FLOOD HAZARD MITIGATION PLAN
FOR
COLORADO

September 2010

Prepared Pursuant to
Disaster Mitigation Act 2000 & Section 409, PL 93-288

Prepared for
Colorado Water Conservation Board
Department of Natural Resources

In Cooperation with
The Department of Local Affairs
Division of Emergency Management

Original Plan Prepared by the CWCB (Bill Stanton) in 1982
after the Lawn Lake dam failure flood

Updated and revised in 2004, 2007, and 2010

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EXECUTIVE SUMMARY

The Colorado Flood Hazard Mitigation Plan summarizes the State of Colorado's (State) vulnerability to flooding and outlines strategies to manage and reduce the impact of flood hazards. The Plan conforms to the Standard State Hazard Mitigation planning requirements of the Disaster Mitigation Act of 2000. The main components of this Plan include a detailed vulnerability assessment and mitigation strategy. Included is a description of the process used to prepare the Plan and a profile of the flood hazards in Colorado, including the nature of impacts and probability of occurrence. The vulnerability assessment discusses the past and potential impacts to Colorado's citizenry, economy, environment, and State assets. The vulnerability assessment is covered in detail in Sections 3.3-3.5. The mitigation strategy outlines the goals of the Plan and specific action items intended to meet those goals. Many of these mitigation actions are ongoing and can occur during and in between flood events. A capability assessment describes the State's plans, policies and procedures in place that already help manage and reduce flood impacts. Information on agency responsibilities and existing flood mitigation programs, local flood mitigation plans and contacts for local government outreach and assistance are also included. The Plan describes funding sources that can be used to implement local mitigation projects and plans and a description of the process for implementation, monitoring, and evaluating the Plan.

1 PREREQUISITE

1.1 Formal Adoption by the State

With the submission of the 2010 State of Colorado Natural Hazards Mitigation Plan (NHMP), the NHMP is hereby approved and adopted by the State of Colorado – Department of Local Affairs, Office of the Governor. The Flood Hazard Mitigation Plan (Plan) is incorporated as an annex to the NHMP and is consequentially approved by the Office of the Governor. Adoption by the Office of the Governor empowers the Colorado Water Conservation Board (CWCB) and the Colorado Division of Emergency Management (DEM) to execute their responsibilities with respect to disaster preparedness, response, recovery, and mitigation.

The 2010 State of Colorado Natural Hazards Mitigation Plan was approved and adopted by the State of Colorado, Department of Local Affairs, and Office of the Governor. For this 2010 Plan Revision, it will be the responsibility of the Division of Emergency Management to obtain the appropriate formal State approval. A copy of this approval is contained in an appendix of the NHMP.

In addition, this Plan was reviewed and formally approved by the board of the Colorado Water Conservation Board on September 14, 2010.

1.2 Assurances of Continued Compliance with Federal Requirements

This Plan 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 §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.) While the act emphasizes the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local 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 Act (Public Law 93-288).

The State of Colorado assures 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 NHMP 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 NHMP demonstrates the State of Colorado's commitment to fulfilling the mitigation objectives in the NHMP and authorizes the agencies identified in the NHMP to execute their responsibilities.

In addition, the Flood Hazard Mitigation Plan complies with and adheres to the Emergency Management Accreditation Program (EMAP) standard. The EMAP is a voluntary review process for state and local emergency management programs. Accreditation is a means of demonstrating, through self-assessment, documentation, and peer review, that a program meets the national standards for emergency management programs.

2 PLANNING PROCESS

2.1 Documentation of Planning Process

2.1.1 Description of Plan Preparation Process

The process established for this planning effort is based on the Disaster Mitigation Act of 2000 planning and update requirements and the Federal Emergency Management Agency's (FEMA) associated guidance for state hazard mitigation plans. The Flood Mitigation Advisory Committee (FMAC) followed FEMA's recommended four-step mitigation planning process:

- Identify and organize available resources
- Identify hazards and assess risk
- Develop a mitigation strategy and mitigation plan
- Implement the plan and monitor progress

The Colorado statewide hazard mitigation planning program is designed to coordinate the efforts of many state agencies and organizations in mitigation planning and programming on an ongoing basis. It is also intended to actively promote and coordinate mitigation planning and programming by local jurisdictions. The DEM took the lead on the 2010 update of the State of Colorado 2007 NHMP umbrella document. The original umbrella document was created in 2001, was updated in 2004, 2007, and 2010 and was designed as a way to tie together various hazard-specific documents that had been developed over the previous years.

The DEM coordinated with other agencies on concurrent state planning and risk management efforts, including the extremely important natural hazard specific annexes to the umbrella document. The Colorado Water Conservation Board (CWCB) took the lead on the 2010 update to the Flood Hazard Mitigation Plan. A consulting firm (AMEC Earth & Environmental) was selected to coordinate and facilitate the 2010 update to the Plan as well as develop a more detailed vulnerability assessment. Since the 2010 update was a comprehensive revision it will be referred to as such in the remainder of the Plan.

2.1.2 Evolution of the Colorado Flood Hazard Mitigation Plan

The original Colorado Flood Hazard Mitigation Plan was prepared by the CWCB (Bill Stanton) following the Lawn Lake dam failure flood in 1982. The plan was updated in 2004 and 2007 as part of the NHMP update process. The 2007 version of this plan contains the narrative of the planning process followed at that time, which mirrored that of the umbrella NHMP. The following description of the planning process is focused on the 2010 plan update process.

2.1.3 2010 Update Planning Process

In 2010 the Plan underwent a significant update as part of the three year State Plan update cycle. The major objectives of this revision included:

- Updating the Plan to meet DMA 2000 and EMAP planning standards
- Developing a comprehensive flood hazard vulnerability assessment with enhanced estimates of risks and potential losses
- Updating the flood hazard mitigation strategy
- Capturing initiatives and projects completed or initiated within the past three years at state and local levels that contribute to flood loss reduction
- Developing additional tools and resources to support local flood mitigation efforts

The results of this effort are captured in this Plan. The Plan outline mirrors that of the FEMA standard mitigation plan update review crosswalk, as well as that of the Colorado Drought Mitigation and Response Plan for consistency among plans and with DMA 2000 planning requirements. The remainder of this section details the planning process used to develop this Plan, with an emphasis on the 2010 update process.

Flood Mitigation Advisory Committee

The development, implementation, and maintenance of the Flood Plan are the responsibility of the Flood Mitigation Advisory Committee (FMAC) under the leadership of the CWCB. The FMAC is made up of representatives of the principal state agencies and organization with authorities, responsibilities, or expertise related to flood hazard mitigation programs. The committee was re-formed during the 2010 update process. Formation of the FMAC was based on state and federal agencies that have a stake in flood hazard mitigation in Colorado and have a lead or supporting role on mitigation actions. Membership included those agencies active in the existing SHMT, the State Flood Task Force, and/or the Drought Mitigation and Response Planning Committee. Specific membership is listed in Section 2.1.4. The FMAC participated in two major planning meetings between June and July 2010 summarized in the following table.

Table 1 Key Planning Meetings of the 2010 Revision Process

Meeting	Date	Purpose
1. Project Kickoff	June 18, 2010	• Review Disaster Mitigation Act planning requirements, scope of work, and schedule • Review role of FMAC • Discuss data collection needs • Discuss stakeholder involvement
2. Risk Assessment and Mitigation Strategy Update (in conjunction with the SHMT)	July 22, 2010	• Present and discuss updated risk assessment • Review and Update Plan Goals and Mitigation Actions

Sign in sheets and documentation of these meetings are included in a planning process reference notebook on file with the CWCB.

In addition to these meetings, a core group of individuals including the CWCB staff and AMEC participated in a meeting to review, revise and update the 2007 Plan's goals on July 19. These revised goals were shared and verified by the FMAC at the July 22 meeting. Additionally, some members of the FMAC participated on the SHMT and other meetings related to the NHMP update. This included a meeting on May 13 where input to an EMAP consequence analysis was solicited from the group and is now captured in Section 3.3. Additional meetings related to public and stakeholder outreach are discussed in Section 2.2.2. In addition to these meetings, the process included individual phone conversations and e-mail between AMEC and CWCB staff with various entities and agencies on the FMAC. CWCB and other agencies conducted internal meetings relative to the existing and proposed mitigation actions and their prioritization.

2.1.4 Involvement in Planning Process

During the update to the Plan, several individuals participated on the FMAC and provided information and assistance to promote the development of the document. The FMAC consists of the following core agencies/entities:

State

- Department of Agriculture – State Conservation Board
- Department of Transportation
- Colorado State University – Colorado Climate Center
- Department of Local Affairs – Colorado Division of Emergency Management
- Department of Local Affairs – Colorado Division of Local Government
- Department of Natural Resources – Colorado Division of Wildlife
- Department of Natural Resources – Colorado Geological Survey
- Department of Natural Resources – Colorado State Forest Service
- Department of Natural Resources – State Land Board
- Department of Natural Resources – State parks
- Department of Natural Resources – Colorado Water Conservation Board (lead agency)
- Department of Natural Resources – Division of Water Resources
- Department of Public Health and Environment

The FMAC members were involved in the planning process through:

- Attending and participating in FMAC meetings
- Providing available data requested
- Reviewing and commenting on Plan drafts and obtain agency buy-in for relevant sections
- Assisting with public input/stakeholder process

During the update to the Plan, several individuals participated on the FMAC and provided information and assistance to promote the development of the document. These people, listed in Table 2, have performed invaluable service to the document, either by providing input and data, writing sections, performing analyses, or editing for content.

Table 2 Participants and Acknowledgments

Name	Agency
Tom Browning	Colorado Water Conservation Board
Joe Busto	Colorado Water Conservation Board
Kevin Houck	Colorado Water Conservation Board
Cristina Martinez	Colorado Water Conservation Board
Thuy Patton	Colorado Water Conservation Board, Office of Water Conservation & Drought Planning
Chris Sturm	Colorado Water Conservation Board
Iain Hyde	Colorado Department of Local Affairs, Division of Emergency Management
Victoria Smith	Colorado Department of Local Affairs, Division of Emergency Management
Barry Cress	Colorado Department of Local Affairs, Division of Local Government
Steven Griffin	Colorado Department of Transportation
Cindy Lair	Colorado Department of Agriculture, State Conservation Board
Tom Schreiner	Colorado Division of Wildlife
Robin Koons	Colorado Department of Public Health and Environment
Jeff Brislawn	AMEC Earth & Environmental
Graeme Aggett	AMEC Earth & Environmental

2.1.5 Agency Involvement in Plan Preparation Process

During the revision to the Flood Hazard Mitigation Plan, several agencies provided input and technical expertise. Several of the agencies listed previously provided data and information to support the Plan's vulnerability assessment. Agencies were provided a worksheet designed to capture information needed to update the Plan. The worksheet was used to collect agency input on changes in capabilities and funding sources since 2007. This worksheet also solicited input on the status of existing mitigation actions outlined in the 2007 Plan to determine which items had been completed, deleted, deferred, or were ongoing. The worksheet was used to survey agencies on flood vulnerability from their perspective, and to solicit input on projects that have contributed towards reducing flood vulnerability over the past three years. FMAC members filled out these questionnaires and worksheets and the information directly contributed to the preparation of this Plan.

Federal agencies were also involved in the process by providing information to support the risk assessment and/or reviewing and commenting on the draft updated document. FEMA Region VIII provided the results of a statewide flood hazard vulnerability analysis that has been incorporated into Chapter 3 of this Plan.

