed by the Governor on 5/19/23.

CDOT Changing Climate and Extreme Weather Impacts on Geohazards in Colorado
Completed in 2021, this study evaluated the impact of climate change induced weather patterns and extreme weather events on geologic hazards (geohazards). The initial step was performing a climate change assessment to identify expected weather patterns and extreme weather events that are a result of climate change. With the information provided by the climate change assessment, CDOT then evaluated how geohazard Frequency and Magnitude (FM) could be affected.

Colorado State Homeland Security Strategy
Developed by the Homeland Security and All-Hazards Senior Advisory Committee (HSAC), this document helps align the goals and priorities of the hazard mitigation program with the state's broader programmatic strategy, and vice-versa. In November 2018, the Framework was revised and updated as the 2019-2023 Colorado State Homeland Security Strategy. The strategies and tasks outlined will enable improved all-hazard preparedness and resiliency, leading to fewer lives lost, reduced economic impacts in affected communities, improved response capabilities, and faster recovery time.

Colorado Water Plan
The 2023 Plan builds on the initial 2014 plan and further enhances community involvement with four focus areas, Vibrant Communities, Robust Agriculture, Thriving Watersheds, and Resilient Planning, through the development of new water projects and the improvement of existing infrastructure to support agricultural, urban, and environmental needs. Several key elements and action items from the Water Plan have been incorporated into the 2023 E-SHMP.

Colorado Forest Action Plan
The 2020 Plan provides a strategic framework to address the benefits, conditions and trends in Colorado's forests, as well as the threats and challenges the state's forests

face across political, jurisdictional and ecological boundaries. This plan helped to guide the state's mitigation strategy toward wildfires. The CSFS plans to integrate the E-SHMP's mitigation strategy in the next review of this plan, to occur in 2025. Additionally, the E-SHMP will help to inform updates to the Living with Wildfire and Watershed Protection themes when this plan is next updated.

Colorado Energy Assurance Emergency Plan (CEAEP)

The Colorado Energy Office (CEO) shares responsibility for energy assurance in the state with the Colorado Public Utilities Commission (PUC) in partnership with DHSEM. Working together, the plan was updated in 2021. Agencies engaged with stakeholders related to potential electric, natural gas, and liquid fuels emergencies including Suncor Refinery, Xcel Energy, petroleum marketers, and the Colorado Propane Gas Association to inform the plan update. Hazards associated with the disruption of utility services are addressed in a number of local HMPs. The 2021 update utilized information from the 2018 E-SHMP.

Colorado Climate Plan

Updated in January 2021 through the first Greenhouse Gas Pollution Reduction Roadmap (Roadmap), it includes a statewide set of policy recommendations and actions to mitigate greenhouse gas (GHG) emissions and to increase Colorado's level of preparedness. The revised plan reflects advances in the discussion on how best to address climate change at the state level, as well as progress since the release of the initial plan in 2014.

Climate Preparedness Strategic Plan

Colorado is in the process of developing its first Climate Preparedness Strategic Plan and Roadmap as directed by SB22-206, due in late 2023, to prepare for the impacts of climate change on Colorado and promote a proactive adaptation to anticipated changes. The "Roadmap" is based on data-driven analysis of the expected future changes to Colorado's climate and anticipated resulting impacts to Colorado's people, landscapes, ecosystems, infrastructure, and economy. It will identify priorities and state-level actions to promote the long-term health of the state, accounting for

projected population growth, and minimize the negative impacts of climate change and natural disasters on Colorado.

Colorado Resiliency Framework
Colorado updated the framework in 2020 which examines and addresses risks and vulnerabilities across four themes: climate adaption, natural hazards, underserved communities, and economic diversity & vibrancy. The framework is the source of the E-SHMP's funding prioritization methodology. The 2018 E-SHMP is also referenced through this framework document in several of the identified priority action strategies.

Colorado Public and Environmental Health Improvement Plan
Updated in 2022, CDPHE focuses one portion of this plan on the state's COVID response strategy and documents mitigation (containment) measures that could be utilized in the future.

Colorado's Strategic Plan for Climate-Smart Natural and Working Lands
Developed in 2022, the objective of this strategic plan is to identify priority actions across Colorado's landscapes to reduce emissions, increase carbon sequestration, and create a climate resilient Colorado. While focused on climate mitigation and adaptation strategies, the Strategic Plan also values the multiple community and ecological benefits that natural working lands (NWL) create. The Strategic Plan presents Colorado's first statewide plan for climate-smart land management and will inform NWL research, programs, and policy development across state agencies.

FEMA Programs

Hazard Mitigation Assistance (HMA)
There are two primary branches of the FEMA Hazard Mitigation Assistance (HMA) family of grants. Additionally, FEMA has recently stood up a capitalization grant that the State of Colorado has begun initial implementation of.

- Non-disaster grants (annual)

  - Building Resilient Infrastructure and Communities (BRIC) program
  - Flood Mitigation Assistance (FMA) program
  - Legislatively awarded Pre-Disaster Mitigation (PDM) program
- Disaster grants
  - Hazard Mitigation Grant Program (HMGP) – tied to a presidentially declared disaster
  - Hazard Mitigation Grant Program-Post Fire (HMGP-PF) – tied to a Fire Management Assistance Grant
- Safeguarding Tomorrow through Ongoing Risk Mitigation Revolving Loan Fund (STORM-RLF)

DHSEM's Mitigation Section is responsible for the administration of all programs. As the primary federal funding streams for hazard mitigation, these grants are core components of the state's hazard mitigation program. The Mitigation Section works with FEMA and local communities to identify new projects each year.

As appropriate, the Mitigation Section will also coordinate with DHSEM's Office of Grants Management (OGM) Public Assistance (PA) team to advise communities on Section 406 Mitigation funding. DHSEM strives to maximize Section 406 Mitigation available through the PA program by way of proactive and ongoing technical assistance. The PA Administrative Plan consistently addresses hazard mitigation. The Mitigation Section maintains the HMGP Administrative Plan where the process and prioritization for post-disaster mitigation (HMGP) funding is described. As stated in the Public Assistance Administrative Plan, during the development of Project Worksheets (PWs), DHSEM may assist the sub-applicant in identifying hazard mitigation opportunities. Section 406 mitigation is discussed further in this Plan in Section 8.6.3 Integration of Mitigation into Post-Disaster Recovery Operations.

DHSEM is currently working with state agency partners and FEMA to create a framework to implement the STORM-RLF. This program will provide DHSEM with a capitalization grant to establish the program and make loans to local governments to implement mitigation projects. This program is not as constrained as the other HMA programs in the types of projects it can fund and does not have a cost-effectiveness requirement like the other HMA programs.

Community Assistance Program – State Support Services Element (CAP-SSSE)

This program (overseen by CWCB) provides funding to states for technical assistance to communities in the NFIP and to evaluate community performance in implementing NFIP floodplain management activities. In this way, CAP-SSSE helps to:

- Ensure that the flood loss reduction goals of the NFIP are met,
- Build state and community floodplain management expertise and capability, and
- Leverage state knowledge and expertise in working with their communities.

National Earthquake Hazards Reduction Program (NEHRP)

Focusing on building code standards, technical guidance, and education, this program is a collaborative effort among FEMA, the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the United States Geological Survey (USGS). Colorado's participation in the program includes the administration of NEHRP grants by the Colorado Geological Survey (CGS). The State's Earthquake Program Manager is a duty assigned to the CGS. NEHRP funding has supported enhanced earthquake hazard risk assessments in local mitigation plans, was used to develop a comprehensive statewide (reported by county) HAZUS analysis for the state's largest faults, and supported significant public education and outreach activities for the 2013 Great Rocky Mountain Shakeout. CGS and DHSEM also participated in the October 18, 2018 International ShakeOut Day in coordination with FEMA Region VIII, and will continue to promote this annual event.

National Dam Safety Program (NDSP)

The Colorado Department of Natural Resources (DNR), Division of Water Resources (DWR) Dam Safety Section receives DHS/FEMA State Assistance Grant funding to reduce risks to life and property associated with dams, increase awareness of the benefits and risks related to dams, and advance the state practice of dam risk management.

Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program

This relatively new program provides technical, planning, design, and construction assistance in the form of grants for the rehabilitation of eligible high hazard potential dams to remove their unsatisfactory condition. Administrative requirements of the program are similar to HMA, including elements that must be addressed through the state and local HMPs. DWR's Dam Safety Section solely managed the program in 2019-2020. Dam Safety and DHSEM's Mitigation Section began jointly implementing this program in 2022. This includes year-round outreach to interested and eligible dam owners. Table 96 provides a summary of HHPD funding utilization.

TABLE 96 – HHPD FUNDING UTILIZATION

HHPD Year	Federal Award Amount	Local Match	Total	Funds Expended
2019	$260,484	$41,026	$301,510	$117,218
2020	$162,539	$0	$162,539	$0
2021	Colorado did not apply in 2021.			
2022	Colorado withdrew its application due to late program requirement changes.			
2023	No program in federal fiscal year 2023.			

Other Federal Programs

US Army Corps of Engineers (USACE)

Colorado's mitigation efforts are closely integrated with a variety of USACE programs. Since May 2013, Colorado's Flood TAP meetings have been jointly hosted with the

Silver Jackets. This has led to increased coordination on joint flood mitigation efforts which include:

- Silver Jackets
- Risk Assessments
- Risk Communication
- Dam Safety Program
- Levee Safety Program
- Flood Risk Management Program
- Civil Works Emergency Management Program
- Specific Colorado Projects
    - Cherry Creek Dam Evacuation Project
    - Estes Park Floodproofing Study

US Geological Survey (USGS)

Colorado's mitigation efforts align with a variety of USGS programs which include:

- National Earthquake Information Center (NEIC)
- Colorado citizens reporting earthquakes through the USGS "Did You Feel It?" program
- National Earthquake Hazards Reduction Program (NEHRP)
- Geologic hazard mapping

Similar to CWCB, Dam Safety, and CSFS, the DHSEM Mitigation Section also works closely with its counterparts at the CGS to identify projects eligible for HMA funding on an annual basis.

National Weather Service (NWS) – StormReady
A nationwide program that helps communities better protect citizens during severe weather, encourages communities to take a proactive approach to improving local hazardous weather operations, and provides guidance to emergency managers on how to improve hazardous weather operations. There are over 40 StormReady communities in Colorado, including 36 counties, 17 municipalities, two universities, and other private entities.

US Forest Service (USFS) – Community Wildfire Defense Grant Fund (CWDG)
The CWDG is intended to help at-risk local communities and Tribes plan for and reduce the risk of wildfire. The Colorado State Forest Service (CSFS) facilitates this program in Colorado which provides funding to communities for two primary purposes.

- Develop and revise Community Wildfire Protection Plans (CWPP).
- Implement projects described in a Community Wildfire Protection Plan that is less than ten years old.

The Community Wildfire Defense Grant Program also helps communities in the wildland urban interface (WUI) implement the three goals of the National Cohesive Wildland Fire Management Strategy.

- Restore and Maintain Landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances, in accordance with management objectives.
- Create Fire Adapted Communities (FAC): Human populations and infrastructure can better withstand a wildfire without loss of life and property.
- Improve Wildfire Response: All jurisdictions participate in making and implementing safe, effective, and efficient risk-based wildfire management decisions.

US Bureau of Reclamation (USBR) – WaterSMART

Through WaterSMART, the Bureau of Reclamation works cooperatively with states, tribes, and local entities as they plan for and implement actions to increase water supply through investments to modernize existing infrastructure and attention to local water conflicts. The Drought Act of 1991 empowered the USBR to provide support to states and local jurisdictions after they had experienced a drought emergency. The WaterSMART program is an umbrella for the six USBR water programs. The Drought Response program is one that provides financial assistance to develop or update drought contingency plans and drought resiliency projects. The CWCB is interested in leveraging some of this funding as a match for state drought planning grants.

National Fire Protection Association (NFPA) – Firewise

Firewise provides education on adapting to living with wildfire. Communities develop action plans that guide residential risk reduction activities, while engaging and encouraging their neighbors to become active participants in building a safer place to live. More than 200 Colorado communities (including Property and Homeowner Associations and neighborhoods) have achieved recognition as Firewise communities. CSFS leads this effort.

Community Development Block Grant - Disaster Recovery Grants (CDBG-DR)

Housing and Urban Development (HUD) provides flexible grants to help low-income areas of cities, counties, and states recover from presidentially declared disasters. Following a disaster, Congress may appropriate additional funding for the CDBG Program as Disaster Recovery grants. This funding helps rebuild affected areas and provides crucial seed money to start the recovery process. Since CDBG-DR assistance may fund a broad range of recovery activities, HUD fills a gap to help communities and neighborhoods that otherwise might not recover due to limited resources. The State of Colorado received $12 million in CDBG-DR funding following the 2013 flood disaster (DR 4145). DOLA administers the state's CDBG-DR funding.

Commitment to Comprehensive Mitigation Program

Section 322 of the Disaster Mitigation Act of 2000 provides for a significant increase in HMGP funding available to states with an Enhanced mitigation plan. It requires Colorado to demonstrate ability and commitment to manage HMA grants effectively, and to ensure advancements in the tenets and benefits of mitigation as comprehensively as possible. Colorado is committed to a comprehensive statewide hazard mitigation strategy including effective state management of all FEMA Mitigation Division grant programs.

Colorado's commitment is inclusive of all state agencies and sectors with mitigation responsibilities, capabilities, and resources. As discussed in other sections across the E-SHMP, this comprehensive program includes a broad range of state-supported mitigation initiatives and activities. These long-standing programs and working relationships will also help ensure the state remains compliant with enhanced plan requirements in the future.

This commitment is exemplified through the continued support of this E-SHMP and the annual consultation meetings. DHSEM's Mitigation Section meets with FEMA mitigation staff annually to provide an opportunity for an open and honest dialogue about what FEMA and the state are doing well and what could be improved to provide better service to Colorado. The meeting also serves as an opportunity to celebrate positive outcomes.

Beginning in 2017, DHSEM has invited other SHMT member agencies to attend these annual consultation meetings; this helps keep all agencies apprised of the progress of the statewide mitigation program and helps further integrate other planning efforts into the E-SHMP. The annual consultation runs the gamut of mitigation programs and considerations impacting Colorado as well as touching on important changes at the federal level and national best practices. These annual consultations inform key mitigation stakeholders of progress made at the state level and serve to share information across many sectors to include: building sciences, HMA, the National

Flood Insurance Program, mitigation planning, and Environmental & Historic Preservation (EHP).

Additionally, the FEMA Region VIII and DHSEM mitigation planning personnel conduct mitigation planning meetings nearly every month. These coordination calls aim to further mitigation planning initiatives, share current relevant topics and activities, address issues of mutual concern, develop new strategies for integrating local plans into other planning mechanisms, promote available cross sector and cross region training, and share overall best practices. FEMA Region VIII planners also provide to DHSEM's mitigation plans unit a monthly plan status report for concurrence, which is also included in Colorado's monthly Dashboard Report from FEMA.

Program Utilization

Grant Applications

Following a disaster declaration or FEMA Notice of Funding Opportunity (NOFO), DHSEM provides a grant announcement in accordance with procedures outlined in the state's HMGP Administrative Plan. This includes providing statewide outreach and technical assistance (TA) to eligible parties and potential sub-applicants conveying their interest in mitigation project development. DHSEM works with local, state, and tribal partners to assist in development of a required project description, location, work schedule, cost estimate, and explanation of how the proposed project solves or mitigates a problem.

Initial eligibility determination is made by DHSEM's Mitigation Section and reviewed with the project sponsor (e.g., sub-applicant). Upon completion of eligibility reviews, full project applications are then requested from sub-applicants, with technical assistance provided by the Mitigation Section specialists in order to craft well-developed project scopes and budgets, in adherence with FEMA project checklist requirements.

Project applications are then developed through a consultative process between the state and the sub-applicant. DHSEM has developed Colorado-specific sub-application templates for various projects, including hazard mitigation plans, property acquisition, elevation, flood control, generators, wildfire fuels treatment and defensible space, and saferooms. Upon receipt of each completed sub-application, DHSEM reviews the submitted documents to ensure that adequate information has been provided and that projects will meet the minimum criteria as defined by 44 CFR §206.434 and §206.436. Following the project's document review, possible site visits or additional sub-applicant meetings may occur. DHSEM then conducts final preparation and prioritization of the selected sub-applications for submittal to FEMA.

Additional details relating to DHSEM's grant application TA support can be found in the Local Coordination chapter of this E-SHMP.

Funding Prioritization

DHSEM will continue to prioritize sub-applications in a manner consistent with the "guiding principles" established by the SHMT in 2018, which were incorporated from the Colorado Resiliency Framework. These nine resiliency prioritization criteria are designed to enable state departments and agencies to prioritize efforts that produce multiple benefits which include:

- **Co-Benefits**: Provide solutions that address problems across multiple sectors including the community, economic, health and social, housing, infrastructure, and watersheds and natural resources sectors — to create maximum benefit.
- **Innovation**: Advance creative approaches and techniques that provide new solutions and encourage continual improvement and advancement of best practices — serving as models for others in Colorado and beyond.
- **High Risk and Vulnerability**: Ensure that strategies identify risk and vulnerability, and directly address the reduction of risk to human well-being,

physical infrastructure, and natural systems. Strategies should consider impact to those who most experience marginalizing.

- **Adaptive Capacity**: Include flexible and adaptable measures that consider future unknowns of changing climate, and economic and social conditions.
- **Economic Benefit-Cost**: Make financial investments that can sustain changes and have the potential for economic benefit to the investor and the broader community —through both direct and indirect returns.
- **Harmonize with Existing Activity**: Expand, enhance, or leverage work being done to build on existing efforts. Engage relevant stakeholders to maximize these efforts and reduce potential conflicts.
- **Social Equity**: Provide solutions that are inclusive, with consideration to populations that are often most impacted by disruptions. Address inequities, remove barriers, and benefit populations by providing access or meeting functional needs. Equitably distribute economic benefits.
- **Long-Term and Lasting Impact**: Create long-term gains to the community with solutions that are replicable and sustainable, creating benefits for present and future generations.
- **Technical Soundness**: Identify solutions that reflect best practices that have been tested and proven to work in similar regional context. Identify measurable indicators to assess performance and success.

These prioritization criteria were evaluated by the SHMT as part of the 2023 E-SHMP update. Based on a review of the state's overall progress towards implementing the E-SHMP's mitigation strategy, coupled with the results of the updated risk and capability assessments, no changes are proposed by the SHMT.

Information from local hazard mitigation plans also informs the prioritization of local assistance. Specifically, the Mitigation Section uses the hazard ranking in the sub-applicant's HMP as a scoring criteria. DHSEM also has a criterion based on whether or not the hazard being addressed in the sub-application is categorized as extremely high in the E-SHMP.

Additional prioritization criteria will also be dictated by each funding program. For example, flood mitigation projects, including those for Repetitive Loss (RL) and Severe Repetitive Loss (SRL) structures, are naturally prioritized by FEMA's FMA Program over other hazard project types, which are not eligible. This is similarly true for dam rehabilitation projects, which are the only hazard type funded by FEMA's HHPD program.

DHSEM utilizes specific subject matter experts pertinent to proposed projects in performing overall prioritization rankings. Unlike BRIC and FMA rankings, HMGP prioritization may happen multiple times during an application period due to the urgency of a post-disaster environment in affected communities. HMGP scoring also has an additional three-tier geographic priority criterion based on: the directly impacted & declared communities, neighboring communities, and then statewide.

Administrative Plan

The Mitigation Section maintains the HMGP Administrative Plan, last updated in February 2022, where the process and prioritization for post-disaster mitigation funding is described. The HMGP Administrative Plan is the primary document used to ensure Colorado remains compliant with HMGP grant requirements and procedures. It describes how the state meets HMGP application timeframes; submits complete, technically feasible, and eligible project applications with appropriate supporting documentation; prepares and submits accurate environmental reviews and benefit-cost analyses; submits complete and accurate quarterly progress and financial reports on time; and completes HMGP projects within established performance periods.

Mitigation Section Structure

DHSEM, housed within CDPS, is the primary state agency tasked to lead and support Colorado's effort to prevent, protect, mitigate, respond to, and recover from all-hazard events. The Division's Office of Emergency Management (OEM) is responsible for the state's comprehensive emergency management program, covering the five mission areas of emergency management including mitigation.

The OEM Mitigation Section is the primary DHSEM entity responsible for coordinating mitigation efforts across the state. The mission of the Mitigation Section is to promote community resiliency and sustainability for the people of Colorado by fostering partnerships and maximizing the availability of hazard mitigation resources.

Within the Mitigation Section, the Plans Unit is responsible for maintenance and update of the E-SHMP as well as facilitating technical assistance for local HMPs. The Projects Unit is responsible for providing assistance to communities in the development, implementation, and successful completion of HMA funded projects. Since 2014, the Mitigation Section has provided direct mitigation assistance to local and tribal governments. This assistance includes program updates and assistance with grant application preparation and management. As requested, the DHSEM Mitigation Section, in conjunction with other state agency and subject matter experts, may provide technical assistance to communities to solve mitigation problems and will review all applicable funding sources, tools, and expertise to assist communities.

DHSEM's Mitigation Section continues to develop and maintain a working knowledge of federal, state, and local funding and programs, and will place particular focus on HMA grants, Public Assistance Section 406 mitigation, the HHPD grant program, NFIP, Risk MAP, and the CRS program.

An enhanced benefit of an integrated SHMT, in coordination with the DHSEM Mitigation Section, is the ongoing practice of SMEs convened to review and prioritize applications submitted for specific HMA funding programs. This HMA application scoring and ranking process maintains established working relationships with SMEs

from various state agencies and increases awareness of proposed projects throughout the state. By participating in this process, these agency representatives gain additional knowledge and understanding of eligible HMA projects and may advise their stakeholders accordingly.

The State of Colorado is committed to developing and improving mitigation capabilities at the local and tribal level by providing workshops, training, and technical assistance.

Program Management and Capability Enhancements

As part of this E-SHMP update, DHSEM reassessed the state's recent grants management performance. Some grants management challenges include:

- Accurate benefit-cost analysis (BCAs) in applications
- Clarification on scopes of work (SOW) in applications, a common reason for FEMA requests for (additional) information (RFIs)
- Timely quarterly reports
- Project closeouts

To ensure compliance with the HMA program throughout application development, the Mitigation Section works closely with sub-applicants to comprehensively respond to Requests for Information (RFIs) to ensure they are complete and no additional RFIs will be required. In addition, the following processes are standard practice within the Mitigation Section:

- All HMGP sub-applications are submitted to FEMA through the National Emergency Management Information System (NEMIS) within 12 months from the date of the disaster declaration unless FEMA extends the application period.
- All BRIC and FMA applications are submitted to FEMA through the FEMA GO system within the application cycle.

- FEMA's Eligibility and Completeness Review Checklist is submitted with each application.
- All applications are determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response.
- FEMA's Environmental Review & Historic Preservation Compliance Checklist is submitted with each application.
- DHSEM Mitigation Section carefully reviews BCAs to ensure completeness and all supporting documentation is included.
- The following items relate to the management of sub-grant agreements.
- **Quarterly Reports**: The Mitigation Section has consistently achieved a score of 90% and above in FEMA's Quarterly Progress Report Scorecard which evaluates timeliness, completeness, and reasonableness of submitted quarterly reports. Improvement will continue.
- **Reimbursement**: The Mitigation Section continues to review all reimbursement documentation in detail to meet the state's deadline of issuing payments to sub-recipients within 45 days of receiving all necessary information.
- **Procurement**: The Mitigation Section requires copies of contracts, requests for proposals/qualifications used for soliciting a bid, the ensuing bid tabulation from the proposal review team, et cetera to ensure compliance with all applicable parts of 2 CFR, Subtitle A, Chapter II, Part 200 and will continue to do so.
- **Period of Performance**: The Mitigation Section works closely with subrecipients to ensure work will be completed within the allotted Period of Performance (PoP) through proactive communication, monitoring of project

milestones outlined in the project application, review of quarterly reports, and monitoring of project expenses submitted to date.

- **Period of Performance Extension Requests**: The Mitigation Section will request extensions to grant PoPs from FEMA on receipt of specific and compelling justifications from sub-recipients. These requests will comply with either the 2015 HMA Guidance or 2023 HMA Program and Policy Guide, as appropriate, in terms of content and timeline.

- **Audits**: CDPS will perform regular monitoring of the HMA administered programs as programmatically required. Should any findings be identified as a result of this auditing those will be shared with FEMA Region VIII and a performance plan will be developed to address any concerns as needed.

- **Close Out**: DHSEM will close out all plans, projects, and grants within the deadline required in either the 2015 HMA Guidance or 2023 HMA Program and Policy Guide, as appropriate.

- **Standard Forms**: During both quarterly reporting and at grant closeout DHSEM submits SF-424A and SF-424C documents to FEMA as appropriate for their review.

Overcoming Barriers

The ability and commitment to manage HMA grants effectively is necessary to maintain Enhanced plan status. The time and expertise required to work with sub-applicants to develop high quality and complete scopes of work for project applications becomes difficult to sustain during disaster recovery periods. Therefore, DHSEM is sustaining improvements made to grants management capabilities. These include:

- DHSEM Executive Leadership is committed to maintaining mitigation and grant management staffing. At least seven mitigation professionals and DHSEM grant

management staff as required will remain focused on existing HMA program performance, including a dedicated planner.

- Utilizing EMGrants Pro for application development, project management, tracking, and reporting of all grants.
- Utilizing Colorado-specific checklists to augment and align with FEMA checklists to reduce potential RFIs.
- Creating a training plan and library for current and future employees.

The success of the Mitigation Program is dependent on the skills and capacity of the staff employed within the Mitigation Section. Current staff members have received formal training on mitigation planning and project development, FEMA grants management, NEMIS training, and the conduct and review of benefit-cost analysis. Staff members have attended several all-hazard mitigation workshops or state hazard mitigation officer training sessions.

Newly hired staff will receive direct training from existing staff and will attend formal FEMA training as appropriate.

Training for local units of government before and following an HMA award is ongoing. Formality depends upon the needs of the community. Currently, DHSEM offers annual training on basic hazard mitigation planning, non-disaster grant applications, and using FEMA's BCA software. Additional training is offered as new guidance, practices, or software modules are released by FEMA.

Recent improvements to mitigation knowledge and capability at the state and local level include:

- DHSEM Mitigation Planning Workshop for Local Government (G318) training courses in coordination with FEMA Region VIII.

- DHSEM hazard mitigation planning outreach and technical assistance to County Commissioners and staff, during local HMP update kickoff and planning meetings.
- DHSEM BCA training courses in coordination with FEMA Region VIII.
- DHSEM Mitigation Section disseminates requests for hazard mitigation project sub-applications when new funding sources become available. Through its replication of FEMA's eGrants application in EMGrants Pro, specialists can assist communities with developing project applications year-round. This outreach is further amplified through peer messaging to Dam Safety, CWCB, CSFS, Colorado Counties, Inc. (CCI), Colorado Municipal League (CML), Colorado's Public Works Chapter, DOLA Regional Managers, CDOT, and the CRO for greater statewide distribution to partners and stakeholders.

The recovery period after a disaster presents a unique opportunity to address hazard mitigation, while both attention and funding are often at their highest. Section 406 grants in particular are highly useful for implementing hazard mitigation as part of Public Assistance (PA) program projects, following declared disasters.

Hazard Mitigation Assistance Program Compliance

A key function of the SHMT is continued integration of HMA Programs into state and local planning, and into the E-SHMP planning strategy, through augmented program updates, grant compliance reporting, and referrals to key working groups on emerging issues in hazard identification and mitigation practices.

To ensure maximum use of available funds, DHSEM encourages prospective sub applicants to pre-enter potential projects into EM Grants year-round; this typically includes preliminary designs and engineering work. This helps ensure the state has a list of application-ready projects that can easily be submitted as funds become available, or if new project applications are not sufficient to maximize available

funding. Table 97 provides a summary of the state's requested allocations for HMGP funding since 2020.

TABLE 97 – HMGP APPLICATION SUBSCRIPTIONS SINCE 2020

Grant	Federal Amount Authorized	Submitted Federal Amounts Requested	State Management Costs Authorized
5334	$1,889,043	$523,133	$251,872
5378	$1,557,556	$1,475,107	$207,674
4581	$6,784,885	$6,784,855	$753,876
4498	$58,663,266	$93,792,290	$6,518,141
4634	$9,795,692	$29,965,444	$1,088,410
5423	$1,048,736	$1,048,736	$139,832
Total	$79,739,178	$133,589,595	$8,959,805

With the dramatic increases in BRIC funding availability, there is increased interest and opportunity to utilize Project Scoping applications which fall under the Capability and Capacity Building (C&CB) state set aside. Utilization of these funds allows for sub-applicants to complete the FEMA eligibility criteria and BCA with the assurance of funding support.

The State of Colorado is committed to making the most effective and efficient use of available FEMA mitigation grant monies and has been successful at utilizing these available funds. The DHSEM Mitigation Section works closely with external state partners at CWCB, the Dam Safety Program, CGS, CSFS, DOLA, and other agencies to identify project needs and evaluate their eligibility for HMA funding. This approach has led to an increase in funding requests by other state agency representatives familiar with funding needs, and by targeted messages shared with state partners providing project-specific information to their stakeholders. This expanded peer-to-peer messaging has been well received externally.

Table 98 presents HMA mitigation project funding that the state has managed since 2013.

TABLE 98 – HMA MITIGATION PROJECT FUNDING 2013 – 2023

Grant	Federal Amount Awarded	State Management Costs	Total	Funds Expended	End of Period of Performance
FMA 2011	$2,234,899	$223,489	$2,458,388	$2,238,650	Closed 9/2/16
PDM 2012	$5,870,790	$704,934	$6,575,724	$4,658,037	Closed 10/3/19
PDM 2013	$249,582	$25,000	$305,247	$250,913	Closed 9/24/18
HMGP 4067	$436,959	$38,409	$475,368	$475,368	Closed 10/1/18
PDM 2014	$1,196,524	$119,778	$1,316,302	$724,002	Closed 8/24/18
HMGP 4133	$19,979	$1,136	$21,115	$21,115	Closed 10/10/18
PDM 2015	$246,932	$24,693	$271,625	$105,760	Closed 2/20/20
HMGP 4134	$908,713	$53,299	$962,012	$816,545	Closed 1/29/21
PDM 2016	$1,422,057	$107,763	$1,529,820	$285,388	Closed 12/30/20
HMGP 4145	$59,874,136	$3,141,835	$63,015,971	$57,121,302	Closed 6/17/21
HMGP 4229	$2,569,238	$153,657	$2,722,895	$2,102,441	Closed 1/29/21
HMGP-PF 5155	$280,186	$38,611	$318,797	$316,731	Closed 7/31/23

Grant	Federal Amount Awarded	State Management Costs	Total	Funds Expended	End of Period of Performance
PDM 2017	$11,505,506	$822,757	$12,328,264	$10,292,912	3/22/25
FMA 2017	$99,000	$12,142	$111,142	$86,103	Closed 5/17/21
PDM 2018	$17,628,283	$1,425,765	$19,054,048	$13,333,856	4/1/24
FMA 2018	$54,806	$5,481	$60,287	$60,287	4/1/23
PDM 2019	$555,311	$56,955	$612,266	$519,992	4/1/24
FMA 2019	$112,500	$11,250	$123,750	$123,750	4/1/23
BRIC 2020	$599,985	$87,007	$686,992	$304,557	12/29/25
FMA 2020	$410,625	$41,040	$451,665	$1,666	4/20/25
BRIC 2021	$1,000,000	$160,000	$1,160,000	$0	8/31/25
HMGP-PF 5334	$523,133	$33,367	$556,500	$63,175	3/31/24
HMGP-PF 5378	$764,407	$201,444	$965,851	$84,134	10/17/24
HMGP-PF 4581	$1,043,974	$91,388	$1,135,362	$67,962	1/15/25
HMGP-PF 4498	$4,721,832	$2,539,481	$7,261,313	$1,131,481	8/9/25
TOTAL	**$114,329,357**	**$10,120,681**	**$124,480,704**	**$95,186,127**	-

These figures reflect highly upon the DHSEM Mitigation Section's ability to work with local communities in developing eligible, high-quality applications which are able to compete at the national level, as well as its programmatic knowledge and ability to maximize available resources to meet statewide community mitigation needs.

The numbers show that the State of Colorado has been successful at expending 84% of available mitigation funding under the HMA grants closed to date, and increase of 8% since the last E-SHMP update. Colorado has also received four regular HMGPs and three Post-Fire HMGPs since the last E-SHMP update. Excluding HMGP 4731, which was authorized in August 2023, DHSEM and its partners have submitted sub-applications for 168% of the available funding in these programs. This ensures that Colorado is able to maximize its use of these funds in the case of project underruns and withdrawn projects.

Table 99 and Table 100 present a summary of mitigation project funding by project type and pending funding by project type, respectively.

TABLE 99 – HMA MITIGATION PROJECT FUNDING BY PROJECT TYPE 2013 - 2023

Project Type	Number of Projects	Total Costs of All Projects
Wildfire Mitigation	29	$15,447,214
Flood Mitigation	55	$148,876,972
Geologic Mitigation	2	$3,119,015
Other Hazards, 5% Projects, Capacity Building, and Scoping	41	$5,499,203
HMPs and Related Plans	66	$7,317,812
Total	193	$180,260,216

TABLE 100 - PENDING HMA MITIGATION PROJECT FUNDING BY PROJECT TYPE 2013 - 2023

Project Type	Number of Projects	Total Costs of All Projects
Wildfire Mitigation	11	$41,983,496
Flood Mitigation	11	$85,041,395
Geologic Mitigation	2	$11,665,737
Other Hazards, 5% Projects, Capacity Building, and Scoping	13	$12,464,404
HMPs and Related Plans	5	$491,772
Total	**42**	**$180,260,216**

Table 101 presents the alignment between the state's mitigation strategy and these various project types that are being, and are planned to be, implemented.

TABLE 101 - TYPES OF FUNDED PROJECTS ALIGNED TO MITIGATION GOALS AND OBJECTIVES

Project Type	Goals	Objectives
Wildfire Mitigation	I, II, III, IV, VII, VIII	A, B, F, H, H, I, J, L, M, O, P, R
Flood Mitigation	I, II, IV, V, VI, VII, VIII	A, B, E, F, H, I, J, P, R
Geologic Mitigation	I, II, IV, V, VI, VII, VIII	A, B, E, F, H, I, J, P, R
Other Hazards, 5% Projects, Capacity Building, and Scoping	I, III, IV, V, VII, VIII	A, B, C, D, E, G, I, J, L, N, O, P, Q, R
HMPs and Related Plans	I, II, III, IV, V, VII, VIII	B, C, D, F, G, L, O, R

Maintaining Capability

The State of Colorado will continue to maintain the following capabilities during the life of this E-SHMP. These capabilities are continually assessed, and all are reviewed during the state's annual enhanced validation reviews conducted with FEMA. No issues

were noted by FEMA during the most recent validation review conducted in August 2022.

- Meet application time frames and submit complete project applications.
- Submit accurate environmental reviews and benefit-cost analysis.
- Submit complete and accurate quarterly progress and financial reports.
- Complete HMA projects within established performance periods, including financial reconciliation.
- Request period of performance extensions when sub-recipients provide specific and compelling justifications in accordance with the 2015 HMA Guidance or 2023 HMA Program and Policy Guide, as appropriate.
- Closeout all sub-awards, state management costs, and awards in accordance with the 2015 HMA Guidance or 2023 HMA Program and Policy Guide, as appropriate. Closeout requirements for awards under the 2015 HMA Guidance are in that document. 2023 HMA Program and Policy Guide are in that document in Part VI, Chapter F, beginning on page 90. Requirements for awards under the 2023 HMA Program and Policy Guide are in Part 9, Chapter C, beginning on page 176.

Utilizing Non-FEMA Programs

Expanding the use of non-FEMA funding for implementing hazard mitigation is seen as an important effort for the state to continuously pursue. As summarized in the Hazard Mitigation Capabilities chapter of this E-SHMP, there are an increasing number of non-FEMA resources available at the federal and state levels. The following list highlights past successes in utilizing these types of funds.

- For Colorado Presidential Disasters 4067, 4133, 4134, and 4145, the State Disaster Emergency Fund (DEF) supported half (12.5%) of the non-federal share

on HMGP projects and Public Assistance 406 projects for state and local entities.

- The state provided 12.5% match on stream restoration projects to reduce risk to life and property through Phase 2 of the Natural Resources Conservation Service (NRCS) Emergency Watershed Protection Program (EWPP) sponsored by the CWCB.
- The CRO Annual Report documents state matching funds across multiple programs.
- In the past, DOLA's Heritage Planning Grants have been awarded to assist local governments with mitigation planning.
- Senate Bill 21-054 provided DHSEM $3 million to use as match for wildfire mitigation projects. At this time, over $2.1 million of those funds have been spent or obligated.

CDOT has been mitigating risk to transportation infrastructure and the traveling public for decades. This includes landslide, debris flow, and rockfall mitigation along state highway corridors, avalanche mitigation, and flood mitigation.

The Colorado Information Analysis Center (CIAC) maintains a Critical Infrastructure Protection (CIP) program, which works with private industry, state, local, tribal, territorial, and federal partners to protect lifelines, structures, systems, and assets that are vital to Colorado's infrastructure (e.g., government facilities, energy, food, and agriculture, and thirteen other sectors defined by the U.S. Department of Homeland Security). The program works to mitigate the risk to these facilities through involvement in federal critical infrastructure programs, and by working to share critical information between owners and operators of critical infrastructure.

Assessing Effectiveness

Mitigation effectiveness can be measured through the FEMA Benefit Cost Analysis (BCA) tool or assessing losses avoided from an actual event. Other state agencies, namely CDOT, use public safety as the primary measure for mitigation investments in highway infrastructure. Some examples of assessment methodologies and potential case studies are presented in the following sections.

Benefit Cost Analysis

To ensure a consistent approach in determining the cost-effectiveness of all projects submitted for FEMA's HMA funding, DHSEM is required to use FEMA's BCA module and process, which is consistent with *OMB Circular A-94 Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*.

At its most basic level, a BCA determines whether the cost of investing in a mitigation project today (the "cost") will result in sufficiently reduced damage in the future (the "benefits"), to justify spending money on a project. If the benefit is greater than the cost, then the project is considered cost-effective; if the benefit is less than the cost, then the project is not cost-effective. The Benefit-Cost Ratio (BCR) is a way of stating whether benefits exceed project costs, and by how much. It is figured by dividing the benefits by the costs. If the result is 1.0 or greater, then the project is cost-effective.

Three approaches are used to determine a project's BCR: lower-bound analysis, upper-bound analysis, and best estimate. The lower-bound and upper-bound methods are used in many cases to make final determinations of cost-effectiveness when there is limited data. In other cases, quick screening analysis with these approaches yields inconclusive results and additional data and screening may be required. Best estimate analysis produces the most accurate results.

Lower-Bound Analysis

The lower-bound analysis considers only the most important benefits of a project and ignores other benefits that may be difficult to quantify. If the results indicate that a project is cost-effective, then no further analysis is needed, and no additional data

has to be collected. Lower-bound analyses should not be used to rank or set priorities among projects, as they only determine broadly if a project is cost-effective. To summarize this type of analysis:

- All of the benefits have not been identified.
- Can determine if a project can be broadly considered cost-effective.
- Can determine if a project can be broadly considered NOT cost-effective (and needs upper-bound analysis)

Upper-Bound Analysis

If a lower-bound analysis shows that a project is not cost-effective, then the next step is an upper-bound analysis. While benefit data may still be limited, upper-bound analysis uses professional judgment to estimate which input data will produce the highest reasonable benefits.

Upper-bound analysis cannot determine if a project is cost-effective because it relies on the highest reasonable estimate of benefits. An upper-bound analysis can only determine whether the project BCR is less than 1.0 and thus is not worth pursuing further. As with lower-bound analyses, upper-bound analyses should not be used to rank or set priorities among projects. To summarize this type of analysis:

- Often the next step if the lower-bound analysis is negative (not cost-effective).
- Uses the highest reasonable estimate of benefits for a project.
- Analyzes as many inputs as possible, assigning the highest reasonable value to each.
- Can determine if a project can be broadly considered cost-effective.
- Can determine if a project can be broadly considered NOT cost-effective (cannot move forward).

Best Estimate Analysis

The best estimate analysis is used when the project application data is complete or nearly complete. This analysis provides a more accurate BCR because it considers more data in the analysis. Because this method of BCA provides the best estimate of cost-effectiveness, it can be used to rank or prioritize competing projects. To summarize, this analysis method:

- Project application data is complete, or almost complete.
- Produces more accurate analysis than lower-bound and upper-bound analyses.
- Determines whether a project is cost-effective or not cost-effective.

DHSEM encourages applicants to pre-screen their proposed mitigation projects by using an upper-bound analysis, so an early determination of cost-effectiveness can be made. BCAs will be conducted by project applicants with technical assistance from DHSEM and/or FEMA, or by TA consultants. DHSEM periodically conducts trainings and workshops for local and tribal governments on mitigation grants processes, including BCA.

A positive benefit-cost ratio (greater than one) does not necessarily guarantee that a hazard mitigation project will be approved, but it can provide insight into the mitigation potential of a project. The results of this analysis can also help communities evaluate current and future mitigation projects and adjust their overall mitigation strategy accordingly.

Determination Process

The three-step process used to determine a mitigation project's cost-effectiveness is presented below:

Step 1 - Screen Project Application Data

Engineering Review: Review the feasibility of completing the project from an engineering standpoint. Will the project provide the necessary protections? Will it reduce the expected damages? Is there a more efficient design? How much will the

project realistically cost at the time of grant award (sometimes 3 or more years in the future)?

Environmental Assessment: Are there any potential environmental concerns: endangered species, impacts on floodways or floodplains, regulated work periods, etc.?

Project Application Data Review: Do you have sufficient information and data for input into the benefit-cost model? Table 102 shows the type of data necessary to conduct a BCA for flood, tornado, and earthquake hazard mitigation projects. However, some basic information will be the same for any hazard mitigation project.

TABLE 102 – APPLICATION DATA FOR BCA

Input	Flood Project Data	Tornado Safe Room Project Data	Earthquake Project Data
Hazard Data (often not included in application)	Flood insurance study data or historical flood data from application	Windspeed Zone	Seismic hazard data from a credible source
First Floor Elevation	Is this available from engineering surveys or can it be estimated from observed flood depths?	Not applicable	Not applicable
Scope	What problem does the project address? How vulnerable is the building, item, or area?	Same as flood	Same as flood
Cost	Is there a well-documented cost-estimate or only a rough estimate?	Same as flood	Same as flood

Input	Flood Project Data	Tornado Safe Room Project Data	Earthquake Project Data
Useful Lifetime	How long will the project provide protection (mitigation) against damage and losses?	Same as flood	Same as flood
Economic Considerations	What is the square footage of the building? What are the replacement values of the building (or other facility) and contents?	Not applicable	Same as flood
Occupancy	Not usually applicable	Occupancy by hour	What are the levels of occupancy and visitors during various times throughout the day?
Function	What is the function of the facility and is it entirely or partially related to emergency response and recovery?	Same as flood	Same as flood
Damage Estimates - Without Mitigation	What type of building is it? Why does damage occur? What is the historically observed damage?	Not applicable (life safety mitigation)	Same as flood Are engineering reports available that describe building/ facility seismic vulnerabilities?

Input	Flood Project Data	Tornado Safe Room Project Data	Earthquake Project Data
Damage Estimates - With Mitigation	How effective will the mitigation project be in reducing future damage? (Reduced damage can be percent or dollar values)	Not applicable (life safety mitigation)	Same as flood

Step 2 - Conduct a Benefit-Cost Analysis

Input data as requested through the latest version of the BCA Module to determine a preliminary BCR.

Step 3 - Review the Results of the Analysis

Typically, if the project is cost-effective as determined by a lower-bound or best estimate analysis, then no further analysis or additional data collection is required, and the application moves to the next level in the funding process. If the project is not cost-effective as determined by an upper-bound or best estimate analysis, then no further analysis or additional data collection is possible, and the project is rejected. If the cost-effectiveness of a project cannot be adequately determined, then additional data must be collected.

Loss Avoidance Studies

Assessing the performance of hazard mitigation measures is critical to substantiate the value of mitigation efforts completed and validates the future allocation of funding to these kinds of projects. DHSEM conducts a loss avoidance assessment after each Presidential Disaster Declaration and may do so after non-declared disasters, where warranted. These post-event assessments use real event data (direct physical damages and displacement costs) to evaluate the impacts that were prevented by completed mitigation projects. The impacts of fatalities and injuries can be included using FEMA's Value of a Statistical Life (VSL). However, the analysis does not typically

include other, less-quantifiable impacts such as loss of critical services, roadway closures, and human impacts (mental stress or lost productivity).

The assessment reports dollars saved due to mitigation measures (losses avoided) and calculates a Return on Investment (ROI) by comparing the cost of the project to actual losses avoided over time. Moreover, the assessment provides insight that the state and local communities can use to identify effective mitigation activities, improve mitigation strategies, and increase communities' resilience to natural hazards.

DHSEM currently utilizes EMGrants Pro as a centralized grants management system. Continuing the use of EMGrants Pro to track future mitigation projects will aid in analyzing mitigation effectiveness in a methodical and consistent manner. While EMGrants Pro only monitors FEMA-funded mitigation projects, it can be used as a foundation to examine methods for tracking effectiveness of non-FEMA-funded projects as well.

The Mitigation Section is in the process of mapping all previous projects in GIS. They will provide that layer to the SEOC so that when an incident occurs DHSEM can easily overlay the incident and relevant projects. The Section can then determine if it needs to physically evaluate the project's effectiveness. Additionally, success stories will be conveyed to SHMT members during annual meetings, as well as at future Enhanced plan compliance meetings, documented in this E-SHMP, in forthcoming updates, and modified as necessary in the Mitigation Actions Database.

The methodology presented below will initially be applied to assess effectiveness of FEMA-funded hazard mitigation projects in the State of Colorado, but the process can be used for state-sponsored mitigation projects as well. For example, if CDOT upsizes a culvert which later prevents a highway from being flooded or washed out, this process can be used to capture losses avoided and mitigation effectiveness.

Phase 1: Project Identification and Selection

When a significant hazard event occurs, DHSEM will compare the location of the event to the previous projects that have been mapped. If there is a project or projects within the impacted area, DHSEM will review available data on the project(s) (application scope of work, BCA, or other sources). An assessment will also be conducted to determine if there are any mitigation projects in areas not impacted by the incident/disaster, which could be used to extrapolate losses that could have been reduced if the incident/disaster had happened in that area. Additionally details to evaluate include:

- Is the mitigation project of a type that could potentially reduce losses from the incident/disaster?
- Was a pre-event Benefit Cost Analysis (BCA) done for the project?
- Is there adequate data for the project to calculate effectiveness?
- What was the cost of the mitigation project?

Projects with adequate data are advanced to Phase 2.

Phase 2: Hazard Event Analysis

DHSEM then reviews data on the hazard event. This information may come from local observation, damage assessments, NOAA-NWS reports, or field investigation. Wherever possible, effectiveness should be measured in terms of interconnected hazards rather than simply looking at one event. For example, fire mitigation efforts may also be effective at decreasing flood losses. The analysis will then answer the following questions:

- Confirm that the hazard affected the project area.
- Confirm the hazard event was severe enough to have caused damage if the project had not been in place.

- Has there been an estimation on the recurrence interval of the event? (i.e., – 100-year storm, 500-year flood, et cetera).

Technical resources may be needed to support analysis of the event, and can include:

- Flood: Flood TAP, CWCB, USGS, consultants
- Wildfire: CSFS, local fire protection districts, consultants
- Geologic Hazards: CGS, USGS, consultants

If the hazard caused damage to the project, or would have in the absence of mitigation, the project is advanced to Phase 3.

Phase 3: Loss Avoidance Analysis
If sufficient quantitative data exists, compare the damage actually sustained with the damage that would likely have been sustained without mitigation. If not, a qualitative analysis can be completed that summarizes the benefits (general losses avoided) and effectiveness (Did the project perform as intended?) of the mitigation action.

Phase 4: Project Effectiveness and Documentation
The Loss Avoided is then compared to the project cost to determine the project's Return on Investment (ROI), similar to how the Benefit Cost Ratio (BCR) is calculated in a pre-event BCA. The results are documented by the sub-applicant in a memorandum or other report and provided to the DHSEM Mitigation Team.

Table 103 summarizes the FEMA case study: *Reducing Losses through Higher Regulatory Standards 2013 Colorado Floods Case Study FEMA-DR-4145-CO*. This study used a loss avoidance methodology to determine how much damage would have been reduced if certain regulatory and policy actions had been in place, using both a 100-year (1% annual chance) flood event, and the 2013 flood event as models.

TABLE 103 -REGULATORY LOSSES AVOIDED ANALYSIS[51]

100-Year Flood	Best Practice/Scenario	2013 Colorado Floods
Regulating floodplain development when the community entered the NFIP (referred to as "earlier") would have resulted in 32% estimated losses avoided in Boulder County and more than 52% estimated losses avoided in Larimer and Weld Counties.	Floodplain development regulations adopted earlier	Regulating floodplain development earlier would have resulted in 36% estimated losses avoided in Boulder County and more than 53% estimated losses avoided in Larimer and Weld Counties.
Regulating floodway development earlier would have resulted in estimated losses avoided of $32 million for Boulder County, $64 million for Larimer County, and $13 million for Weld County.	Floodway development regulations adopted earlier	N/A
Adopting freeboard earlier would have resulted in a 38% decrease in estimated losses for Boulder County and an over 18% decrease in losses for Larimer and Weld Counties.	Freeboard adopted earlier	Adopting freeboard earlier would have resulted in a 10% decrease in estimated losses for Boulder County and an over 4% decrease in losses for Larimer and Weld Counties.
If freeboard had never been adopted, there would be a 331% increase in estimated losses for	Freeboard never adopted	If freeboard had never been adopted, there would be a 32% increase in estimated losses for

[51] Reducing Losses Through Higher Regulatory Standards, 2013 Colorado Floods Case Study

Boulder County, 68% increase in losses for Larimer County, and 148% increase in losses for Weld County.		Boulder County, 5% increase in losses for Larimer County, and 11% increase in losses for Weld County.
If freeboard was increased by two feet, there would be a decrease in estimated losses in Boulder, Larimer, and Weld Counties of more than 70%.	Freeboard regulated to a higher or lesser standard	If freeboard was increased by two feet, there would be a decrease in estimated losses in Boulder, Larimer, and Weld Counties of more than 74%.
If critical facilities had been regulated earlier, there would have been a decrease in estimated losses in Boulder, Larimer, and Weld Counties of more than 64%.	Critical facilities regulated	N/A
N/A	Erosion setback (St. Vrain Creek)	If development of new structures were regulated in the new St. Vrain Creek erosion zone, Individual Assistance (IA) losses estimated at $1.4 million would have been avoided.
N/A	Benchmark years	The overall ratio of damage costs to replacement costs declines over time, demonstrating a reduction in severity of losses with improvements in regulatory standards. The cost of damage per building generally increases

		over time as a result of overall higher replacement cost exposures.
N/A	NFIP claims and CRS outreach	High CRS outreach communities' benefit from more extensive NFIP coverage both inside and outside the SFHA more than low-outreach communities.
N/A	Basements	Basement-only losses for the 2013 event were mostly outside the SFHA and accounted for 22% of all the IA losses, demonstrating the need to address or develop mitigation strategies for basements in all flood-prone areas.

In 2015, CDOT published the white paper titled "*The Economic Impacts of Geologic Hazard Events on Colorado Transportation Facilities*" which presented a detailed quantitative assessment of how rockfalls, rockslides, landslides, debris flows, and sinkholes affect the state's transportation infrastructure.

The statewide impacts from geologic hazards along CDOT highways can be grouped into two categories:

- Direct costs incurred by CDOT for maintenance labor and equipment, engineering, and construction activities, and

- Indirect costs including but not limited to property damage, injury or fatalities, traveler delay, lost productivity, loss of revenue to businesses and communities, and environmental impacts.

Based on review of CDOT program activities, the estimated annual direct costs to the department from geologic hazard events is $17M to $20M, which includes the Maintenance Program.

From 2010 to 2015, CDOT maintenance staff inputted an average of 8,500 work orders for geologic hazard related response activities, with an average cost of about $600 per work order. This resulted in over $4.5 to $5.5 million of annual expenses for high-frequency but low-cost events. Based on an historical data review, the study estimates 50 geologic hazard events per year that require support above the CDOT maintenance level for non-routine work. Of these, approximately 20 percent have an indirect cost related to traffic impacts, property damage, and potentially injury.

The report also analyzes the economic impact of geologic hazards on CDOT roadways, using three events from 2014. These events included short- and long-term closures, direct and user costs, and losses were estimated at $30 million. This study provides baseline information for measuring the effectiveness of mitigation actions along transportation corridors.

Other examples of actual or projected losses avoided due to mitigation actions taken are:

- The City of Longmont: $5.7 million in pre-disaster mitigation funding was utilized to improve the flow capacity of Left Hand Creek through the city. The project prevented and estimated $22.5 million in damages during the 2013 flood. Former FEMA Administrator Long used this project as an example of the value of mitigation spending during testimony before the US Congress in 2018.

- Hayman Fire Fuel Treatment: Satellite images identify where the 2002 wildfire stopped precisely in an area that had undergone fuels treatment. A study on the effectiveness of different strategies from the Hayman Fire was conducted by the U.S. Forest Service in 2003.

- CDOT's Interstate 70 Risk and Resilience Pilot: In 2017 a first-of-its kind approach to address vulnerabilities in Colorado's highway infrastructure was piloted. 450 miles of Interstate 70, from the Utah to Kansas borders, were examined for future damage and closure potential from physical threats. These included natural hazards like avalanche and wildfire, as well as human-caused threats like high vehicle bridge strikes. It provides a quantitative, data-driven, approach to risk and mitigation benefit calculation.

Implementation of E-SHMP's Mitigation Strategy

In addition to the project-level effectiveness described previously, the state quantifies "effectiveness" as the completion of the state-level mitigation actions identified through the E-SHMP planning process. Since the 2018 plan update, nearly 90% of all actions identified for completion by state agencies have been accomplished.

Monitoring, Evaluating, and Updating

The E-SHMP is considered to be a living document. The SHMT has agreed to follow a comprehensive plan maintenance approach moving forward that supports this living document assertion. All portions of the E-SHMP will be reviewed and revised as appropriate on a regular basis, and when conditions under which the plan was developed change, such as new or revised capabilities, a major disaster, availability of funding, and refinements to the SHMT coordination process.

In recognition of the ongoing and effective coordination between multiple state agencies, the SHMT has decided to discontinue the bi-annual meeting schedule identified in the 2018 E-SHMP. Going forward, the SHMT will meet annually to discuss Mitigation Action statuses, including losses avoided due to mitigation activities and

calculated/projected savings from mitigation activities. As a standing agenda item, the CRO has also offered to devote time at one of its quarterly meetings to review progress on the E-SHMP, where all resiliency sectors and FEMA "lifelines" are represented.

The state will evaluate progress made towards the E-SHMP's Mitigation Goals through an assessment of progress made across all of the identified Mitigation Actions, in addition to local projects that state agencies help to support. The SHMT will use this information to evaluate the effectiveness and efficiency of the mitigation program, and either validate the strategy as is, or determine if any revisions should be made to the goals, objectives, and/or specific mitigation actions. Additionally, integration with local, state, regional, and federal/national planning initiatives will also be reviewed.

ANNEX – DISASTER DECLARATION HISTORY

Colorado has an extensive history of disaster declarations at both the state and federal levels. These historic state and federal-level disaster or emergency declarations are documented within this Annex.

State Emergency Declarations

Since 2017, there have been 56 emergency declarations from Colorado Governors for events related to natural hazards. While many of the most recent declarations are for wildfire, the hazards in Colorado are diverse and often devastating. Declarations since 1980, shown in Table 104, present the varied types of hazard events and areas of the state affected by disasters.

TABLE 104 STATE EMERGENCY DECLARATIONS (1980 TO 2023)[52]

Year	Hazard	Locations Affected
1980	Grasshopper Infestation	Logan, Morgan, Sedgwick, Phillips, Washington, Weld Counties
1980	Flooding	Weld, Logan, Washington, Morgan, Larimer, Sedgwick Counties
1980	Severe Winter Storm	Cheyenne, Kit Carson Counties
1981	Water System	City of Trinidad and Vicinity
1981	Grasshopper Infestation	Eastern Colorado Counties
1981	Dam Safety	Adams, Weld Counties
1981	Tornadoes	Adams, Denver, Jefferson, Weld Counties
1982	Severe Winter Storm	Denver, Arapahoe, Adams, Jefferson,

[52] Colorado Governor's Executive Orders | Archives / https://www.colorado.gov/governor/executive-orders

Year	Hazard	Locations Affected
		Boulder, El Paso, Weld Counties
1982	Dam Failure	Lawn Lake Dam, Larimer County
1982	Flooding	Ouray County
1984	Severe Winter Storm	Conejos County
1984	Water System	Oak Creek, Routt County
1984	Flooding	Delta, Dolores, Hinsdale, Saguache, Mesa, Montrose, Moffat, Rio Blanco, Pitkin, San Miguel, Ouray, Eagle, Gunnison Counties, Town of Silt
1986	Earth Slide	Delta County
1986	Earthflow	SH 133, N of Paonia Reservoir
1986	Winter Storm	Weld County
1987	Wildfire	Garfield County
1987	Flood Mitigation	Alamosa County
1987	Wildfire	Cheyenne, Lincoln, Elbert Counties
1987	Flooding	Park County
1988	Wildfire - 3 Executive Orders	Lefthand Canyon, Boulder County, Larimer County, Fremont County
1988	Tornado	Denver County
1989	Wildfire	Black Tiger Fire, Boulder County
1989	Flooding	Town of Rico
1990	Hailstorm	Denver, Boulder Counties
1990	Wildfire	Olde Stage Fire, Boulder County
1990	Severe Thunderstorm	El Paso County

Year	Hazard	Locations Affected
1990	Tornado	Limon
1990	Blizzard	Several Locations
1992	Flood	Fort Collins
1994	Flood	Pueblo County, Town of Lyons, Boulder County
1994	Wildfires	Garfield, Delta, Douglas, Jefferson Counties; Statewide
1995	Flood	Weld, Morgan Counties
1996	Tornadoes	Morgan, Washington Counties
1996	Wildfire	Buffalo Creek, Jefferson County
1996	Flood	Buffalo Creek, Jefferson County
1996	Wildfire, Drought, Severe Weather	Several Locations
1997	Blizzard - 2 EOs in October, December	South Central Colorado, eastern Front Range
1997	Landslides	Jefferson County
1997	Flooding	Fort Collins, Weld, Morgan, Logan, Phillips, Clear Creek, Elbert, Kiowa, Baca, Otero, Lincoln, Crowley, Prowers, Sedgwick Counties; Town of Holyoke
1998	Landslides, Rockfalls	Archuleta, Garfield, Mesa, Gunnison, Rio Blanco Counites
1998	Wildfire	Mt. Evans
1999	Flood - 2 Executive Orders	Sedgwick, Washington Counties

Year	Hazard	Locations Affected
1999	Flooding, Landslides, Mudslides	Bent, Crowley, Custer, El Paso, Elbert, Fremont, Kiowa, Larimer, Otero, Las Animas, Pueblo, Weld Counties
2000	Flood	Elbert County
2000	Wildfires - multiple Executive Orders	Montezuma, Jefferson, Park, Boulder, Larimer, Las Animas Counties
2001	Severe Winter Storms	Eastern Plains and Front Range counties
2002	Wildfires	Statewide
2002	Mudslides	San Miguel County
2002	Drought	Statewide
2003	Sinkhole	Interstate 70, Eagle County
2003	Wildfire	Cherokee Fire
2003	Snow Emergency	Statewide
2004	Wildfire	Larimer County
2004	Tornadoes	Logan County
2005	Wildfire	Pueblo, Custer Counties
2006	Snow Emergencies - 2 Executive Orders	24 counties - December
2006	Severe Winter Storm - October	Southern Colorado, including El Paso County
2006	Wildfires - multiple Executive Orders	Garfield, Teller, Custer Counties
2006	Wildfire - 2 Executive Orders	Las Animas, Huerfano Counties; Costilla, Huerfano Counties

Year	Hazard	Locations Affected
2006	Drought	South Platte Basin in Northern Colorado
2006	Flooding	Douglas, Teller, Fremont, Pueblo, Garfield Counties
2007	Tornado	Holly, Prowers Counties
2007	Tornadoes	Prowers, Phillips, Cheyenne Counties
2007	Rockfalls	Interstate 70, U.S. Highway 6 Garfield; Clear Creek, Jefferson Counties
2008	Wildfires	Crowley County
2008	Contamination of Water Supply	City of Alamosa
2008	Severe Tornadoes	Weld, Larimer Counties
2008	Wildfire	Housetop Fire, Mesa County
2008	Wildfires	Las Animas County
2009	Severe Blizzard	Statewide
2009	Severe Spring Snowstorm	Statewide
2010	Wildfire	Larimer County
2010	Wildfire	Boulder County
2010	Rockslide	Interstate 70
2011	Wildfire	Custer, Fremont Counties
2011	Wildfire	Las Animas County
2011	Wildfire	Teller County
2011	Wildfire	Las Animas County

Year	Hazard	Locations Affected
2011	Wildfire	Larimer County
2011	Flooding	Boulder County
2011	Wildfire	Jefferson County
2012	Wildfire	Moffat County
2012	Wildfire	Larimer County
2012	Wildfire	Montezuma County
2012	Wildfire	Custer County
2012	Wildfire	Garfield County
2012	Flooding	El Paso, Larimer Counties
2012	Bridge Damage	Fremont County
2012	Wildfire	Rio Blanco County
2012	Sinkhole	Lake County
2012	Wildfire	Mesa County
2012	Wildfire	Mesa County
2012	Wildfire	El Paso County
2012	Wildfire	Montezuma County
2012	Wildfire	El Paso County
2012	Wildfire	Larimer County
2012	Wildfire	Larimer County
2012	Wildfire	Larimer County
2012	Wildfire	Jefferson County
2013	Winter Storm	Statewide

Year	Hazard	Locations Affected
2013	Flooding	Adams, Arapahoe, Broomfield, Boulder, Chaffee, Clear Creek, Crowley, Denver, El Paso, Gilpin, Fremont, Jefferson, Lake, Larimer, Lincoln, Logan, Morgan, Otero, Park, Pueblo, Prowers, Sedgwick, Washington, Weld Counties
2013	Wildfire	Garfield County
2013	Flooding	El Paso County
2013	Wildfire	Jefferson County
2013	Wildfire	Mineral, Rio Grande, Hinsdale Counties
2013	Wildfire	Huerfano, Las Animas Counties
2013	Wildfire	Grand County
2013	Wildfire	Huerfano County
2013	Wildfire	El Paso County
2013	Wildfire	Fremont County
2014	Landslide	Mesa County
2014	Rockslide	U.S. Highway 550 over Red Mountain Pass
2014	Extreme Weather	Statewide
2015	Mine Accident	Gold King Mine, Silverton, and downstream waters
2015	Severe Weather	Communities east of the Continental Divide, Rio Blanco, Garfield Counties
2016	Wildfire	Larimer County
2016	Wildfire	Custer, Pueblo Counties
2016	Wildfire	Pueblo County

Year	Hazard	Locations Affected
2016	Wildfire	Fremont County
2016	Wildfire	Boulder County
2016	Blizzard	Northeastern Colorado, including Denver metropolitan area
2016	Rockslide	U.S. Highway 70 in Glenwood Canyon
2017	Wildfire	Summit County
2017	Wildfire	Statewide
2017	Snow and Heavy Rains	Jefferson, Boulder, Larimer, Weld Counties
2017	Extreme Weather and Flooding	Bent, Custer, Fremont, Huerfano, Otero, Pueblo Counties
2017	Wildfire	Boulder County
2017	Wildfire	Logan, Phillips Counties
2017	Wildfire - 3 Executive Orders	Moffat County
2017	Wildfire	Routt County
2017	Wildfire	Routt County
2018	Wildfire	La Plata, San Juan Counties
2018	Wildfire	Statewide
2018	Wildfire	Costilla, Huerfano Counties
2018	Wildfire	Montrose County
2018	Wildfire	Park County
2018	Wildfire	Teller County
2018	Wildfire	Moffat County
2018	Wildfire	Rio Blanco County

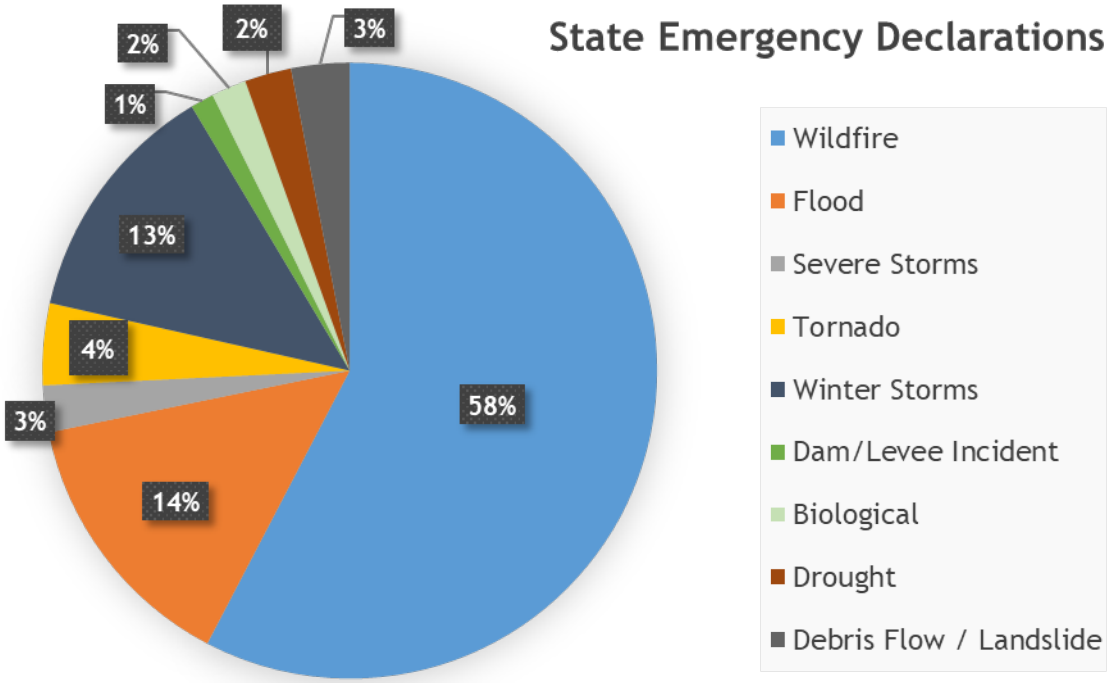
Year	Hazard	Locations Affected
2018	Wildfire	Eagle County
2018	Wildfire	Moffat, Rio Blanco Counties
2018	Wildfire - 2 Executive Orders	Rio Blanco County
2018	Drought	40 Counties
2018	Rock Landslide	US Highway 550 near Ouray
2018	Wildfire	Grand County
2019	Water Supply	Delta County
2019	Severe Winter Weather and Blizzard Conditions	Hinsdale, Elbert, Douglas, El Paso Counties
2019	Severe Winter Weather and Blizzard Conditions	Logan, Douglas, Arapahoe, Adams, Jefferson, Elbert, Phillips, Sedgwick, Morgan, Larimer, El Paso Counties
2019	Avalanche Debris and Flooding Risk	Hinsdale County
2019	Rockslide	State Highway 145
2019	Wildfire	Park County
2019	Severe Winter Weather and Blizzard Conditions	Larimer, Weld, Logan, Sedgwick, Phillips, Boulder, Morgan, Washington, Yuma, Clear Creek, Adams, Broomfield, Jefferson, Denver, Arapahoe, Douglas, Elbert, Lincoln, Kit Carson Counties
2020	COVID-19	Statewide
2020	Wildfire	Jefferson County
2020	Wildfire	Mesa, Garfield Counties

Year	Hazard	Locations Affected
2020	Wildfire	Garfield, Eagle Counties
2020	Wildfire	Statewide
2020	Wildfire - 2 Executive Orders	Larimer County
2020	Wildfire	Las Animas County
2020	Wildfire	Jackson County
2020	Wildfire	Grand County
2020	Wildfire	Boulder County
2021	Severe Winter Weather	Statewide
2021	Wildfire	Routt County
2021	Flooding, Mudslides, Debris Flow	Interstate 70, Glenwood Canyon
2021	Burn Scar Flooding, Mudslides, Rockslides	Garfield, Larimer, Eagle, Grand, Routt, Rio Blanco, Pitkin Counties
2022	Wildfire, Straight-Line Winds	Boulder County
2022	Wildfire	Otero, Bent Counties
2022	Avian Influenza	Statewide
2022	Wildfire	Teller County
2022	Wildfire	La Plata County
2022	Wildfire	Conejos County
2022	Highly Pathogenic Avian Influenza	Statewide

Year	Hazard	Locations Affected
2023	Extreme Cold	Statewide
2023	Wildfire	Bent County
2023	Severe Weather, Flooding	Arapahoe, Cheyenne, Douglas, El Paso, Elbert, Kit Carson, Lincoln, Logan, Washington Counties
2023	Wildfire	Garfield County
2023	Wildfire	Las Animas
2023	Wildfire	Gunnison County

Figure 185 portrays Colorado disaster emergencies declared by the Governors from 1980 to mid 2023 by hazard type. The hazard types were consolidated into those consistent with FEMA reporting. Note that wildfires have been the cause of a majority of state declarations, nearly three times more than the next highest event type, flooding. Severe winter weather and landslides/etc. are the next most common causes for state declarations.