2.1.6 Description of Plan Review and Analysis

During the 2010 Plan revision, the FMAC updated each of the sections of the previously approved plan to include new information and improve organization and formatting of the Plan's contents. The FMAC analyzed each section using FEMA's Multi-Hazard Mitigation Planning Guidance for Standard State Mitigation Plans to ensure that the Plan met these requirements. As part of the 2010 Plan revision, every section was updated with new or revised information. Table 3 shows which sections of the Plan were revised with highlights of what was updated or altered. More detailed documentation on the revision methodology and process is provided at the beginning of each Plan section.

Additionally, the FMAC reviewed and provided comment on the draft revised Plan. The document was shared electronically through e-mail and posted on an FTP site for download. Comments were solicited during a 10 day period in August.

Table 3 Changes in the 2010 Plan Revision

Plan Element	Highlights of Update/Revision
Prerequisite Adoption by the State	• Language updated for 2010 • Added approval by CWCB Board
Planning Process Documentation of the Planning Process Coordination Among Agencies Program Integration	• Description of 2007 process related to umbrella NHMP removed • Planning effort updated and documented • Multi-agency outreach and coordination • Changes in coordination noted
Risk Assessment Identifying Hazards Profiling Flood Hazards Assessing Vulnerability by Jurisdiction Assessing Vulnerability of State Facilities Estimating Potential Losses by Jurisdiction Estimating Potential Losses of State Facilities	• Levee failure identified and profiled as a component of the flood hazard • Included debris flows in hazard profile • Added description of major drainage basins in the state • Includes EMAP consequence analysis • Includes the first comprehensive analysis of flood risk on a statewide basis, county by county • Includes updated rollup of information in local mitigation plans

Plan Element	Highlights of Update/Revision
Mitigation Strategy Hazard Mitigation Goals State Capability Assessment Local Capability Assessment Mitigation Actions Funding Sources	• Goals reassessed and revised to reflect current priorities • Mitigation Action table expanded and organized by revised goals • Actions revised and prioritized • New actions developed • Updated capability assessment review • Funding sources updated
Coordination of Local Mitigation Planning Local Funding and Technical Assistance Local Plan Integration Prioritizing Local Assistance	• Information revised with changes and assistance provided in past three years
Plan Maintenance Process Monitoring, Evaluating, and Updating the Plan Monitoring Progress of Mitigation Activities	• Process revisited, minor revisions

2.2 Coordination among Agencies

2.2.1 Involvement of Federal and State Agencies

Federal and state agencies were integrally involved in the development of the information provided in this revision to the Plan. The agencies are identified in the previous sections. Both federal and state agencies were represented on the FMAC and participated in meetings previously listed. As indicated, these meetings served as a means to identify federal and state requirements, assign roles and responsibilities to obtain pertinent information, provide for the exchange or transmission of the information, and specifically provide insight and data pertinent to the risk assessment and mitigation strategies. In addition, the FMAC provided a mechanism for federal and state agencies to review the draft Plan and provide comments that were incorporated into the final document.

2.2.2 Involvement of Interested Groups

Early in the planning process, local groups, agencies, and organizations were identified that may have an interest in the Plan or could participate as stakeholders in the process. Stakeholders could participate in various ways, either by contributing input at meetings, being aware of planning activities through an e-mail group, providing information to support the effort, or reviewing and commenting on the draft Plan.

The following groups were identified as interested groups. Specific contacts were indentified within certain groups to solicit input on the draft Plan. Others may be considered for additional involvement or outreach in the future.

Other Federal Agencies

- National Weather Service (NWS)
- FEMA
- U.S. Army Corp of Engineers (USACE)
- U.S. Geological Survey (USGS)
- U.S. Department of Agriculture – Natural Resource Conservation Service (NCRS)

Other Local and State Government

- CWCB – Office of Water Conservation and Drought Planning
- Colorado Counties Inc.
- Colorado Emergency Management Association
- Colorado Governor's Flood Task Force
- Colorado Municipal League
- Urban Drainage and Flood Control District

Conservation Organizations

- Colorado River Water Conservation District

Other Organizations

- Colorado Association of Stormwater and Floodplain Managers (CASFM)
- Colorado Watershed Assembly
- Rocky Mountain Insurance Information Association

Outreach Efforts

Plan outreach was accomplished by raising awareness of the update at meetings and conferences, and by advertising the public comment period through CWCB e-mail blasts. The update to the Plan was promoted at the following functions:

- Colorado Municipal League Conference in June 2010
- Outreach to local governments at State Floodplain Rule Change meetings:
  - June 23 in Longmont
  - July 7 in Montrose

The draft updated Plan was posted on the CWCB website for public and stakeholder review and comment between August 20 and September 9. The comment period was advertised by the CWCB by e-mail blasts to the Flood Task Force interested groups subscriber list (includes over 640 subscribers) and CASFM e-mail groups. Comments were received from four entities, including individual counties, cities, and private sector associations, and integrated where

appropriate. The plan was also presented at a public forum on September 14 when it was formally approved by the board of the Colorado Water Conservation Board.

2.2.3 Changes in Coordination

The granting agency for the Colorado Flood Mitigation Assistance (FMA) program was transferred from the CWCB to the Colorado Division of Emergency Management (DEM). CWCB continues to provide technical assistance and related efforts to support DEM and the local applicants on future applications. Additionally, DEM transferred the full administrative responsibilities of the Community Assistance Program (CAP) to the CWCB in 2010 to allow FEMA to pass grant funds directly to the CWCB.

2.3 Program Integration

2.3.1 Integration of Mitigation Planning with other State Planning Efforts

The State of Colorado is committed to the multi-agency mitigation strategy outlined in this Plan. One of the Plan goals listed in Section 4.1 of this Plan is directly related to this:

- Coordinate and Provide Technical Assistance for state, local, and Watershed Planning Efforts

Section 4.4 Mitigation Actions provides additional detail on actions designed to improve coordination and integration efforts. Details on related planning programs and initiatives are also discussed in Section 4.2 State Capability Assessment.

Mitigation planning has been closely integrated with the planning efforts related to the following programs:

- Flood Mitigation Assistance (FMA) Program
- Pre-Disaster Mitigation Program
- Flood Map Modernization Program

In addition, the CWCB completed and approved the "State of Colorado Floodplain and Stormwater Criteria Manual" in 2006. This planning document provides guidance to local communities on issues related to flood and stormwater management within the state.

CWCB supports watershed planning and projects designed to restore and protect watersheds. This is more clearly defined in the CWCB Board's Policy Implementation Objectives, which include multi-objective planning, project development, and stream restoration. In order to achieve this objective, the Board and staff participate with partners to plan and undertake multi-objective projects designed to reduce flood hazards, stabilize and restore stream channels, provide habitat, reduce erosion, and increase the capacity to utilize water. This objective is

discussed in greater detail in Section 4.2.3 State Policies Related to Development in Floodprone Areas.

2.3.2 Integration of Mitigation Planning with FEMA Mitigation Programs and Initiatives

Mitigation planning associated with this document has strived to include the integration of other FEMA mitigation programs and initiatives. Specifically, the goals of the NFIP Repetitive Loss Program have been integrated into the evaluation of mitigation projects identified through this planning process. Repetitive loss properties will be included as a criterion during the evaluation process. Furthermore, a discussion of repetitive loss properties is included in this document with specific information provided on the number of repetitive loss properties in Colorado on a county-by-county basis. Through the integration of this information into the planning activities, the capability of Colorado to be selected for the nationally competitive grant programs should be increased.

CWCB is also working on efforts to increase local participation in the Community Rating System (CRS). The CWCB developed the Colorado CRS Strategy Report in March 2010 to further this effort. A list of mitigation action items will be developed following an evaluation of the report's recommendations.

The CWCB is a Cooperating Technical Partner (CTP) with the Federal Emergency Management Agency (FEMA). The CWCB works with local governments outside of the Denver Metro Area to develop new Flood Insurance Studies and Flood Insurance Rate Maps. Within the six county Denver Metro area the Urban Drainage & Flood Control District is the CTP. FEMA has operated the Map Modernization Program since 2004. This was a five year program with a nationwide budget of $1 billion. The next phase of the Map Modernization Program is now underway. RiskMAP will combine flood hazard mapping, risk assessment tools and hazard mitigation planning into one seamless program. FEMA with the support of Congress will continue the nationwide RiskMAP program starting in FY10. The budget for RiskMAP will be determined on an annual basis. Colorado has been the leading state for FEMA Region VIII in terms of helping achieve mapped population and stream miles, the goals of the first phase of Map Modernization. Colorado typically receives $1-1.5 million dollars worth of grant money each year and this amount is expected to decrease slightly this year due to the amount of money available from Congress. Colorado continues to provide cost-sharing leverage for DFIRM and future RiskMAP projects.

3 RISK ASSESSMENT

The foundation of the Colorado Flood Hazard Mitigation Plan is the statewide risk assessment. It sets the stage for identifying mitigation goals and activities to help the State become resilient against floods and keep Colorado residents safe. The major components of this risk assessment include a hazard identification/analysis and a vulnerability analysis that answer the following questions: What are the flood hazards that could affect Colorado? What can happen as a result of those hazards? How likely is each of the possible outcomes? When the possible outcomes occur, what are the likely consequences and losses, and how does this vary across the state? This section attempts to answer these questions based on the best available data.

The Federal Emergency Management Agency (FEMA) defines risk assessment terminology as follows:

- **Hazard**—A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Vulnerability**—Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Exposure**—Exposure describes the people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Risk**—Risk depends on hazards, vulnerability, and exposure. It is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. It refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.
- **Risk Assessment**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

3.1 Identifying Flood Hazards

This hazard analysis assesses various risks facing the State and its communities in order to evaluate and rank them. This process is then used to characterize flood hazards for emergency planning. It estimates the probability of occurrence and the severity of consequences for each hazard and provides a method of comparison. The evaluation involves many interrelated variables (e.g., demographics, topography, scope, etc.), and should be used by state and local officials in planning and prioritizing allocation of resources.

A careful examination of flood hazard event profiles relevant to Colorado serves to define historic hazard trends and provides a reference point for understanding the potential impacts from future predicted events. Reviewing historic data assists in evaluating hazard event profiles, which focus on answering the following questions: How often might a particular disaster occur? Where are we most likely to be affected? and, How bad can it get?

The flood hazards that threaten Colorado are profiled below.

3.1.1 Description of Flood Hazards Affecting State

The natural hazards affecting the state are described in detail in the NHMP 2001 umbrella document. This document focuses on a summary of the flood hazards that affect the State of Colorado.

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of stream banks, (2) the unusual and rapid accumulation of runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land. Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel. Rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of specific physiographic characteristics. Generally, the rise in water surface elevation is quite rapid on small (and steep gradient) streams and slow in large (and flat sloped) streams.

Floods are often measured in terms of magnitude and the statistical probability that they will occur. The 100-year flood event is the standard national measurement for flood mitigation actions and insurance. The 100-year flood, or the one percent AEP (annual exceedance probability) flood, "has a 1 in 100 chance of being equaled or exceeded in any 1 year, and it has an average recurrence interval of 100 years…" (http://pubs.usgs.gov/gip/106/). This recurrence interval is an *average*; it does not necessarily mean that a flood of such a magnitude will happen exactly every 100 years. Only a few years may pass between one 100-year flood and another while two other 100-year floods may be separated by 150 years. The 500-year flood event is another measurement which "has a 0.2 percent chance (or 1 in 500) chance of occurring in a given year" (http://pubs.usgs.gov/gip/106/pdf/100-year-flood_041210web.pdf).