FIGURE 185 COLORADO STATE EMERGENCY DECLARATIONS



Federal Declarations

Colorado has received numerous federal declarations, grants, and designations related to disasters. These include Major Disaster and Emergency Declarations from the President, Fire Management Assistance grants through FEMA, and designations related to crop damages from the United States Department of Agriculture (USDA).

Major Disaster and Emergency Declarations

Since 1955, Colorado has received 25 presidential disaster declarations and seven emergency declarations for natural hazard events. Table 105 displays these declarations by year, including whether the declaration resulted in assistance and the funds allocated based on available data. The assistance programs include Public Assistance, Individual Assistance, and Hazard Mitigation.

TABLE 105 FEDERAL DISASTER DECLARATIONS (1955 - 2023)[53]

Year	Disaster Number	Disaster Event Description	Assistance Program and Federal Funds ($ millions)
1955	DR-33-CO	Flooding	Public/Individual Assistance, Hazard Mitigation - Unknown Funds
1956	DR-59-CO	Flooding	Public/Individual Assistance, Hazard Mitigation - Unknown Funds
1965	DR-200-CO	Tornadoes, Severe Storms, Flooding	Public/Individual Assistance - Unknown Funds
1969	DR-261-CO	Severe Storms, Flooding	Public/Individual Assistance - Unknown Funds
1970	DR-293-CO	Heavy Rains, Flooding	Public/Individual Assistance - Unknown Funds
1973	DR-379-CO	Dam Failure	Public/Individual Assistance - Unknown Funds

[53] Disaster Declarations for States and Counties | FEMA

Year	Disaster Number	Disaster Event Description	Assistance Program and Federal Funds ($ millions)
1973	DR-385-CO	Heavy Rains, Snowmelt, Flooding	Public/Individual Assistance - Unknown Funds
1973	DR-396-CO	Flooding, Landslides	Public Assistance - Unknown Funds
1976	DR-517-CO	Severe Storms, Flash Flood	Public/Individual Assistance - Unknown Funds
1977	EM-3025-CO	Drought	Public Assistance - Unknown Funds
1982	DR-665-CO	Estes Park Dam Break Flood	Public/Individual Assistance - Unknown Funds
1984	DR-719-CO	Western Slope Flooding	Public Assistance - Unknown Funds
1997	DR-1186-CO	Flood Disaster in Colorado	Public Assistance - $5.3 Individual Assistance - $2.2 Hazard Mitigation - $2.0
1999	DR-1276-CO	Severe Storms, Flooding, Landslides and Mudslides	Public Assistance - $4.9 Individual Assistance - $0.7 Hazard Mitigation - $1.0

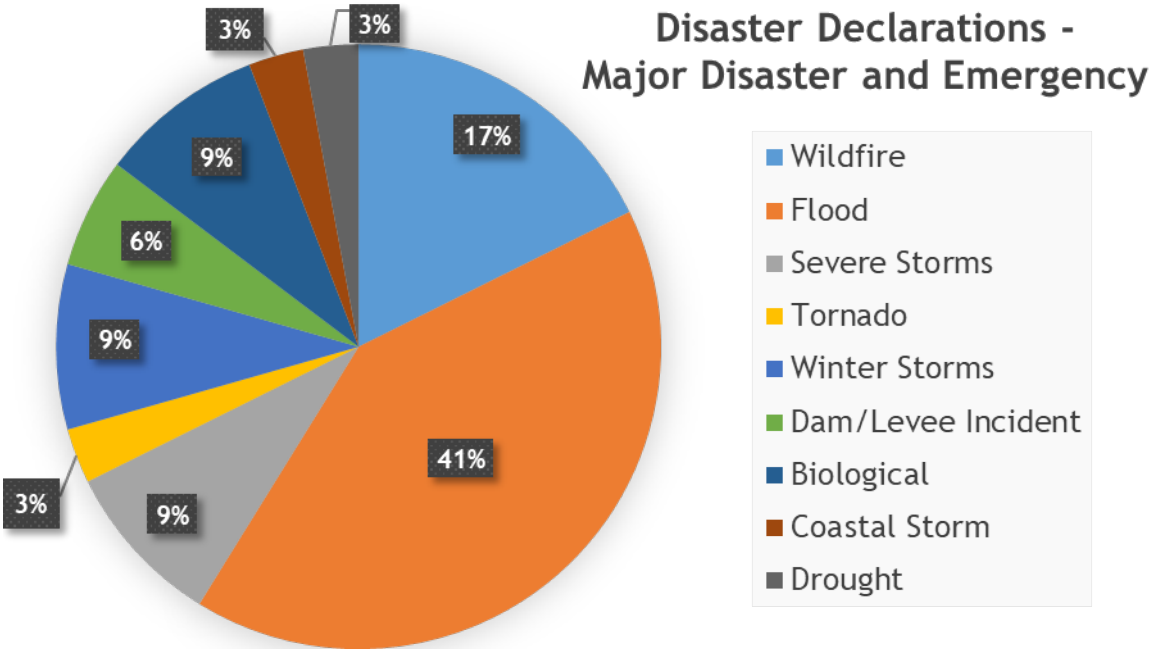
Year	Disaster Number	Disaster Event Description	Assistance Program and Federal Funds ($ millions)
2001	DR-1374-CO	Severe Winter Storms	Public Assistance - $4.6 Hazard Mitigation - $0.6
2002	DR-1421-CO	Wildfires	Hazard Mitigation - $0.3 Individual Assistance - Unknown Funds
2003	EM-3185-CO	Snow Emergency	Public Assistance - $6.2
2005	EM-3224-CO	Hurricane Katrina Evacuation	Public Assistance - Unknown Funds
2007	EM-3270-CO, EM-3271-CO	Snow Emergency	Public Assistance - $11
2008	DR-1762-CO	Severe Storms and Tornadoes	Individual Assistance - $1.1 Hazard Mitigation - $0.18
2012	DR-4067-CO	Wildfires	Public Assistance - $5.0 Hazard Mitigation - $0.82
2013	DR-4133-CO	Wildfires	Public Assistance - $173.4 Hazard Mitigation - $0.02
2013	DR-4134-CO	Wildfires	Public Assistance - $6.6 Hazard Mitigation - $1.15
2013	DR-4145-CO	Severe Storms, Flooding, Landslides, and Mudslides	Public Assistance - $345.2 Individual Assistance -

Year	Disaster Number	Disaster Event Description	Assistance Program and Federal Funds ($ millions)
			$61.9 Hazard Mitigation - $67.39
2013	EM-3365-CO	Severe Storms, Flooding, Landslides, and Mudslides	Public Assistance - $61.9 Individual Assistance - $345.2
2015	DR-4229-CO	Severe Storms, Tornadoes, Flooding, Landslides, and Mudslides	Public Assistance - $20.2 Hazard Mitigation - $3.3
2020	EM-3436-CO	COVID-19	No funding
2020	DR-4498-CO	COVID-19 Pandemic	Public Assistance - $2,026 Individual Assistance - $22.7 Hazard Mitigation - $58.7
2020	DR-4581-CO	Wildfires	Public Assistance - $37.9 Hazard Mitigation - $0.65
2021	DR-4634-CO	Wildfires and Straight-line Winds	Public Assistance - $45.6 Individual Assistance - $3.4 Hazard Mitigation - $9.8
2023	DR-4731-CO	Severe Storms, Flooding, and Tornadoes	Public Assistance - Figures Pending

In Figure 186, the primary incident types assigned by FEMA in the disaster declarations are presented. This illustration of the presidential disasters and emergencies,

declared for Colorado since 1955, shows the diverse range of hazards affecting the state. Flooding is the hazard for a majority of these declarations, while wildfire disasters are the most recent hazard of concern. The coastal storm declaration is related to the state accepting people displaced by Hurricane Katrina.

FIGURE 186 DISASTER DECLARATIONS INCLUDING MAJOR DISASTER AND EMERGENCY



Fire Management Assistance Grant Awards

In addition to presidential declarations, Colorado has received 70 fire management assistance grant (FMAG) awards for suppression and management since 1978, as shown in Table 106.

TABLE 106 WILDFIRES RESULTING IN FIRE MANAGEMENT ASSISTANCE GRANTS[1]

Year	Fires
1978	Deer Creek Canyon
1980	Bear Trap

Year	Fires
1989	Sunnyside
1990	Old Stage
1994	Wake Complex, South Canyon, Roxborough Complex
1996	Buffalo Creek
2000	Bobcat Gulch, Eldorado, Hi Meadow
2001	Armageddon-Carter Lake
2002	Again, Big Elk, Black Mountain, Burn Canyon, Coal Seam, Cuerno Verde, Dierich Creek, Fisher-Trinidad Complex, Grizzly Gulch, Hayman, Iron Mountain, Million, Missionary Ridge, Panorama, Schoonover, Snaking, Spring-Trinidad Complex, Ute Pass, Valley, Wiley Ridge
2003	Buckhorn Creek, Cherokee Ranch, Cloudy Pass, Lincoln Complex, Overland
2004	McGruder, Picnic Rock
2005	Mason
2006	Red Apple, Mato Vega, Mauricio Canyon
2007	Newcastle
2008	Nash Ranch, Ordway
2009	Olde Stage
2010	Reservoir Road, Fourmile Canyon
2011	Indian Gulch
2012	Crystal, Duckett, High Park, Lower North Fork, Waldo Canyon, Weber, Wetmore
2013	Black Forest, East Peak, Royal Gorge, West Fork Complex
2016	Beulah Hill, Cold Spring, Junkins

Year	Fires
2018	Chateau, Lake Christine, Spring Creek
2020	Calwood, Cameron Peak, East Troublesome, Grizzly Creek, Pine Gulch
2021	Marshall

US Department of Agriculture Secretarial Disaster Designations

Colorado regularly receives USDA secretarial disaster designations. These designations typically result from drought, but also include adverse weather events. Excessive rain, flooding, hail, high winds, insects, and extreme temperatures account for extensive damages and losses as well. The Secretarial Disasters since 2003 are shown in Table 107, although years prior produced numerous additional declarations. Since 2003, Colorado has received a secretarial disaster declaration for drought every year, with the exception of 2007 and 2016.

The majority of drought declarations since 2013 have been through the Fast Track designation process for severe drought, which was implemented in 2012. The process provides for a nearly automatic designation when, during the growing season, any portion of a county meets the D2 (Severe Drought) drought intensity value for eight consecutive weeks or a higher drought intensity value for any length of time as reported in the U.S. Drought Monitor.

TABLE 107 USDA SECRETARIAL DISASTER DESIGNATIONS (2003-2023)[54]

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2003	S1797, S1890	Drought	Baca, Bent, Cheyenne, Elbert, Kiowa, Lincoln, Phillips, Prowers
2003	S1843	Drought, Insects	Alamosa, Archuleta, Chaffee, Conejos, Costilla, Crowley, Custer,

[54] USDA Disaster Designation Information

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
			Dolores, Fremont, Garfield, Hinsdale, Huerfano, La Plata, Lake, Las Animas, Mesa, Mineral, Moffat, Montezuma, Otero, Pueblo, Rio Blanco, Rio Grande, Routt, Saguache
2004	S1947	Drought, Freeze, Hail	Baca, Chaffee, Cheyenne, Custer, Eagle, Fremont, Garfield, Grand, Jackson, Kiowa, Kit Carson, Lake, Lincoln, Phillips, Pitkin, Prowers, Pueblo, Routt, Summit, Yuma
2004	S2009, S2031	Drought	Huerfano, Las Animas, Moffat, Rio Blanco
2005	S2160	Drought, Freezing Temperatures	Delta, Kit Carson
2005	S2188	Drought, Wind, Heavy Rain, Hail	Crowley, El Paso, Lincoln, Otero, Park, Phillips, Pueblo, Teller, Washington, Yuma
2005	S2217	Drought, Crop Diseases, Insect Infestation	Logan
2005/6	S2287	Drought, Crop Diseases, Insect Infestation	Huerfano, Kiowa, Las Animas, Sedgwick

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2005/6	S2327	Drought, Fire, High Winds, Heat	Adams, Alamosa, Baca, Broomfield, Chaffee, Cheyenne, Conejos, Costilla, Custer, Denver, Dolores, Douglas, Elbert, Fremont, Hinsdale, Huerfano, Kit Carson, Lake, Las Animas, Mineral, Montezuma, Morgan, Prowers, Pueblo, Rio Grande, Saguache, San Miguel, Weld
2006	S2329	Heat, High Winds, Insect Pests, Late Freeze, Drought	Arapahoe, Archuleta, Bent, Boulder, Crowley, Delta, El Paso, Gunnison, Jefferson, Kiowa, La Plata, Montrose, Ouray, Park, Phillips, Teller, Washington
2006	S2351	Heat, High Winds, Drought	Eagle, Garfield, Larimer, Logan, Otero, Pitkin, Rio Blanco, Yuma
2006	S2382, S2480	Drought	Jackson, Lincoln, Mesa, Moffat, Sedgwick
2008	S2750, S2802	Drought	Adams, Arapahoe, Baca, Bent, Cheyenne, Crowley, Douglas, El Paso, Elbert, Fremont, Huerfano, Kiowa, Kit Carson, Las Animas, Lincoln, Logan, Otero, Park, Prowers, Pueblo, Teller, Washington, Weld
2009	S2970	Drought	Dolores, Mesa, Montezuma, Montrose, San Miguel

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2010	S2987	Drought	Yuma, Fremont, Otero, Montrose, Mesa, Dolores, Montezuma, San Miguel
2011	S3113	Drought	Bent, El Paso, Kiowa, Las Animas, Lincoln, Prowers, Pueblo
2012	S3229	Drought	Arapahoe, Cheyenne, Crowley, Elbert, El Paso, Kiowa, Kit Carson, Lincoln, Pueblo, Washington
2012	S3260	Drought, Excessive Heat, High Winds	Statewide
2012	S3267, S3269, S3276, S3281, S3282, S3284, S3289, S3290, S3315, S3319, S3347	Drought, Wind, High Winds, Fire, Wildfire, Excessive Heat, Insects	Archuleta, Baca (3), Cheyenne, Conejos, Costilla, Delta, Dolores, Garfield, Gunnison, Jackson (2), Kiowa, Kit Carson, La Plata, Larimer (2), Las Animas, Logan, Mesa (2), Moffat (2), Montezuma (3), Montrose (2), Phillips, Prowers, Rio Blanco, Routt, San Miguel, Sedgwick, Weld (2), Yuma (3)
2012	S3307	Freezing Conditions	Delta, Garfield, Gunnison, Mesa, Montrose, Ouray, Pitkin, San Miguel
2012	S3347	High Winds, Hail, Flash Flooding	Adams, Boulder, Broomfield, Larimer, Logan, Morgan, Weld
2013	S3641	Drought	Baca, Cheyenne, Kiowa, Kit Carson, Prowers, Yuma

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2013	S3455, S3456, S3459, S3461, S3463, S3466, S3505, S3508, S3518, S3539, S3545, S3548,S3550, S3575	Drought, Winds, High Winds, Fire, Wildfire, Heat, Excessive Heat, Insects	Adams (2), Alamosa (3), Arapahoe (2), Archuleta (4), Baca (4), Bent, Boulder (2), Broomfield (2), Chaffee (2), Cheyenne (2), Clear Creek (2), Conejos (4), Costilla (4), Crowley, Custer (2), Delta, Denver (2), Dolores (2), Douglas (2) Eagle (3), El Paso, Elbert, Fremont (2), Garfield (3), Gilpin, Grand (2), Gunnison (3), Hinsdale (3), Huerfano (3), Jackson (2), Jefferson (2), Kiowa (2), Kit Carson (2), La Plata (3), Lake (2), Larimer (3), Las Animas (3), Lincoln, Logan (2), Mesa (2), Mineral (3), Moffat (4), Montezuma (4), Montrose (3), Otero, Ouray (2), Park (2), Phillips (2), Pitkin (3), Prowers (2), Pueblo, Rio Blanco (2), Rio Grande (2), Routt (3), Saguache (4), San Juan, San Miguel (3), Sedgwick (2), Summit (2), Teller (2), Washington, Weld (3), Yuma (3)
2013	S3573	Freeze	Baca, Prowers
2013	S3583	Frost, Freezes	Delta, Garfield, Gunnison, Mesa, Montrose, Ouray, Pitkin, San Miguel

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2014	S3627, S3629, S3630, S3632, S3634, S3645, S3651, S3653, S3669, S3698, S3703, S3714	Drought, Winds, High Winds, Fire, Wildfire, Heat, Excessive Heat, Insects	Arapahoe (2), Archuleta (5), Baca (8), Bent (3), Cheyenne (4), Conejos (3), Costilla (6), Crowley (3), Custer (2), Delta, Dolores (3), Douglas (2), El Paso (2), Elbert (2), Fremont (2), Hinsdale, Huerfano (2), Kiowa (5), Kit Carson (5), La Plata (3), Las Animas (5), Lincoln (2), Logan (2), Mesa (3), Mineral, Moffat, Montezuma (7), Montrose (3), Otero (3), Ouray, Phillips (3), Pitkin, Prowers (4), Pueblo (3), Rio Blanco, Rio Grande, San Juan, San Miguel (4), Sedgwick(3), Teller (2), Washington (2), Yuma (7)
2014	S3733	Excessive Rain, High Winds, Hail	Kit Carson, Yuma
2014	S3760	Freeze	Delta, Garfield, Gunnison, Mesa, Montrose, Ouray, Pitkin, San Miguel
2014	S3764	Hail	Bent, Crowley, Kiowa, Las Animas, Otero, Pueblo
2015	S3783, S3785, S3787, S3788, S3790,	Drought, Winds, High Winds, Fire, Wildfire, Heat, Excessive Heat, Insects	Arapahoe, Archuleta (2), Baca (4), Bent, Cheyenne (2), Conejos, Costilla (2), Crowley, Dolores, El Paso, Elbert, Garfield, Huerfano, Kiowa (2),

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
	S3792, S3802, S3826		Kit Carson (2), La Plata, Las Animas (2), Lincoln, Mesa, Moffat, Montezuma (2), Montrose, Otero, Prowers (2), Pueblo, Rio Blanco, San Miguel, Washington, Yuma
2015	S3925	Severe Freeze	Delta, Gunnison, Mesa, Montrose
2016	S4087	Hail	Weld, Larimer
2017	S4145, S4148, S4152	Drought	Adams, Arapahoe, Baca (3), Bent, Boulder, Broomfield, Cheyenne, Crowley, Douglas, Elbert, El Paso, Kiowa, Kit Carson, Larimer, Las Animas, Lincoln, Logan, Morgan, Prowers (2), Pueblo, Washington, Weld
2017	S4208	High Winds, Hail, Excessive Rain, Flash Flooding	Kit Carson
2017	S4249	Freeze	Delta, Gunnison, Mesa, Montrose
2017	S4250	Hail	Bent, Crowley, Kiowa, Las Animas, Otero, Pueblo
2017	S4251	Hail, Excessive Rain	Dolores, La Plata, Montezuma, Montrose, Ouray, San Juan, San Miguel
2017	S4261	Severe Freezes	Delta, Gunnison, Mesa, Montrose, Ouray, San Miguel

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2018	S4279, S4280, S4281, S4285, S4286, S4289, S4290, S4291, S4293, S4300, S4304, S4308, S4309, S4313, S4315, S4318, S4320, S4326, S4329, S4331, S4334, S4336, S4338, S4345, S4347, S4352, S4357, S4386,	Drought	Alamosa (3), Arapahoe (2), Archuleta, Baca (6), Bent (5), Boulder (2), Broomfield, Chaffee (5), Cheyenne (2), Clear Creek, Conejos (3), Costilla (6), Crowley (3), Custer (4), Delta (3), Dolores (3), Douglas (2) Eagle (3), El Paso (4), Elbert (3), Fremont (6), Garfield (7), Gilpin (2), Grand (2), Gunnison (6), Hinsdale (3), Huerfano (5), Jackson (3), Jefferson (2), Kiowa (4), Kit Carson (2), La Plata (4), Lake (3), Larimer (2), Las Animas (8), Lincoln (3), Mesa (7), Mineral (2), Moffat (7), Montezuma (5), Montrose (6), Otero (4), Ouray (4), Park (2), Pitkin (6), Prowers (5), Pueblo (6), Rio Blanco (5), Rio Grande (2), Routt (5), Saguache (4), San Juan (3), San Miguel (4), Summit, Teller (3), Washington, Weld

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
	S4392, S4407, S4408, S4410		
2018	S4365	Hail, High Winds	Boulder, Broomfield, Jefferson, Weld, Gilpin, Grand, Larimer
2018	S4383	Excessive Rain, Flash Flooding, Flooding, High Winds, Hail, Lightning	Kit Carson
2018	S4397	Excessive Rain, Flash Flooding, Hail, High Winds, Lightning, Tornadoes	Weld, Larimer
2018	S4404	Excessive Rain, Hail, High Winds, Tornadoes	Adams, Weld, Logan, Morgan, Phillips, Sedgwick, Washington, Yuma

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2019	S4466, S4468, S4469, S4481, S4569	Drought	Alamosa (2), Arapahoe, Archuleta (2), Baca (2), Bent, Boulder, Chaffee (2), Cheyenne, Clear Creek (2), Conejos (2), Costilla (3), Crowley, Custer (2), Delta, Dolores (2), Douglas, Eagle (2), El Paso, Elbert, Fremont (2), Garfield (2), Gilpin, Grand, Gunnison (2), Hinsdale, Huerfano (2), Jackson, Jefferson (2), Kiowa, Kit Carson, La Plata (2), Lake (2), Larimer, Las Animas (3), Lincoln, Mesa (2), Mineral, Moffat (2), Montezuma (4), Montrose (2), Otero, Ouray, Park (2), Pitkin (2), Pueblo, Rio Blanco (2), Rio Grande, Routt, Saguache (2), San Juan, San Miguel (2), Summit (2), Teller, Washington
2019	S4531	Excessive Rain, Flash Flooding, Flooding, High Winds, Tornadoes, Hail, Lightning	Cheyenne, Kit Carson

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2020	S4646, S4648, S4650, S4651, S4652, S4655, S4665, S4680, S4687, S4692, S4703, S4704, S4722, S4723, S4742, S4745, S4755, S4761, S4770, S4775, S4787, S4793, S4798, S4801, S4802, S4807, S4829,	Drought	Adams (3), Alamosa, Arapahoe (4), Archuleta (3), Baca (5), Bent (3), Boulder (3), Broomfield (2), Chaffee (4), Cheyenne (5), Clear Creek (3), Conejos (2), Costilla (2), Crowley (4), Custer (4), Delta, Denver, Dolores (3), Douglas (3), Eagle (4), El Paso (7), Elbert (3), Fremont (7), Garfield (5), Gilpin (2), Grand (4), Gunnison (3), Hinsdale (2), Huerfano (3), Jackson (3), Jefferson (2), Kiowa (4), Kit Carson (5), La Plata (3), Lake (5), Larimer (5), Las Animas (4), Lincoln (6), Logan (5), Mesa (3), Mineral (2), Moffat (7), Montezuma (5), Montrose (2), Morgan (4), Otero (3), Ouray (2), Park (4), Phillips (4), Pitkin (4), Prowers (5), Pueblo (6), Rio Blanco (4), Rio Grande (2), Routt (4), Saguache (3), San Juan (2), San Miguel (3), Sedgwick (4), Summit (4), Teller (4), Washington (5), Weld (5), Yuma (4)

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
	S4848, S4852, S4853		
2020	S4696	Hard Freeze	Delta, Garfield, Gunnison, Mesa, Montrose, Pitkin
2020	S4866	Excessive Rain, Flash Flooding, Flooding	Kit Carson, Yuma

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2021	S4915, S4917, S4919, S4920, S4922, S4925, S4926, S4966, S5086, S5119	Drought	Adams, Alamosa, Arapahoe, Archuleta (2), Baca (4), Bent, Boulder, Broomfield, Chaffee, Cheyenne (2), Clear Creek, Conejos (2), Costilla (2), Crowley, Custer (2), Delta, Denver, Dolores (2), Douglas, Eagle, El Paso, Elbert, Fremont (2), Garfield (2), Gilpin, Grand, Gunnison, Hinsdale, Huerfano (2), Jackson (2), Jefferson, Kiowa (2), Kit Carson (2), La Plata (2), Lake, Larimer, Las Animas (2), Lincoln, Logan, Mesa, Mineral, Moffat (4), Montezuma (4), Montrose (2), Morgan, Otero, Ouray, Park, Phillips (2), Pitkin, Prowers (2), Pueblo (2), Rio Blanco (2), Rio Grande, Routt (2), Saguache (2), San Juan, San Miguel (2), Sedgwick, Summit, Teller, Washington, Weld (2), Yuma (3)
2021	S5018	Freeze	Delta, Mesa, Garfield, Gunnison, Montrose, Pitkin
2022	S5147	Drought	Statewide

Year	Declaration Number	Disaster Type	Affected Counties and Number of Designations
2022	S5145, S5150, S5154, S5156, S5163, S5175, S5177, S5199, S5207, S5207, S5210, S5217	Drought	Archuleta, Baca (3), Cheyenne, Conejos, Costilla, Kiowa, Kit Carson, La Plata, Las Animas, Montezuma, Prowers, Yuma
2023	S5372, S5389, S5398	Drought	Adams, Arapahoe, Baca, Bent, Cheyenne, Crowley, Custer, El Paso, Elbert, Fremont, Huerfano, Kiowa, Kit Carson, Las Animas, Lincoln, Logan, Morgan, Otero, Phillips, Prowers, Pueblo, Sedgwick, Washington, Weld, Yuma

ANNEX – DROUGHT RESPONSE PLAN

Ongoing Monitoring, Mitigation, and Drought Response Efforts

Background and Context

The Colorado Water Conservation Board (CWCB) works with the Department of Homeland Security and Emergency Management (DHSEM) to update drought mitigation planning in the Enhanced State Hazard Mitigation Plan (E-SHMP) every five years as required by the Federal Emergency Management Agency (FEMA). Prior to 2023, (from 1981-2023 the Colorado Water Conservation Board (CWCB) also maintained a stand-alone Colorado Drought Mitigation and Response Plan (Drought Plan). However, since the initial drought plan was developed, federal legislation including but not limited to the federal Disaster Mitigation Act (2002) and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (1988), have provided stronger federal frameworks for emergency response and mitigation planning through FEMA. These frameworks include drought mitigation and response planning in federally-required state plans, negating the need for a stand-alone drought plan. Consequently, the drought mitigation components of Colorado's previous drought plan are now included in the E-SHMP, which has become the state's go-to hazard mitigation planning document. Additional actions the CWCB will take around climate and drought planning are captured in the Colorado Water Plan. The drought monitoring response measures and framework attached to the previous drought plan are now included in an Annex to the Colorado Enhanced State Hazard Mitigation Plan (E-SHMP). [55]

55 Authority comes from a range of state and federal enabling documents including: Colorado Title 24, Article 33.5, Part 701 et. seq., Colorado Revised Statutes, as amended; entitled the Colorado Disaster Emergency Act of 1992; The Colorado State Emergency Operations Plan, April 2013; The federal Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121- 5207); The National Response Framework, May 2013; Code of Federal Regulations (CFR) Title 44 - Emergency Management and Assistance, revised October 1, 2008; Title 7 Code of Federal Regulations (CFR) Part 1945 – Emergencies Subpart A and Parts

Drought Monitoring and Response

Initial response activities to a drought hazard event are primarily to observe and often include increased monitoring and data-gathering. As drought intensifies and impacts become more evident across a variety of societal, economic, and environmental sectors, the state increases monitoring, escalates drought awareness, and works with state, federal and local agencies to promote drought relief programs.

While increased monitoring alone may be unable to address drought directly, it provides a vehicle for understanding local conditions, evaluating possible ways to support or help alleviate acute issues and, in some cases where drought is prolonged, trigger processes which open up federal funding. Due to the long-term nature and slow onset of drought, "response resources" for a drought includes long term situational monitoring from professionals including the leadership from the agencies identified within this document.

The following response framework provides an operational system to serve the State of Colorado in responding to drought from the early stages of a drought event through sustained periods of drought conditions, with the intent to assess and reduce impacts to the state.

759 and 762 Disaster Designation Process; Agricultural Assistance Act of 2003, P.L. 108-07; Plant Protection Act; Food, Agriculture, Conservation, and Trade Act of 1990. Additional responsibilities come from C.R.S. 37-80-102 designation that CWCB undertake (1)(i) Collection and distribution of data on snowfall and prediction of probable runoff therefrom; and (7) Under the control and direction of the state engineer, and in cooperation with the Colorado water conservation board, there shall be a water supply section, which has the duty to collect and study data and distribute such information on the water supplies, both surface and groundwater, of the state of Colorado in order to make a more efficient administration of the uses thereof. The state engineer shall employ such hydrologists and hydraulic engineers as are necessary to determine sources of water supply, forecast runoff, define characteristics and amounts of return flows, and determine diversion requirements, transmission losses, evaporation losses, historic usage, and general stream regimen.

Drought Monitoring Framework Purpose and Scope

The purpose of the Colorado's drought response efforts serve to:

- Provide an effective and systematic means for the state to evaluate how it can reduce the impacts of water shortages on Colorado's people, property and environment over the short term or long term.
- Collect, monitor and disseminate water availability information to inform drought declaration and response
- Activate time-limited task forces as necessary to identify needs and guide response resources to the state and affected local jurisdiction(s). Provide in-state mutual aid and/or coordination.
- Assist local governments when possible through available state programs relative to drought and drought conditions.
- Coordinate Intergovernmental relations throughout the response period.
- Provide an operational structure that attempts to mirror the National Incident Management System (NIMS) and the National Response Framework (NRF) that applies to drought related operations and response needs.

The scope of this response is designed to be scalable to address events that may impact regionally limited areas or extensive areas of the state. The scope includes a full range of requirements for response operations to a drought event. The implementation of short, intermediate, and long-term actions will be determined by the degree necessary to adequately protect public health, life and safety as well as to conserve and preserve water resources for the purpose of preserving and sustaining the economy and protecting the environment.

Understanding the Nature of Drought

Colorado is susceptible to droughts that can have significant long-term impact to the state's environment, economy and population and drought impacts will vary depending on where the drought occurs and how long it persists. Drought can move very slowly, with impacts compounding and worsening with time, so an early drought response is vital. Monitoring water availability conditions and forecasts that are suggestive of drought conditions can allow for early planning discussions specific to the affected sectors, regions, or communities. Though the response phase of an emergency or disaster is often considered the timeframe required to restore a community to its pre-disaster condition or re-establish a state of normalcy in the affected communities, for a drought hazard, the situational awareness unfolds much slower than typical emergency response for other hazards.

Drought may create significant human and/or animal suffering, property damage and economic hardship to individuals, governments, the environment, and the business community. Response and recovery operations may overlap requiring simultaneous efforts; however, recovery and mitigation operations may move into a longer-term strategic process. Best practices include maintaining standard operating procedures, central coordination and identifying pre-designated responsibilities but allowing for the response to be nimble enough to address shifting challenges as they evolve and respond at the appropriate scale to effectively channel resources.

Groups and Duties

Colorado's drought response identifies specific response roles and responsibilities of state departments, agencies, quasi-governmental, non-governmental organizations and non-profit organizations. Colorado drought mitigation and response is designed to work within the existing framework of government, pulling together key personnel from both federal and state levels. These include:

Water Conditions Monitoring Committee (WCMC) - This group, previously called the Water Availability Task Force (WATF) is responsible for drought monitoring and long-

term mitigation through cooperation, coalition-building, and education. The WCMC consists of the Director or their designee for the Department of Natural Resources (DNR), the Department of Local Affairs (DOLA), the Department of Homeland Safety and Emergency Management (DHSEM), the Colorado Department of Agriculture (CDA), The Department of Natural Resources (DNR) and the Colorado Water Conservation Board (CWCB) who will serve as the lead agency(s) for coordinating the WCMC. The WCMC also invites members of the public including local water managers and public information officers (PIOs), basin roundtables and others to attend, participate and share information, especially as it pertains to local drought mitigation and response efforts. The WCMC also includes emergency management professionals, federal land managers, scientists and experts in climatology and weather forecasting. The latter includes the Office of State Climatologist, the National Oceanic and Atmospheric Administration (NOAA) and the Natural Resource Conservation Service (NRCS). The lead agencies within the WCMC also make the recommendation to senior leadership to formally activate the Drought Task Force by more formally engaging Department Directors when drought concerns have escalated.