The causes of floods relate directly to the accumulation of water from precipitation, rapid snowmelt, or the failure of manmade structures, such as dams or levees. Floods caused by precipitation are further classified as coming from:

- Rain in a general storm system
- Rain in a localized intense thunderstorm
- Melting snow
- Rain on melting snow
- Ice jams

Floods may also be caused by structural or hydrologic failures of dams or levees. A hydrologic failure occurs when the volume of water behind the dam or levee exceeds the structure's capacity resulting in overtopping. Structural failure arises when the physical stability of the dam or levee is compromised due to age, poor construction and maintenance, seismic activity, rodent tunneling, or myriad other causes.

Each of these causes results in floods that have distinct characteristics relative to flow rate, rate of rise, volume, duration, and flood season.

General Rain Floods

General rain floods can result from moderate to heavy rainfall occurring over a wide geographic area lasting several days. They are characterized by a slow steady rise in stream stage and a peak flood of long duration. As various minor streams empty into larger and larger channels, the peak discharge on the mainstream channel may progress upstream or downstream (or remain stationary) over a considerable length of river. General rain floods can result in considerably large volumes of water. The general rain flood season is historically from the beginning of May through October. Because the rate of rise is slow and the time available for warning is great, few lives are usually lost, but millions of dollars in valuable public and private property are at risk.

Thunderstorm Floods

Damaging thunderstorm floods are caused by intense rain over basins of relatively small area. They are characterized by a sudden rise in stream level, short duration, and a relatively small volume of runoff. Because there is little or no warning time, the term "flash flood" is often used to describe thunderstorm floods. The average number of thunderstorm days per year in Colorado varies from less than 40 near the western boundary to over 70 in the mountains along the Front Range. The thunderstorm flood season in Colorado is from the middle of July through October.

Snowmelt Floods

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

Rain on Snowmelt Floods

Rain on snow flooding occurs most often in Colorado during the month of May. It is at this time of year that large general rainstorms occur over western Colorado. These rainstorms are most often caused when warm moist air from the Gulf of Mexico begins pushing far enough north that it begins to affect western weather. In combination with this movement of air mass is the continued possibility of cold fronts moving into Colorado from the Pacific Northwest. When

these weather phenomena collide, long lasting general rainstorms can often occur. Rain on snowmelt exacerbates an already tenuous situation as snowmelt waters rush down heavily incised stream channels. Any abnormal increase in flow from other sources usually causes streams to leave their banks.

During the summer months of May and June when rivers are running high, there is a potential for flooding due to rain falling on melting snow. Usually such rain is over a small part of a basin, and the resulting flood is of short duration and may often go unnoticed in the lower reaches of a large drainage basin. To some extent, the cloud cover associated with the rain system can slow the melting cycle and offset the compound effect. In some cases, however, rainfall may be heavy and widespread enough to noticeably affect peak flows throughout the basin.

Ice Jam Floods

Ice jam floods can occur by two phenomena. In the mountain floodplains during extended cold periods of 20 to 40 degrees below zero, the streams ice over. The channels are frozen solid and overbank flow occurs, which results in ice inundation in the floodplains. Ice jam floods can occur when frozen water in the upper reaches of a stream abruptly begins to melt due to warm Chinook winds. Blocks of ice floating downstream can become lodged at constrictions and form a jam. The jam can force water to be diverted from the stream channel causing a flood. An ice jam can also break up, suddenly causing a surge of water as the "reservoir" that was formed behind it is suddenly released. Ice jamming occurs in slow moving streams where prolonged periods of cold weather are experienced. Sometimes the ice jams are dynamited, allowing a controlled release of the backed up water to flow downstream.

Dam Failure Floods

Dam failure floods are primarily a result of hydrologic or structural deficiencies. The operation of a reservoir can also influence the safety of the structure. Dam failure by hydrologic deficiency is a result of inadequate spillway capacity, which can cause a dam to be overtopped during large flows into the reservoir. Dam failure by hydrologic deficiency occurs from excessive runoff after unusually heavy precipitation in the basin. Large waves generated from landslides into a reservoir, or the sudden inflow from upstream dam failures, are other causes of dam failure by overtopping. Overtopping is especially dangerous for an earth dam because the down-rush of water over the crest will erode the dam face and, if continued long enough, will breach the dam embankment and release all the stored water suddenly into the downstream floodplain.

Examples of structural deficiencies include seepage through the embankment, piping along internal conduits, erosion, cracking, sliding, overturning, rodent tunneling, or other weakness in the structure. Old age is often at the root of structural deficiencies. Seismic activity in Colorado has recently been recognized as a potential source of structural problems due to liquefaction of sand layers in the embankment of a dam.

The mechanics of a structural failure depends on the type of dam and the mode of failure. Dam failure floods due to structural deficiencies are characterized by a sudden rise in stream level and relatively short duration similar to a thunderstorm flood. They can occur at any time, but earthen dams appear to be most susceptible to structural failure during the fall and spring freezing and thawing cycles.

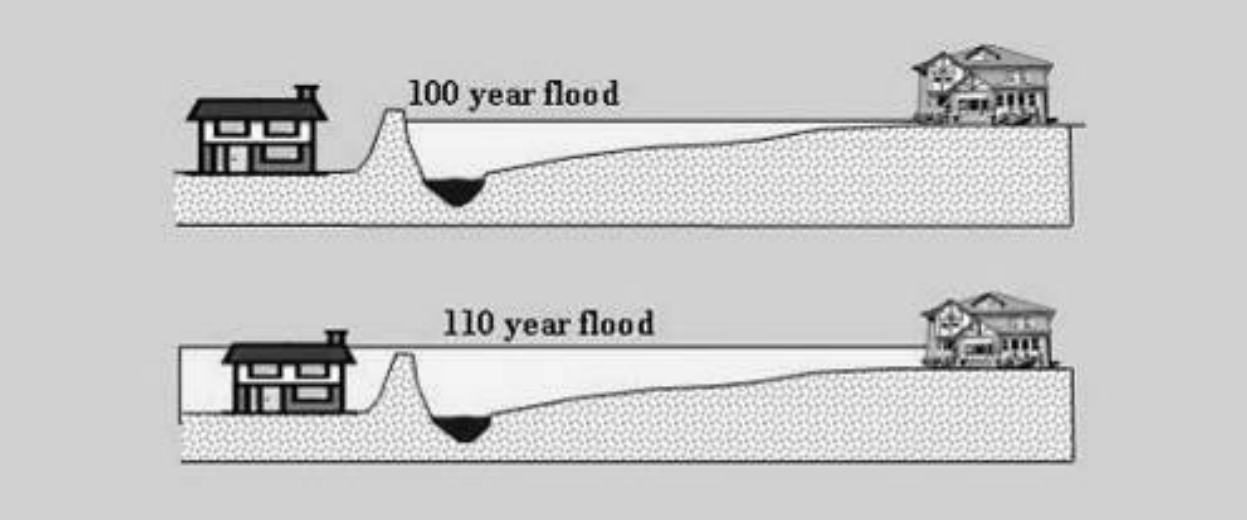
Levee Failure Floods

A levee is an earthen embankment constructed along the banks of rivers, canals and coastlines to protect adjacent lands from flooding by reinforcing the banks. By confining the flow, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the river bank, raising the level of the land around the river. To construct a man-made levee, workers pile dirt or concrete along the river banks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments.

Many communities receive additional flood damage protection from "non-levee embankments," or NLEs. No formal definition or technical criteria exist for NLEs. However, one of the best informal definitions to date is "any structure that provides protection from the 1% annual chance flood." Highways, railroads, canals, culverts, bridges, landscaping features, and other similar structures could be considered NLEs. Such embankments, while not designed to prevent flooding behind them, do have a mitigating effect on flooding. Although NLEs have this effect, they are not recognized as accredited flood mitigation structures by FEMA.

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. As seen in Figure 1, overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.

Figure 1 Flooding from Levee Overtopping



Source: Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.
http://www.floods.org/ace-files/leveesafety/lss_levee_history_galloway.ppt

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.

Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the

tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns.

The complicated nature of levee protection was made evident by events such as Hurricane Katrina. Flooding can be exacerbated by levees that are breached or overtopped. As a result, FEMA and the U.S. Army Corps of Engineers are re-evaluating their policies regarding enforcement of levee maintenance and post-flood rebuilding. Both agencies are also conducting stricter inspections to determine how much protection individual levees actually provide. The CWCB is committed to aiding local governments with the increased levels of compliance with federal regulations. CWCB will assist qualifying entities who are in good standing with the NFIP through technical and financial assistance. CWCB assistance may include grant funding, participation in levee inspections, assistance in developing Maintenance Deficiency Correction Plans, site visits, and participation in public hearings. In addition, the CWCB will also discourage the construction of new levees to protect new developments, and instead encourage other types of flood mitigation projects.

Alluvial Fans, Mudslides and Debris Flows

Alluvial fans and debris flows can greatly exacerbate flood hazards. Alluvial fans can increase flooding due to the wide expanse of land and unpredictable flowpaths. Normally, the process of mapping flood hazards is relatively straightforward. Flood rates and the topography of the land around stream channels are usually known, making the process of flood mapping easier. In contrast, the convex shape of alluvial fans offers no directing channel for floodwaters. This causes the waters to spread over much greater distances, potentially endangering many more people. Additionally, flow rates in alluvial fans and debris flows are harder to quantify because of loose debris. Debris flows and mudslides can uproot trees and lift boulders, making the hazard even more dangerous. These types of hazards are not well mapped in the state. Although it is not required by FEMA, the CWCB supports mapping of alluvial fans and debris flows.

Post-Wildfire

Wildfires greatly reduce natural flood mitigation by stripping the land of soil cohesiveness and vegetation ground cover. Vegetation helps stem the velocity of runoff down a slope and also assists with water absorption into the soil. As a result of the loss of vegetation, post-wildfire areas are increasingly susceptible to flash floods. Moderate rainstorms can turn into walls of water several feet high. These floods can also capture loose soil and other debris and quickly turn into devastating debris flows or mudslides. These areas are not required to be mapped in relation to flood hazards, but the CWCB encourages local jurisdictions to do so and to regularly update the maps.