Drought Task Force (DTF) - When the DTF is activated, drought response and incident mitigation is the collective responsibility of the DTF. As drought conditions worsen and local drought declarations and restrictions are announced, the DTF may recommend that the Governor take specific actions. The Governor may coordinate assistance among state agencies and request outside assistance from other federal agencies and neighboring states. The Governor can also declare a 30-day disaster emergency (CRS 24-33.5-704(4)). The Governor can also request a federal drought declaration be declared to help open up support. This may be a U.S. Presidential Emergency Declaration, USDA or some other federal action (see DTF section below). The general sequence of actions is outlined in Table 1.

Ongoing Duties of the WCMC

The function of the WCMC is to monitor current conditions and forecast the likelihood of significant climate and weather changes that may alter precipitation and

temperature trends. While the group is primarily focused on drought, the group also works to convene flood specialists and fire specialists given the interconnections between each of these natural disasters (drought increases fire risk and rain on burns scars causing increased flood risk). These events are compounded by the magnitude of climate extremes and climate change.

The WCMC presents on and compiles reports on the following indicators and outlooks: Snowpack, Precipitation, Temperatures, Streamflow, Reservoir levels, Groundwater levels, Soil Moisture, Palmer indexes, Historical climate norms, Long term precipitation and temperature outlooks, and Climate variations (including La Niña and El Niño conditions). The group also determines requirements for routine and special reports and modifies them as necessary. It provides other task forces with this information where overlap has been established and/or invites those groups to the WCMC. The WCMC also identifies resource information gaps and makes recommendations to the CWCB to address them.

The WCMC assesses current and pending impacts to Colorado's water supply including water storage and precipitation deficits that could lead to potential impacts to regions and/or sectors. Data reported by the WCMC provides support by indicating the sectors and portions of the state likely to be affected by pending or current drought conditions. Long range forecasting has been improving over the years and may become a factor in the indicators noted in Table 1 in future updates to this plan.

Primary data sources and indicators used by the WCMC include: Monthly Water Supply Reports, the U.S. Drought Monitor, Monthly Climate Report, Historical norms, Weather forecasts and long-term outlooks, Experimental Precipitation Statistical Forecast (e.g. three month outlook), Reservoir levels, Streamflow data, Rain gauge sites, NRCS Snow Telemetry Network (SNOTEL) sites, USBR Snow Data Assimilation System (SNODAS), Standard Precipitation Index (SPI), Surface Water Supply Index (SWSI), and Palmer Drought Severity Index (PDSI).

Duties of the DTF When Activated

The Colorado drought response team is organized in the form of a DTF which is comprised of the directors of key state agencies. The DTF will respond appropriately to the drought conditions with the intent to protect, conserve and preserve water resources to sustain life; and to advise and make recommendations to the Governor who may provide additional drought assistance or seek a Presidential drought disaster declaration.

The DTF is activated to help better understand the local, regional or sector specific impacts. The DTF has the ability to set time-bound work groups that can provide drought impact input based on regional, issue or sector specific needs and may utilize the WCMC for information sharing. These groups may last for a single meeting, or a set number of subsequent meetings within a given year to gain specific input on how drought is affecting an area in order to inform actionable monitoring and mitigation efforts and inform the DTF, state agencies, the legislature and/or the Governor. As conditions change, the DTF may determine needs such as increasing: monitoring activities across impact sectors, information sharing at WCMC meetings and determine the level of activation necessary to provide response resources to affected or potentially affected jurisdictions (see Figure 1 and Table 1 below).

General Response Functions and Process

General response functions of the WCMC, DTF and any ad hoc group that is developed to support these groups may include: increased information sharing and communications, evaluation of most impacted sectors and regions, procurement and resource tracking, supporting local response measures and enhancing applicable state drought programs. The Drought Task Force may request or propose requesting federal assistance programs such as USDA Program Assistance, Small Business Administration Declaration, Economic Development Administration (EDA) Program support, and/or request of a Presidential Disaster Declaration.

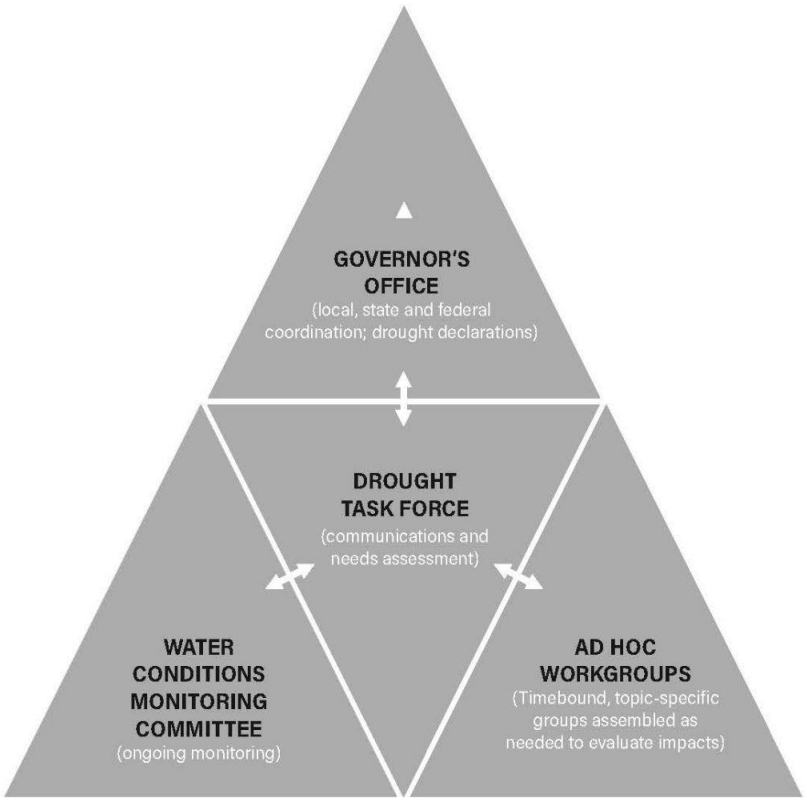
Figure 1 graphically depicts, and Table 1 outlines, the general sequence of events of the Drought Response Plan. Severity indices are intended to provide a general framework and by themselves do not initiate response actions. Expert judgment from the WCMC and further data analysis may be required to fully understand impacts of abnormally dry conditions suggested by the indicators. Recommendations for action may also be dependent on timing, location, extent, water supply and subjective considerations, and recognize that different parts of the state may be in different phases at different times.

Additional Emergency Response Duties

All state agencies or departments are required under the authority of Colorado Disaster Emergency Act of 1992 (Act) and this Response Plan to carry out assigned activities related to mitigating the effects of a major emergency or disaster and to cooperate fully with each other, the Division of Homeland Security and Emergency Management (DHSEM), and other political subdivisions in providing emergency assistance. All state agencies or departments are required under the authority of the Colorado Disaster Emergency Act of 1992 to fully cooperate with each other and any other political subdivisions in providing the specific assistance necessary to respond to a disaster or emergency. The Act also applies to all state agencies or departments that serve as members of the DTF.

This Plan identifies the manner in which to carry out assigned activities relative to drought or water supply availability incidents which vary from normal response activities due to the atypical manner in which drought or water supply availability incidents unfold. The CWCB will lead, provide coordination and support the WCMC and the DTF as well as any time-bound workgroups the DTF recommends developing. This work includes tracking impacts from water shortages, improving water availability monitoring, increasing public awareness and education, augmenting water supply, facilitating watershed and local planning, as well as reducing water demands (e.g. encouraging water conservation, drought planning, efficiency planning and enabling rulemaking that support drought restrictions, land use planning, etc).

FIGURE 1 DROUGHT PLAN IMPLEMENTATION CYCLE



Information Collection and Dissemination

Information collected through the WCMC and DTF (when activated)

The water availability information tracked and shared via the WCMC will be synthesized into regular summary reports available to the public and stakeholders. The WCMC meetings, recordings and the CWCB website will be used as the primary means for disseminating summary information to local governments and the public regarding the drought status and any response activities. The CWCB will be responsible for updating and maintaining the information on the website on at least a monthly basis when a meeting has been held and/or there are changing conditions that need to be reported. Other communications methods include newsletter, summary reports, email, and/or webinars for regularly scheduled meetings. When activated, the DTF may create Drought Summary Memorandum/Situation Reports for the governor as needed and/or requested.

Drought Declaration Types

- **Local Drought Declarations** - a declaration made by a local authority at the municipal or county scale
- **State Drought Declarations** - a disaster emergency declared by the Governor for a 30-day time period which can be extended (CRS 24-33.5-704(4))
- **Federal Drought Declarations** - made by one or more federal authorities or entities when a drought declaration is either triggered by conditions (see Farm Service Agency below), autonomously declared or is made after a request of a leading Colorado authority
- **Presidential Disaster Declarations** - The Governor, a governor's authorized representative or an Indian Tribal Council leader may request the President of the United States declare a drought disaster for activation of federal assistance programs to help drought-affected communities through the Federal Emergency Management Agency (FEMA). There has never been a Presidential Disaster Declaration made for Drought.
- **Secretarial Disaster Declarations** - The secretary for the United States Department of Agriculture (USDA) can and has made several USDA Secretarial Disaster Declarations when damages and losses due to a natural disaster create a minimum of 30% production loss in at least one crop in the county. The Secretarial Disaster Declaration is widely used and makes low-interest loans and other emergency assistance available for those affected, e.g., to farmers and ranchers in the case of agricultural disasters due to drought. Under a new streamlined process by the Farm Services Agency (FSA), a nearly automatic USDA Disaster Declaration can be made if any portion of a county has experienced eight consecutive weeks of severe drought (D2) according to the U.S. Drought Monitor (Congressional Research Service, 2013), provided it occurs during the growing season.

The State of Colorado's drought response framework is described in detail in Table 1 below.

TABLE 1 - Drought Response Plan Summary Action Table

Drought Phase	Severity Indicators and Impacts*	Response Activity	Actions to be Considered
Normal Conditions	Severity Indicators Drought Monitor - D0 Abnormally Dry: • Surface Water Supply Index (SWSI) +2.0 to -1.9 • Standard Precipitation Index (PSI) -0.5 to -0.7 • Palmer Drought Supply Index (PDSI) -1 to -1.9 Other Considerations • SPI range maintained for six months. • Impact to the number of river basins or modified Palmer climate division. Impacts Short-term dryness slowing planting, growth of crops or pastures.	Regular monitoring	• CWCB monitors situation on monthly basis through the WCMC, discusses trends with National Weather Service (NWS), State Climatologist, State Engineer, Natural Resource Conservation Service (NRCS), and others as appropriate. • Data reviewed for drought emergence and summarized in monthly drought updates. • Implement long-term mitigation actions identified in drought mitigation plan
Phase 1	Severity Indicators Drought Monitor - D1 Moderate Drought: • SWSI -2.0 to -2.9 • SPI -0.8 to -1.2 • PDSI -2.0 to -2.9 Other Considerations N/A Impacts Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested.	More close monitoring of conditions for persisting or rapidly worsening drought; Official drought not yet declared	• Assess need for formal DTF activation depending on timing, location, or extent of drought conditions, existing water supply, and recommendation of WCMC. • DTF member lead agencies notified of need for potential activation.
Phase 2	Severity Indicators Drought Monitor - D2 Severe Drought • SWSI -3.0 to -3.9 • PDSI -3.0 to -3.9 • SPI2 -1.3 to -1.5 Indicator blend Percentile: 6-10 Other Considerations PDSI is less than -2.0 in any river basin or modified Palmer climate division. Impacts Crop or pasture losses likely; water shortages common; water restrictions likely to be imposed.	Drought Task Force activated; potential Drought Emergency declared	• DTF and CWCB staff prepare a memorandum of potential drought emergency based on WCMC analysis for the governor. • The DTF and CWCB staff meet to evaluate need for ad hoc workgroup(s). • Any activated workgroups may make an initial damage or impact assessment (physical and economic) or provide input on local conditions and sector-level impacts.
Phase 3	Severity Indicators Drought Monitor D3 to D4 Extreme/Exceptional Drought • SWSI -4.0 to -5.0 • PDSI -4.0 to -5.0 or less • SPI -1.6 to -2.0 or less Other Considerations PDSI Lowest reading at -2.0 to -3.9 in any river basin or modified Palmer climate division; SPI Less than -1.0 to -1.99 for six months. Impacts Major crop/pasture losses; widespread water shortages or restrictions very likely to be imposed. Phase 3 impacts under Exceptional Drought also include widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.	Drought Emergency is declared by proclamation of the governor.	• Governor's Memorandum updated to activate additional Impact Task Forces as necessary. • DTF continues to assess, report, and recommend response measures and incident mitigation. • Unmet needs are reported to the DTF Chairs. • DTF Chairs determine the unmet needs that can be met by reallocation of existing resources. Those which cannot are forwarded to the Governor with recommendations to support a request for a Presidential Drought Declaration. •Governor may request a presidential declaration. • If approved, Federal-State Agreement establishes Colorado DHSEM Director as the State Coordinating Officer (SCO). • Work with the governor's office on long-term recovery operations.

State Departments and Agency Responsibilities

State Emergency Operations

In a drought hazard incident, state emergency operations will be driven by the information delivered by the WCMC and the activation of the DTF. The DTF will report to the Governor and any additional resources necessary to handle the impacts of the incident or ongoing conditions will be determined by the Governor. The Governor may request a USDA Drought Declaration from the Secretary of Agriculture, which activates programs to assist in recovery operations. In water supply availability incidents where the onset of impact is rapid, state emergency operations should follow the components of ICS and NIMS as they are designed in collaboration with the WCMC, as applicable.

Administration, Logistics, and Mutual Aid

Administration

During an emergency or disaster, state (and local) government shall determine, if necessary, what normal administrative procedures, if any, shall be suspended, relaxed or made optional in order to prevent unnecessary impediments of emergency operations and response activities. Such action should be carefully considered and the consequences should be projected realistically. Any state government departure from the usual methods of doing business will normally be stated in the Governor's declaration or Executive Order of Disaster/Emergency, or as specified in this Plan and its supporting documents. Mutual aid, if needed from other states, will follow protocols outlined in existing memorandums of understanding or mutual aid agreements in place.

Finance

- A major disaster or emergency may require the expenditure of large sums of state (and local) funds. Financial operations may be carried out under compressed schedules and intense political pressures, which will require expeditious actions that still meet sound financial management and

accountability requirements. Although drought and water supply availability incidents may dictate a different process for declaration, the requirement for financial support is nonetheless vital.

- State financial support for emergency operations shall be from funds regularly appropriated to state departments. If the demands exceed available funds, the Governor may make additional funds available from the Disaster Emergency Fund. If money available from the fund is insufficient, the Governor has the authority under a State Declaration of Disaster/Emergency to transfer and expend money appropriated for other purposes.

- State departments designated as Lead Agencies for Emergency Support Functions conducting emergency support activities will be responsible for organizing their functional activities to provide financial support for their operations. Each department is responsible for maintaining appropriate documentation to support requests for reimbursement, for submitting bills in a timely fashion and for closing out assignments.

- State and local government entities are responsible for documenting all emergency or disaster related expenditures using generally accepted accounting procedures. Care must be taken throughout the course of the emergency to maintain logs, records, receipts, invoices, purchase orders, rental agreements, etc. These documents will be necessary to support claims, purchases, reimbursements and disbursements. Record keeping is necessary to facilitate closeouts and to support post response audits.

- Sources of funding for drought mitigation and response efforts are outlined in Section 4 of the Colorado Drought Mitigation Plan. Additional reference for funding and relief options can be referenced in Appendix C Drought Mitigation Capabilities Summary.

Drought Response Framework Evaluation and Maintenance

- During the 2023 update to the Enhanced State Hazard Mitigation Plan (E-SHMP) all state drought planning and response documentation related to mitigation was consolidated in the E-SHMP. Subsequent revisions to this Annex will supersede all previous Drought Plan editions and are effective immediately for planning, training and exercising, and preparedness and response operations.

- Individual implementation plans and procedures may be developed by the agency or ad hoc work group as needed. These procedures will detail who (by title), what, when, where and how emergency tasks and responsibilities will be conducted.

- Implementation procedures shall be maintained and kept current by all parties on the following schedule:

    - Updates can occur at any time based upon the change of federal guidance or the needs as determined by the CWCB, the WCMC and/or the DTF.

    - A cursory review of this plan and any drought trigger levels will occur annually in conjunction with a fall WCMC meeting.

    - Updates to the full plan will occur when the state's E-SHMP is updated (e.g. every five years).

ANNEX - COLORADO RURAL ELECTRIC ASSOCIATION HMP

Introduction and Background

Electric Cooperatives are private, not-for-profit companies that exist for the sole purpose of providing electricity to their members. Electric cooperatives are owned and regulated by their members and governed by a board of directors elected from the membership. The board of directors set policies, procedures, and rates that are implemented by the cooperative's professional staff. Cooperatives pride themselves in providing near-cost electric service to members.

Electric cooperatives were established to provide electrical service to rural areas of the United States, which in the 1930s were still without electricity in an estimated nine out of ten rural homes. Investor-owned utility companies were unwilling to provide this service to rural areas throughout the country as it was believed there would be insufficient revenue in these areas to support the needed infrastructure investments.

The Rural Electrification Administration (REA) was created on May 11, 1935, as part of Franklin Delano Roosevelt's "New Deal", with the primary goal of bringing electricity to farms and rural areas. The Executive Order establishing the REA, and the passage of the Rural Electrification Act a year later, marked the first steps in a public-private partnership that has, over the last 85-plus years, helped rural America achieve near-total electrification.

America's Electric Cooperative Network

According to the National Rural Electric Cooperative Association (NRECA, 2023), more than 900 electric cooperatives exist in the U.S. These cooperatives power 56% of the nation's landmass, including 21.5 million businesses, homes, schools, and farms in 48 states, from Alaskan fishing villages to dairy farms in Vermont, and the suburbs and exurbs in between, as shown in Figure 187.

Although cooperatives serve only 12% of the nation's electric consumers (42 million people), they own and maintain 42% of the nation's electric distribution lines. This creates large networks for cooperatives to manage and maintain with fewer customers, and when comparing revenue per mile, rural electric cooperatives (RECs) are at a significant economic disadvantage to investor-owned or municipal distribution providers. Also unlike the rest of the electric sector, electric co-ops sell the majority of their power to households rather than businesses. This is evident when comparing cooperatives' percentage sales by kWh to municipal and investor-owned providers.

Some of these cooperatives provide generation and transmission (G&T), while others are solely distribution cooperatives. G&T cooperatives generate electricity by providing wholesale power through their own electric generation facilities or by purchasing power on behalf of the distribution members. They then transmit this power to distribution cooperatives, who deliver electricity to end consumers.

Cooperative businesses adhere to seven guiding principles, which are:

1. Voluntary and Open Membership - Cooperatives are voluntary organizations, open to all persons able to use their services and willing to accept the responsibilities of membership, without respect to gender, social, racial, political, or religious affiliation.

2. Democratic Member Control - Cooperatives are democratic organizations controlled by their members, who actively participate in setting policies and making decisions. The elected representatives are accountable to the membership. In primary cooperatives, members have equal voting rights (one member, one vote), and cooperatives at other levels are organized in a democratic manner.

3. Members' Economic Participation - Members contribute equitably to, and democratically control, the capital of their cooperative. At least part of that capital is usually the common property of the cooperative. Members usually

receive limited compensation, if any, on capital subscribed as a condition of membership. Members allocate surpluses for any or all the following purposes: developing the cooperative, possibly by setting up reserves, part of which at least would be indivisible; benefiting members in proportion to their transactions with the cooperative; and supporting other activities approved by the membership.

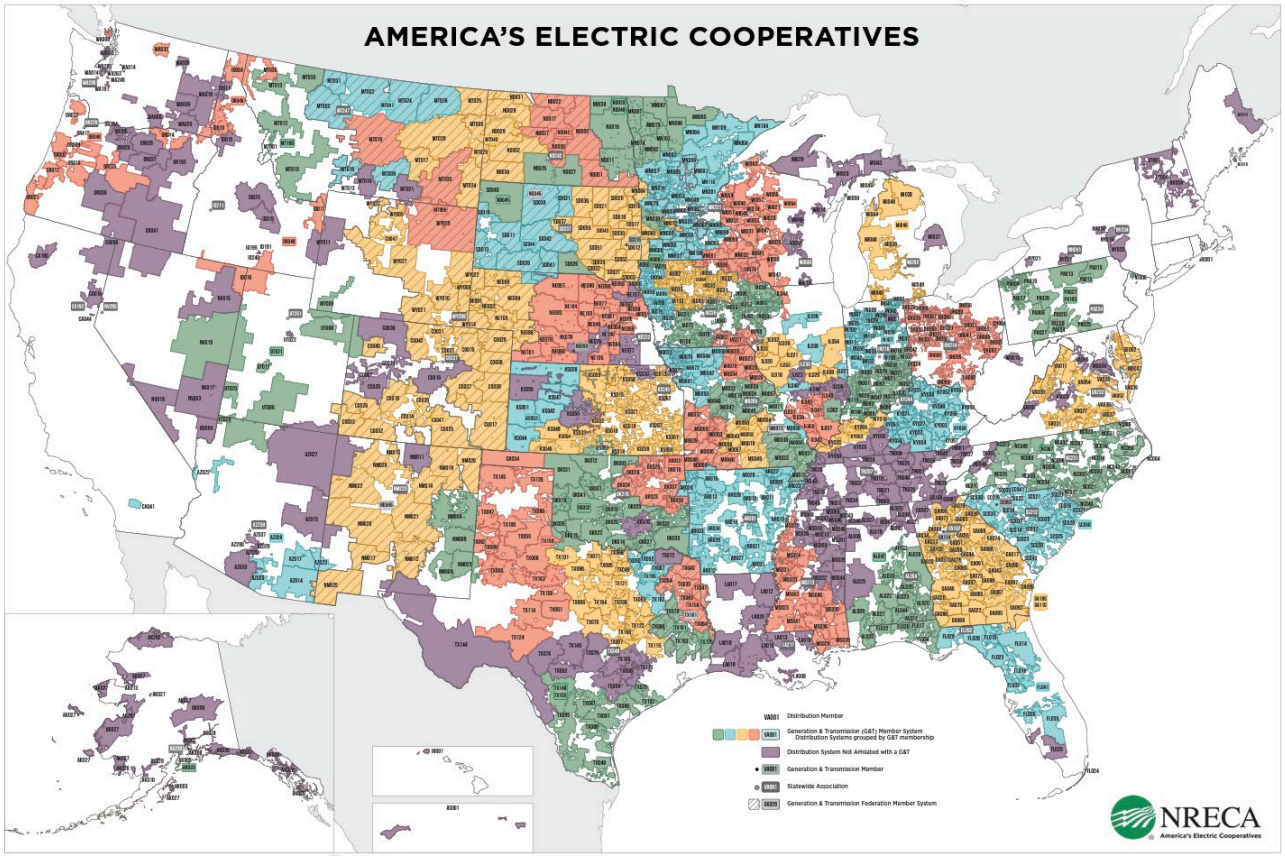
4. Autonomy and Independence - Cooperatives are autonomous, self-help organizations controlled by their members. If they enter into agreements with other organizations, including governments, or raise capital from external sources, they do so on terms that ensure democratic control by their members and maintain their cooperative autonomy.

5. Education, Training, and Information - Cooperatives provide education and training for their members, elected representatives, managers, and employees so they can contribute effectively to the development of their cooperatives. They inform the public, particularly young people, and opinion leaders, about the nature and benefits of cooperation.

6. Cooperation Among Cooperatives - Cooperatives serve their members most effectively and strengthen the cooperative movement by working together through local, national, regional, and international structures.

7. Concern for Community - Focusing on member needs, cooperatives work for the sustainable development of their communities through policies accepted by their members.

FIGURE 187 – AMERICA'S ELECTRIC COOPERATIVES



Colorado Cooperatives

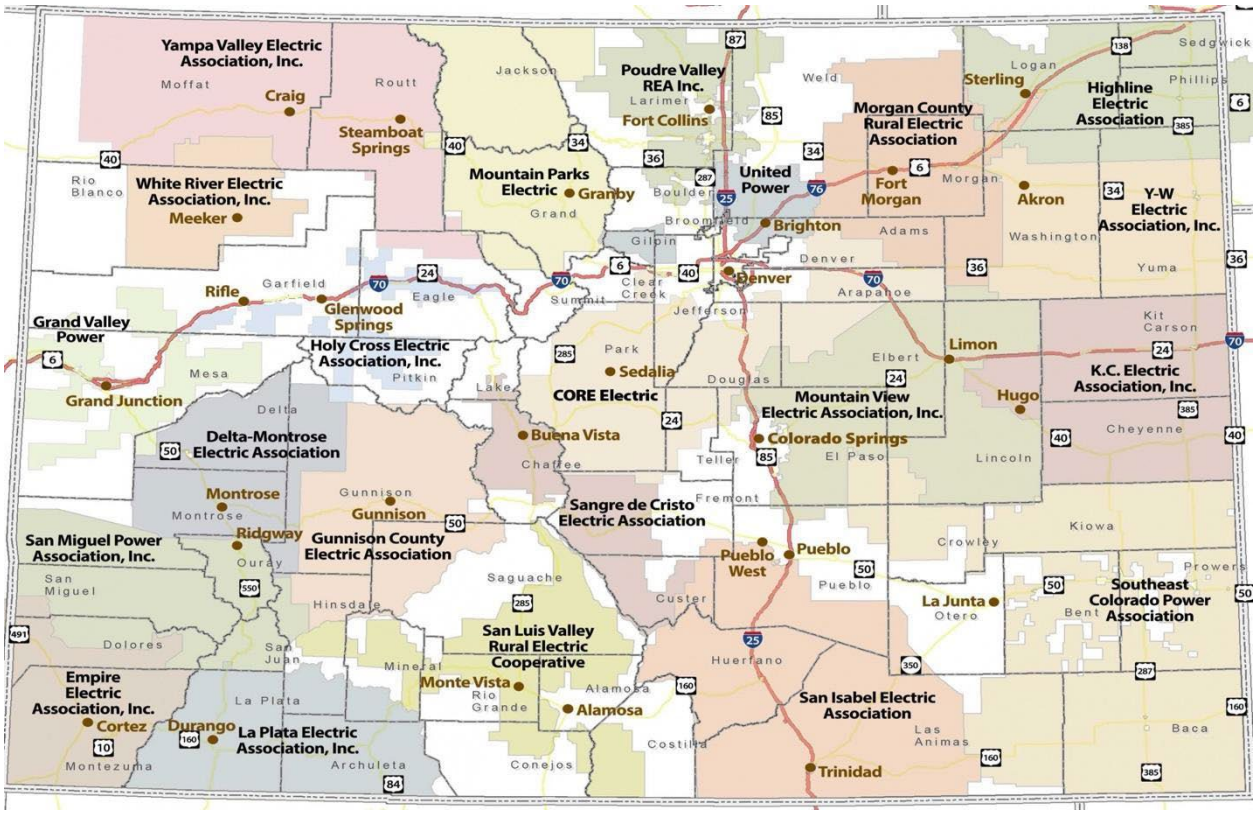
Today, more than 1.25 million Coloradans depend on a cooperative for their electricity. Serving 70% of the land area in Colorado, cooperatives reach every county but one. Colorado's electric cooperatives serve the electricity needs of communities from mountain towns and ski resorts to irrigated farmland. These needs are served by 26 RECs and one G&T. Four of these RECs are headquartered outside of Colorado and serve multi-state regions, and the other 22 are headquartered in Colorado and serve Colorado consumers. REC service territories are shown on the statewide electric service provided map in Figure 188.

Tri-State Generation and Transmission Association, a G&T, provides electricity to 17 of these 21 cooperatives. The remaining four cooperatives receive their power supply from an investor-owned utility or power marketer, with some self-generating a portion of their power from renewables such as solar. G&Ts serving Colorado are

experiencing changes in wholesale power production, as the state transitions from non-renewable energy sources such as coal and natural gas to renewables such as solar, wind, and hydro-electric power. These changes have been accelerated by the state's clean energy roadmap, the setting of benchmark targets, and the passing of several climate and energy bills.

In addition to providing electric service, cooperatives support their communities by promoting development and revitalization projects, small businesses, job creation, and other community services. In Colorado, electric co-ops have built a system that includes nearly 80,000 miles of power lines and employs more than 2,500 people.

FIGURE 188 – REC SERVICE TERRITORIES



Colorado Rural Electric Association (CREA)

CREA is a trade association that represents and serves 21 of Colorado's 22 electric cooperatives that distribute electricity, and Tri-State Generation and Transmission Association, the G&T that generates electricity for 17 of the state's cooperatives.

Organized in 1945 to provide a variety of services to its member cooperatives, the association allows cooperatives to share in the advantages of a larger utility operation, but maintain control and ownership at the local level. CREA is governed by a board of directors made up of one elected representative from each of Colorado's 21 distribution cooperatives, plus 3 CEOs from Colorado cooperatives, and one member from Tri-State G&T. The association exists as a united representative for its members and functions for their mutual benefit to promote rural electrification and to foster the principles upon which the electric cooperatives were founded. Some of the services and programs offered by CREA include:

- Legislative Support
- Communications
- Safety Training and Loss Control
- Education Programs

Planning Process

Background

Prior to 2010, federal hazard mitigation funding had not generally been available to Colorado RECs, who were largely unaware of the opportunity available to them. The development of an electric cooperative annex to the 2010 State of Colorado Hazard Mitigation Plan was done in response to the passage of the Disaster Mitigation Act of 2000 (DMA2K). The annex was developed so RECs would be included as participants in Colorado's State Hazard Mitigation Plan, making them eligible for the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance Program (HMA). Colorado's RECs initially participated in a 2021-22 plan update process, which was initiated by the Colorado Division of Homeland Security & Emergency Management (DHSEM) in partnership with RECs across the state. This 2023 update was undertaken to align this Annex with the E-SHMP 5-year update cycle.

REC service areas do not typically stop at county borders and may exist throughout multiple counties and or across state lines (see Figure A-2). Therefore, it makes sense to be covered by the state hazard mitigation plan rather than participating in multiple local planning efforts.

Plan Participants

Twenty-one of Colorado's 22 RECs participated in the update to the Rural Electric Cooperative Annex to the Colorado State Hazard Mitigation Plan, including completing a robust survey, developing mitigation actions, and approving the 2023 update to this Annex. CREA Safety & Loss Control Department coordinated and facilitated the planning process and authored the annex.

The 21 Colorado cooperatives participating in this planning effort combine for a total of 68,105 miles of distribution lines serving approximately 570,520 customers in 60 of the state's 64 counties. Table 108 lists the current participating cooperatives, the counties in which they operate, their miles of distribution line, the number of meters per line, and the total number of customers they serve.

TABLE 108 - PARTICIPATING COOPERATIVES

Cooperative	Counties Served	Meters Per Mile	Miles of Line	Number of Meters
Delta-Montrose Electric Association	Delta, Montrose, Gunnison	10.43	3,358	35,007
Empire Electric Association	Dolores, Montezuma, San Miguel	9.3	1,841	17,209
Grand Valley Power INC.	Mesa, Delta, Garfield,	11.77	1,702	20,027

Cooperative	Counties Served	Meters Per Mile	Miles of Line	Number of Meters
Gunnison County Electric Association	Gunnison, Hinsdale, Saguache	10	1,097	11,374
Highline Electric Association	Phillips, Logan, Sedgwick, Yuma, Washington, Weld, Morgan	2	5,170	10,509
Holy Cross Energy	Garfield, Pitkin, Eagle, Gunnison, Mesa	20.2	3,072	61,991
K.C. Electric Association	Cheyenne, Kit Carson, Lincoln	2.16	3,080	6,637
La Plata Electric Association	La Plata, Archuleta, Mineral, Hinsdale, San Juan	12.57	3,745	47,085
Morgan County Rural Electric Association	Adams, Arapahoe, Logan, Morgan, Washington, Weld	3.11	2,912	9,044
Mountain Parks Electric INC.	Grand, Jackson, Summit, Routt, Larimer	12	1,869	22,600

Cooperative	Counties Served	Meters Per Mile	Miles of Line	Number of Meters
Mountain View Electric Association INC.	Arapahoe, Crowley, Douglas, Elbert, El Paso, Lincoln, Pueblo, Washington	9.6	6,242	59,901
Poudre Valley Rural Electric Association INC.	Larimer, Weld, Boulder	11.4	4,428	50,518
San Isabel Electric Association INC.	Pueblo, Las Animas, Huerfano, Otero, Fremont, Custer, Costilla	5.31	4,659	24,748
San Luis Valley Rural Electric Cooperative INC.	Alamosa, Rio Grande, Costilla, Conejos, Mineral, Hinsdale, Saguache	4.6	2,776	12,975
San Miguel Power Association INC.	Montrose, San Miguel, Dolores, Mesa, San Juan, Hinsdale, Ouray	7.49	189	14,152

Cooperative	Counties Served	Meters Per Mile	Miles of Line	Number of Meters
Sangre de Cristo Electric Association INC.	Chaffee, Custer, Fremont, Lake, Saguache	7.7	1,796	13,853
Southeast Colorado Power Association	Baca, Bent, Cheyenne, Crowley, Kiowa, Las Animas, Lincoln, Otero, El Paso, Prowers, Pueblo	1.8	5,738	10,567
United Power INC.	Adams, Broomfield, Weld, Jefferson, Boulder, Gilpin	15.62	6,551	102,305
White River Electric Association	Rio Blanco, Moffat, Garfield	3.31	1,031	3,412
Y-W Electric Association INC.	Yuma, Washington	2.21	3,968	8,787
Yampa Valley Electric Association INC.	Routt, Moffat, Grand, Eagle, Rio Blanco	9.65	2,881	27,819

REC Survey

CREA conducted a survey at the end of 2022 of the 21 participating RECs, regarding their perceptions, past experiences, and concerns regarding the impacts of natural hazards on their utility systems. The survey contained 30 questions, collecting data about the hazards affecting each cooperative; the impacts of those hazards; mitigation capabilities, planning, and actions; and emergency response planning, needs, and activities. The survey was completed by 100% of the 21 distribution cooperatives surveyed, or 95% of the distribution cooperatives across the state. The responses to the survey can be found in Appendix A.

Survey highlights include:

- 67% of survey respondents have conducted a hazard analysis and risk assessment in the past 10 years (48% in the past three years).
- 90% of survey respondents have been involved with local pre-disaster mitigation planning in their local jurisdiction(s).
- 90% of survey respondents indicated their cooperative had participated in local, regional, or state-level emergency response planning.
- 71% of survey respondents indicated their cooperative had participated in local or state-level emergency response exercises.
- 76% of survey respondents indicated their cooperative had participated in local, regional, or state-level emergency response activities during an actual natural hazard event.
- 62% of survey respondents indicated their cooperative had worked with local emergency management coordinator(s) in identifying or developing mitigation measures to reduce the impact of natural disasters on critical electric infrastructure.

- Survey respondents identified the top natural hazards that had affected or damaged critical infrastructure in the cooperative service territory as – fire, lightning, winter weather, windstorms, thunderstorms, and floods.
- Survey respondents identified fire, winter weather, and windstorms as having the highest potential to impact critical electric infrastructure in their service territories.
- Less than 50% of survey respondents indicated a high capability to respond to the same natural hazards (fire, winter weather, and windstorms) that were identified as having the potential for high impact.
- Survey respondents rated the following assets as being the most critical to overall system integrity: substations, transformers, and transmission and distribution lines. Other assets ranked as being critical included human capital, telecommunications, control centers, warehouses, and vehicles.

Vulnerability Assessment

Impacts

Power outages have a huge impact on consumers, and for companies that supply power to homes for lighting, cooking, heating/cooling, and other essential needs, their main concern is keeping the lights on. As noted in *Economic Benefits of Increasing Electric Grid Resilience to Weather Outages*, severe weather is the single leading cause of power outages in the United States. Outages caused by severe weather such as thunderstorms, hurricanes, and blizzards account for 58% of outages observed since 2002 and 87% of outages affecting 50,000 or more customers (U.S. Department of Energy, 2013).

Power outages caused by the top natural hazards reported in our survey, fire, lightning, winter weather, windstorms, thunderstorms, and floods, can have significant economic impacts. These events may force the closure of businesses, schools, and government offices. Homeowners may see food spoiled, be displaced

from their homes, or experience flooding inside of their homes, all due to power outages. Large-scale power outages due to extreme weather may also require state and local governments to open shelter facilities to care for people displaced from their homes. For events reaching the level of a Presidentially Declared Disaster, FEMA may allow local governments to recover some costs, but in smaller events all the costs are borne by local businesses, communities, and the local government.

Power outages may also make vulnerable populations more vulnerable, and RECs serve 92% of the nation's poorest counties (NRECA, 2023). People recovering from illnesses, the elderly, children, and low-income populations, may be more vulnerable to the impacts of power outages than others. This is due to a variety of issues including carbon monoxide poisoning from improper use of generators, the inability to access safety information, increased crime during extended outages, dependence on electronic medical equipment, or those in rural areas experiencing longer outages due to proximity of personnel and equipment to infrastructure.

Past Disaster Data

Severe weather has and will continue to have a profound impact on RECs across the state. Data on past severe weather events and natural disasters in Colorado is collected by National Weather Service offices. The most severe events from 2010-2022 are listed below (NOAA, 2023).

- 2012 Wildfires
- Summer 2012 Heat & Drought
- September 2013 Floods
- 2013 Wildfires
- June 2015 Berthoud Tornado
- March 2016 Blizzard

- January 2017 Ice Storm
- May 2017 Denver Hailstorm
- Summer 2018 Hailstorms
- Winter 2018-19 Avalanches
- March 2019 Bomb Cyclone
- August 2019 Bethune hailstorm
- 2020 Cameron Peak and East Troublesome Fires
- June 2021 Weld County Tornado
- July 2021 Flash Flooding and Debris Flows in Cameron Peak burn area
- March 2021 Blizzard
- 2021 Marshall Fire

Hazard Profiles

During the planning process, CREA discussed hazard threats with cooperatives through meetings, surveys, and informal discussions. CREA identified 17 potential natural hazards that might affect the cooperatives based on the State Hazard Mitigation Plan: avalanche, drought, earthquake, erosion and deposition, expansive soil, extreme heat, fire, flood, hailstorm, landslides/debris flow, lightning, precipitation, subsidence, thunderstorm, tornado, windstorm, and winter weather. Of these natural hazards, six (fire, lightning, winter weather, windstorms, thunderstorms, and floods) had adversely impacted or were the greatest concerns for Colorado electric cooperatives. Only these six hazards will be profiled in this Annex, with all other hazards profiled in the State Hazard Mitigation Plan.

Floods

Flooding has the potential to damage REC buildings and utility infrastructure, and the historic floods of September 2013 did impact utility infrastructure. According to the National Weather Service, following a few days of light to moderate rains in portions of the state, the clouds unleashed torrents of rain across relatively large portions of the Front Range from the evening of September 11th through much of September 12th. A very rich, subtropical airmass situated itself over the state through much of this week, but on the evening of September 11th, a weak disturbance coincided with the showers and thunderstorms. That resulted in a very slow and almost stationary area of heavy rain along the Front Range. That rainfall, heavy at times, lasted through much of September 12th, before finally decreasing late that night. A few showers and storms occurred in the days that followed, with the last bout of locally heavy rain on Sunday, September 15th (NOAA, 2019).

Rainfall totals through this period reached 6 to 18 inches in many areas of the Front Range, including most of the foothills from around I-70 northward to the Wyoming border, eastern and northern sections of the Denver Metro area, and portions of Teller and El Paso County including western sections of Colorado Springs. The heaviest totals of 12 to 18 inches were widespread through much of Central Boulder County, stretching from Boulder north and west toward Jamestown, Lyons, and into Central Larimer County including the Estes Park area. The vast majority of this rain fell in about 30 hours from the 11th through the 12th. The 24-hour state precipitation record was broken in Fort Carson, Colorado, with a whopping 11.85 inches of rain falling on September 12th. Boulder set a calendar day record rainfall of 9.08 inches, which shattered the previous wettest day of 4.80 inches set on July 31, 1919. Finally, a one-month record of 18.16 inches in September also shattered Boulder's previous all-time monthly record of 9.59 inches set in May of 1995 (NOAA, 2019).

In addition to the initial damage it causes, flooding also has the potential to significantly limit cooperatives' recovery efforts. Eighteen of the cooperatives responding to the survey stated that critical assets had been damaged or adversely

affected by flooding. Seven rated its potential future impact on their infrastructure as high, with another nine rating it as medium. The flooding event of 2013 caused damage throughout the state and affected cooperative utility infrastructure, making recovery efforts more difficult.

Lightning

Eighteen cooperatives responding to the survey stated that lightning had previously damaged or adversely affected their critical assets. Nine rated its potential future impact on their infrastructure as high, with 11 rating it as medium. Lighting is a danger throughout the entire state of Colorado, which ranks 19th in the nation with respect to the number of cloud-to-ground lightning flashes (NOAA, 2020).

Based on data from the National Weather Service, lightning causes 2 fatalities and 12 injuries per year in the State of Colorado. In an average year, about 500,000 lighting flashes hit the ground in Colorado. In recent years, Colorado was tied for 7th in the nation when it comes to lighting fatalities (years 2008-2018). When you look at a longer period, Colorado ranks 4th in the nation for fatalities (years 1959-2019).

The unpredictable nature of lightning causes it to be one of the most feared weather elements. Individuals reliant on electricity to meet day-to-day health needs, such as those reliant on oxygen machines, may be impacted because of lightning-caused power outages. This group is susceptible to serious injury or death because of lightning-caused power outages. Additionally, lightning can often be the cause of equipment damage and wildfires, which can cause power outages and have long-reaching effects on infrastructure and resources.

Wildfire

Cooperative transmission lines and electrical supply lines serving neighborhoods in the wildland-urban interface are at risk of Colorado's wildfire hazard as are the rural communities they serve. Additionally, Colorado residents and businesses served by RECs are at risk for both wildland fires and electrical outages caused by fire-impacted electric infrastructure.

Wildfires can burn power poles and melt power lines, making them unable to transmit power until repairs can be made. Depending on the extent of fire-damaged electrical infrastructure, repairs could take days or months. Extended repairs have the potential for significant economic impacts on RECs due to lost revenue in addition to the cost of repairs.

Loss of electrical power following a fire could have an impact on cooperative customers, even if the customers were not otherwise impacted by the fire. Nineteen of the cooperatives responding to the survey stated that critical assets had been damaged or adversely affected by fire in the past. Seventeen cooperatives rated its potential future impact on their infrastructure as high, with four rating it as medium.

Colorado has had a devastating history dealing with wildfires, with 20 of the largest wildfires occurring in the last 20 years. Below are lists of Colorado's largest and most destructive fires (Colorado Department of Public Safety, 2023).

TABLE 109 - COLORADO'S LARGEST WILDFIRES BY ACREAGE

Rank	Fire	Acres	Year
1	Cameron Peak	208,913	2020
2	East Troublesome	193,812	2020
3	Pine Gulch	139,007	2020
4	Hayman	137,760	2002
5	Spring Creek	108,045	2018
6	High Park	87,284	2012
7	Missionary Ridge	70,285	2002
8	West Fork	58,570	2013
9	416	54,129	2018

Rank	Fire	Acres	Year
10	Papoose	49,628	2013
11	Bridger	25,800	2008
12	Last Chance	45,000	2012
13	Bear Springs	44,662	2001
14	MM 117	42,795	2018
15	Beaver Creek	28,380	2016
16	Bull Draw	36,549	2018
17	Badger Hole (Multiple States)	33,421	2018
18	Grizzly Creek	32,631	2020
19	Logan	32,546	2020
20	Burn Canyon	31,300	2002

TABLE 110 - COLORADO'S MOST DESTRUCTIVE WILDFIRES BY HOMES LOST

Rank	Fire	Acres	Year
1	Marshall	1,084	2020
2	Black Forest	489	2020
3	East Troublesome	366	2020
4	Waldo Canyon	346	2002
5	High Park	259	2018

Windstorms

High winds are an extremely common occurrence in Colorado, and often can result in severe damages. These windstorms can be widespread and highly damaging, or can

result in limited site-specific problems for electric cooperatives. On June 6, 2020, Washington, Logan, and Weld counties experienced severe straight-line winds that snapped several utility poles, knocking out power to several towns and farms.

Of the cooperatives that participated in the mitigation survey, 19 indicated that they have had electrical infrastructure adversely affected or damaged by windstorms. Thirteen of the respondents indicated that windstorms have a high potential to adversely impact electrical infrastructure, with eight ranking the potential impact as medium.

The most vulnerable electrical structures to wind events are overhead utility lines and poles, and many rural electric utility lines in Colorado are overhead. State-wide there are over 80,000 miles of distribution line, all of which can be considered vulnerable to damage from windstorms. To create a system that is less vulnerable to windstorms, overhead lines would need to be converted to underground lines or strengthened to withstand high wind events. This would be a massive and costly undertaking.

Winter Weather

Winter storms in Colorado typically generate wind in conjunction with precipitation, adding drifting snow to the impacts of winter storms. For RECs, the biggest impacts are seen in damaged power poles and lines, electrical wires, and communication towers.

During a winter weather event, telecommunications and power can be disrupted for days. Additionally, winter storm conditions impact rural electric staff's ability to reach damaged infrastructure, as well as their ability to do their jobs safely. Injury or death to linemen are real threats when these conditions exist. Heavy snow or accumulated ice can also isolate people from assistance or services. Because winter storms are common in Colorado, vulnerable populations can be significantly impacted. Those impacts include the inability to access services like grocery stores, pharmacies, or doctors, and to get to places of employment. When power is disrupted, consumers

are left in the dark without the ability to cook or heat their homes, and often without access to devices where they may receive safety communications or call for help.

Rural areas tend to be more susceptible to power outages during winter storms due to the high percentage of overhead lines and often being in areas that experience heavier snowfall and higher winds. These outages also tend to be of greater duration than those in more populated areas due to the proximity of crews and equipment. Rural locations also have a higher density of livestock and farming, which can be significantly impacted by winter weather.

Electric cooperatives are highly vulnerable to winter storms due to their expansive network across the state and the frequency of winter storms. Twenty of the 21 survey respondents indicated that their electrical infrastructure had been affected and/or damaged by winter storms. When asked what type of impact a winter storm has to potentially damage their infrastructure, 17 cooperatives responded that they posed a high potential threat, the highest of all natural hazards surveyed, with four responding medium. The cold temperatures that accompany winter storms also pose many challenges for utility crews. Difficult driving conditions including icy roads and drifting snow, as well as harsh environmental conditions like extreme temperatures and wind chill, put crews working outside, and their equipment, in danger.

Thunderstorms

Thunderstorms are common in Colorado and can generate many of the hazards already discussed here, such as high winds, lightning, heavy rain, snow, and potential flooding. Macrobursts such as the June 2020 storm that impacted Washington, Logan, Phillips, and Sedgwick counties can clock 100-plus mph winds, uproot trees, snap utility poles and lines, and damage buildings (NOAA, 2023).

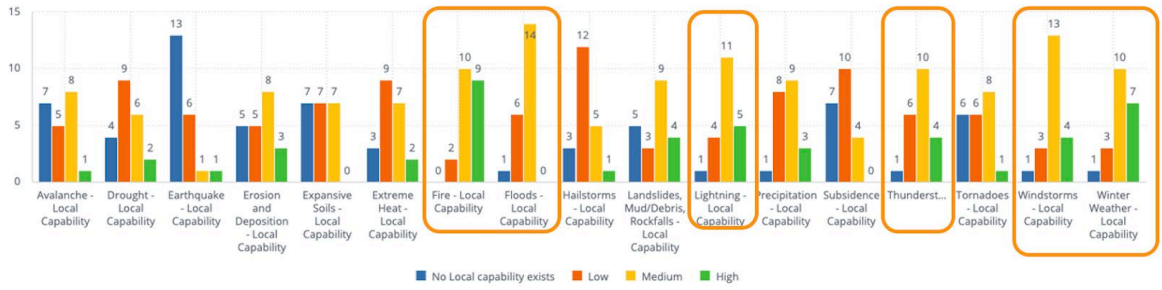
Sixteen of the cooperatives indicated that thunderstorms had adversely affected or damaged their infrastructure, with eight stating that thunderstorms posed a high potential threat and seven indicating medium. Thunderstorms have the potential to damage equipment and infrastructure and cause power outages across the state.

Capability Assessment

This section profiles the local capabilities of Colorado RECs to contend with the natural hazards listed in this plan. According to the survey results in Appendix A, to date 10 RECs have conducted a hazard analysis and risk assessment outside of this Annex process within the last three years. Nineteen cooperatives reported participating in both emergency response and mitigation planning with their local jurisdictions. Fifteen reported participating in state response exercises, and 16 reported having worked with local government during actual hazard events. Thirteen RECs reported having copies of their local government's mitigation or emergency response plans.

CREA identified 17 potential natural hazards that might affect the cooperatives based on the State Hazard Mitigation Plan: avalanche, drought, earthquake, erosion and deposition, expansive soil, extreme heat, fire, flood, hailstorm, landslides/debris flow, lightning, precipitation, subsidence, thunderstorm, tornado, windstorm, and winter weather. Of these natural hazards, six (fire, lightning, winter weather, windstorms, thunderstorms, and floods) had adversely impacted or were the greatest concerns for Colorado electric cooperatives. Of note is that less than half of the survey respondents indicated a high level of local capability to contend with those six natural hazards of greatest concern (Figure 189).

FIGURE 189 – HAZARD SURVEY RESULTS



Mitigation Planning

The purpose of developing an Annex to the Colorado State Hazard Mitigation Plan specific to RECs is to create a plan for mitigating future hazards and preparing for

disasters. This includes establishing a common set of mitigation goals across the state, identifying and prioritizing mitigation actions, and evaluating the success of those actions over time. Hazard mitigation activities are being pursued by RECs so future natural disasters will have less of an impact on the electric cooperative businesses, their customers, and ultimately residents of and visitors to the State of Colorado.

Mitigation actions taken by a REC may eliminate or reduce the effects of the natural hazards identified for Colorado. Consideration of which actions are taken and prioritization of those actions are based on factors such as the level and probability of risk reduction, cost, implementation challenges, and enforcement or audit requirements. There is typically a point beyond which taking additional mitigation actions will raise costs without appreciably enhancing the protection afforded.

Colorado's electric cooperatives support the goals and mission statement detailed in the Colorado State Hazard Mitigation Plan. The cooperatives also participated in a mitigation strategy workshop where they provided input into the development of the mitigation goals and actions shown below.

Going forward, the State of Colorado and CREA will continue to work with cooperatives to:

- Increase awareness of risks and utility infrastructure vulnerabilities to natural hazards
- Establish hazard mitigation goals
- Identify strategies to assist with mitigation implementation
- Establish priorities for the use of cooperative and public resources to mitigate hazards
- Enable cooperatives, as sub-applicants, to seek hazard mitigation funding from FEMA

- Improve recovery efforts related to natural disasters
- Minimize public safety concerns and power supply disruptions to persons served by electric cooperatives

Goals, Objectives, and Actions

The mitigation goals, objectives, and actions focus on the natural hazards most frequently affecting or damaging critical electrical infrastructure, or rated as having a high potential to do so. Being the most frequent and high-impact hazards also means they are likely to result in the highest cost to cooperatives. These hazards include:

- Wildfire
- Lighting
- Thunderstorms
- Windstorms
- Winter Weather
- Flooding

Goals & Objectives

Goal 1: Minimize the loss of life and personal injuries

Objective: Educate the members about hazards when natural disasters occur

Goal 2: Wildfire Mitigation

Objective: Reduce the damage to REC critical assets.

Goal 3: Reduce losses and damages to infrastructure due to natural disasters

Objective: Strengthen and harden lines where feasible

Goal 4: Minimize interruption of essential services

Objective: Strengthen and harden lines, line patrol, and hazard recognition

Goal 5: Enhance relationships between RECs and local emergency management

Objective: Participate in statewide emergency drills, participate in CREA statewide annual drills

Goal 6: Reduce costs of disaster response and recovery

Objective: Strengthen the mutual aid agreements, assist cooperatives when in need of assistance in recovery

Goal 7: Incorporate equity considerations into all mitigation strategies

Objective: Review cost analysis in future projects

Mitigation Actions

All 21 electric cooperatives provided input into the development of the mitigation actions included in Table 111. The 2023 update includes a revised order of actions that reflects the cooperatives' changing priorities. The Table also identifies the status of actions and progress made toward meeting plan goals. Colorado's RECs have been proactive in working to reduce the vulnerability of their systems and improve their resilience to natural hazards. All survey respondents reported having taken some mitigation actions to make critical electric infrastructure more resistant to natural hazards. Examples are changing from overhead to underground power lines, updating vegetation plans and clearing fuel sources to minimize wildfire potential, replacing poles, and installing backup generation in critical facilities. Many RECs have used their own funding to complete these activities, but several have begun to leverage FEMA HMA funding.

TABLE 111 - REC MITIGATION ACTIONS

Action / Goal #	Mitigation Measures	Project Location	Responsible Parties	Priority Rank	Projected Timetable	Progress Since 2011
1	Weather Monitoring	Statewide	Cooperative, County, State	High	Ongoing	Cooperatives use weather and radar monitoring and apps to stay on top of impending storms. Cooperatives communicate the status of outages through social media, texts, and other platforms to inform members about outages. Cooperatives have taken measures to educate members of what to do during outages.
2	Vegetation Management, Pole Replacement, Cross Arm Enhancement, Wildfire Mitigation	Statewide	Cooperative, USFS, County, State	High	Ongoing	Cooperatives have individually assessed and implemented plans to reduce wildfire exposure. Cooperatives have implemented vegetation management plans, increased member education, and identified and replaced high priority poles. Some have replaced overhead lines with hardened insulated (tree) wire that will not arc or cause fires.

Action / Goal #	Mitigation Measures	Project Location	Responsible Parties	Priority Rank	Projected Timetable	Progress Since 2011
3	Hot Spot Identification	Statewide	Cooperative	High	Ongoing	Cooperatives have individually assessed their systems to identify vulnerable or week spots in the system. Cooperative's patrol and inspect lines to identify areas for improvement. Cooperatives also test poles for integrity and safety.
4	Harden Communications, Facility Backup Generation, Remote Facility Control	Statewide	Cooperative	High	Ongoing	Cooperatives have individually taken steps to improve outage duration. Cooperatives participate in mutual aid programs for times when the cooperatives resources are strained. CREA supports a disaster aid plan that all the cooperatives participate in. The plan includes a committee that meets regularly and conducts drills.
5	Participation in Local and Emergency Management Exercises	Statewide	Cooperative, County, State	High	Ongoing	CREA has developed relationships with State Emergency resources, and communicates and provides updates to these contacts regularly. CREA attends meetings and participates in exercises

Action / Goal #	Mitigation Measures	Project Location	Responsible Parties	Priority Rank	Projected Timetable	Progress Since 2011
						with emergency managers throughout the state.
6	Strengthen lines, put lines underground where feasible	Statewide	Cooperative	High	Ongoing	CREA's disaster aid plan connects cooperatives and vendors to aid in response and recovery, sharing resources like labor, parts, and equipment. This includes a statewide communication plan for disaster assistance and disaster aid coordinators for each side of the state.
7	Maintenance Programs	Statewide	Cooperative	High	Ongoing	Cooperatives have individually assessed their systems for ways to improve the reliability of service. Some cooperatives have placed overhead lines underground, some have replaced overhead lines with hardened insulated wire, and some have implemented the use of drones to identify areas of concern.

ANNEX – HIGH AND SIGNIFICANT HAZARD DAMS

Table 112 provides a listing of all high and significant hazard dams across the State of Colorado, as of August 2023.

TABLE 112 COLORADO HIGH AND SIGNIFICANT HAZARD DAMS (AUGUST 2023)[56]

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00004	Bear Creek Dam - South Embankment	Jefferson	DENVER	High
CO00004	Bear Creek Dam	Jefferson	DENVER	High
CO00009	Empire (Outlet Embankment)	Weld	ORCHARD	High
CO00012	Horse Creek	Weld	KUNER	High
CO00016	Jackson Lake	Morgan	GOODRICH	High
CO00050	Trinidad Dam	Las Animas	TRINIDAD	High
CO00085	Hallenbeck #1	Mesa	WHITEWATER	High
CO00087	Hallenbeck #2	Mesa	WHITEWATER	High
CO00088	Hogchute	Mesa	WHITEWATER	High
CO00089	Juniata	Mesa	WHITEWATER	High
CO00091	Great Western	Broomfield	WESTMINSTER	High
CO00093	Ketner	Jefferson	WESTMINSTER	High
CO00100	Smith Irrigation	Adams	BRIGHTON	High
CO00101	Standley Lake	Jefferson	WESTMINSTER	High
CO00104	Quincy	Arapahoe	AURORA	High