3.2 Flood Hazard Profile

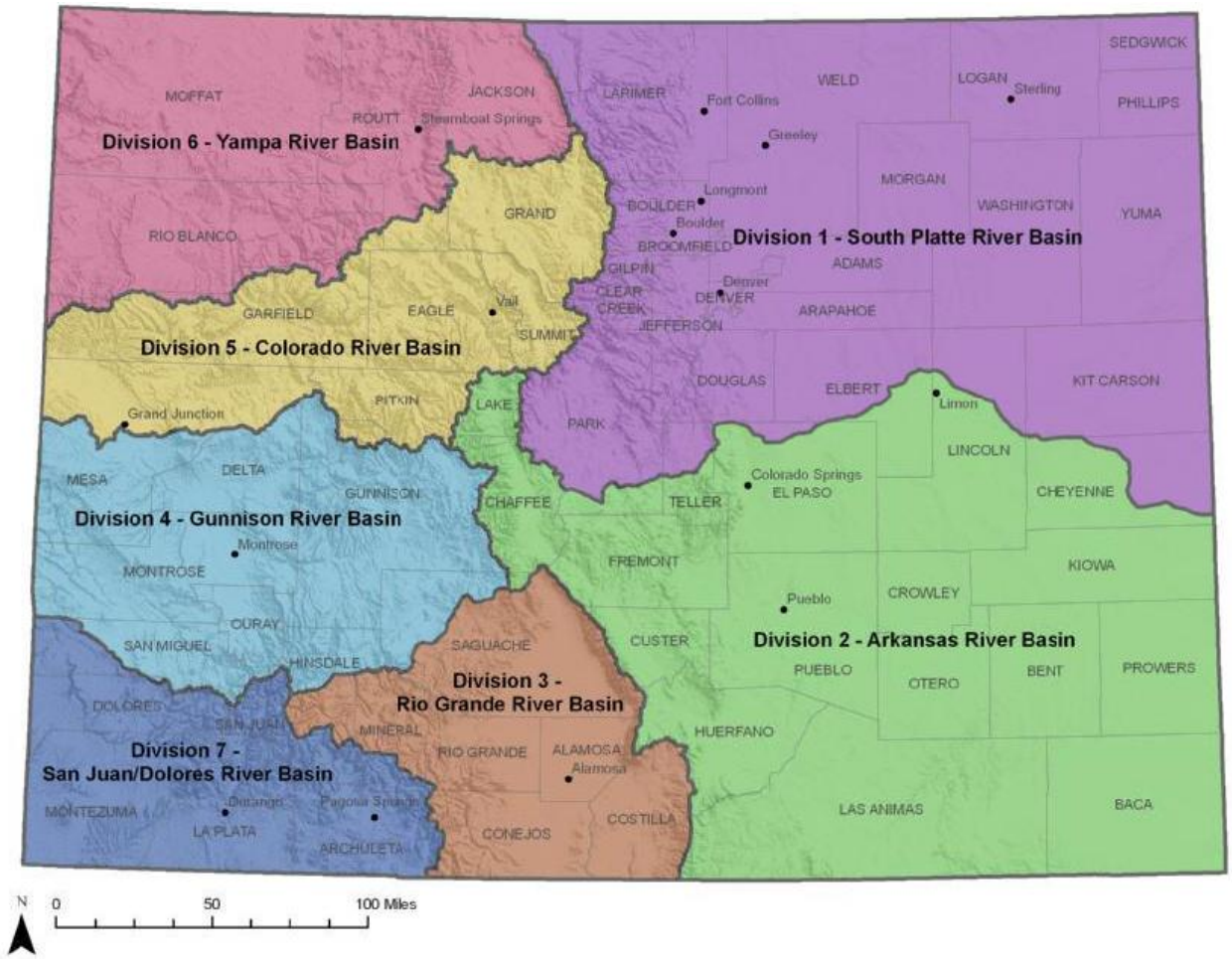
The relationship between flood hazards and population identifies patterns of risk. Such relationships are not new to Colorado. Flooding has occurred here long before people settled in high-risk areas. Risk grows from the increasingly close association between natural phenomena and a growing population.

People become vulnerable to hazards when they choose (knowingly or unknowingly) to live near the areas where these extreme events occur. Vulnerability is also related to preparedness. People who prepare for the occurrence of an extreme event are less vulnerable to it than those who do not. The vulnerability of Colorado's population is rooted in a relationship between the occurrences of extreme events, the proximity of people to these occurrences, and the degree to which these people are prepared to cope with these extremes of nature.

3.2.1 Location of Flood Hazards in Colorado

The location of Colorado's rivers is closely related to the impact of flood hazards on growth and development within the state. Many rivers originate in Colorado, and flood prone areas have been identified in 268 cities and towns and in all of the 64 counties in the state. Between 20 and 30 large magnitude floods (in terms of peak discharge) occur somewhere in Colorado every year. In order to provide an understanding of potential flood hazards in Colorado, this section describes the major river basins and mapped flood hazard areas within the state. Figure 2 depicts the major river basins within the State of Colorado.

Figure 2 Major River Basins



South Platte River Basin

Including the Republican River basin, the South Platte basin encompasses all or part of 23 counties over 27,660 square miles. Elevation in the basin ranges from 14,000 feet at the Continental Divide to 3,400 feet at the Colorado-Nebraska state line. The largest population centers in the basin are Denver with a population of about 560,000 people and Aurora with 287,000 people. The South Platte River is the major stream in the basin. The South Platte basin is expected to experience major strains on water use from population growth. Population growth could also potentially mean that more people will be at risk to flood. Some of the state's most devastating floods occurred in the South Platte basin. In a 2006 report by the CWCB, historic flood damages for the basin were estimated to be $3.4 billion at the time of the study. (Source: http://cwcbweblink.state.co.us/weblink/docview.aspx?id=113233&searchhandle=30039)

Arkansas River Basin

Of all the river basins in Colorado, the Arkansas River basin encompasses the greatest surface area of the state at 28,268 square miles. It extends over the entire southeastern corner of Colorado, and 18 counties lie within the area of the basin. Elevation in the basin varies from 14,000 feet at the headwaters near Leadville to 3,340 feet at the Colorado-Kansas border. The major population centers in the basin are Colorado Springs with roughly 375,000 people and Pueblo with a population of about 104,000. The population of the counties that lie within the basin is expected to grow by nearly half a million people between 2000 and 2030, placing major strains on water usage and increasing the number of people exposed to flood hazards. (Source: http://cwcbweblink.state.co.us/WebLink/0/doc/113226/Page1.aspx?searchid=f1b625c0-5b1f-4ece-8425-37f76b227b96)

Rio Grande River Basin

The Rio Grande basin stretches over 7,543 square miles in Colorado and has an average elevation of 7,500 feet. The Rio Grande is the major stream in the basin. Its headwaters are found in the Rio Grande National Forest in the south-central portion of the state. A portion of the basin is considered to be a "closed basin." Surface water in this portion does not contribute to the flow of the Rio Grande. The population within the basin is considered sparse to moderate. The largest population centers are Alamosa, with roughly 8,300 people, and Monte Vista, with 4,542 people. Historic damages for the basin were estimated at $12.1 million as of a 2006 study by the CWCB. (Source: http://cwcbweblink.state.co.us/weblink/docview.aspx?id=113231&searchhandle=30039)

Gunnison River Basin

The Gunnison River basin is roughly 7,800 square miles in size, extending all the way from the Continental Divide to Grand Junction where it empties into the Colorado River. Elevation in the basin ranges from 14,000 feet to 4,550 feet. The annual flow of the Gunnison River is 547,000 acre-feet per year at the stream gage near the Town of Gunnison. Tributaries include Cochetopa Creek, Tomichi Creek, Uncompahgre River, East River, and Taylor River. The population in the river basin is relatively sparse. Eleven major reservoirs lie within the basin, including Blue Mesa, Morrow Point, Crystal, Taylor Park, Ridgway, Paonia, Crawford, Silverjack, Gould, Overland, and Fruitgrowers Reservoirs. Agriculture and hydroelectric power account for the primary uses of the waters, although there is some municipal and industrial usage as well. (Source: ftp://dwrftp.state.co.us/cdss/swm/in/GunnisonInfo_200407.pdf)

Colorado River (Grand River) Basin

The Colorado River basin encompasses roughly 9,916 square miles of west-central Colorado. The Colorado River is the major stream in the basin. Its tributaries include the Fraser River, Williams Fork River, Muddy Creek, Blue River, Eagle River, Roaring Fork River, Rifle Creek, and Plateau Creek. The Colorado River originates in Rocky Mountain National Park at an

elevation of about 12,800 feet and descends to 4,325 feet at the Colorado-Utah state line. The average annual streamflow is approximately 57,000 acre-feet near the headwaters and 4.9 million acre-feet by the time the river reaches Grand Junction. Population in the basin is moderate at about 253,000 people. There are 20 reservoirs in the basin that help enable irrigation projects, power generation, municipal and industrial use, recreation, tourism, and transbasin diversions which bring water to many of the eastern parts of the state. (Source: http://cwcbweblink.state.co.us/weblink/0/doc/125202/Page1.aspx?searchid=613f0ec8-2c8d-4d1f-a8c7-45025da55104)

Yampa/White River Basin

The Yampa River basin encompasses the majority of Routt and Moffat County in the northwestern corner of Colorado. The basin extends over roughly 7,660 square miles of Colorado and ranges from 12,200 feet to 5,600 feet in elevation. The Yampa River is the major stream in the basin. Its tributaries include Bear River, Chimney Creek, Walton Creek, Fish Creek, Trout Creek, Elk River, Elkhead Creek, Fortification Creek, Williams Fork River, and the Little Snake River. Average annual streamflow is about 62,000 acre-feet near the headwaters and 1,623,000 acre-feet at the lower elevations. The area is sparsely populated, and major water usage includes industry, agriculture, hydroelectric power generation, municipal water supply, recreation and tourism. The nine major reservoirs along the Yampa River are Stillwater Reservoir No. 1, Allen Basin, Yamcolo, Lake Catamount, Pearl Lake, Steamboat Lake, Fish Creek, Stagecoach, and Elkhead Reservoirs.
(Source: ftp://dwrftp.state.co.us/cdss/swm/in/YampBasinInfo_20091019.pdf)

The White River basin lies immediately south of the Yampa River basin. The primary stream is the White River, which empties into the Green River after flowing into Utah. About 3,750 square miles of the river basin is within Colorado. It encompasses most of Rio Blanco County and smaller portions of Moffat and Garfield Counties. The headwaters of the White River begin at 11,000 feet elevation. The average annual streamflow is 596,000 acre-feet where the White River crosses from Colorado into Utah. The White River's tributaries include Big Beaver Creek, Fawn Creek, Hahn Creek, Piceance Creek, Yellow Creek, Douglas Creek, and the North and South Forks of the White River. Much of the basin is publicly-held lands, primarily under the direction of the Bureau of Land Management. Very few people live within the basin. Meeker and Rangely, which both have populations of less than 3,000 people, are the primary population centers. The basins' water resources are primarily used for agriculture, recreation, and tourism. There are no federal storage projects in the basin, although Taylor Draw Reservoir, Lake Avery Reservoir and the Rio Blanco Reservoir provide sources of hydroelectric power and recreation. (Source: ftp://dwrftp.state.co.us/cdss/swm/in/WhiteBasinInfo_20091102.pdf)

Dolores/San Juan River Basin

The Southwest Basin encompasses the Dolores and San Juan River Basins, whose headwaters originate in the San Juan Mountains. Navajo Reservoir lies along the San Juan River, which

flows into New Mexico and Utah before emptying into the Colorado River. About 7,200 square miles of the San Juan River lies within Colorado. Elevations within the basin range from a high of 13,000 feet at the Continental Divide to 4,800 feet in the Four Corners area of Colorado. The San Juan's major tributaries include the Navajo River, Peidra River, Los Pinos River, Animas River, Florida River, La Plata River, Mancos River, and McElmo Creek.

The Dolores River originates near Bolam Pass in San Juan National Forest at an elevation of nearly 13,700 feet. The Dolores River supplies McPhee Reservoir before flowing into Utah where it joins the Colorado River. Roughly 4,350 square miles of the river runs through Colorado alone. Major tributaries to the Dolores River include the River's own West Fork, Lost Canyon Creek, Disappointment Creek, West Paradox Creek, and the San Miguel River. The principal water use in these basins is irrigation for agriculture, but the rivers are also a source of hydroelectricity and municipal water for the sparsely populated region. In addition to Navajo and McPhee Reservoirs, other major water resource development projects in the basin include Vallecito Reservoir, Jackson Gulch Reservoir, Lemon Reservoir, and the San Juan Chama Project. (Source: ftp://dwrftp.state.co.us/cdss/swm/in/SanJuanInfo_20051101.pdf)

Floodplains

Colorado's mapped floodplains are presented in the figures below. Figure 3 illustrates the 1% and 0.2% annual chance DFIRM flood zones in the state that were effective as of July 2010. In 2010, a FEMA HAZUS-MH study was integrated into the Plan Update. HAZUS-MH is a software program developed by FEMA to estimate potential losses from scenario events such as flooding. The HAZUS estimates supplemented the DFIRM data and provided the FMAC with a greater understanding of the potential impacts of flooding in Colorado communities. The HAZUS flood zones are shown below in Figure 4. More discussion on the HAZUS analysis is included in Section 3.4.2.