[56] https://nid.sec.usace.army.mil/#/

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00105	Pinon Canyon Detention	Las Animas	TRINIDAD	High
CO00112	Riverside	Weld	ORCHARD	High
CO00123	Barnes Meadow	Larimer	FORT COLLINS	High
CO00127	Chambers Lake	Larimer	FORT COLLINS	High
CO00129	Cobb Lake	Larimer	WINDSOR	High
CO00130	Comanche	Larimer	FORT COLLINS	High
CO00138	Hourglass	Larimer	FORT COLLINS	High
CO00139	Indian Creek	Larimer	TIMNATH	High
CO00140	Long Draw	Larimer	FORT COLLINS	High
CO00143	Milton Seaman	Larimer	LAPORTE	High
CO00145	Panhandle	Larimer	FORT COLLINS	High
CO00146	Park Creek	Larimer	FORT COLLINS	High
CO00148	Spring Creek	Gunnison	GUNNISON	High
CO00150	Peterson Lake	Larimer	FORT COLLINS	High
CO00151	Taylor Park	Gunnison	GUNNISON	High
CO00154	Water Supply No 3	Larimer	FORT COLLINS	High
CO00157	Boyd Lake	Larimer	LOVELAND	High
CO00158	Gurley	San Miguel	NORWOOD	High
CO00161	Lone Cone	San Miguel	NORWOOD	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00162	Miramonte	San Miguel	NORWOOD	High
CO00165	Lon Hagler	Larimer	LOVELAND	High
CO00166	Mariano	Larimer	LOVELAND	High
CO00167	Rist - Benson	Larimer	LOVELAND	High
CO00171	Button Rock	Boulder	LYONS	High
CO00172	Clover Basin	Boulder	LONGMONT	High
CO00173	Foothills	Boulder	LONGMONT	High
CO00176	Left Hand Park	Boulder	LONGMONT	High
CO00177	Left Hand Valley	Boulder	BOULDER	High
CO00182	Pleasant Valley	Boulder	LONGMONT	High
CO00184	Trout Lake	San Miguel	Sawpit	High
CO00187	Lower Beaver Brook	Clear Creek	GOLDEN	High
CO00188	Upper Beaver Brook	Clear Creek	GOLDEN	High
CO00191	Lower Chinns	Clear Creek	IDAHO SPRINGS	High
CO00193	Fall River	Clear Creek	IDAHO SPRINGS	High
CO00195	Georgetown	Clear Creek	LAWSON	High
CO00197	Kalcevic	Adams	WESTMINSTER	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00199	Loch Lomond	Clear Creek	IDAHO SPRINGS	High
CO00201	Magic Mountain #1	Jefferson	PLEASANT VIEW	High
CO00203	Maple Grove	Jefferson	LAKEWOOD	High
CO00205	Ralston	Jefferson	ARVADA	High
CO00206	Buckeye #1	Montrose	PARADOX	High
CO00210	Lower Urad	Clear Creek	EMPIRE	High
CO00213	Barker Meadow	Boulder	BOULDER	High
CO00214	Baseline - East	Boulder	BOULDER	High
CO00215	Boulder - North	Boulder	BOULDER	High
CO00219	Erie	Boulder	ERIE	High
CO00223	Glacier Lake	Boulder	BOULDER	High
CO00227	Hayden	Boulder	BOULDER	High
CO00230	Jasper	Boulder	ELDORA	High
CO00231	Kossler	Boulder	ELDORADO SPRINGS	High
CO00232	Leggett & Hillcrest	Boulder	BOULDER	High
CO00237	Cerro	Montrose	MONTROSE	High
CO00240	Mckay Lake - East	Adams	WESTMINSTER	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00241	Marshall Lake	Boulder	MARSHALL	High
CO00243	Mesa Park	Boulder	BOULDER	High
CO00247	Gross	Boulder	Eldorado Springs	High
CO00249	Silver Lake	Boulder	BOULDER	High
CO00250	Six Mile - Main	Boulder	BOULDER	High
CO00256	Valmont 'A'	Boulder	BOULDER	High
CO00259	Waneka	Boulder	LAFAYETTE	High
CO00267	East	Jefferson	LAKEWOOD	High
CO00287	Franktown Parker Fpp-1	Douglas	DENVER	High
CO00299	Pueblo	Pueblo	PUEBLO	High
CO00300	Englewood	Arapahoe	LITTLETON	High
CO00301	Main	Jefferson	LAKEWOOD	High
CO00306	Full Moon Aka Crystal	Ouray		High
CO00307	Smith	Jefferson	LAKEWOOD	High
CO00328	Evergreen	Jefferson	EVERGREEN	High
CO00336	Polly A. Deane	Jefferson	LITTLETON	High
CO00342	Tarryall	Park	DECKERS	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00343	Wagon Tongue	Park	LAKE GEORGE	High
CO00345	Wellington	Jefferson	BUFFALO CREEK	High
CO00347	Woodland Park	El Paso	WOODLAND PARK	High
CO00351	Antero	Park	HARTSEL	High
CO00357	Cheesman	Jefferson	DECKERS	High
CO00359	Eleven Mile Canyon	Park	LAKE GEORGE	High
CO00361	Barren	Delta	CEDAREDGE	High
CO00363	Jefferson Lake	Park	JEFFERSON	High
CO00372	Montgomery	Park	ALMA	High
CO00373	Big Battlement	Delta	CEDAREDGE	High
CO00377	Flagler	Kit Carson	ST. FRANCIS, KANSAS	High
CO00384	Point of Rocks	Logan	ILIFF	High
CO00385	Prewitt	Washington	MERINO	High
CO00387	Crystal	Montrose	DELTA	High
CO00397	Beaver	Gunnison	PAONIA	High
CO00404	Spring Run #2	El Paso	COLORADO SPRINGS	High
CO00407	North Catamount	Teller	GREEN MT FALLS	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00408	South Catamount	Teller	GREEN MT FALLS	High
CO00410	Crystal Creek	El Paso	GREEN MT FALLS	High
CO00418	Fountain Valley No 2	El Paso	WIDEFIELD	High
CO00426	Manitou	El Paso	CASCADE	High
CO00428	South Suburban	El Paso	COLORADO SPRINGS	High
CO00434	Rampart	El Paso	Colorado Springs	High
CO00435	Bruce Park	Delta	PAONIA	High
CO00436	Palmer Lake #2	El Paso	PALMER LAKE	High
CO00438	Penrose	El Paso	COLORADO SPRINGS	High
CO00444	Gold Camp	El Paso	COLORADO SPRINGS	High
CO00445	Big Tooth	El Paso	MANITOU SPRINGS	High
CO00446	Mt. Elbert Forebay Saddle Dike	Lake	NONE	High
CO00446	Mt. Elbert Forebay	Lake	KOBE	High
CO00446	Mt. Elbert Forebay Inlet/Outlet Dike	Lake	NONE	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00450	Woodmoor Lake	El Paso	MONUMENT	High
CO00457	North Fork	Chaffee	PONCHA SPRINGS	High
CO00458	Brush Hollow	Fremont	PUEBLO	High
CO00461	Canon Wtrsd C-3	Fremont	CANON CITY	High
CO00462	Canon Wtrshd. Det. C-4	Fremont	CANON CITY	High
CO00463	Dry Creek Flood Control	Fremont	FLORENCE	High
CO00470	Niver Creek Detention	Adams	THORNTON	High
CO00476	Cedar Mesa	Delta	CEDAREDGE	High
CO00482	Fairview	Montrose	MONTROSE	High
CO00487	Comanche	Pueblo	PUEBLO	High
CO00489	Beckwith	Pueblo	COLORADO CITY	High
CO00493	St. Charles #3	Pueblo	PUEBLO	High
CO00494	Lake Isabel	Pueblo		High
CO00498	Horseshoe Lake	Huerfano	WALSENBURG	High
CO00511	Alessi Flood Control Dam	Huerfano	WALSENBURG	High
CO00512	Floodwater Ret. B-3	Larimer	WELLINGTON	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00513	Wahatoya Lake	Huerfano	LA VETA	High
CO00514	Walsenburg City Lake	Huerfano	WALSENBURG	High
CO00515	Adobe Creek	Bent	LAS ANIMAS	High
CO00524	Floodwater Ret. B-4	Larimer	WELLINGTON	High
CO00533	Fisher Peak Det. Fpc-1	Las Animas	TRINIDAD	High
CO00534	Fisher Peak Det. Fpc-2	Las Animas	TRINIDAD	High
CO00543	Monument Lake	Las Animas	MONUMENT PARK	High
CO00544	North Lake	Las Animas	VIGIL	High
CO00556	Crawford	Delta	CRAWFORD	High
CO00564	Deep Slough	Delta	CEDAREDGE	High
CO00572	Hotel Lake Dam	Delta	CEDAREDGE	High
CO00580	Kennicott Slough	Delta	CEDAREDGE	High
CO00582	Kiser Slough	Delta	CEDAREDGE	High
CO00594	Marcot Park	Delta	CEDAREDGE	High
CO00598	Monument	Gunnison	PAONIA	High
CO00601	Eggleston	Delta	CEDAREDGE	High
CO00603	Onion Valley	Montrose	CRAWFORD	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00604	Overland #1	Delta	PAONIA	High
CO00607	Park	Delta	CEDAREDGE	High
CO00629	Carl Smith	Delta	LAZEAR	High
CO00639	Ward Creek	Delta	CEDAREDGE	High
CO00640	Ward Lake	Delta	CEDAREDGE	High
CO00643	Weir and Johnson	Delta	CEDAREDGE	High
CO00645	West #1	Delta	HOTCHKISS	High
CO00653	Youngs Creek #1 & 2	Delta	CEDAREDGE	High
CO00663	Goose Pasture Tarn	Summit	BRECKENRIDGE	High
CO00668	Eagle Park Reservoir	Eagle	REDCLIFF	High
CO00670	Sylvan Lake	Eagle	EAGLE	High
CO00671	Robinson	Eagle	REDCLIFF	High
CO00673	Homestake Project	Eagle	MINTURN	High
CO00676	Chapman Reservoir	Pitkin	NORRIE	High
CO00677	Consolidated	Garfield	GLENWOOD SPRINGS	High
CO00678	Crooked Creek	Eagle	THOMASVILLE	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00683	Lake Ann	Pitkin	EL JEBEL	High
CO00684	Spring Park	Eagle	EL JEBEL	High
CO00685	Wildcat	Pitkin	BASALT	High
CO00693	Grass Valley	Garfield	SILT	High
CO00695	Meadow Creek	Garfield	NEW CASTLE	High
CO00712	Little King Ranch	Grand	HOT SULPHUR SPRINGS	High
CO00713	Meadow Creek	Grand	TABERNASH	High
CO00714	Monarch Lake	Grand	HOT SULPHUR SPGS	High
CO00717	Williams Fork Main	Grand	Parshall	High
CO00719	Granby #12	Delta	CEDAREDGE	High
CO00720	Granby #5-11	Delta	CEDAREDGE	High
CO00741	Roatcap Wash Watershed Rw-1	Montrose	DELTA	High
CO00747	Garnet Mesa	Delta	DELTA	High
CO00751	Limon Watershed L-1	Lincoln	LIMON	High
CO00759	Two Buttes	Baca	HOLLY	High
CO00762	Alberta Park	Mineral	SOUTH FORK	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00763	Beaver Park	Rio Grande	SOUTH FORK	High
CO00764	Big Meadows - Main Dam	Mineral	SOUTH FORK	High
CO00767	Continental	Hinsdale	SOUTH FORK	High
CO00770	Fuchs	Rio Grande	DEL NORTE	High
CO00772	Humphreys	Mineral	4UR Ranch	High
CO00775	Metroz Park, Lower	Mineral	SOUTH FORK	High
CO00776	Million Reservoir	Rio Grande	PRIVATE PROPERTY	High
CO00778	Rito Hondo	Hinsdale	SOUTH FORK	High
CO00780	Santa Maria	Mineral	SOUTH FORK	High
CO00788	Trujillo Meadows	Conejos	ANTONITO	High
CO00790	Sanchez	Costilla	SAN LUIS	High
CO00800	Vouga	Saguache	GUNNISON	High
CO00805	Rio Grande	Hinsdale	SOUTH FORK	High
CO00806	Cottonwood #5	Mesa	MOLINA	High
CO00807	Leon Lake	Mesa	COLLBRAN	High
CO00815	Terrace	Conejos	CAPULIN	High
CO00818	Mountain Home	Costilla	ARROYA HONDO, NM	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00823	Loveland Water Storage	Larimer	LOVELAND	High
CO00825	Flowing Park	Mesa	WHITEWATER	High
CO00831	Upper Highline	Mesa	MACK	High
CO00834	Parker Basin #3	Mesa	MOLINA	High
CO00837	North Poudre # 2	Larimer	FORT COLLINS	High
CO00838	North Poudre # 3	Larimer	WELLINGTON	High
CO00841	North Poudre # 6	Larimer	FORT COLLINS	High
CO00842	North Poudre #15	Larimer	FORT COLLINS	High
CO00845	Richards	Larimer	FORT COLLINS	High
CO00850	Terry Lake	Larimer	FORT COLLINS	High
CO00851	Cache La Poudre	Larimer	TIMNATH	High
CO00852	Warren Lake	Larimer	WINDSOR	High
CO00853	Windsor	Weld	WINDSOR	High
CO00854	Windsor Lake	Weld	WINDSOR	High
CO00855	Windsor #8	Larimer	FORT COLLINS	High
CO00861	Valley No. 1	El Paso	COLORADO SPRINGS	High
CO00871	Upper Blue	Summit	BRECKENRIDGE	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00875	Dillon	Summit	SILVERTHORNE	High
CO00881	Noecker	Eagle	EAGLE	High
CO00895	Stagecoach	La Plata		High
CO00895	Terminal	La Plata	Rockwood	High
CO00897	Bull Creek #4	Mesa	MOLINA	High
CO00900	Fisher Canon	El Paso	COLORADO SPRINGS	High
CO00901	Lake Moraine	El Paso	MANITOU SPRINGS	High
CO00902	Teller	Pueblo	Pueblo	High
CO00922	Grimes Brooks	Routt	MC COY	High
CO00925	Heart Lake	Garfield	DOTSERO	High
CO00934	L E D E	Eagle	GYPSUM	High
CO00935	Big Creek #1	Mesa	PLATEAU CITY	High
CO00937	Big Creek #3	Mesa	PLATEAU CITY	High
CO00949	Coon Creek #1	Mesa	MESA	High
CO00960	Indian Wash Det.	Mesa	GRAND JUNCTION	High
CO00962	Big Beaver	Rio Blanco	MEEKER	High
CO00976	Elkhead Creek	Moffat	CRAIG	High
CO00980	Blunn	Jefferson	ARVADA	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01001	Pole Mountain	Jackson	COWDREY	High
CO01015	Sheriff	Rio Blanco	MILNER	High
CO01020	Fish Creek	Routt	STEAMBOAT SPRINGS	High
CO01022	Lester Creek	Routt	MILNER	High
CO01030	Stillwater #1	Garfield	YAMPA	High
CO01036	Willow Creek	Routt	MILNER	High
CO01037	Jerry Creek #1	Mesa	GRAND JUNCTION	High
CO01045	Palisade Cabin	Mesa	PALISADE	High
CO01047	Somerville-Mccullah	Mesa	GRAND JUNCTION	High
CO01050	Y T Ranch	Mesa	COLLBRAN	High
CO01060	Durango Terminal	La Plata	DURANGO	High
CO01062	Haviland Lake	La Plata	DURANGO	High
CO01066	Turner	La Plata	DURANGO	High
CO01069	Wommer #1	La Plata	BAYFIELD	High
CO01075	Red Mesa Ward	La Plata	FARMINGTON, NM	High
CO01077	Bauer Lake #2 - Main Dam	Montezuma	MANCOS	High
CO01084	Groundhog	Dolores	DOLORES	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01089	Narraguinnep - Main Dam	Montezuma	BLUFF, UT	High
CO01091	Summit - Main Dam	Montezuma	DOLORES	High
CO01092	Totten	Montezuma	CORTEZ	High
CO01094	Hatcher	Archuleta	PAGOSA SPRINGS	High
CO01095	Lake Capote	Archuleta	BLANCO	High
CO01097	Stevens	Archuleta	PAGOSA SPRINGS	High
CO01099	Williams Creek	Hinsdale	PIEDRA	High
CO01116	Lake Henry	Crowley	ORDWAY	High
CO01143	Clear Creek	Chaffee	BUENA VISTA	High
CO01147	Windsor	Denver	DENVER	High
CO01153	Mc Lellan	Arapahoe	LITTLETON	High
CO01157	Black Hollow	Weld	SEVERANCE	High
CO01163	Douglas	Larimer	FORT COLLINS	High
CO01164	Elder	Larimer	FORT COLLINS	High
CO01165	Fossil Creek	Larimer	WINDSOR	High
CO01169	Halligan	Larimer	FORT COLLINS	High
CO01174	Long Pond	Larimer	FORT COLLINS	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01181	Tucker Lake - South Dam	Jefferson	ARVADA	High
CO01187	Lake Loveland	Larimer	LOVELAND	High
CO01200	Beaver Park	Boulder	LYONS	High
CO01216	Leyden	Jefferson	ARVADA	High
CO01221	Davis No. 1	Boulder	BOULDER	High
CO01226	Lagerman	Boulder	LONGMONT	High
CO01239	Cabin Creek Upper	Clear Creek	Georgetown	High
CO01240	Cabin Creek Lower	Clear Creek	Georgetown	High
CO01241	Clear Lake	Clear Creek	Georgetown	High
CO01250	Hyatt	Jefferson	ARVADA	High
CO01279	Spring Gulch Dam	Douglas	DENVER	High
CO01280	Cherry Creek Dam	Arapahoe	DENVER	High
CO01281	Chatfield Dam	Douglas	DENVER	High
CO01283	John Martin Dam - Fort Lyon Protective Works	Bent	LAMAR	High
CO01283	John Martin Dam	Bent	LAMAR	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01299	Kettle Creek Diversion Dam	El Paso	COLORADO SPRINGS	High
CO01300	Bonny	Yuma	HALE	High
CO01304	Skeel	Denver	DENVER	High
CO01323	St. Charles Mesa #2	Pueblo	PUEBLO	High
CO01327	Martin Lake	Huerfano	WALSENBURG	High
CO01361	Benchmark Lake	Eagle	AVON	High
CO01376	Jerry Creek #2	Mesa	GRAND JUNCTION	High
CO01404	Johnson	La Plata	DURANGO	High
CO01406	Floodwater Ret. B-2	Larimer	WELLINGTON	High
CO01545	Grizzly	Pitkin	ASPEN	High
CO01650	Carter Lake Dam No. 2	Larimer	BERTHOUD	High
CO01650	Carter Lake Dam No. 3	Larimer	LOVELAND	High
CO01650	Carter Lake Dam No. 1	Larimer	BERTHOUD	High
CO01654	Flatiron	Larimer	LOVELAND	High
CO01656	Granby Dike 4	Grand	GRANBY	High
CO01656	Granby Dike 3	Grand	GRANBY	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01656	Granby Dike 2	Grand	GRANBY	High
CO01656	Granby Dike 1	Grand	GRANBY	High
CO01656	Granby	Grand	GRANBY	High
CO01658	Green Mountain	Summit	KREMMLING	High
CO01659	Horsetooth - Satanka Dike	Larimer	FORT COLLINS	High
CO01659	Horsetooth - Soldier Canyon	Larimer	FORT COLLINS	High
CO01659	Horsetooth - Dixon Canyon	Larimer	FORT COLLINS	High
CO01659	Horsetooth - Spring Canyon	Larimer	FORT COLLINS	High
CO01659	Horsetooth	Larimer	FORT COLLINS	High
CO01660	Marys Lake Dike No. 2	Larimer	ESTES PARK	High
CO01660	Marys Lake Dike No. 1	Larimer	ESTES PARK	High
CO01662	Olympus	Larimer	OLYMPUS HEIGHTS	High
CO01663	Rattlesnake	Larimer	LOVELAND	High
CO01664	Ruedi	Pitkin	BASALT	High
CO01666	Shadow Mountain Dike	Grand		High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01666	Shadow Mountain	Grand	GRANBY	High
CO01669	Sugar Loaf Dike	Lake	NONE	High
CO01669	Sugar Loaf	Lake	BUENA VISTA	High
CO01670	Willow Creek Bor Co	Grand	HOT SULPHUR SPRINGS	High
CO01671	Platoro	Conejos	PLATORO	High
CO01671	Platoro Dike	Conejos	PLATORO	High
CO01675	Blue Mesa	Gunnison	AUSTIN	High
CO01677	Bonham-Wells	Mesa	PLATEAU CITY	High
CO01683	Fruitgrowers	Delta	AUSTIN	High
CO01685	Jackson Gulch	Montezuma	MANCOS	High
CO01687	Kitson	Mesa	MOLINA	High
CO01688	Lemon	La Plata	BONDAD	High
CO01689	Morrow Point	Montrose	DELTA	High
CO01691	Paonia	Gunnison	SOMERSET	High
CO01692	Rifle Gap	Garfield	RIFLE	High
CO01693	Silver Jack	Gunnison	DELTA	High
CO01695	Vallecito	La Plata	BAYFIELD	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01697	Vega	Mesa	COLLBRAN	High
CO01754	Cottonwood #1	Mesa	MOLINA	High
CO01756	Cottonwood #4	Mesa	MOLINA	High
CO01759	Water Supply No 4	Larimer	FORT COLLINS	High
CO01766	Joe Wright	Larimer	FORT COLLINS	High
CO01769	Handy	Larimer	BERTHOUD	High
CO01771	Ish #3 (Main Dam)	Larimer	BERTHOUD	High
CO01772	Johnstown	Weld	JOHNSTOWN	High
CO01775	Mccall	Boulder	LONGMONT	High
CO01782	Idaho Springs	Clear Creek	IDAHO SPRINGS	High
CO01783	Upper Long Lake	Jefferson	ARVADA	High
CO01784	Lower Long Lake	Jefferson	ARVADA	High
CO01791	Willow Springs #1	Jefferson	LAKEWOOD	High
CO01797	Julesburg #4	Sedgwick	SEDGWICK	High
CO01799	South Lake	El Paso	COLORADO SPRINGS	High
CO01821	Bergen East	Jefferson	MORRISON	High
CO01823	Harriman	Jefferson	LAKEWOOD	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01886	Offield	Moffat	POT CREEK CAMPGROUND	High
CO01888	Barr Lake	Adams	HUDSON	High
CO01899	Milton Lake	Weld	KERSEY	High
CO01917	Long Lake	Routt	STEAMBOAT SPRINGS	High
CO01972	Glen Eyrie #3	El Paso	COLORADO SPRINGS	High
CO01973	Highline	El Paso	COLORADO SPRINGS	High
CO01984	Wildhorse	Weld	NONE	High
CO02005	Dillon	Summit	Silverthorne	High
CO02012	Marston Lake - North Dam	Denver	DENVER	High
CO02015	College #3	Larimer	FORT COLLINS	High
CO02018	North Poudre # 5	Larimer	FORT COLLINS	High
CO02020	Rocky Ridge	Larimer	FORT COLLINS	High
CO02036	Kluver	Larimer	FORT COLLINS	High
CO02045	Twin Lakes Bor	Lake	GRANITE	High
CO02049	Mason	Teller	PUEBLO	High
CO02050	Mc Reynolds	Teller	PUEBLO	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02053	Florence South Res. No. 1	Custer	COAL CREEK	High
CO02066	Mount Pisgah	Teller	CANON CITY	High
CO02068	Deweese	Custer	CANON CITY	High
CO02069	St. Charles #2	Pueblo	PUEBLO	High
CO02088	Lookout Mountain	Jefferson	GOLDEN	High
CO02093	Clinton Gulch	Summit	FRISCO	High
CO02126	Sylvan	Grand	PARSHALL	High
CO02128	Nissen #2	Broomfield	BROOMFIELD	High
CO02140	Lake Catamount	Routt	STEAMBOAT SPRINGS	High
CO02167	Boss Lake	Chaffee	GARFIELD	High
CO02188	Black Lake #1	Eagle	VAIL	High
CO02214	Holly	Arapahoe	LITTLETON	High
CO02219	Strontia Springs	Douglas	Kassler	High
CO02248	Yamcolo	Garfield	YAMPA	High
CO02259	Apishapa	Las Animas	AGUILAR	High
CO02289	Valley No. 2	El Paso	COLORADO SPRINGS	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02345	Kelly Road Detention	Denver	DENVER	High
CO02363	East Portal Dam	Larimer		High
CO02364	Lily Lake Dam	Larimer	ESTES PARK, CO	High
CO02438	Chapel Hills #2	El Paso	COLORADO SPRINGS	High
CO02440	Non Potable Reservoir Dam 2	El Paso	COLORADO SPRINGS	High
CO02441	Non Potable Reservoir Dam 3	El Paso	COLORADO SPRINGS	High
CO02572	Taylor Draw	Rio Blanco	Rangely	High
CO02666	Bull Canal (Main Reservoir)	Weld	FORT LUPTON	High
CO02667	Rawhide	Larimer	WELLINGTON	High
CO02674	Harper Lake	Boulder	LOUISVILLE	High
CO02676	Morrison Raw Water	Jefferson	MORRISON	High
CO02677	Spinney Mountain	Park	LAKE GEORGE	High
CO02698	Middle Fork	Garfield	GRAND VALLEY	High
CO02702	Stagecoach	Routt	Steamboat Springs	High
CO02706	Ridgway	Ouray	COLONA	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02707	Mcphee - Great Cut Dike	Montezuma	ANETH, UT	High
CO02707	Mcphee	Montezuma	SLIDE ROCK	High
CO02708	Westerly Creek	Denver	DENVER	High
CO02709	Senac	Arapahoe	AURORA	High
CO02719	Equalizer	Larimer	MILLIKEN	High
CO02725	Saddle Pond	Pitkin	WOODY CREEK	High
CO02751	Fairmount Reservoir	Jefferson	WHEAT RIDGE	High
CO02774	Shavano Valley #1-Sv-1	Montrose	DELTA	High
CO02777	Superior	Boulder	SUPERIOR	High
CO02778	Terminal	Broomfield	WESTMINSTER	High
CO02779	Julesburg #1	Logan	DORSEY	High
CO02780	Julesburg #1a	Logan	DORSEY	High
CO02781	Julesburg #2	Sedgwick	DORSEY	High
CO02782	Julesburg #3	Sedgwick	DORSEY	High
CO02785	Lake Grant	Gunnison	SKYLAND METRO	High
CO02786	Chase Gulch	Gilpin	BLACK HAWK	High
CO02787	Woman Creek	Jefferson	WESTMINSTER	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02788	Ritschard	Grand	KREMMLING	High
CO02795	Regulating Reservoir	El Paso	COLORADO SPRINGS	High
CO02797	Mountain View	Archuleta	PAGOSA SPRINGS, CO	High
CO02798	Marston Lake - South Dam	Denver	DENVER	High
CO02799	Marston Lake - East Dam	Denver	DENVER	High
CO02800	Marston Lake - Northwest Dike	Denver	DENVER	High
CO02804	Western Hillside Reservoir	Eagle	AVON	High
CO02810	Fishers Canyon Debris Basin Dam	El Paso	COLORADO SPRINGS	High
CO02813	Trout Creek	Chaffee	NATHROP	High
CO02814	Fortune	Jefferson	WESTMINSTER	High
CO02816	Exposition Park	Arapahoe	AURORA	High
CO02819	Boulder - South	Boulder	BOULDER	High
CO02820	Baseline - Northwest	Boulder	BOULDER	High
CO02835	Mckay Lake - South	Broomfield	WESTMINSTER	High
CO02840	Empire (Nw Embankment)	Weld	ORCHARD	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02841	Empire (Mcintyre Dike)	Weld	ORCHARD	High
CO02842	Empire (East Embankment)	Morgan	ORCHARD	High
CO02845	Shavano Valley #2-Sv-2	Montrose	OLATHE	High
CO02851	Fish Creek Saddle	Routt	STEAMBOAT SPRINGS	High
CO02852	Guanella	Clear Creek	EMPIRE	High
CO02853	Jerry Creek Dike 1	Mesa	GRAND JUNCTION	High
CO02857	Longmont Wtp Forebay Embankment	Boulder	HYGIENE	High
CO02858	South Platte Reservoir	Arapahoe	LITTLETON	High
CO02859	Siena	Broomfield	LAFAYETTE	High
CO02861	Barton Porter West	Garfield	SILT	High
CO02864	South Tani Reservoir	Adams	THORNTON	High
CO02865	Dunes	Adams	BRIGHTON	High
CO02866	Spires Broadmoor North Debris Dam	El Paso	COLORADO SPRINGS	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02867	Spires Broadmoor South Debris Dam	El Paso		High
CO02869	Big Meadows - North Dike	Mineral	SOUTH FORK	High
CO02872	Humphreys - Spillway Dam	Mineral	SOUTH FORK	High
CO02874	Erickson	Weld	EVANS	High
CO02875	Narraguinnep - Dam 2	Montezuma	BLUFF, UT	High
CO02876	Narraguinnep - Dam 3	Montezuma	BLUFF, UT	High
CO02882	Summit - South Dam	Montezuma	BLUFF, UT	High
CO02890	Lake Deborah	Pitkin	SNOWMASS VILLAGE	High
CO02896	Pine Brook	Boulder	BOULDER	High
CO02905	Flood Control Basin No. 1	Larimer	FORT COLLINS	High
CO02922	Dry Creek	Larimer	BERTHOUD	High
CO02924	Genesee No. 2	Jefferson		High
CO02932	Crow Lane No. 1	Larimer	LYONS	High
CO02939	James Tingle	Park	JEFFERSON	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02945	Stratton	Teller	COLORADO SPRINGS	High
CO02949	Rueter Hess	Douglas	PARKER	High
CO02952	Ridges Basin	La Plata	DURANGO	High
CO02955	Shoshone Diversion Dam	Garfield	GLENWOOD SPRINGS	High
CO02956	Ten Mile Pond #3 Dam	Summit	Frisco, CO	High
CO02957	Mayflower Pond # 5	Summit	Frisco, CO	High
CO02958	Robinson Tailing Pond #1dam	Summit	Red Cliff	High
CO02968	Bosley Wash Detention Basin	Mesa	CLIFTON	High
CO02979	East Side Detention Facility	Larimer	TIMNATH	High
CO02982	Florence South Res. No. 2	Fremont	FLORENCE	High
CO02989	Hunters Overlook Reservoir	Weld		High
CO02991	Leach Creek Detention Basin	Mesa	GRAND JUNCTION	High
CO03011	Tucker Lake - North Dam	Jefferson	ARVADA	High

NID ID	Dam Name	County	City	Hazard Potential Classification
CO03020	Chambers Reservoir	Douglas	PARKER, CO	High
CO03021	Long Hollow	La Plata		High
CO03032	Mundt	Weld		High
CO03046	Fort Lupton Terminal	Weld	UNINCORPIRATED WELD COUNTY	High
CO03047	Garden of The Gods	El Paso	COLORADO	High
CO00003	Bijou #2 Dam #1	Morgan	LOG LANE VILLAGE	Significant
CO00070	Anderson #1	Mesa	GRAND JUNCTION	Significant
CO00072	Anderson #2	Mesa	GRAND JUNCTION	Significant
CO00076	Fruita #1	Mesa	GRAND JUNCTION, CO	Significant
CO00078	Fruita #2	Mesa	WHITEWATER	Significant
CO00090	Coal Ridge Waste Dam #1	Weld	PLATTEVILLE	Significant
CO00095	Lower Latham	Weld	KERSEY	Significant
CO00110	Gobbo #1	Mesa	DEWEY, UTAH	Significant
CO00119	Gobbo #3	Mesa	DEWEY, UTAH	Significant
CO00131	Curtis Lake	Larimer	FORT COLLINS	Significant
CO00132	Dowdy Lake	Larimer	FORT COLLINS	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00137	Greeley Lake West	Weld	GREELEY .	Significant
CO00156	Berthoud	Larimer	JOHNSTOWN	Significant
CO00164	Hertha	Larimer	BERTHOUD	Significant
CO00168	Akers & Tarr	Weld	GILCREST	Significant
CO00169	Allen Lake	Boulder	LONGMONT	Significant
CO00204	Pomona No. 2 and No. 3	Jefferson	ARVADA	Significant
CO00212	Albion Lake	Boulder	BOULDER	Significant
CO00220	Frederick	Weld	FIRESTONE	Significant
CO00224	Goose Lake	Boulder	BOULDER	Significant
CO00234	Los Lagos No. 3	Boulder	PINECLIFFE	Significant
CO00235	Louisville No. 1	Boulder	LOUISVILLE	Significant
CO00244	Panama No. 1 - East	Boulder	FREDERICK	Significant
CO00246	Prince No. 1	Boulder	ERIE	Significant
CO00260	Aurora-Rampart	Douglas	KASSLER	Significant
CO00284	Gaynor	Boulder	LONGMONT	Significant
CO00294	Casto	Mesa	GATEWAY	Significant
CO00295	J. O. Hill	Douglas	DECKERS	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00297	Kendrick	Jefferson	LAKEWOOD	Significant
CO00298	Craig #1	Mesa	GATEWAY	Significant
CO00303	Pinery	Douglas	PARKER	Significant
CO00304	Craig #2	Mesa	GATEWAY	Significant
CO00312	Wauconda	Douglas	SEDALIA	Significant
CO00327	Beers Sisters Lake	Jefferson	LITTLETON	Significant
CO00329	Harwood'S Storage Reservoir	Jefferson	LAKEWOOD	Significant
CO00366	Lake George	Park	LAKE GEORGE	Significant
CO00371	Manitou Park Lake	Teller	DECKERS	Significant
CO00389	Chief Creek #4	Yuma	WRAY	Significant
CO00396	Wray Watershed District #1	Yuma	WRAY	Significant
CO00398	Wray Watershed District #3	Yuma	WRAY	Significant
CO00399	Wray Watershed District #4	Yuma	WRAY	Significant
CO00400	Wray Watershed District #5	Yuma	WRAY	Significant
CO00401	Wray Watershed District #6	Yuma	WRAY	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00412	Curr	El Paso	COLORADO SPRINGS	Significant
CO00422	Keeton Lake	El Paso	PUEBLO	Significant
CO00429	Monument Lake	El Paso	MONUMENT	Significant
CO00460	Cripple Creek #2	Teller	CANON CITY	Significant
CO00469	Mud Gulch Det. Mg-1	Fremont	FLORENCE	Significant
CO00471	Rosemont	Teller	PUEBLO	Significant
CO00481	Skaguay	Teller	PUEBLO	Significant
CO00488	St. Charles Mesa	Pueblo	PUEBLO	Significant
CO00497	Daigre	Huerfano	LA VETA	Significant
CO00519	Crooked Arroyo Det Ca-1	Otero	LA JUNTA	Significant
CO00520	Crooked Arroyo Det Ca-3	Otero	LA JUNTA	Significant
CO00521	Crooked Arroyo Det Ca-4	Otero	LA JUNTA	Significant
CO00551	Floodwater Ret. B-5	Larimer	WELLINGTON	Significant
CO00568	Donnelly #1	Delta	CEDAREDGE	Significant
CO00577	Island Lake	Delta	CEDAREDGE	Significant
CO00581	Kiser	Delta	CEDAREDGE	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00595	Mckoon	Delta	CEDAREDGE	Significant
CO00620	Reed	Delta	CEDAREDGE	Significant
CO00631	Tomahawk	Gunnison	PAONIA	Significant
CO00655	Youngs Creek #3	Delta	CEDAREDGE	Significant
CO00664	Reynolds	Summit	DILLON	Significant
CO00665	Sawmill	Summit	BRECKENRIDGE	Significant
CO00666	Black Lake #2	Eagle	VAIL	Significant
CO00667	Goodenough #2	Delta	HOTCHKISS	Significant
CO00680	Hopkins	Garfield	GLENWOOD SPRINGS	Significant
CO00681	Hughes	Garfield	GLENWOOD SPRINGS	Significant
CO00682	Ivanhoe	Pitkin	THOMASVILLE	Significant
CO00689	Jones	Grand	STATE BRIDGE	Significant
CO00696	Park	Garfield	NEW CASTLE	Significant
CO00698	Barton Porter East	Garfield	NEW CASTLE	Significant
CO00701	Matheson	Grand	KREMMLING	Significant
CO00703	Mcmahon #2	Grand	KREMMLING	Significant
CO00706	Whiteley Peak	Grand	KREMMLING	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00708	East Branch	Grand	PARSHALL	Significant
CO00716	Scholl	Grand	KREMMLING	Significant
CO00737	Fort Lyon Control Basin	Prowers	GRANADA	Significant
CO00752	Limon Watershed L-2	Lincoln	LIMON	Significant
CO00753	Limon Watershed L-3	Lincoln	LIMON	Significant
CO00765	Bristol Head #2	Mineral	SOUTH FORK	Significant
CO00773	Love Lake	Mineral	PRIVATE PROPERTY	Significant
CO00781	Shaw - North Dam	Mineral	SOUTH FORK	Significant
CO00792	Smith	Costilla	ARROYA HONDO, NM	Significant
CO00812	Troutvale #1 (Upper)	Hinsdale	SOUTH FORK	Significant
CO00813	Troutvale #2 (Lower)	Hinsdale	SOUTH FORK	Significant
CO00814	La Jara - Dam No. 1	Conejos	CAPULIN	Significant
CO00816	Road Canyon #1	Hinsdale	SOUTH FORK	Significant
CO00821	Bolen	Mesa	GRAND JUNCTION	Significant
CO00824	Deep Creek #2	Mesa	WHITEWATER	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00826	Grand Mesa #1	Mesa	GRAND JUNCTION	Significant
CO00827	Grand Mesa #8	Mesa	WHITEWATER	Significant
CO00836	North Poudre #1	Larimer	FORT COLLINS	Significant
CO00839	North Poudre # 4	Larimer	WELLINGTON	Significant
CO00843	Mesa Creek #4	Mesa	MESA	Significant
CO00846	Mesa Creek #1	Mesa	MESA	Significant
CO00856	Woods Lake	Weld	GREELEY	Significant
CO00860	Palmer Lake #5	El Paso	COLORADO SPRINGS	Significant
CO00879	Upper Black Creek Res	Summit	KREMMLING	Significant
CO00882	Welsh	Eagle	WOLCOTT	Significant
CO00884	Jumbo Mesa Creek 5	Mesa	MESA	Significant
CO00892	Gardner Park	Routt	YAMPA	Significant
CO00894	Pastorius - Main Dam	La Plata	BONDAD	Significant
CO00896	Keeler	La Plata	DURANGO	Significant
CO00914	Bull Basin #2	Mesa	MOLINA	Significant
CO00941	Margaret Spurgeon #1	Boulder	BOULDER	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO00942	Wohler	Routt	BURNS	Significant
CO00946	Big Beaver	Mesa	MOLINA	Significant
CO00947	Bull Creek #5	Mesa	MOLINA	Significant
CO00948	Colby Horse Park	Mesa	COLLBRAN	Significant
CO00971	D.D. & E. Wise	Rio Blanco	MAYBELL	Significant
CO00993	Lake John	Jackson	COWDREY	Significant
CO00995	Lake Roslyn	Jackson	WALDEN	Significant
CO00999	North Michigan Creek	Jackson	WALDEN	Significant
CO01018	Allen Basin	Rio Blanco	OAK CREEK	Significant
CO01023	Lake Creek	Routt	YAMPA	Significant
CO01040	Mesa Creek #3	Mesa	MESA	Significant
CO01042	Monument #1	Mesa	COLLBRAN	Significant
CO01046	Horse Creek	Otero	LAS ANIMAS	Significant
CO01055	Echo Canyon	Archuleta	TRUJILLO	Significant
CO01056	Spence	Archuleta	DULCE, NM	Significant
CO01058	Town Center	Archuleta	PAGOSA SPRINGS	Significant
CO01063	Henderson Lake	La Plata	HERMOSA	Significant
CO01072	Cortez #1	Montezuma	CORTEZ	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01076	Bauer Lake #1	Montezuma	MANCOS	Significant
CO01086	Big Pine	Montezuma	DOLORES	Significant
CO01090	A. M. Puett	Montezuma	CORTEZ	Significant
CO01106	Prospect	Weld	ROGGEN	Significant
CO01142	Prospect Lake	El Paso	COLORADO SPRINGS	Significant
CO01150	Harris Park Estates #1	Park	SHAFFERS CROSSING	Significant
CO01154	Angel Lake	Weld	GREELEY	Significant
CO01155	Annex #8	Larimer	FORT COLLINS	Significant
CO01159	Clarks Lake	Larimer	WELLINGTON	Significant
CO01162	Dixon Canyon	Larimer	FORT COLLINS	Significant
CO01170	Parvin	Larimer	FORT COLLINS	Significant
CO01175	Loup Lake	Weld	SEVERANCE	Significant
CO01176	Hiawatha	Larimer	FORT COLLINS	Significant
CO01183	Fairport	Larimer	FT. COLLINS	Significant
CO01184	Horseshoe Lake (East Dam)	Larimer	LOVELAND	Significant
CO01188	St. Marys Lake	Clear Creek	IDAHO SPRINGS	Significant
CO01190	Loveland Lake	Larimer	BERTHOUD	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01191	Little Thompson	Weld	MILLIKEN	Significant
CO01192	George Rist	Larimer	LOVELAND	Significant
CO01194	Ryan Gulch	Larimer	LOVELAND	Significant
CO01195	South Side	Larimer	LOVELAND	Significant
CO01196	Sunny Slope	Larimer	BERTHOUD	Significant
CO01201	Brainard Lake	Boulder	LYONS	Significant
CO01203	Clennon	Weld	PLATTEVILLE	Significant
CO01210	Highland #1	Weld	PLATTEVILLE	Significant
CO01211	Highland #2 (South)	Boulder	LONGMONT	Significant
CO01212	Highland #3	Weld	LA SALLE	Significant
CO01218	New Thomas	Weld	EVANS	Significant
CO01219	Union	Weld	PLATTEVILLE	Significant
CO01229	Mcintosh	Boulder	LONGMONT	Significant
CO01236	Oligarchy #1	Boulder	LONGMONT	Significant
CO01249	Green Lake	Clear Creek	GEORGETOWN	Significant
CO01285	Upper Derby	Adams	Commerce City	Significant
CO01286	Ladora	Adams	Commerce City	Significant
CO01315	R. D. Nixon	El Paso	PUEBLO	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01347	Ramah Det. and Rec.	El Paso	RAMAH	Significant
CO01357	Meridian Lake Park #1	Gunnison	CRESTED BUTTE	Significant
CO01359	Lake Arrowhead	Gunnison	DELTA	Significant
CO01375	Currier #2	Mesa	COLLBRAN	Significant
CO01383	Craig Holding & Evaporation Ponds	Moffat	MAYBELL	Significant
CO01402	Thomas	Pitkin	CARBONDALE	Significant
CO01403	Craig Raw Water	Moffat	MAYBELL	Significant
CO01405	Gardner Lake	Mesa	GRAND JUNCTION	Significant
CO01408	Sappington	Archuleta	DULCE, NM	Significant
CO01591	Mcginnis Meadows Reservoir	Garfield	BUFORD	Significant
CO01638	Fish Creek #2	Gunnison	CIMARRON	Significant
CO01676	Blackman_*	Mesa		Significant
CO01703	Jones #1	Grand	KREMMLING	Significant
CO01723	Linn and Clark	Archuleta	PAGOSA SPRINGS	Significant
CO01734	Lone Tree	Larimer	JOHNSTOWN	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01742	Webster Lake East	Adams	NORTHGLENN	Significant
CO01747	Pinon Lake	Archuleta	BLANCO, NM	Significant
CO01755	Cottonwood #2	Mesa	MOLINA	Significant
CO01765	Worster	Larimer	FORT COLLINS	Significant
CO01768	Donath Lake	Larimer	LOVELAND	Significant
CO01773	Gold Lake #1	Boulder	LONGMONT	Significant
CO01789	Belisle	Arapahoe	ENGLEWOOD	Significant
CO01790	Bergen West	Jefferson	LAKEWOOD	Significant
CO01793	Burgess #1	Teller	DECKERS	Significant
CO01800	Pringtime	Teller	PUEBLO	Significant
CO01816	Upper Tule Lake	Arapahoe	LITTLETON	Significant
CO01822	Bowles #1	Jefferson	BOWMAR	Significant
CO01826	Ward #5	Denver	DENVER	Significant
CO01827	Johnston	Jefferson	LITTLETON	Significant
CO01835	Holbrook	Otero	CHERAW	Significant
CO01836	Lake Meredith	Crowley	ROCKY FORD	Significant
CO01837	Crooked Arroyo Det Ca-2	Otero	LA JUNTA	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO01847	Dye	Otero	SWINK	Significant
CO01851	Thurston Lake	Prowers	LAMAR	Significant
CO01866	Eaton - Law	Weld	GREELEY	Significant
CO01902	Lower Derby	Adams	Commerce City	Significant
CO01912	Elk Lake	Moffat	BAGGS, WYOMING	Significant
CO01964	Rapid Creek #1	Mesa	PALISADE	Significant
CO01990	Sherwood	Larimer	FORT COLLINS	Significant
CO02014	Claymore	Larimer	LAPORTE	Significant
CO02022	Twin Lakes Reservoir	Larimer	FORT COLLINS	Significant
CO02024	Nee-Noshe	Kiowa	LAMAR	Significant
CO02026	Queen	Kiowa	LAMAR	Significant
CO02047	Bison Park	Teller	PUEBLO	Significant
CO02051	Wilson	El Paso	PUEBLO	Significant
CO02059	Belmear Lake	Dolores	SLICK ROCK	Significant
CO02089	Arapahoe Lake	Arapahoe	DENVER	Significant
CO02110	East Lake #2	Adams	THORNTON	Significant
CO02131	Broadacre Lake	Mineral	SOUTH FORK	Significant
CO02148	Signal #1	Adams	FORT LUPTON	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02151	Wadley #1	Adams	FORT LUPTON	Significant
CO02159	Chapman	Rio Blanco	OAK CREEK	Significant
CO02160	Cripple Creek #3	Teller	CANON CITY	Significant
CO02161	Victor #2	Teller	PUEBLO	Significant
CO02164	Nottingham	Eagle	AVON	Significant
CO02176	Dale	Grand	PARSHALL	Significant
CO02177	Musgrave	Grand	KREMMLING	Significant
CO02180	Mountain Lake	Lake	LEADVILLE	Significant
CO02181	Big Evans Gulch No. 2	Lake	LEADVILLE	Significant
CO02186	La Veta Lake North	Huerfano	LA VETA	Significant
CO02190	Badding	Adams	NORTHGLENN	Significant
CO02212	Pawnee Raw Water	Morgan	BRUSH	Significant
CO02213	Dove Creek #1	Dolores	DOVE CREEK	Significant
CO02238	Floodwater Ret. B-6	Larimer	WELLINGTON	Significant
CO02247	Northglenn Terminal	Adams	WESTMINSTER	Significant
CO02342	The Ranch	Adams	WESTMINSTER	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02352	Fairway	Larimer	WINDSOR	Significant
CO02360	Carriage Hills #1 (Upper)	Larimer	ESTES PARK	Significant
CO02413	Carmody	Jefferson	LAKEWOOD	Significant
CO02425	Memorial Dam	Denver	SHERIDAN	Significant
CO02426	Lockport	Jefferson	KITTREDGE	Significant
CO02435	Bristlecone	El Paso	COLORADO SPRINGS	Significant
CO02436	Pinon	El Paso	COLORADO SPRINGS	Significant
CO02439	Non Potable Reservoir Dam 1	El Paso	COLORADO SPRINGS	Significant
CO02535	Duncan	La Plata	DURANGO	Significant
CO02550	Leonard Thomas Reservoir	Pitkin	ASPEN	Significant
CO02552	Christenson	Pitkin	OLD SNOWMASS	Significant
CO02571	Skinny Fish Reservoir	Garfield	BUFORD	Significant
CO02593	Windy Gap	Grand	HOT SULPHUR SPRINGS	Significant
CO02621	Mill Creek Dam No 1	Hinsdale		Significant
CO02622	Mill Creek No 2	Hinsdale		Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02634	Wray Watershed District #2	Yuma	WRAY	Significant
CO02665	Vancil	Morgan	SNYDER	Significant
CO02718	Mccullough	El Paso	COLORADO SPRINGS	Significant
CO02736	Lazy O Reservoir No 2	Pitkin	SNOWMASS	Significant
CO02745	Flannery	Garfield	GLENWOOD SPRINGS	Significant
CO02746	Mcgechie	Montezuma	CORTEZ	Significant
CO02748	Nucla 3rd Ave Reservoir	Montrose	NUCLA	Significant
CO02775	Million Dollar	Douglas	CASTLE ROCK	Significant
CO02784	Westminster Lake	Adams	WESTMINSTER	Significant
CO02793	Bear Creek	Routt	STEAMBOAT SPRINGS	Significant
CO02796	Stainton #3	Garfield	GLENWOOD SPRINGS	Significant
CO02807	Golden #2 Pond	Garfield	GLENWOOD SPRINGS	Significant
CO02808	Alsbury	Mesa	SILT	Significant
CO02817	40th Street Dentention Basin	Pueblo	PUEBLO	Significant
CO02818	Droz Creek	Chaffee	PONCHA SPRINGS	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02821	Panama No. 1 - South	Boulder	FREDERICK	Significant
CO02826	Bijou #2 Dam #2	Morgan	LOG LANE VILLAGE	Significant
CO02827	Bijou #2 Dam #3	Morgan	LOG LANE VILLAGE	Significant
CO02828	Bijou #2 Dam #4	Morgan	LOG LANE VILLAGE	Significant
CO02829	Highland #2 (North)	Boulder	BERTHOUD	Significant
CO02831	Ish #3 (East Dam)	Boulder	MILLIKEN	Significant
CO02836	Horseshoe Lake (South Dam)	Larimer	LOVELAND	Significant
CO02837	Gold Lake #2	Boulder	LONGMONT	Significant
CO02838	Gold Lake #3	Boulder	LONGMONT	Significant
CO02843	Lake Christine	Eagle	BASALT	Significant
CO02854	Meadowview	Jefferson		Significant
CO02870	Shaw - South Dam	Mineral	SOUTH FORK	Significant
CO02873	La Jara - Dam No. 2	Conejos	CAPULIN	Significant
CO02881	Pastorius - East Dike	La Plata	BONDAD	Significant
CO02883	Bauer Lake #2 - West Dam	Montezuma	MANCOS	Significant
CO02885	Griggs	La Plata	BAYFIELD	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02887	Grass Valley East Dike	Garfield	NEW CASTLE	Significant
CO02913	Willow Spring Pond	Eagle	BASALT	Significant
CO02917	Devinney	Jefferson	LAKEWOOD	Significant
CO02921	Cornerstone Pond No. 4	Ouray	MONTROSE	Significant
CO02925	Cornish Plains Reservoir	Weld	BARNESVILLE	Significant
CO02943	Garfield Wildlife Pond	Garfield	SILT	Significant
CO02944	Southern Pond Open Space	La Plata	DURANGO	Significant
CO02946	Valana K Reservoir No. 1	Pitkin	BASALT	Significant
CO02959	Robinson Tailings Pond #2 Dam	Park	Frisco, CO	Significant
CO02960	Arkansas Pond	Lake	Leadville, Co	Significant
CO02961	Abbey Detention Basin	Fremont	CANON CITY	Significant
CO02962	Aspen Lodge	Larimer	RURAL DEVELOPMENT, BIG OWL RD	Significant
CO02963	#1 Tailings Pond	Eagle	KREMMLING	Significant
CO02967	Bills Ranch Lake	Summit	FRISCO	Significant

NID ID	Dam Name	County	City	Hazard Potential Classification
CO02978	Crystal Lake	Otero	ROCKY FORD	Significant
CO02980	Florence North Res. No. 1	Fremont	FLORENCE, CO	Significant
CO02981	Florence North Res. No. 2	Fremont	FLORENCE	Significant
CO03005	Sand Creek Detention Basin No. 6	El Paso	COLORADO SPRINGS	Significant
CO03006	Sheer Bliss	Pitkin	SNOWMASS VILLAGE	Significant
CO03018	Thibodeaux	La Plata	IGNACIO	Significant
CO03051	Joe Blake Water Treatment Plant Forebay	Douglas	LITTLETON	Significant
CO82444	Currier	Mesa		Significant
CO82448	Glacier Spg Retaining Pond	Mesa	MESA, CO	Significant

ANNEX - PLANNING ROSTER

Table 113 provides a listing of all individuals comprising the 2024 E-SHMP Planning Team.

TABLE 113 PLANNING TEAM

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Adrid	Emily	DNR					x	
Aimone	Nicole	FEMA	Mitigation	Deputy Branch Chief		x		
Akers	Chris	DOLA	Demography Office	Economist				
Alban	Adam	Office of the State Controller	Office of Risk Management			x	x	9/9/2002
Alexander	Sally	Colorado State University	Office of Risk Management & Insurance	Director				
Alvarez	Emily	FEMA	Mitigation	Community Planner, Region VIII	x			
Andrade	Luis	FEMA					x	
Andrews	John	USDA	NRCS	State Conservation Engineer				
Archuleta	Corine	CORE				x		

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Arsenault	Matt	CDPS			x	x		
Asher	Jonathan	Governor's Office		Senior Policy Advisor		x		
Atkins	Rich	Local EM - Chaffee County	County OEM	Emergency Manager	x	x		
Baca	Bobbie	Department of Regulatory Agencies	Division of Insurance	Supervisor				1/4/23
Bagley	Marcus	DHSEM	CIAC	Cybersecurity Supervisor				
Bailey	Lynn	DHSEM	Integrated Preparedness	Manager		x	x	
Baldwin	Maggie	Co Dept Agriculture	Animal Health Division	State Veterinarian				11/9/22
Baum	Katherine	FEMA	Mitigation	Community Planner, Region VIII	x			
Bernet	Courtney	City and County of Denver	Office of Emergency Management	OEM Senior Emergency Management Specialist				
Berry	Karen	CGS					x	

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Beveridge	Daniel	Co State Forest Service		Fire, Fuels, and Watershed Manager	x	x	x	2/23/23
Beyers	Julie	DHSEM	Mitigation	Project Specialist	x	x	x	
Blanco Castaño	Marta	Co State Dept Natural Resources	CWCB	Flood Mapping Program Assistant				10/27/22
Bloom	Victoria	CDPHE					x	
Boag	Angela	DNR	Climate, Forest Health, and Energy	Assistant Director	x		x	
Bol	Kirk	Co Dept Public Health and Environment	Center for Health and Environmental Data	Vital Statistics Program Manager•Center for Health and Environmental Data				
Bolin	Drew	Public Utilities Commission	Strategic Communications	Section Chief				
Bornemann	Erin	State Historic Preservation Office	History Colorado Center | Heritage Services	Information Management Director		x	x	11/7/22

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Bouwman	Michael	DHSEM	Preparedness	Program Coordinator / CEPA Program Manager	x			
Bowman	Dave	Co Dept Local Affairs	DLG	Deputy Director			x	4/11/23
Brown	Peg	Department of Regulatory Agencies	Division of Insurance	Deputy Commissioner		x		1/4/23
Brunette	Chris	Co Div Fire Prevention and Control	Fire & Life Safety Section	Chief		x	x	2/8/23
Buchanan	Jacque	CSFS		Deputy Regional Forester				
Butner	Lauren	CDPS			x			
Carlson	Jill	Co Geographic Survey		Deputy Director & Eng. Geologist		x		9/26/22
Carrillo	AJ	CDPHE					x	
Cha	Blongshia	NRCS				x		
Chapman	Michael	Co Dept Transportation	Weather Operations	michael.chapman@state.co.us				

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Chon	Enrique	Co Geographic Survey		Seismologist				
Ciarlo	Brittney	Local EM - Huerfano County	County OEM	Emergency Manager	x	x	x	
Clauss	William	Colorado Rural Water Association						
Clay	Lisa	Local EM - Gunnison County	County OEM	Emergency Manager	x			
Conway	Michael	Department of Regulatory Agencies	Division of Insurance	Commissioner of Insurance				11/8/22
Cooperstein	Mike	DNR	Colorado Avalanche Info Center	Lead Avalanche Forecaster		x		9/23/22
Crowder	Rob	Local EM - Sedgwick County	County OEM	Emergency Manager	x			
Davis	Sheila	CDPHE	Office of Health Equity	Director				

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Decatur	Stephen	City and County of Denver	Office of Emergency Management	Hazard Mitigation Specialist				
DeMorat	Mo	Local EM - Routt County	County OEM	Emergency Manager	x			
Denney	Trevor	DHSEM	Field Services	Manager	x			
Dice	Dave	CDA	Animal Health	Animal Incident Management Specialist				3/20/23
Diker	Kenan	CDPHE					x	
DiPrince	Dawn	State Historic Preservation Office	History Colorado Center	State Historic Preservation Officer				
Doesken	Nolan	Colorado Climate Center		Sr. Research Associate / Fort Collins Weather Station Dir.				
Drosselmeyer	Emily	DHSEM	Mitigation	Mitigation Projects Supervisor	x	x	x	
Eisemann	Maria	Colorado Energy Office	Transportation Fuels & Technology	Senior Policy Analyst	x	x	x	

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Evans	Clint	NRCS		Deputy Chief for Programs (Acting)		x		
Fant	Sara	DHSEM		Integrated Preparedness Specialist				
Fead	Terri	DNR	CWCB	Floodplain Mapping Program Mgr.		x		10/27/22
Fitzgerald	Scot	CGS		GIS				
Follingstad	Gretel	NOAA	National Integrated Drought Information System	Intermountain West- Drought Early Warning System Coordinator				
Frazen	Dan	CDA	Animal Health Division	Ag Emergency Coordinator		x	x	11/9/22, 1/11/23, 3/20/23
Gadd	Colleen	DHSEM						
Gammonley	Jim	DNR/ Colorado Parks & Wildlife	Avian Program Leader					2/13/23

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Garceau	Tracy	Department of Regulatory Agencies	Division of Insurance	Supervisor				1/4/23
Garner	Elizabeth	DOLA	Demography Office	State Demographer				8/30/22
Garner	Merrie	Local EM - Carbon Valley EMA	Local OEM	Emergency Manager	x			
Geyer	Rebecca	EPA	Region 8	Environmental Scientist				
Goerlitz	Debbie	DHSEM	Mitigation	Project Speciliast	x	x	x	
Goodrich	Cody	Department of Regulatory Agencies	Division of Insurance	Program Assistant				1/4/23
Greene	Ethan	DNR	Colorado Avalanche Info Center	Director	x		x	
Group	Robert	CDOT		Geohazards Program Manager		x	x	12/5/22, 3/16/23
Hadlock	Sara	CSFS		Admin for Jacque Buchanan (must copy her)				

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Hall	Abby	EPA	Office of Community Revitalization	Senior Advisor for Local and Regional Planning				
Hanger	Rick	DOLA	Division of Housing	Housing Development Mgr., Technology & Standards Section				
Hansen	Richard	USGS	Colorado Water Science Center	Information Technology Team Member	x			
Harden	Marguerite	DOLA	CRO	Local Resiliency Manager		x		11/30/22
Heavener	Greg	NOAA	NWS	Warning Coordination Meteorologist				
Hettinger	Amanda	CDPHE	Preparedness & Response	Office Director		x		
Hill	Andy	DOLA	Community Development Office	Program Manager				
Hirsch	Jenna	CREA		Director Safety & Loss Control		x		2/10/23
Hoover	Courtney	CSFS						
Horton	Margaret	CDPHE				x		11/30/22

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Houck	Kevin	DNR	CWCB	Chief, Watershed and Flood Protection				9/22/22, 10/27/22
Hudak	Christopher	DHSEM	Recovery	State Coordinator	x	x	x	
Hunyadi	John	DNR	Division of Water Resources	Chief, Dam Safety Branch		x		11/8/22
Huston	Joan	FEMA	Mitigation	Acting DR Branch Chief		x		
James	Michelle	CDPS	School Emergency Response Grants	Grants Manager	x			
Johnson	Tricia	Co Dept Higher Ed		Deputy Director				
Johnson	Nicole	CDPHE	Emergency Preparedness and Response	Emergency Preparedness Exercise Coordinator		x	x	1/30/23
Johnson	William	CDOT	Performance and Asset Management	Branch Manager	x	x	x	
Kersting	Alice	FEMA	Mitigation	Program Analyst, Region VIII	x			

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
King	Rodney	Local EM - Conejos County	County OEM	Emergency Manager	x	x		
Klein	Kevin	DHSEM		Division Director			x	
Kotlinski	Nic	CSFS	Science and Data	Program Manager	x	x	x	4/3/23
Kraft	Jeff	OEDIT	Staff Divisions	Deputy Director				
Kurle	Jaclyn	Human Services	OEM	Emergency Manager		x		
Lair	Cindy	CDA	Colorado State Conservation Board	Program Manager		x	x	
LaPlace	Brooke	FEMA					x	
Leggett	Clint	Mineral County				x		
MacKay	Robert	FEMA	Mitigation	Building Codes Coordinator		x		
Mahan	Doug	DNR	CWCB / NFIP	NFIP Community Assistance Program Coordinator		x		9/22/22
Mann	Tim	DHSEM	Whole Community Inclusion	Planning Specialist	x			

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Martinez	Sadie	DHSEM	Access and Functional Needs	Coordinator	x			10/31/22
Martsof	Andrew	Local EM - Mesa County	County OEM	Emergency Manager	x			
McCord	Noah	DHSEM		Voluntary Agency Coordinator		x	x	
McCormick	Kyle	FEMA					x	
McFerson	KC	DOLA		Senior Planner			x	
McGowan	Sean	FEMA		Earthquake Program Mgr. & Building Science Lead				
McIntire	Jessica	CDPS			x	x		
Medved	Holly	CDPHE	Emergency Preparedness and Response	Planning Supervisor		x	x	
Merrifield	Irene	DHSEM	Mitigation	Planning Supervisor	x	x	x	
Meyers	Pat	OEDIT		Chief Economic Recovery Officer / Executive Director				

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Miller	Anne	DOLA	CRO	Director	x	x		11/30/22, 4/11/23
Minor	Joel	CDPHE	Office of Health Equity	EJ Program Manager				
Mitchell	Henry	CDPHE	Office of Emergency Preparedness & Response	Deputy Director		x	x	1/30/23
Moeller	Michelle	CDPS						
Montrose	Kahla	CSFS	Watershed Program			x	x	2/13/23
Moore	Estella	CDPHE	EPA non-point source (NPS) grants	NPS Program Coordinator				
Moore	Don	DHSEM		SEOP Program Manager	x	x	x	
Morgan	Matt	CGS		State Geologist / Director				9/26/22
Murphy	Robert	CDPHE	Water Quality Control Division	SWAP Program Manager		x		

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Myers	Rick	FEMA	Environmental & Historic Preservation					
Nicholson	Bradyn	CDPHE	PHCOP 3 - Prevention Services	Built Environment Coodinator		x		
Norton	Holly	State Historic Preservation Office	History Colorado Center	Director OAHP - Community Museums				11/7/22
Oester	Nicole	CDOT	Chief Engineer's Office	Physical Science Researcher/Scientist		x	x	12/5/22
Omran	Taryn	CDHE					x	
Osborn	David	DHSEM	Field Operations	Field Manager - San Luis Valley		x	x	
O'Grady	Megan	DNR			x			
Peitzsch	Erich	USGS		Research Physical Scientist				
Peterson	Jeff	CDOT	Division of Transportation Development	Environmental Protection Specialist			x	10/24/22

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Pettis	Greg	DHSEM						
Plymell	Vincent	Department of Regulatory Agencies	Division of Insurance	Director of Consumer Education/PIO				1/4/23
Pressly	Rob	FEMA Region 8	Community Planner, Mitigation Division			x		
Przybylski	Samantha	FEMA	Mitigation			x		
Raymond	Jim	DHSEM	Recovery	State Recovery Officer	x			
Reeves	Steven	DNR	CWCB	PSRS			x	10/27/22
Roberts	Erika	Jefferson County	Emergency Services Section	Deputy Emergency Manager			x	
Rogers	Jimmy	CDHE						
Roldan	Gabby	CDPS			x			
Romero-Heaney	Kelly	DNR	CWCB	Asst. Director Water Policy / CWCB Director	x			
Ryder	Melissa	FEMA					x	

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Sabo	Shayle	DOLA	CRO	Resiliency Program Manager	x	x		
Sand	Logan	FEMA	Mitigation	Acting Senior Community Planner, Region VIII	x	x		
Sands	Russ	DNR	CWCB	PSRS		x		10/5/22, 10/27/22, 2/28/23
Sayeed	Hana	OEDIT	Staff Divisions	Deputy Director of Economic Recovery				
Schumacher	Russ	Colorado Climate Center		State Climatologist		x		1/19/23
Selby	Diana	CSFS	Program Delivery & State Lands Program	Manager / Program Specialist				
Singer	Kent	CREA		Executive Director				
Slaughter	Stephen	USGS		Landslide Response Coordinator				
Smercina	Edward	Local EM - Rio Blanco County	County OEM	Emergency Manager	x	x	x	

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Smith	Dana	Department of Education	Education - K-12	Chief Communications Officer				
Smith	Jessica	History CO				x	x	
Snart	Rocco	DFPC	Wildland Fire Management	Planning Branch Chief	x			
Sorensen	Chris	DHSEM	Operations	Section Chief				
Stahnke	Brian	FEMA	Mitigation	Senior Engineer		x		
Stein	Sam	DNR	CWCB	PSRS		x	x	10/5/22, 2/28/23
Stewart	Kris	Local EM - Delta County	County OEM	Emergency Manager	x			
Sturm	Chris	DNR	CWCB					9/28/22, 10/27/22
Swenka	David	CDOT	Chief Engineer's Office	Professional Engineer		x		10/24/22
Thomas	David	CDOT	Chief Engineer's Office	Professional Engineer - Geotech				12/5/22
Thompson	Mark	DHSEM	Mitigation	State Hazard Mitigation Officer	x	x	x	

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
Thompson	Trent	US EDA		Representative				
Tillotson	Gary	CO State Fire Chiefs	City of Glenwood Springs Fire Chief	Representative				
Toll	Weston	CSFS	Watershed Program	Program Specialist				2/13/23
Townley	Cate	DOLA	CRO	Built Environment Specialist			x	11/30/22
Treinen	Eric	Local EM - Alamosa County	County OEM	Emergency Manager		x		
Trost	Micki	DHSEM		Strategic Communications Director		x	x	
VanHorn	Carolina	Governor's Office	Office of Climate and Preparedness	Deputy Director				6/1/2023
Varella	Brian	CDOT	Region 4	Resident Engineer				
Weismiller	Kat	DNR	CWCB	Deputy Section Chief for Water Supply Planning		x	x	10/5/22, 10/27/22, 2/28/23

Last Name	First Name	Organization	Department	Position	Workshop #1	Workshop #2	Workshop #3	1-on-1 Meeting(s)
West Fordham	Amanda	CSFS	Science and Data	Associate Director	x	x	x	
Wetherill	Terry	Local EM - Mineral County	County OEM	Emergency Manager	x			
Williams	Ethan	DHSEM	Planning	Plans Section Chief				10/31/22
Willis	Mike	DHSEM		Director			x	
Wiseman	Christy	DOLA		Land Use and Water Planner				
Wittner	Art	Local EM - Rio Grande County	County OEM	Emergency Manager	x			
Wood	Dr. Mary	CPW		State Wildlife Veterinarian		x		2/13/23
Xavier	Mimi	Colorado Public Utilities Commission		Senior Policy Engineer				

ANNEX - FEMA APPROVAL PACKET

U.S. Department of Homeland Security
Region 8
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

FEMA

R8-MT

December 18, 2023

Mike Willis, Director
Colorado Office of Emergency Management
Division of Homeland Security and Emergency Management
9195 E. Mineral Avenue, Suite 200
Centennial, CO 80112

Director Willis:

FEMA Region 8 is pleased to announce the approval of the Colorado Enhanced State Hazard Mitigation Plan. FEMA found the plan to be in compliance with Title 44 of the Code of Federal Regulations (CFR) Section 201.5, Enhanced State Mitigation Plans. The plan remains approved through December 17, 2028.

This plan approval confirms the continued eligibility of the State of Colorado to receive non-emergency funding including Public Assistance (Categories C-G), Fire Management Assistance Grants (FMAG), Hazard Mitigation Grant Program (HMGP), Hazard Mitigation Grant Program – Post Fire (HMGP – Post Fire), Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA), Flood Mitigation Assistance Swift Current, Safeguarding Tomorrow Revolving Loan Fund Program, and the Rehabilitation of High Hazard Potential Dam (HHPD) grant programs. As a State with a FEMA-approved Enhanced State Mitigation Plan, Colorado is also eligible at the time of a disaster declaration to receive increased funds under the Hazard Mitigation Grant Program (HMGP), based on twenty percent of the total estimated eligible Stafford Act disaster assistance. The Colorado Enhanced State Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA every five years to maintain eligibility to apply for funding through the programs referenced above.

We commend the State of Colorado for its time and effort developing this plan and the State's continued commitment to reducing future disaster losses. Please contact Logan Sand, Senior Community Planner at (720) 625-9657 with any questions.

Sincerely,

Nancy J. Dragani
Regional Administrator

Enclosure
cc: Mark Thompson, State Hazard Mitigation Officer, Colorado Division of Homeland Security and Emergency Management

State Mitigation Plan Review Tool

The State Mitigation Plan Review Tool (**Plan Review Tool**) demonstrates and documents how the state mitigation plan meets the regulations set forth in 44 CFR Part 201 and offers FEMA mitigation planners an opportunity to provide feedback to the state.

The **Regulation Checklist** must be completed by FEMA. The FEMA Plan Approver must reference the State Mitigation Planning Policy Guide when completing the Plan Review Tool. The purpose of the checklist is to identify the location of relevant or applicable content in the plan by element/sub-element and to determine if each requirement has been "Met" or "Not Met."

The **Required Revisions** summary at the bottom of each element must clearly explain the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is "Not Met." Sub-elements should be referenced by the appropriate number, where applicable (e.g., S2-a, S2-b). Requirements for each element and sub-element are described in detail in Sections 3 and 4 of the State Mitigation Planning Policy Guide.

The **HHPD section and FMAG sub-elements** only need to be completed if the state is pursuing eligibility for those grant programs.

The **Plan Assessment** must be completed by FEMA. This assessment provides more comprehensive feedback to the state to acknowledge where the plan exceeds minimum requirements and provides suggestions for improvements. FEMA will describe the strengths that are demonstrated and highlight examples of best practices. FEMA's suggestions for improvement are not required to be made for plan approval.

For greater clarification of the elements in the regulation checklist, please see Sections 3 and 4 in the State Mitigation Planning Policy Guide. This document defines terms and phrases used within this review tool.

1. Plan and Review Information

Plan Information			
State	Colorado		
Title and Date of Plan	State of Colorado Hazard Mitigation Plan August 29, 2023		
Plan Update Version	Version 7		
State Point of Contact Name	Mark Thompson		
Title	State Hazard Mitigation Officer		
Agency	Division of Homeland Security and Emergency Management		
Address	9195 E. Mineral Ave., Ste. 200 Centennial, CO 80112		
Phone Number	720.852.6600		
Email	markw.thompson@state.co.us		
Meets mitigation planning requirements for HHPD?	**Yes**	**Meets mitigation planning requirements for FMAG?**	Yes

Review Information	
Date Received by FEMA region	September 27, 2023; November 30, 2023; December 7, 2023
FEMA Reviewer (Planning)	Logan Sand, Community Planning Section Chief
FEMA Reviewer (Planning)	Rob Pressly, Community Planner
FEMA Reviewer (Planning)	Ariana Borrello, Community Planner
FEMA Reviewer (Planning)	Brooke LaPlaca, Community Planner
FEMA Reviewer (HMA)	Samantha Przybylski, Grants Management Specialist
FEMA Reviewer (406)	Luis Andrade, Resilience Engineer

Review Information	
FEMA Reviewer (EHP)	Bridget Mehaffey, Environmental Protection Specialist
FEMA Reviewer (NFIP)	Matt Piscopo, Flood After Fire Specialist
FEMA Reviewer (Dam Safety)	Rich Hansen, Program Specialist – Dam Safety
FEMA Reviewer (Building Sciences)	Robert MacKay, Building Codes Coordinator
FEMA Reviewer (Earthquake Program)	Sean McGowan, Earthquake Program Manager
FEMA Reviewer (Risk MAP)	Christine Gaynes, Acting Risk Analysis Branch Chief and Risk MAP Program Team Lead
FEMA Reviewer (BRIC Technical Assistance)	Kyle McCormick, Community Planner
Plan Status (Not Approved, Approvable Pending Adoption, Approved)	**Approved**, December 18, 2023

SUMMARY	YES	NO
STANDARD STATE MITIGATION PLAN		
Does the plan meet the standard state mitigation plan requirements?	X	
ENHANCED STATE MITIGATION PLAN		
Does the plan meet the enhanced state mitigation plan requirements?	X	

2. Standard State Mitigation Plan Regulation Checklist

PLANNING PROCESS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S1. Does the plan include a description of the process used to develop the plan? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S1-a. Does the plan describe the current process used to update the plan, including how the plan was prepared, the schedule or time frame, specific milestones and activities, the agencies and stakeholders who were involved in the process, and if the mitigation planning process was integrated to the maximum extent possible with other state planning efforts?	Mitigation Strategy>2023 Mitigation Actions	Met
S2. Does the plan describe how the state coordinated with other agencies and stakeholders? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S2-a. Does the plan describe how the state coordinated with other state agencies, appropriate federal agencies, and other stakeholders, and how they were involved in the process?	Planning Process>State Hazard Mitigation Team	Met
Planning Process Required Revisions:		

HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state? [44 CFR § 201.4(c)(2)(i)]		
S3-a. Does the plan include a current overview of all natural hazards that can affect the state, including the type, location and previous occurrences?	HIRA>Risk Assessment Overview>Hazard Identification, HIRA>Hazard Profiles>Definition, Location, Contributing Factors, and Past Occurrences, Annex>Disaster Declarations	Met
S4. Does the risk assessment provide an overview of the probabilities of future hazard events? [44 CFR § 201.4(c)(2)(i)]		
S4-a. Does the risk assessment provide an overview of the probability of future hazard events that includes projected changes in the location, range of anticipated intensities, frequency, and/or duration of each natural hazard?	HIRA>Hazard Profiles>Probability	Met
S4-b. Does the probability include considerations of changing future conditions, including climate change (e.g., long-term weather patterns, average temperature, and sea levels) on the type, location and range of anticipated intensities of identified hazards?	HIRA>Hazard Profiles>Climate Change Impacts	Met
S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S5-a. Does the risk assessment include an overview and analysis of the vulnerability to state assets from the identified hazards as well as a summary of the most vulnerable assets?	HIRA>Hazard Profiles>Risk & Vulnerability>State Assets>Previous Losses, Exposure, and Lifelines	Met
S5-b. Does the risk assessment estimate potential dollar losses to state assets located in identified hazard areas?	HIRA>Hazard Profiles>Risk & Vulnerability>State Assets>Exposure	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S6. Does the risk assessment include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S6-a. Does the risk assessment provide an overview and analysis of vulnerable jurisdictions based on the state and local government risk assessments?	HIRA>Risk Assessment Overview, HIRA>Hazard Profiles>Risk & Vulnerability>Local County/Tribe>Hazard Rankings and Exposure, HIRA>Hazard Profiles>Risk &Vulnerability>Populations at Risk, HIRA>Hazard Profiles>Climate Change Impacts, HIRA>Hazard Profiles>Past Occurrences, HIRA>Hazard Profiles>Risk & Vulnerability>State Assets>Lifelines	Met
S6-b. Does the risk assessment include an overview and analysis of the potential losses to the identified vulnerable structures based on estimates in the local risk assessments as well as the state risk assessment?	HIRA>Hazard Profiles>Risk & Vulnerability>Local County/Tribe >Exposure	Met
S7. Was the risk assessment revised to reflect changes in development? [44 CFR § 201.4(d)]		
S7-a. Does the plan provide a summary of recent development and potential or projected development in hazard-prone areas based on state and local government risk assessments?	HIRA>Risk Assessment Overview, HIRA>Hazard Profile>Recent and Future Development	Met
Hazard Identification and Risk Assessment Required Revisions: Click or tap here to enter text.		

STATE MITIGATION CAPABILITIES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S8. Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment? [44 CFR § 201.4(c)(3)(ii)]		
S8-a. Does the plan include an evaluation of state laws, regulations, policies and programs related to hazards that improve or impede resilience to future natural hazard events and other future conditions, including the effects of climate change?	Capabilities>Programs, Policies, Regulations, & Practices, Capabilities>Building Codes, Plan Implementation>Integration>Floodplain Management>NFIP	Met
S8-b. Does the plan include a general discussion of state funding capabilities for hazard mitigation actions and projects?	Plan Implementation>Integration>FEMA Programs, Capabilities>Funding	Met
S8-c. Does the plan include a summary of obstacles, challenges and proposed solutions related to any state capabilities, including a brief discussion of potential strategies for overcoming any challenges related to implementing and enforcing hazard-resistant building codes statewide, as applicable, and changes since the previous plan approval?	Capabilities>Obstacles, Challenges, & Solutions, Capabilities>Programs, Policies, Regulations, & Practices	Met
State Mitigation Capabilities Required Revisions: Click or tap here to enter text.		

MITIGATION STRATEGY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S9. Does the mitigation strategy include goals to reduce long-term vulnerabilities from the identified hazards? [44 CFR § 201.4(c)(3)(i)]		
S9-a. Does the plan identify hazard mitigation goals representing what the state seeks to accomplish through mitigation plan implementation using a wide range of funding, including non-FEMA funding?	Mitigation Strategy>Goals & Objectives	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S9-b. Are the goals consistent with the hazards and vulnerabilities identified in the risk assessment?	Mitigation Strategy>Goals & Objectives	Met
S10. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment? [44 CFR §§ 201.4(c)(3)(i), 201.4(c)(3)(ii) and 201.4(c)(3)(iii)]		
S10-a. Does the plan identify actions based on the current risk assessment to reduce the vulnerability of jurisdictions within the state, as well as the vulnerability of state assets as described in Elements S5 and S6?	Mitigation Strategy>2023 Mitigation Actions	Met
S10-b. Does the plan describe the process used by the state to evaluate and prioritize actions that are cost-effective, environmentally sound, and technically feasible?	Plan Implementation>Program Utilization>Funding Prioritization	Met
S10-c. Does the plan describe how each action contributes to the hazard mitigation goals?	Mitigation Strategy>2023 Mitigation Actions	Met
S10-d. Does the plan describe how local government mitigation strategies link to the state mitigation strategy?	Mitigation Strategy>2023 Mitigation Actions, Local Coordination>HMPs>Review, Coordination, & Integration	Met
S11. Does the plan identify current and potential sources of funding to implement mitigation actions and activities? [44 CFR § 201.4(c)(3)(iv)]		
S11-a. Do mitigation activities include the identification of current and/or potential sources of federal, state, local or private funding for implementation?	Capabilities>Funding	Met
S11-b. Does the plan identify FEMA mitigation funding sources (if applicable), including, but not limited to: HMGP, BRIC, FMA and PA Mitigation, at a minimum?	Capabilities>Funding	Met
S12. Was the plan updated to reflect progress in statewide mitigation efforts and changes in priorities? [44 CFR § 201.4(d)]		
S12-a. Does the plan provide a narrative of the status of each mitigation action in the previous plan?	Mitigation Strategy>2018 Mitigation Actions	Met
S12-b. Was the prioritization of mitigation actions and activities updated based on the updated analysis of risks, capabilities and progress?	Plan Implementation>Program Utilization>Funding Prioritization	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
Mitigation Strategy Required Revisions: Click or tap here to enter text.		