Figure 3 Mapped DFIRM Flood Zones in Colorado

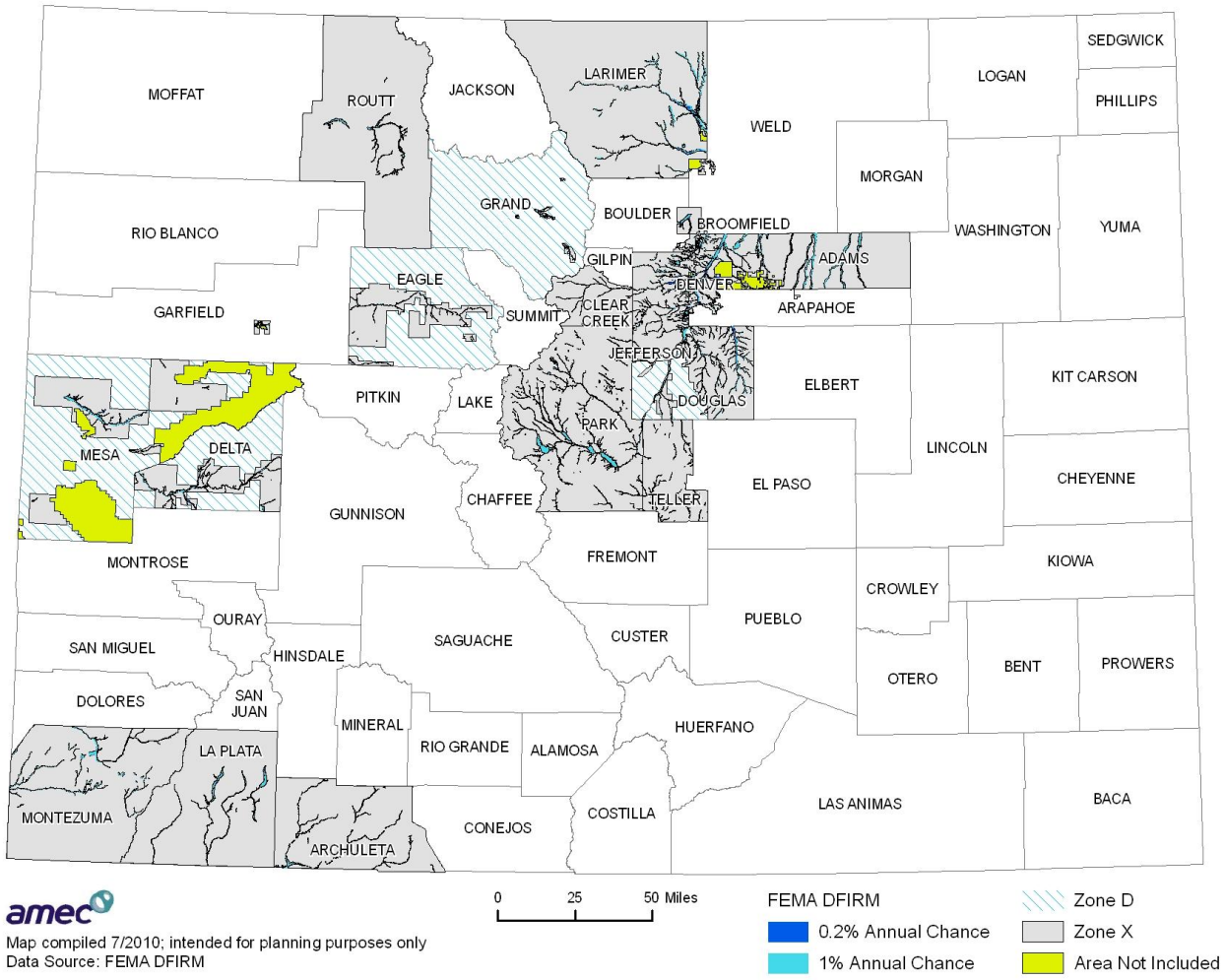
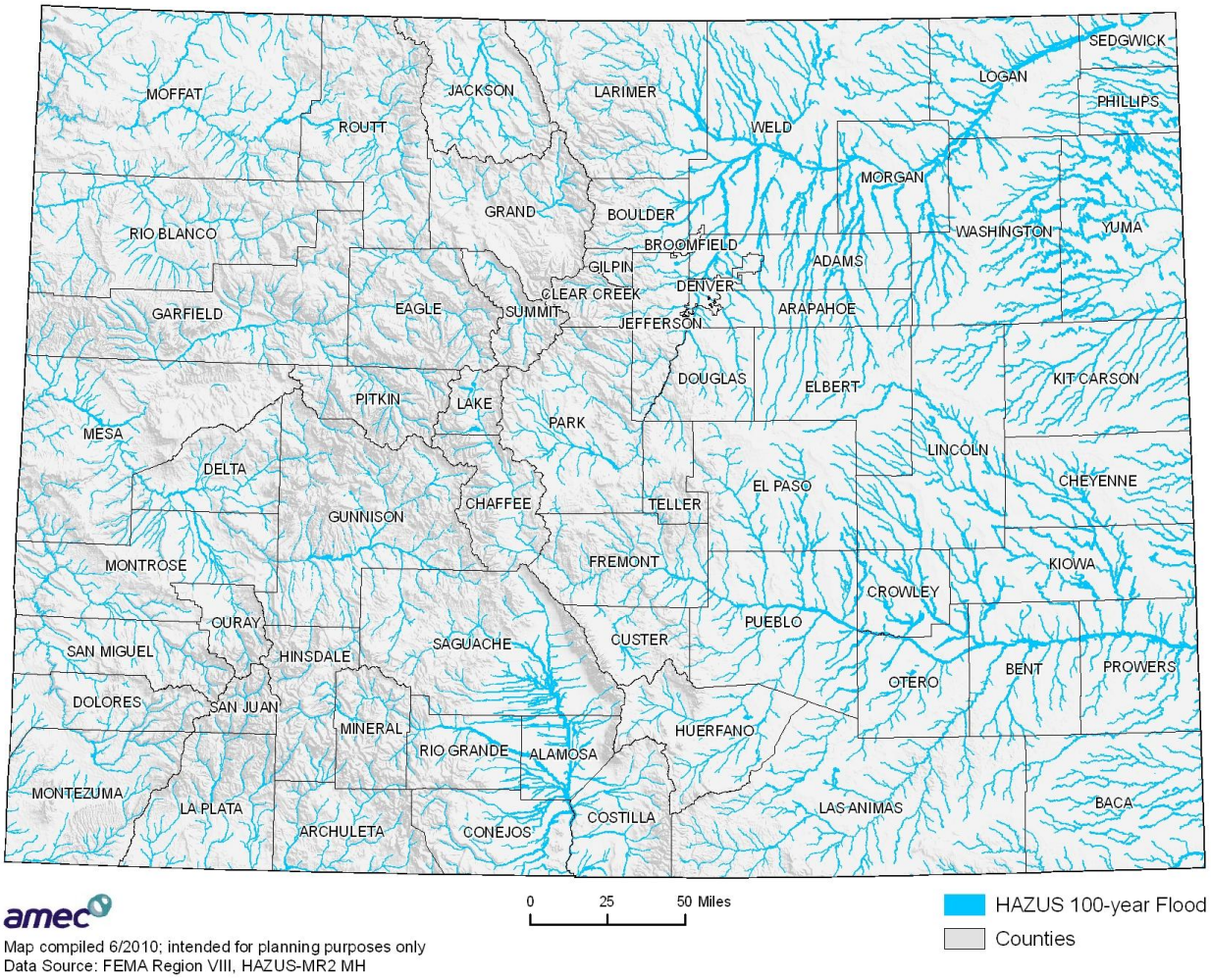
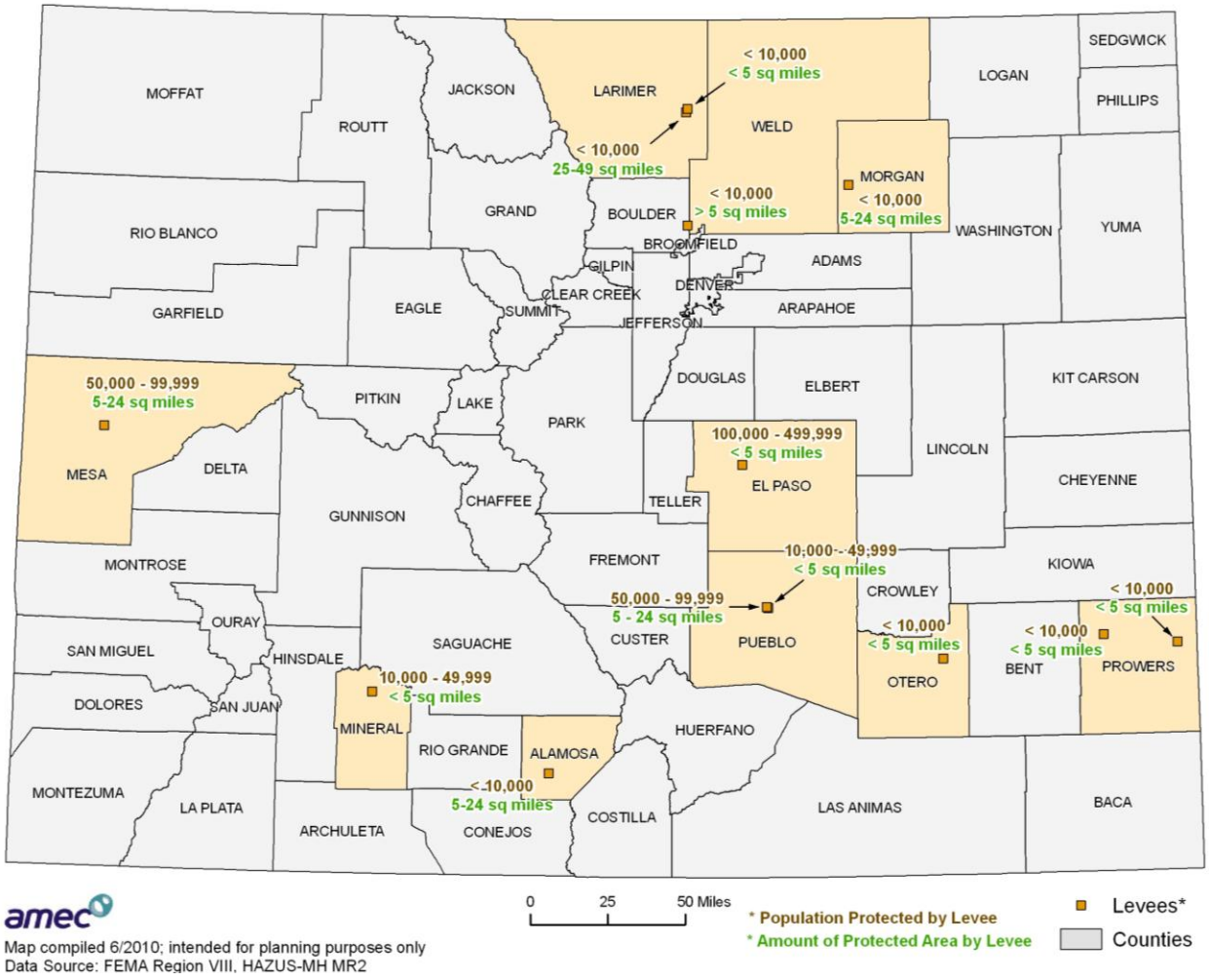


Figure 4 HAZUS-MH 100-year Floodplains in Colorado



This 2010 Plan update marks the first time that levee failure was identified as a component of the flood hazard within Colorado. Figure 5 shows the location of all Colorado levees identified in the U.S. Army Corp of Engineers database in addition to the population and area protected by each levee.