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S13. Does the plan generally describe and analyze the effectiveness of local government mitigation policies, programs, and capabilities? [44 CFR § 201.4(c)(3)(ii)]		
S13-a. Does the plan provide a summary of current local government policies, programs and capabilities of jurisdictions to accomplish hazard mitigation?	Capabilities>Local Mitigation Capabilities	Met
S13-b. Does the plan describe the effectiveness of local government mitigation policies, programs and capabilities?	Capabilities>Local Mitigation Capabilities, Capabilities>Programs, Policies, Regulations, & Practices>Land Use/Zoning, Capabilities>Programs, Policies, Regulations, & Practices>Flood Hazard Mapping Program, Capabilities>Obstacles, Challenges, & Solutions	Met
S14. Does the plan describe the process to support the development of approvable local government mitigation plans? [44 CFR §§ 201.3(c)(5) and 201.4(c)(4)(i)]		
S14-a. Does the plan describe how the state supports developing or updating FEMA-approvable mitigation plans?	Local Coordination>Technical Assistance>Hazard Mitigation Planning	Met
S14-b. Does the plan provide a brief summary of barriers to developing or updating, adopting, and implementing FEMA-approved local government mitigation plans based on an analysis of plan and jurisdiction coverage data and trends across the state and steps to remove barriers to help local governments advance mitigation planning, including how plan and jurisdiction coverage data and trends inform those steps?	Local Coordination>Technical Assistance>Hazard Mitigation Planning>Advancing Local HMPs	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S15. Does the plan describe the criteria for prioritizing funding? [44 CFR § 201.4(c)(4)(iii)]		
S15-a. Does the plan describe criteria for prioritizing jurisdictions to receive planning and project grants under available federal and non-federal programs?	Plan Implementation>Program Utilization>Funding Prioritization	Met
S16. Does the plan describe the process and time frame to review, coordinate, and link local and tribal mitigation plans with the state mitigation plan? [44 CFR §§ 201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)]		
S16-a. Does the plan describe the state's process and time frame to review and submit approvable local and tribal mitigation plans to FEMA?	Local Coordination>HMPs>Review, Coordination, and Integration	Met
S16-b. Does the plan describe the state's process and time frame to share risk assessment data and mitigation priorities with local governments for their plan updates, as well as integrate local risk assessment and mitigation actions into the state mitigation plan updates?	Local Coordination>HMPs>Review, Coordination, and Integration	Met
Local Planning Coordination and Capability Building Required Revisions: Click or tap here to enter text.		

REVIEW, EVALUATION, AND IMPLEMENTATION

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S17. Is there a description of the method and schedule for keeping the plan current? [44 CFR §§ 201.4(c)(5)(i) and 201.4(d)]		
S17-a. Does the plan describe the agency/office responsible for monitoring, evaluating and updating the plan?	Plan Implementation>Monitoring, Evaluating, and Updating	Met
S17-b. Does the plan describe the schedule for monitoring, evaluating, and updating the plan?	Plan Implementation>Monitoring, Evaluating, and Updating	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S18. Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§ 201.4(c)(5)(ii) and 201.4(c)(5)(iii)]		
S18-a. Does the plan describe the system for tracking the implementation of the mitigation activities and projects identified in the mitigation strategy, including all mitigation activities and not just those funded by FEMA?	Plan Implementation>Monitoring, Evaluating, and Updating	Met
S18-b. Does the system include the schedule, the agency/office responsible for coordination, and the role of the agencies/offices identified in the mitigation strategy as responsible for implementation of actions?	Plan Implementation>Monitoring, Evaluating, and Updating	Met
S18-c. Does the plan describe a system for reviewing progress on achieving the mitigation strategy's goals that includes the criteria and process for evaluating progress?	Plan Implementation>Monitoring, Evaluating, and Updating	Met
Review, Evaluation, and Implementation Required Revisions:		

ADOPTION AND ASSURANCES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S19. Did the state provide documentation that the plan has been formally adopted? [44 CFR § 201.4(c)(6)]		
S19-a. Did the state provide documentation of formal adoption by the highest elected official or designee prior to FEMA approval?	Formal State Adoption	Met
S20. Did the state provide assurances? [44 CFR § 201.4(c)(7)]		
S20-a. Does the plan include assurances that the state will manage and administer FEMA funding in accordance with applicable federal statutes and regulations?	Assurances of Continued Compliance	Met
S20-b. Does the plan include assurances that the state will update its plan whenever necessary to reflect changes in state or federal laws and statutes?	Assurances of Continued Compliance	Met
Adoption and Assurances Required Revisions: Click or tap here to enter text.		

HIGH HAZARD POTENTIAL DAMS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD1. Did Element S2 (planning process) describe how the state dam safety agency, other agencies, and stakeholders participated in the planning process and contributed expertise, data, studies, information, etc. relative to high hazard potential dams?		
HHPD1-a. Does the plan describe how the state dam safety agency, other agencies, and stakeholders were involved in the planning process?	Planning Process	Met
HHPD1-b. Does the plan describe the types of data contributed?	Planning Process>One-on-One Agency Meetings>Office of Dam Safety	Met
HHPD2. Did Element S6 (risk assessment) address all dam risk for high hazard potential dams in the risk assessment?		
HHPD2-a. Does the plan provide a list of high hazard potential dams that have been identified by the state with their names, National Inventory of Dams identification numbers, locations by jurisdiction, and other relevant information, as well as maps?	Annex>High and Significant Hazard Dams	Met
HHPD2-b. Does the plan summarize statewide vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	HIRA>Dam/Levee Incident, HIRA>Dam/Levee Incident>Contributing Factors	Met
HHPD2-c. Does the plan document limitations and describe the approach to address deficiencies?	HIRA>Dam/Levee Incident>Contributing Factors	Met
HHPD3. Did Element S9 (mitigation goals) include mitigation goals to reduce long-term vulnerabilities from high hazard potential dams?		
HHPD3-a. Does the plan address a reduction in vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents as part of their own goals or with other long-term strategies?	Mitigation Strategy>Goals & Objectives	Met
HHPD3-b. Does the plan link the proposed actions to reduce long-term vulnerabilities consistent with the goals?	Mitigation Strategy>2023 Mitigation Actions	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD4. Did Element S10 (mitigation actions) prioritize mitigation actions and activities to reduce vulnerabilities from high hazard potential dams?		
HHPD4-a. Does the plan include actions to reduce vulnerabilities to/from high hazard potential dams?	Mitigation Strategy>2023 Mitigation Actions	Met
HHPD4-b. Does the plan describe the process to evaluate and prioritize actions related to high hazard potential dams that are cost-effective, environmentally sound and technically feasible?	Plan Implementation>Program Utilization>Funding Prioritization	Met
HHPD4-c. Does the plan describe how each action to reduce risks related to high hazard potential dams contributes to the goals and describe how strategies are linked to the state mitigation strategy?	Mitigation Strategy>2023 Mitigation Actions	Met
HHPD5. Did Element S11 (funding sources) identify current and potential sources of funding to implement mitigation actions and activities for high hazard potential dams?		
HHPD5-a. Does the plan include various funding sources to mitigate vulnerabilities to and from high hazard potential dams from hazards and the potential consequences associated with dam incidents, as well as funding sources to rehabilitate or remove high hazard potential dams?	Capabilities>Funding	Met
HHPD6. Did Element S13 (local coordination) generally describe and analyze the effectiveness of local mitigation policies, programs, and capabilities that address high hazard potential dams?		
HHPD6-a. Does the plan provide a summary of the local policies, programs, and capabilities to implement mitigation actions and reduce vulnerabilities from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	Capabilities>Local Mitigation Capabilities	Met
HHPD6-b. Does the plan describe challenges to implementing local mitigation policies, programs and capabilities to reduce vulnerabilities to and from high hazard potential dams and the approach to overcome these challenges?	Capabilities>Obstacles, Challenges, & Solutions	Met
HHPD6-c. Does the plan describe opportunities for implementing mitigation actions to reduce risks to and from high hazard potential dams through local capabilities?	Capabilities>Obstacles, Challenges, & Solutions	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD7. Did Element S15 (prioritizing funding) describe the criteria for prioritizing funding for high hazard potential dams?		
HHPD7-a. Does the plan describe the method for funding actions to reduce vulnerabilities to and from high hazard potential dams if these actions were prioritized differently than mitigation actions for other hazards?	Plan Implementation>Program Utilization>Funding Prioritization	Met
HHPD7-b. Does the plan document limitations and describe the approach to addressing deficiencies?	Capabilities>Obstacles, Challenges, & Solutions	Met
HHPD Required Revisions: Click or tap here to enter text.		

FIRE MANAGEMENT ASSISTANCE GRANTS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
FMAG1. Does the plan address wildfire risks? [44 CFR 201.4(c)(2); 44 CFR § 204.51(d)(2)]		
FMAG1-a. Does the risk assessment provide an overview of the location and previous occurrences of wildfire hazards in the state?	HIRA>Wildfire>Location, HIRA>Wildfire>Past Occurrences	Met
FMAG1-b. Does the risk assessment provide an overview of the probability of future wildfire events that includes projected changes in the location, intensity, frequency and/or duration of wildfire hazards?	HIRA>Wildfire>Probability	Met
FMAG1-c. Does the risk assessment address the vulnerability of state assets located in wildfire hazard areas and estimate the potential dollar losses to those assets?	HIRA>Wildfire>Risk& Vulnerability	Met
FMAG1-d. Does the risk assessment include an overview and analysis of local governments' vulnerability to wildfires and the potential losses to vulnerable structures?	HIRA>Wildfire>Risk& Vulnerability	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
FMAG2. Does the plan's mitigation strategy contain wildfire-related mitigation initiatives? [44 CFR 201.4(c)(3); 44 CFR § 204.51(d)(2)]		
FMAG2-a. Does the mitigation strategy identify mitigation actions and activities to reduce the vulnerability of jurisdictions within the state as well as the vulnerability of state-owned assets as described in Elements S5 and S6?	Mitigation Strategy>2023 Mitigation Actions	Met
FMAG Required Revisions: Click or tap here to enter text.		

3. Enhanced State Mitigation Plan Regulation Checklist

ENHANCED STATE PREREQUISITES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E1. Does the enhanced plan include all elements of the standard state mitigation plan? [44 CFR § 201.5(b)]		
E1-a. Does the enhanced plan meet all the required elements of the standard state mitigation plan?	n/a	Met
E2. Regarding HMA, is the state maintaining the capability to meet application time frames and submitting complete project applications? [44 CFR § 201.5(b)(2)(iii)(A)]		
E2-a. Are all applications complete and submitted by the end of each program's respective application period?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E2-b. Are all applications entered into FEMA's electronic data systems (i.e., NEMIS, eGrants, and/or FEMA GO)?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E2-c. Is a complete Minimum Criteria Checklist for Project Subapplicants or equivalent documentation prepared for all subapplications?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E2-d. Are all applications determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E3. Regarding HMA, is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses? [44 CFR § 201.5(b)(2)(iii)(B)]		
E3-a. Are all applications and amendments determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response, including all data requested by FEMA to support cost-effectiveness determinations and EHP compliance reviews?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E4. Regarding HMA, is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time? [44 CFR § 201.5(b)(2)(iii)(C)]		
E4-a. Are all progress reports complete and submitted on time?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E4-b. Are all FFR SF-425s submitted on time?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E4-c. Does the state consistently comply with the Financial Management Standard requirements described in 2 CFR §§ 200.300 to 200.309?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E5. Regarding HMA, is the state maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation? [44 CFR § 201.5(b)(2)(iii)(D)]		
E5-a. Is all work as part of HMA subawards completed by the end of the period of performance, as described in the HMA Guidance?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E5-b. Have there been no major findings on the last single audit obtained by the state related to HMA programs?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E5-c. Are all grant closeout activities, including financial reconciliation, completed within 120 days from the end of the performance period as outlined in 2 CFR 200.344?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
E5-d. Have actual expenditures been documented and are they consistent with SF-424A or SF-424C?	Plan Implementation>Program Utilization, Plan Implementation>HMA Program Compliance>Maintaining Capability	Met
Enhanced State Prerequisites Required Revisions: Click or tap here to enter text.		

INTEGRATED PLANNING

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E6. Does the plan demonstrate integration, to the extent practicable, with other state and/or regional planning initiatives and FEMA mitigation programs and initiatives? [44 CFR § 201.5(b)(1)]		
E6-a. Does the enhanced plan demonstrate integration with other state and/or regional planning initiatives?	Plan Implementation>Integration, Capabilities>FEMA Core Capabilities, Planning Process>State Hazard Mitigation Team	Met
E6-b. Does the enhanced plan demonstrate integration of FEMA mitigation programs and initiatives?	Plan Implementation>Integration>FEMA Programs, Capabilities>FEMA Core Capabilities, Capabilities>Programs, Policies, Regulations, and Practices	Met
Integrated Planning Required Revisions: Click or tap here to enter text.		

DEMONSTRATING COMMITMENT TO A COMPREHENSIVE STATE MITIGATION PROGRAM

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E7. Does the state demonstrate commitment to a comprehensive mitigation program? [44 CFR §§ 201.3(c), 201.5(b)(4) and 201.6(d)]		
E7-a. Does the state demonstrate commitment to statewide programs, initiatives and plans that advance mitigation and resilience?	Plan Implementation>Integration, Capabilities>Programs, Policies, Regulations, and Practices	Met
E7-b. Does the state demonstrate a commitment to mitigation training and capability building?	Plan Implementation>Integration, Local Coordination>Technical Assistance	Met
E7-c. Does the state demonstrate a commitment to its mitigation planning responsibilities by helping local governments update and adopt their plans before they expire?	Plan Implementation>Integration	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
Demonstrating a Commitment to a Comprehensive State Mitigation Program Required Revisions: Click or tap here to enter text.		

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E8. Is the state effectively using existing mitigation programs to achieve mitigation goals? [44 CFR §§ 201.5(a) and 201.5(b)(3)]		
E8-a. Does the state demonstrate and document the full and effective use of existing FEMA programs (if funding is available)?	Plan Implementation>Integration>FEMA Programs	Met
E8-b. Does the state demonstrate and document the full and effective use of non-FEMA programs?	Plan Implementation>Assessing Effectiveness	Met
Effective Use of Existing Mitigation Programs to Achieve Mitigation Goals Required Revisions: Click or tap here to enter text.		

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E9. Does the enhanced plan document capability to implement mitigation actions? [44 CFR §§ 201.5(b)(2)(i), 201.5(b)(2)(ii), and 201.5(b)(2)(iv)]		
E9-a. Does the enhanced plan describe the system to rank the mitigation measures according to established eligibility criteria, including a process to prioritize between funding programs, jurisdictions, and proposals that address different or multiple hazards?	Plan Implementation>Program Utilization>Funding Prioritization	Met
E9-b. Does the enhanced plan describe how the state will assess the effectiveness of mitigation actions, mitigation the agencies that are involved as well as the timeline, and use the results to inform the mitigation strategy?	Plan Implementation> Assessing Effectiveness	Met
Documentation of the State's Implementation Capability Required Revisions: Click or tap here to enter text.		

4. Plan Assessment

The Plan Assessment comments can be used to help guide the ongoing maintenance and update of your mitigation plan.

Standard State Mitigation Plan Requirements

PLANNING PROCESS

Strengths

- DHSEM has strong relationships with other State agencies and other partners and effectively coordinated with them to develop this plan. A roster of 160 individuals for the State Hazard Mitigation Team (SHMT) is impressive and it is commendable the planning team held 40 individual meetings with State agency representatives. The first-time inclusion of local governments participating directly in the 2023 planning process was also great to see.
- In general, the planning process was easy to follow and the plan provides a comprehensive list of the agencies and stakeholders involved. The workshop summaries were well done. Breaking out agenda items, major takeaways, and action items succinctly showed how the State coordinated with the SHMT and summarized what information was covered in the workshops.
- We are pleased that the Planning Team chose to focus solely on natural hazards for this plan update. While other hazard types identified in the 2018 (cyber attack, mine accidents, hazardous materials release, etc.) are important to address, removing them from the State plan helps ensure that time, resources, and effort are focused on thoroughly addressing risk and vulnerability to natural hazards in this plan.

Opportunities for Improvement

- State Mitigation Plans are not required to include supporting documentation for the planning process in the plan. However, we strongly recommend including information like agendas, sign-in sheets, notes, invites, surveys, etc., as part of an appendix for future Enhanced State Hazard Mitigation Plans (E-SHMPs). This helps provide transparency on who was involved and how decisions were made throughout plan development and can be a useful resource for the planning team for future updates.
- Holding over 40 meetings with individual agencies and SHMT members is impressive. However, we would have liked to see more details about these meetings and how findings were incorporated into the plan.
- While tribal governments are mentioned in parts of the plan, it does not appear tribal representatives were involved in the plan update. For the next plan, be sure to address whether or not tribal governments were involved, and if so, how they participated.
- The plan identifies the State Historic Preservation Officer (SHPO) as representing the Natural & Cultural Resources sector, but it is unclear how the SHPO was involved in the update. In the next plan update please provide more detail how the SHPO contributed to the plan.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

Strengths

- The inclusion of the Future Avoided Cost Explorer tool in hazard profiles provides great data and information about future damages from flooding, drought, and wildfire under different population growth and climate scenarios.
- Many of the hazard profiles provide a thorough history of significant events that paint the picture of hazard impacts seen across the state. Including images from events can help tell the story, too.
- The Mitigation Strategy Overview provides a good introduction to social vulnerability indexes and equity tools relative to the State of Colorado.

Opportunities for Improvement

- We recognize that the State currently has data limitations that impact the ability to analyze the vulnerability to State-owned and local assets (elements S5 and S6), as well as risk and vulnerability impacts from changes in local development (element S7). However, these data limitations will not be acceptable for the next plan update. In the next E-SHMP, we expect to see an analysis of asset types and specific assets that are most vulnerable for each hazard profile, as well as an analysis of how the risk assessment was updated based on recent and future development identified from local hazard mitigation plans. General statements and assumptions provided for these elements will not be adequate to meet the requirements for the next plan.
- The analysis of risk to socially vulnerable and underserved populations meets the minimum requirements for element S6. We expect to see more robust analysis for the next E-SHMP. Hazard profiles identify populations the State considers a Disproportionately Impacted Community in counties that have high risk to a given hazard, but a more granular analysis of these communities and their risk and vulnerability is lacking. The Flood profile, for example, notes that El Paso, Huerfano, La Plata, Larimer, Mesa, Pueblo, and Weld counties have a high risk to flooding and contain populations that are low income, housing burdened, and people of color. Why are these populations called out, i.e., what makes these populations particularly vulnerable to flooding? Where in the counties are they located, e.g., are low-income or mobile home communities located in the 100-year floodplain in certain jurisdictions? For the next plan update, to fully meet this requirement the State must include a more detailed analysis on which socially vulnerable and underserved populations are at risk to a hazard and what makes them vulnerable.
- The State should include more detail on climate change impacts for a number of the hazard profiles for the next ESHMP. While the profiles address climate change impacts to location, extent/intensity, frequency, and duration, the level of information provided is inconsistent throughout. For example, the Extreme Heat profile notes the frequency of extreme heat events is projected to rise. The State should include more specificity on where and who these projections will impact, such as potential disproportionate impacts on particularly high-risk communities. The profile also notes extreme heat events are projected to increase and expand to more northern and higher elevation regions – which ones? The Wildfire profiles states total area burned per year is projected to increase substantially in the Rocky Mountain West– what does substantially

mean for Colorado? How much is the acreage burned expected to increase? Was there an opportunity to integrate information from the Climate Preparedness Roadmap that was being developed at the same time this plan was being updated?

- For the next plan update, consider consistently overlaying maps to demonstrate how hazards interact with at risk populations, assets, etc. For example, the Avalanche profile includes Figure 19 *Avalanche Hazard Areas by County* followed by Figure 20 *Colorado 2030 Estimated Population Growth*, but because these are two separate maps readers must go back and forth to identify whether a county has avalanche risk and whether its population is expected to decline, remain steady, or grow. Overlaying these two maps would make it easier to understand how population trends may lead to reduced or increased exposure to future avalanche risk.
- Table 6 *Colorado Hazard Risk Classification* presents the risk classifications for identified hazards based on expected impacts to property, economy, environment, and public health/safety. While it is helpful to understand what went into classifying hazards as extremely high, high, moderate, and low risk, providing the analysis in an appendix for each hazard would provide transparency for how the State determined each hazard's risk classification.
- The State should provide more robust narrative around the Rural Capacity Index to strengthen the information displayed by Figure 12 *Rural Capacity*. What does it mean for a community to be Low Capacity vs. High Capacity on this scale? Additionally, the information provided on this map isn't integrated elsewhere in the plan. How can this information support the State's assessment of local capacity to carry out mitigation efforts?
- In the next plan, the flood section should address pluvial or localized, non-riverine flooding which is a risk to communities with storm sewers, culverts, or other drainage infrastructure. This can occur due to inadequate capacity or debris blocking the conveyance to inlets or culverts. These systems are especially susceptible to flash floods that inundate the system.

STATE MITIGATION CAPABILITIES

Strengths

- Table 70 *State Statutes Relevant to General Mitigation* provides a clear summary of regulations, programs, and policies which enable State agencies to address hazard mitigations. Including similar consistent detail throughout the table of limitations would strengthen this section in the next E-SHMP update.
- The discussion of numerous State agencies and their mitigation responsibilities demonstrates a comprehensive approach to mitigation at the state level.
- Table 77 *Hazard Mitigation Funding Programs* includes thorough detail on the funding programs available for mitigation, and DOLA's Community Funding Guide is a great resource to highlight.
- The plan includes a good description of State agency responsibilities for delivering floodplain management services/activities and available funding sources for floodplain management.

Opportunities for Improvement

- The State has not adopted a statewide building code and the section on local building codes could be more robust with greater focus on the importance of building codes. The State does not

have a database of Colorado jurisdictions that have building codes so there is no way to track this. Perhaps this could be a future mitigation action.

- The Obstacles, Challenges, and Solutions section provides many ideas to add into the mitigation strategy. Consider identifying federal technical assistance efforts such as Building Resilient Infrastructure and Communities (BRIC) Direct Technical Assistance that can assist with local technical expertise and capacity building challenges.
- Funding capabilities are outlined and generally discussed (including how the State hopes to use Safeguarding Tomorrow Revolving Loan Fund), but this section could include information on anticipated funding challenges and opportunities in the next few years, e.g., different priorities in BRIC, uncertain Flood Mitigation Assistance or BRIC future funding amounts, more Hazard Mitigation Grant Program funds becoming available as disasters become more common, and other similar assessments.

MITIGATION STRATEGY

Strengths

- We commend the State for having 90% of the mitigation actions from the 2018 plan underway or completed. This demonstrates that the State uses the plan to pursue actions which reduce risk and vulnerabilities to hazards across Colorado.
- Requiring counties and municipalities that receive State funds for developing comprehensive plans to include all hazards from their hazard mitigation plan is a great way to ensure integration across these planning activities.

Opportunities for Improvement

- While there are many actions carried over from the 2018 plan that address flooding, it is surprising to see that there are no new mitigation strategies developed for a hazard the State has identified as Extremely High Risk. There are also no new specific hazard mitigation actions that address Severe Winter Weather and Tornado despite being rated as high hazards.
- Including more detail on next steps and potential challenges, in addition to benefits of each mitigation action, would provide clarity on how each action will be implemented. Consider including potential non-state partners for mitigation actions.
- For the next plan update, please provide more detail on the status of existing mitigation activities. It will be helpful to not only describe what work has been done, but also next steps, challenges, and benefits seen from implementing the mitigation actions to fully understand the impacts of implementing the E-SHMP.
- In the next plan update, please include more information and analysis on the decision-making process concerning the creation of the mitigation strategy and mitigation actions. Specifically highlighting how climate change impacts as well as underserved and socially vulnerable communities were considered during the updating and creation of mitigation activities can strengthen your mitigation actions and connections to mitigation goals and objectives.
- Consider using mitigation "actions," "measures," or "activities" instead of "projects" to be more inclusive of all potential hazard mitigation activities, including non-construction activities, building codes, etc.

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Strengths

- It's great to see the level of local coordination and capability building the State provides. Having 95% of the population covered by an approved plan is a notable accomplishment.
- The Local Capabilities section describes limitations in local capabilities well. The Challenges section also explores gaps local communities have in engaging underserved communities and challenges from the impacts of climate change.
- The criteria for jurisdiction prioritization are clearly described and include extra attention to communities with high vulnerability and climate change/future considerations.

Opportunities for Improvement

- The plan notes that local hazard mitigation plans often lack information on local assets at risk to hazards or fail to discuss recent and future development. This information is critical for local communities to have to fully understand their risk and develop mitigation actions that minimize risk and vulnerability. Moving forward, we expect to see the State support local communities to ensure local hazard mitigation plans include a thorough analysis of local assets at risk, as well as impacts from recent and future development.
- While the plan discusses the gaps local communities have in engaging underserved populations and challenges resulting from the impacts of climate change, we will expect to see more information in the next plan update for how the State will support local communities to address these gaps and challenges. Are there trainings, tools, or other specific resources the State can provide that can help local communities identify or engage with vulnerable populations, or effectively understand future climate conditions and the impact to future hazard risk?

REVIEW, EVALUATION, AND IMPLEMENTATION

Strengths

- Taking advantage of existing regularly scheduled meetings to provide updates on the continuous plan implementation monitoring is an excellent idea and a great way to ensure stakeholders are engaged and informed.

Opportunities for Improvement

- In the next plan update, consider highlighting future opportunities and projects. This will give a better picture of what the State is looking forward to or how it hopes to better utilize HMA programs in the future. This portion of the plan feels more like a report of what has been done since the last E-SHMP.
- Consider including feedback from the latest Enhanced Validation meeting in the Maintaining Capabilities section on page 520. The information in this plan is from the previous Enhanced Validation, not the most recent.

ADOPTION AND ASSURANCES

Strengths

- The adoption resolution makes it clear that the Governor is in full support of State agencies to implement the E-SHMP and carry out the mitigation actions developed for this plan. We look forward to seeing all that the State will accomplish through this plan.

HIGH HAZARD POTENTIAL DAMS

Strengths

- The plan provides good historical context of dam failures across the state, and highlights some of the implementation challenges of the High Hazard Potential Dams program.
- The State-developed web mapping application provides a dynamic map for users to search dams within Colorado.

Opportunities for Improvement

- Consider participation and/or soliciting feedback from federal partners, dam owners, and non-profits that may play a role in dam safety across the state.
- It would be good to include inundation areas within the web mapping application. However, it is understandable if this is protected data and is deliberately omitted.
- The next plan update should include additional actions specifically related to high hazard potential dams. For example, the plan highlights the ongoing Risk Assessments on High Hazard Dams as a success. To date, assessments have only been completed for 15% of high hazard dams. It is unclear why this action isn't included in the 2023 plan as it appears the State intends to continue to work on this project.

FIRE MANAGEMENT ASSISTANCE GRANTS

Strengths

- The Wildfire hazard profile includes great maps and detailed analyses of cascading risks to other hazards, as well as an analysis of how recent and future development impacts wildfire risk for many Colorado communities. Including this level of detail and analysis consistently across hazard profiles would strengthen the Hazard Identification and Risk Assessment portion of the plan.
- There is a high level of coordination within Colorado on wildfire risk and mitigation issues. The data provided by the Colorado State Forest Service on the risk assessment provides valuable information in this section of the plan.

Opportunities for Improvement

- While many hazard profiles provide detailed accounts of previous events, we found it odd that the Wildfire profile included a table of notable wildfires over the last century but no narrative for

any of them. We expect a brief narrative for notable recent events like the Marshall, East Troublesome, Cameron Peak, and Spring Creek wildfires.
- Drilling down into areas of the state where State-owned assets might be more vulnerable to wildfire based on importance and use of the structure and/or age of structures can help identify where retrofitting or mitigation action may be needed.
- It was great to see the level of analysis completed for local vulnerability to wildfire, including the development pressure identified from local hazard mitigation plans. It might also be beneficial to analyze where higher standards exist for development in high wildfire risk areas. This could help inform where support on building and land use codes in relation to wildfire may be needed, and how actions related to this could be included in the mitigation strategy.

Enhanced State Mitigation Plan Requirements

ENHANCED STATE PREREQUISITES

Opportunities for Improvement

- While the plan meets the requirements for a Standard plan, the analysis of State-owned and local assets, hazard-specific risk to vulnerable and underserved populations, and impacts from recent and future development barely meet the requirements. The current level of analysis for these components of the plan's Hazard Identification and Risk Assessment will not be acceptable for the next plan update, and we have outlined our expectations in the Opportunities for Improvement.

INTEGRATED PLANNING

Strengths

- The level of coordination that is involved with integrating the E-SHMP with other planning mechanisms and groups within Colorado is commendable. The inventory of programs and plans and outcomes of these partnerships shows the Colorado has an integrated planning process and coordinates mitigation efforts in the State.

Opportunities for Improvement

- E-SHMPs are required to demonstrate how the plan's risk information, goals, strategies and actions have been integrated into other state and/or regional plans, programs, policies, initiatives and procedures, as well as results or outcomes. Table 90 *2018 Mitigation Action Status* describes several coordination opportunities and goals, however it is unclear if the goals are being met or what the results or outcomes are. Including this information in the plan may help prioritize partnerships and integration efforts as well as help identify which activities are resulting in mitigation investments to reduce risk.
- One thing to consider as the State moves forward with planning efforts is to identify where the mitigation team could strategically become involved with key stakeholders from non-governmental organizations which work with underserved communities.

- While it is called out in the plan, consider describing the process for how DHSEM coordinates with RiskMAP processes occurring in the state.
- To better support historic preservation efforts, the plan could benefit from addressing requirements of Section 106 of the National Historic Preservation Act (NHPA), engaging in more robust coordination with the CO SHPO, and establishing coordination with Tribal Historic Preservation Offices (THPOs) and Certified Local Governments.

DEMONSTRATING A COMMITMENT TO A COMPREHENSIVE MITIGATION PROGRAM

Strengths

- The State is to be commended for achieving 95% population coverage (at the time of plan writing) under approved mitigation plans.
- The Technical Assistance section does an excellent job of describing the types of technical assistance DHSEM has been providing, like promoting the increased cost match since COVID, providing half the non-federal match, BCA support, etc. The next plan update could better explain who makes up the Mitigation Planning Team, Mitigation Section, and the Mitigation Projects Team, etc. It is not totally clear if this is DHSEM or others.

Opportunities for Improvement

- As noted in the plan, a major data limitation for this plan is a lack of data on local assets and recent and future development. As an Enhanced state, we expect DHSEM to work closely with local communities as they update their hazard mitigation plans to ensure this data is captured and meet elements B2 and E1 for local mitigation plans. This information is not only critical for local communities to fully assess their risk and develop effective mitigation actions, but is also necessary for the State to meet state planning requirements.
- The plan identifies current gaps and limitations in the building code adoption process along with great resources for local and State entities. Consider building upon this section to identify strategies for overcoming these barriers with steps to support and encourage local jurisdictions to adopt and enforce the current (or next most recent) hazard-resistant building code.
- One missed opportunity for this section is a discussion of the additional requirements DHSEM developed for local hazard mitigation plans. The additional requirements ensure that plan teams engage with various State departments during the planning process, use the FACE Hazards tools to assess potential future losses from climate change to certain hazards, and make approved hazard mitigation plans accessible online, among other requirements. Colorado is the only state in Region 8 that includes additional requirements, and we view this as a best practice that other states have shown interest in modeling.
- Page 484 notes that the State Planning Team used to host a one-day course modeled after the G-318 course. Is there an opportunity to revive this offering to local communities and plan developers?
- While the hazard mitigation strategy includes actions related to hazard specific building codes, the plan does not document a step to encourage all local jurisdiction to adopt the current or most recent hazard-resistant building code. The plan does document that this may be the role of the building official to ensure building codes are updated, and following the International Code

Council three-year code updates, however, not every community has the capacity to have a building official according to the plan. Lastly, according to the plan, not all jurisdictions enact detailed building codes nor re-adopt the most recent version. These are all documented challenges, and we would encourage the State to identify action steps to address local challenges or data gaps related to building codes.

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Opportunities for Improvement

- Consider strategies for how the State can fully utilize, when appropriate, federal technical assistance programs related to hazard mitigation priorities in Colorado. Examples include reviewing federal technical assistance grants from the agencies identified in the plan that could support building local capacity, such as BRIC Direct Technical Assistance as well as other federal technical assistance programs. These programs could help increase the State's and local capacity to implement good projects.
- The plan notes that the State is committed to making full and effective use of available funding and provides a table that shows how much funding has been awarded and expended for various FEMA Hazard Mitigation Assistance grants. Notably, Table 98 *HMA Mitigation Project Funding 2013-2023* does not include BRIC Fiscal Year '22. It may also be helpful to know for grants with State allocations how much of the allocated funding was used in comparison.
- Table 105 *Federal Disaster Declarations (1955-2023)* plan lists the amount of public assistance (PA) used dating back to 1997. This does not break down between PA categories C-G and PA Mitigation. While the E-SHMP does reference the PA Administrative Plan and states DHSEM strives to maximize Section 406 Mitigation funds available through the PA program, the State should share what measures, percentage, or outcomes it is using to determine full and effective use of PA Mitigation.
- The plan does not address historic preservation programs. The plan could benefit from coordination with Certified Local Governments and other historic preservation groups.

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Strengths

- The explanation of the three methods to compare benefits and costs was well done.
- The loss avoidance study process is innovative. This is a best practice that will help inform future mitigation efforts.

Opportunities for Improvement

- The plan could benefit by having ranked projects which show state prioritization by funding category along with estimated project costs for each.