Figure 5 Colorado Levees: Protected Population and Area



3.2.2 Flood History in Colorado

Colorado has a long history of tragic flood events. The earliest known floods are reported to have occurred in 1826 in the Arkansas River and Republican River basins. The most notable flood events in Colorado from 1864 to 2010 are presented in Table 4. As indicated in the table, the greatest loss of life occurred during the Big Thompson flood event of 1976. The most damaging flood in Colorado occurred in June 1965 on the South Platte River when over $2.7 billion in damages (2010 dollars) was sustained in the Denver metro area.

Table 4 Notable Flood Events In Colorado: 1864-2010

Year	Location	Deaths	Damages (2010$)
1864	Cherry Creek (Denver)	0	$7,365,830
1896	Bear Creek (Morrison)	27	$8,418,091
1911	San Juan River (by Pagosa Springs and in the San Luis Valley)	2	$7,365,830
1912	Cherry Creek (Denver)	2	$164,152,791
1921	Arkansas River (Pueblo)	78	$1,039,634,343
1935	Monument Creek (Colorado Springs)	18	$71,553,780
1935	Kiowa Creek near Kiowa	9	$21,045,229
1942	South Platte River Basin	?	$11,364,424
1955	Purgatorie River (Trinidad)	2	$49,456,289
1956*	Denver, Jefferson, Arapahoe Counties		unknown
1957	Western Colorado	0	$24,202,014
1965*	South Platte River (Denver)	8	$2,735,879,850
1965	Arkansas River Basin	16	$280,953,815
1969*	South Platte River Basin	0	$29,463,321
1970*	Southwest Colorado	0	$17,888,445
1973*	South Platte River (Denver)	10	$531,392,047
1976*	Big Thompson River (Larimer)	144	$115,748,762
1982*	Fall River (Estes Park)	3	$67,344,734
1983	North Central Counties	10	$35,776,890
1984*	West & Northwest Counties	2	$64,187,950
1993	Western Slope	0	$2,841,106
1995	Western Slope & South Platte	21	$71,553,780
1997*	Fort Collins & 13 East Counties	6	$427,102,604
1999*	Col. Springs, 12 East Counties	0	$136,793,992
2000-6	Statewide Various Events	5	$116,801,024
2006	Beaver, Brush Hollow and Eightmile Creeks (Fremont County)	0	$2,000,000
2006	Horse Creek, West Creek (Douglas)	0	$13,300,000
2006	Vallecito Creek (La Plata)	0	$1,000,000
2007	Chalk Creek Canyon (Chaffee)	0	$1,000,000
2007	Chalk Creek Canyon (mudflows)	0	$2,000,000
2009	Six Mile Creek	0	$321,000
2010	Statewide flooding (various events)	**	**
Totals		**363**	**$6,057,907,951.97**

Sources: Colorado Flood Hazard Mitigation Plan 2007, NCDC, SHELDUS
NOAA NWS (http://www.crh.noaa.gov/bou/?n=floods)
*Denotes federal disaster declaration event
**Figure not available at time of printing

In addition to the data presented in Table 4, the information summarized below documents historic flooding in Colorado due to the types of flooding previously discussed.

General Rain Floods

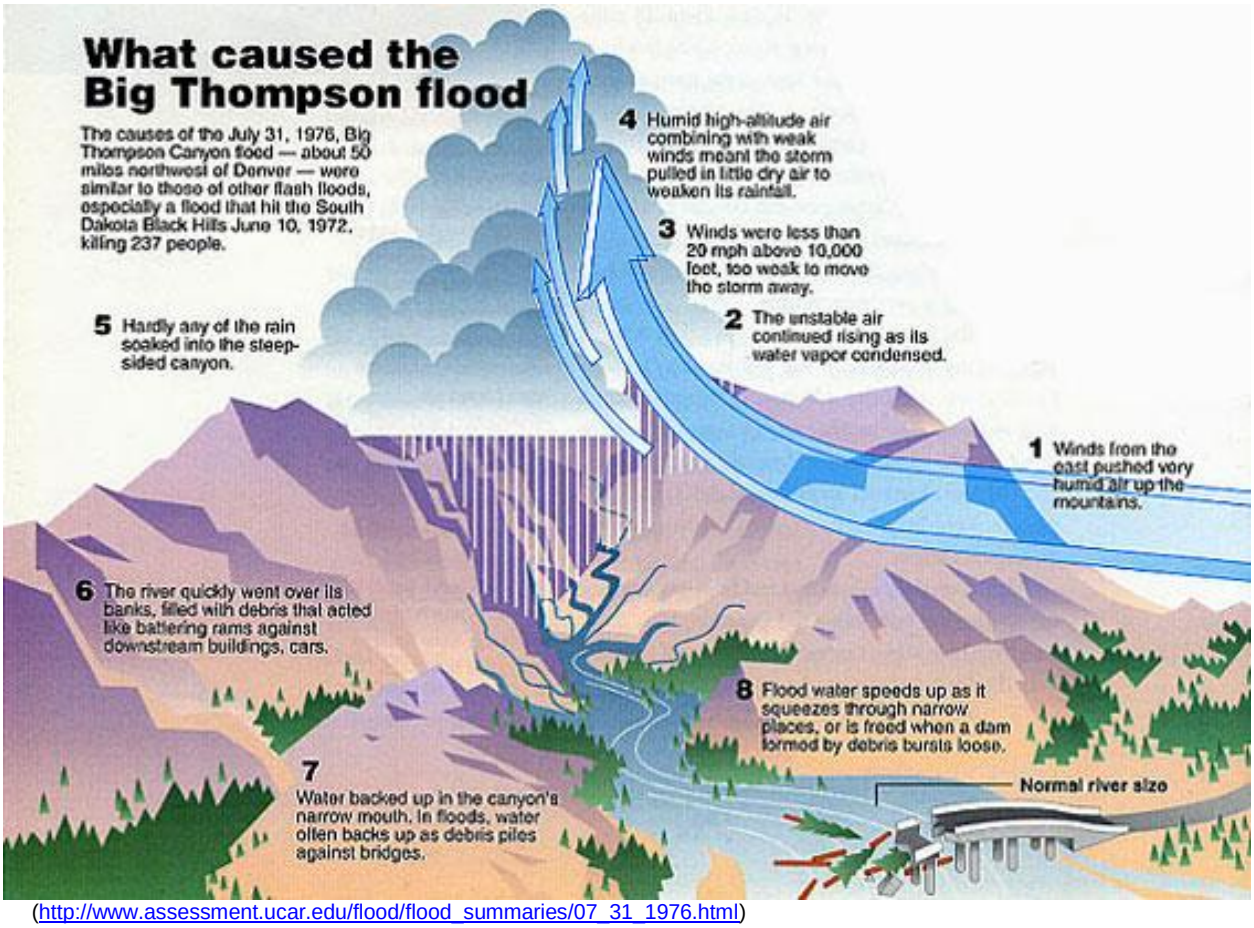
The October 5, 1911 floods in Pagosa Springs and Durango were a result of a general rain system over tributaries of the San Juan River Basin in southwestern Colorado. This flood event resulted in two deaths and damages of approximately $7.8 million (2010 dollars). The damaging floods of June 1965 in the Denver metro area and in the Arkansas River basin were a result of heavy to torrential rainfall over large portions of the South Platte River Basin that lasted several days.

Parts of Buena Vista were flooded after two days of localized rainstorms on July 4 and 5, 2007. Saturated soils and inadequate detention basins resulted in flooding that impacted private residences and apartment complexes.

Thunderstorm Floods

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 (see Figure 6). 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 145 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." (http://www.noaanews.noaa.gov/stories/s688.htm). The Big Thompson flood remains the deadliest natural disaster in Colorado to date.

Figure 6 Big Thompson River Flood Explanation



(http://www.assessment.ucar.edu/flood/flood_summaries/07_31_1976.html)
Line of thunderstorms from Little Rock, Arkansas to Wyoming (these events usually result from large-scale meteorological forces)

On May 15 and 16, 1993, a thunderstorm-induced flood event occurred at Rifle on Rifle and Government Creeks. As is usually the case, the highest flows in the shortest period of time occurred when an estimated 125-year flood discharge impacted Rifle. Structures and vehicles in harm's way suffered damages in excess of $200,000.

On June 17, 1993, a flash flood occurred on Shooks Run in Colorado Springs. Damages were confined to a mobile home park on the creek's edge with losses estimated at $1 million.

In July 1993, the Town of Otis and the unincorporated area of Cope in Washington County and the City of Yuma in Yuma County experienced a weekend flood event as a result of three consecutive days of thunderstorms. Several homes suffered damages and roadways were inundated with loss in excess of $650,000. In Otis, a flood control and storm drainage project protected the northern half of town.

On August 10, 1993 flash floods occurred on several creeks in Delta County. Two roads were washed out and a flood fight was conducted with sandbags on Robideaux Creek near the

Department of Corrections Detention Facility.

On August 26 to 29, 1993, general rainstorms caused flooding in Archuleta and La Plata counties. A subdivision in Archuleta County was threatened and roads damaged as the Rio Blanco overflowed its banks south of Pagosa Springs. In Durango, the Fire Department had their emergency operations plan in effect and came very close to evacuating residents of a mobile home park on the Animas River.

In the spring and early summer of 1995, the lower South Platte River, the lower Arkansas River and the Roaring Fork River were impacted by significant flooding. Most damages were experienced by agricultural landowners.

On July 24 to 28, 1997, the City of Fort Collins and most of eastern Colorado received soaking and/or drenching rains, adding to soil moisture in some locations. As the cold front arrived in the late afternoon of July 27, strong thunderstorms developed just north and west of Fort Collins. Later that night, steady rains developed along the eastern base of the foothills in Larimer County and continued until about noon on July 28. Several inches of new rain were reported just west and northwest of Fort Collins totally saturating the ground, producing major flooding in Laporte, and setting the stage for the evening flood event. On the evening of July 28, 1997, intense rains began around 6:30 p.m. in the foothills west of Fort Collins. Winds from the east and southeast continued to pump moisture into the storm system throughout the evening. The core of the storm was very small but remained nearly stationary over the headwaters of Spring Creek, the Fairbrooke Channel, Clearview Channel, the CSU Drainage Basin, and the West Vine Drainage Basin. Rainfall intensity increased and reached a maximum between 8:30 p.m. and 10:00 p.m. before ending abruptly. A subsequent analysis of rainfall conducted by CSU showed a maximum of 10.2 inches of rainfall in less than five hours near the intersection of Drake Road and Overland Trail.

On July 29, 1997, slow-moving thunderstorms dumped large amounts of rainfall over the Pawnee Creek Basin in Weld and Logan counties and over the Schaefer Draw Basin in Morgan County north of Weldona. Floodwaters from Schaefer Draw entered the unincorporated Town of Weldona on the evening of July 29 while similar damaging floodwaters from Pawnee Creek entered the unincorporated Town of Atwood early on July 30 (west of Sterling and north of U.S. Hwy 6). Additionally, floodwaters flowing east from Atwood entered the City of Sterling.

During the Presidential Declaration incident period (July 28 to August 12, 1997) storm systems drenched other areas in northeastern Colorado, as well as several counties in southeastern Colorado. In addition, the Denver metro area received flooding rains as did the Clear Creek County area to the west of Denver.

These rainfall totals are large, but not extreme in comparison to the largest storms experienced in Colorado. What made this storm so different was that most of the affected basins were receiving heavy rainfall throughout the basin. This is not the "norm" for Colorado. Also, rain on snow is

generally not a great problem in Colorado, but sizeable areas of the Front Range foothills did receive heavy rain on top of several inches of saturated snowpack. The melt rate of this snowpack was low, but additional water was added to the runoff.

The flooding that occurred along Fountain Creek and the Arkansas River was significant and will likely be considered the worst flooding event since 1965. In total, the storm affected Bent, Crowley, Custer, Elbert, El Paso, Fremont, Kiowa, Larimer, Las Animas, Otero, Pueblo, and Weld Counties. These counties sustained damage to roads, bridges, culverts, homes, and business from overtopping, dike breaches, erosion, mudslides, and rockslides.

The City and County of Denver was impacted by localized thunderstorm flooding on May 14, 2007. A woman and her two-year old son sought shelter from rain and hail in a culvert on Lakewood Gulch. Rescuers were able to save the mother, but the two-year old was tragically swept away from his mother during the flood and drowned.

Snowmelt Floods

Floods in June 1983, along the Cache la Poudre River in Fort Collins and Greeley, along Clear Creek and its tributaries in Silver Plume and Georgetown, and along the Arkansas River in Fremont and Chaffee counties were principally due to melting snow. The 1984 floods on the western slope were primarily snowmelt flooding.

Grand, Gunnison, Routt, and Delta Counties experienced minor snowmelt flooding in May 2008 that resulted in isolated instances of structural damage. Several days of high temperatures melted the above-average levels of snowpack in these areas. Damages were relatively minor.

Flooding in northern Colorado along the Front Range in late May and early June 2010 was also mainly due to rapid snowmelt. Routt County dealt with snowmelt flooding once more in June 2010. A stream gage near Milner Colorado recorded record peak discharge along the Elk River on June 8, 2010. However, no significant damages were recorded from the event. The Cache La Poudre River flooded from June 14 -16. and washed out a number of roads in Weld County. Water levels on the Poudre River were exacerbated by rainfall in the days preceding the floods. The Eagle River flowed at twice its normal volume near Gypsum and reached its second highest water level in recorded history. Stream channels around Vail filled with debris and washed out bridges. Water recreation such as kayaking, rafting, and tubing became dangerous, and a few people lost their lives doing such activities.

Rain on Snowmelt Floods

Flooding along the Colorado River in Grand Junction in July 1884, along Clear Creek at Georgetown in June 1965, and along the Gunnison and Colorado Rivers at Grand Junction in June 1983, are examples of flooding from rain on melting snow. The effect of rain on melting snow in the Colorado River Basin in 1983 was felt as far downstream as Mexico. In 1984, rain or melting

snow caused severe flooding conditions at Paonia.

On May 28, 1993, rain on snowmelt flooding occurred at Paonia on the North Fork of the Gunnison River. The rainfall occurred over a five-hour period during the evening. This caused the North Fork of the Gunnison River to reach its highest level since the 1984 flood season. Many miles of agriculture land experienced severe bank erosion in unincorporated Delta County.

Ice Jam Floods

In 1955, 1962, and 1983, flooding in Rangely resulted from ice jams. In addition, flooding in Meeker in 1973 and in Gunnison in 1980 resulted from ice jams.

Levee Failure Floods

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 general rain resulted in large flood inundation and erosion in the Arkansas River and Fountain Creek watersheds.

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.

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 FIRM.

Dam Failure Floods

Although few lives have been lost from dam failures, property damage has been high. There have been at least 130 known dam failures and incidents in Colorado since 1890. The failure of the Lower Latham Reservoir Dam in 1973 and subsequent flooding in the Town of Kersey, Weld County, Colorado, resulted in a Presidential Major Disaster Declaration.

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.

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.

The Lawn Lake Disaster of 1982 resulted from the failure of a privately owned dam on Forest Service property, and $31 million of damage was sustained in Larimer County and Estes Park. A lawsuit awarded $480,000 to one of the four persons killed in the disaster.

The most unusual flood from the failure of a manmade structure in Colorado is probably the complete draining of Lake Emma, a natural lake located high in the San Juan Mountains above Silverton, Colorado. On June 4, 1979, floodwater flowed through a network of tunnels in an abandoned mine that extended under the lake.

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.

Alluvial Fans, Mudslides and Debris Flows

In addition to the deadly flash floods, the Big Thompson Flood of 1976 was also subject to destructive debris flows. Many structures that were not directly damaged by the floodwaters were destroyed by debris flows. Massive sediment deposits literally buried some homes and other structures, seen in Figure 7.

Figure 7 Big Thompson River Debris Flows

(Source: http://pubs.usgs.gov/fs/2006/3095/pdf/FS06-3095_508.pdf)

In 1977, Glenwood Springs suffered $2 million in damages from debris flows following an intense rainstorm. Fortunately, no one was severely injured or killed in the incident. Most of the damage could have been prevented, however, if developers had recognized the hazard presented by building on and around a known debris fan. (Source: http://geosurvey.state.co.us/Default.aspx?tabid=378)

Post-Wildfire Floods

The Buffalo Creek, Elk Creek, and Hayman Fire burn areas faced increased susceptibility to flash flooding and debris flows for years after the fires occurred. The lack of vegetative and soil ground cover increased the rate of erosion in the area, and nothing was left to help absorb and stem the flow of rainwaters. In the case of Buffalo Creek, the fires burned with such intense heat that the soils were rendered hydrophobic. With the loss of natural mitigation measures, a thunderstorm on July 12, 1996 evolved into a deadly flash flood that claimed the lives of two Buffalo Creek residents. Roads were washed out, and the water and telephone utilities in the City of Buffalo Creek were destroyed. Sediment and debris piled up in the North Fork of the South Platte River and in Strontia Springs Reservoir. Problems from sediment deposit, lack of

vegetation and hydrophobic soils continue to be an issue today. (Source: http://www.landandwater.com/features/vol41no1/vol41no1_1.html)

3.2.3 Probability of Future Floods

Flooding will continue to occur in Colorado. As mentioned previously, between 20 and 30 large magnitude floods (in terms of peak discharge) occur somewhere in Colorado every year. Furthermore, between 1965 and 1999, Colorado experienced nine major flood disasters as indicated below:

- 1965: 33 Front Range communities
- 1969: 15 Front Range communities
- 1970: Southwestern Colorado
- 1973: 13 Front Range communities
- 1976: 2 Front Range communities
- 1982: Larimer County (dam failure)
- 1984: 15 Western Slope counties
- 1997: 13 Eastern Colorado counties
- 1999: 12 Southeastern Colorado counties

Based on this flood history, Colorado experiences a major flood disaster roughly once every five years. Therefore, the State faces a 20% chance that a major flood disaster will occur in any given year.

3.3 Assessing Vulnerability by Jurisdiction

The state risk assessment is to include an overview and analysis of the state's vulnerability based on estimates provided in both the local and state risk assessments. The plan must also identify those jurisdictions that are most threatened and most vulnerable to loss and damage due to flood. The following section follows the FEMA requirements and explains the process used to analyze information from the local risk assessments, as well as a requirement that the plan reflects changes in development in hazard prone areas.

According to FEMA's risk assessment guidance (FEMA 386-2), vulnerability is defined as being open to damage or attack, and risk is defined as the possibility of loss or injury. For this assessment vulnerability is summarized at the county level. The vulnerability of a county is approximated by looking at a combination of several factors including previous flood events and impacts, population and area affected by flooding, potential total building loss, potential percent building loss, potential per capita loss, and exposure of state assets. State level analysis includes assets that are considered at-risk from flood such as: state-owned or operated buildings, critical infrastructure, state lands, and fish hatcheries. Only those facilities that are state-owned or operated are specifically addressed in the state assets section of the plan, but the impacts and

vulnerabilities identified for these facilities would apply to similar privately-owned facilities and lands as well.

In addition to the FEMA requirements, the EMAP risk assessment standards require a consequence-based analysis. Table 5 outlines the detrimental impacts that floods can have on various subject areas as designated by EMAP. Detrimental impacts were determined from input from the SHMT at a meeting on May 13, 2010.

Table 5 EMAP Consequence/Impact Analysis: Flood

EMAP Risk Assessment Subject Area	Detrimental Impacts
Health and Safety of Persons in the Area at Time of Incident	• Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas. • Contamination due to hazardous waste results in public health issues. • Private property losses with increased risk to those who don't have flood insurance. Depending on severity of event, many people may be displaced or left homeless. A State-led Disaster Housing Taskforce is assessing the State's disaster housing capabilities and will make recommendations based on the assessments.
Health and Safety of Personnel Responding to the Incident	• Localized impact expected to limit damage to personnel in flood areas at the time of incident. • Impacts to transportation corridors and communications lines affect first responders' ability to effectively respond. High risk to responders in flash flood events prevalent in the state.
Continuity of Operations	• Damage to facilities/personnel in incident area may require temporary relocation of some operations.
Property, Facilities, and Infrastructure	• Localized impact to facilities and infrastructure in incident area. Some severe damage possible. • Private property losses with increased risk to those who do not have flood insurance. • Critical facilities impacted by flooding: communications, hospitals, schools, nursing homes, utilities, waste-water TP/WTP, roadways. Substance abuse agencies damaged or destroyed • Affects public and first responders, loss of electricity to government and businesses, water quality impacts on drinking and wastewater. • Ten of CDOW's 17 hatchery facilities are near flood hazard areas and have an estimated replacement value of $20,000,000. Currently, these facilities have no flood hazard mitigation plans.
Delivery of Services	• Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services. • DEM Recovery and Mitigation staff are working with other state partners including CDPHE and CDOT to develop best practices for the "Restoration of Lifelines" following hazard events.

EMAP Risk Assessment Subject Area	Detrimental Impacts
The 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 impacts and wildlife habitat impacts. • Orphan drums (containers that may contain hazardous materials). Commercial hazmat/hazardous waste. Household hazardous waste. Releases from transportation. Releases into streams, rivers, drinking water supply, ground water, and air.
Economic and Financial Condition	• Local economy and finances adversely affected, possibly for an extended period of time depending on damage and length of investigation.
Regulatory and Contractual Obligations	• Regulatory waivers may be needed locally. • Fulfillment of some contracts may be difficult. Impact may temporarily reduce deliveries.
Reputation of or Confidence in the Entity	• Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective. • Regarding levees, localized impact expected to adversely affect confidence in local, state, and federal government, regardless of the levee owner.

In the sections that follow, the process used to analyze information from previous work is explained, the methodology for assessing vulnerability by county is discussed, and the results of the vulnerability assessment are presented.

3.3.1 Vulnerability Based on Local and State Risk Assessments

The 2010 update included a summary of vulnerability from both local and state level risk assessments. The source of local risk assessment information was from available local hazard mitigation plans. State level risk assessment was based on available HAZUS flood analyses and supplemented with an analysis of flood insurance claims data. Counties most at risk were determined following an evaluation of: displaced population, building loss, per capita loss, repetitive loss, NFIP claims, and claims monies paid out. The findings of these analyses are summarized in the following sections.

3.3.2 Jurisdictions Most Threatened and Most Vulnerable to Damage or Loss

Section 3.4.2 discusses the results of the flood hazard vulnerability assessment for the State of Colorado. This discussion is based on the loss estimates from state and local risk assessments and quantifies the loss by potential impacts to buildings and populations.

3.3.3 Process Used to Analyze Information from Local Risk Assessments

As of January 2010, 44 county-level mitigation plans (including one city-level plan; the City of Boulder) in Colorado had been approved by FEMA. These plans were reviewed and provided insight as to how individual jurisdictions view their vulnerability to flood. Many of these local mitigation plans included planning priorities for the different hazards, including flood. Where available, the planning priority level for flood was extracted from these plans and is presented in Table 6.

Table 6 Local Hazard Mitigation Plans Identifying Flooding as a Planning Priority

Name of Plan	Community	Flood Hazard Priority	Comment
Boulder County Multi-Hazard Mitigation Plan	Boulder County and incorporated jurisdictions and selected special districts (except City of Boulder)	High	
City of Boulder Multi-Hazard Mitigation Plan	City of Boulder	High	
City of Colorado Springs Pre-Disaster Mitigation Plan Update	City of Colorado Springs	"Significant Flood" **Probability:** *Occasional* **Significance:** *Critical*	Also profile "Typical Flood" **Probability:** Highly Likely **Significance:** Limited Plan update currently under FEMA review
Costilla County Multi-Jurisdictional Multi-Hazard Mitigation Plan	Costilla County and incorporated jurisdictions	Moderate	
Delta County Multi-Hazard Mitigation Plan	Delta County, incorporated jurisdictions and selected special districts	High	
Denver Regional Natural Hazard Mitigation Plan	Adams, Arapahoe, Broomfield, Clear Creek, Denver, and Gilpin Counties (and incorporated jurisdictions)	High (across entire planning area)	* Update to 2004 plan is currently in the planning process Expired in 2009
Elbert County Multi-Hazard Mitigation Plan Update	Elbert County, incorporated jurisdictions and selected special districts	High	Ranking for the county, not individual jurisdictions
El Paso County	Unincorporated El Paso County	Included in Plan	The plan identifies and assesses flood related risks; develops flood related mitigation actions
Grand County	Grand County and incorporated jurisdictions	Profile included in Plan	Profiled, but not included within the top five hazards
Gunnison County All-Hazard Mitigation Plan	Gunnison County	"Low Risk"	Plan expired in 2008
Hinsdale County All-Hazard Mitigation Plan	Hinsdale County	"Low Risk"	Plan expired in 2009

Name of Plan	Community	Flood Hazard Priority	Comment
Mesa County	Mesa County and incorporated jurisdictions	High	
Montrose County	Montrose County, City of Montrose, Town of Olathe	Severity*: High Probability: Moderate*	
Northeast Colorado Regional Hazard Mitigation Plan	Cheyenne County and incorporated jurisdictions	Medium	
	Kit Carson County and incorporated jurisdictions	Medium	
	Lincoln County and incorporated jurisdictions	High	
	Logan County and incorporated jurisdictions	High	
	Morgan County and incorporated jurisdictions	High	
	Phillips County and incorporated jurisdictions	High	
	Sedgwick County and incorporated jurisdictions	High	
	Washington County and incorporated jurisdictions	High	
	Weld County and incorporated jurisdictions	High	
Northern Colorado Regional Hazard Mitigation Plan	Larimer County, Cities of Fort Collins and Loveland, Towns of Berthoud, Estes Park and Wellington	Included in Plan	The plan identifies and assesses flood related risks; develops flood related mitigation actions
Ouray County Multi-Hazard Mitigation Plan	Ouray County and incorporated jurisdictions	High	
Park County Multi-Jurisdictional Multi-Hazard Mitigation Plan	Park County, incorporated jurisdictions and selected special districts	Moderate	
Multi-Jurisdictional All-Hazards Pre-Disaster Mitigation Plan for Pitkin and Eagle Counties	Pitkin County and incorporated jurisdictions; Eagle County and incorporated jurisdictions	Included in Plan	The plan identifies flooding as one of the six priority hazards and assesses flood related risks; develops flood related mitigation actions
Prowers County Pre-Disaster Mitigation Plan	Prowers County and incorporated jurisdictions	Included in plan	The plan identifies and assesses flood related risks; develops flood related mitigation actions. Expired in 2009
Rio Blanco County	Rio Blanco County and incorporated jurisdictions	Included in Plan	The plan identifies and assesses flood related risks; develops flood related mitigation actions Expired in 2009
San Miguel County All-Hazard Mitigation Plan	San Miguel County and incorporated jurisdictions	High	

Name of Plan	Community	Flood Hazard Priority	Comment
Summit County Multi-Hazard Mitigation Plan	Summit County and incorporated jurisdictions	High	
Teller County Multi-Hazard Mitigation Plan	Teller County and incorporated jurisdictions	Medium	
Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for Upper Arkansas Area	Chaffee, Custer, Fremont, and Lake Counties (and incorporated jurisdictions)	Flash Flood 2nd of 22 Hazards; Seasonal Flood 7th of 22 Hazards	Expired in 2009

Source: Colorado Division of Emergency Management

The results in Table 6 indicate that most counties consider flooding a high priority for planning purposes. Not all plans included a priority ranking, and among those that did the ranking systems were not uniform. A recommendation for future local planning efforts is to standardize the priority ranking system and flood vulnerability methodology so county-level plans can be more easily compared. The statewide methodology presented in this Plan can be adapted and improved upon at the local level for improvement of local hazard mitigation plans.

State and local hazard mitigation plans were reviewed to assess vulnerability on a jurisdictional level. A worksheet that had been developed by DEM for the 2007 Plan update was utilized in the 2010 Update as well. This worksheet was designed to review local multi-hazard mitigation plans for information on population affected by flooding, number of structures affected by flooding, number of critical facilities affected by flooding, and potential loss (economic) associated with flooding. The information, displayed below in Table 7, was analyzed and incorporated into a spreadsheet to evaluate vulnerability in a quantitative as well as qualitative way. Many of the local multi-hazard mitigation plans did not go into the level of detail addressed by the worksheet, thus, the information in Table 7 must be treated as incomplete. The counties that did include this data in their plans generally referenced the 1% annual chance flood for their calculations. Any information related to the 0.2% annual chance flood is included in the Comments section of Table 7.

The projected vulnerability associated with future development is also identified and reviewed as it pertains to future population, future number of structures, future number of critical facilities, and future potential loss (economic). This includes additional information regarding population shifts, changes in land use, effects of mitigation projects, etc. Most of the local hazard mitigation plans did not include forecasts of vulnerability. For the few that did, vulnerability projections are included in the Comments column.

Table 7 Vulnerabilities Identified in Local Multi-Hazard Mitigation Plans

County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Adams	High	10,000	3,561		$772,000,000 in building exposure $505,000,000 in contents exposure	2020 for population estimates Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Alamosa						**Plan in progress**
Arapahoe	High	11,100	6,151		$1,153,000,000 in building exposure $901,000,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Archuleta						Plan in progress
Baca						Plan in progress
Bent						Plan in progress
Boulder	High	8,810	4,248	35	$456,788,882 (does not include critical facilities)	"Any new construction in mapped flood hazard areas built in accordance with local floodplain management ordinances should be elevated to the 100-year flood, at a minimum. Thus vulnerability to flooding is not considered to be increasing with development. However, there are areas that area not mapped that could still be flood prone." (page 162) (19 critical facilities affected by 500-year flood) 500year potential loss = $399,463,771 (does not include critical facilities)
Broomfield	High	20	10		$1,153,000,000 in building exposure $901,000,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Chaffee						Did not go into detail on loss estimates

County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Cheyenne	Medium	168 (displaced)	1922 (building count)	11 + 1 scour bridge	$6,151,000	"The County continues to lose population, a trend documented in the 2004 Planning Process. There are wind farms being planned in the northern portion of the County." (Cheyenne County Planning Element, page 11)
Clear Creek	High	700	312		$82,000,000 in building exposure $52,000,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Conejos						**Plan in progress**
Costilla	Moderate			1		Did not go into detail on loss estimates
Crowley						**Plan in progress**
Custer						Did not go into detail on loss estimates
Delta	High	746	124	23	$21,468	"The risk of flooding to future development should be minimized by the floodplain management programs of the County and its municipalities, if properly enforced. Risk could be further reduced by strengthening floodplain ordinances and floodplain management programs beyond minimum NFIP requirements." (page 112)
Denver	High	9,900	2,630		$1,132,000,000 in building exposure $846,000,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Dolores						Did not go into detail on loss estimates
Douglas		7,800	5,726		$1,274,000,000 in building exposure $686,000,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas

County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Eagle						Did not go into detail on loss estimates
Elbert	High	140	508	0	$4,170,000	"The floodplain management programs of Elbert County and the Town of Kiowa, if properly enforced, should minimize the risk of flooding to future development. Risk could be further reduced if the Town of Elizabeth were to join the NFIP and strengthen their existing floodplain ordinances and floodplain management programs beyond the minimum NFIP requirements." (page 73)
El Paso						Did not go into detail on loss estimates
Fremont						Did not go into detail on loss estimates
Garfield						**No plan**
Gilpin	High	30	10		$3,000,000 in building exposure $1,400,000 in contents exposure	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Grand						Flooding not identified as a top five hazard – no detail on loss estimates
Gunnison	Low				$1,004,000	
Hinsdale	Low				$2,500,000 - $4,000,000 - $7,000,000	The criteria used to calculate the potential loss estimates are described on page 30 of the Hinsdale LHMP. The numbers presented here are based on a high/medium/low risk flood event.
Huerfano						No plan
Jackson						
Jefferson		19,623	1,592	16 + 6 scour bridges	$723,216,000	Loss estimate based on HAZUS-MH data
Kiowa						Plan in progress

County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Kit Carson	Medium	103 (displaced)	0 (according to 2008 State HMP)	0 + 4 scour bridges	$3,060,000	
Lake						Did not go into detail on loss estimates
La Plata						No plan
Larimer					$750,000	
Las Animas						No plan
Lincoln	High	312 (displaced)	172 (per 2008 State Plan)	42 + 5 scour bridges	$8,920,000	"Lower part of the county, the 'L' is growing steadily. Highway 94 provides a direct route to Colorado Springs within 30/45 minutes. 98% of this growth is manufactured housing. The high growth rate, countywide, however, is attributed to the State Department of Corrections prison." (Lincoln County Planning Element, page 12)
Logan	High	3,818 (displaced)	4,588 (per 2008 State Plan)	9 +8 scour bridges	$52,966,000	
Mesa	High					Did not go into detail on loss estimates
Mineral						**Plan in progress**
Moffat						No plan
Montezuma						No plan
Montrose	High severity, moderate probability					"Based on land use and population growth projections, Montrose County anticipates continued rapid population growth. In the absence of effective mitigation measures, these projections indicate increasing loss potential from the prioritized hazards identified in this plan." (page 60)
Morgan	High	3,488 (displaced)	232 (per 2008 State Plan)	11+ 9 scour bridges	$97,477,000	Loss estimates based on HAZUS-MH data
Otero						**Plan in progress**
Ouray	High	1163	493	8	$25,833,866	Loss estimates based on GIS data

County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Park	Moderate					
Phillips	High	935 (displaced)	135 (per 2008 State Plan)	68 + 4 scour bridges	$27,783,000	
Pitkin						Did not go into detail on loss estimates
Prowers					City of Lamar Total 2002 Assessor's Valuation: $32,114,190 Town of Granada Total 2002 Assessor's Valuation: $999,530 Town of Holly Total 2002 Assessor's Valuation: $2,190,270 Town of Wiley Total 2002 Assessor's Valuation: $1,155,620	(approx. 10% of Lamar is in flood zone A and 60% of the City is in flood zone B) (approx. 95% of Granada is in flood zone B) (approx. 80% of Holly is in flood zone B) (approx. 5% of Wiley is in flood zone A)
Pueblo						
Rio Blanco						Did not go into detail on loss estimates
Rio Grande						**Plan in progress**
Routt						**No plan**
Saguache						**Plan in progress**
San Juan						**No plan**
San Miguel	High		2,098		$116,124,300 - $216,765,360 - $379,339,380	Shallow, medium, deep flooding
Sedgwick	High	375 (displaced)	15 (per 2008 State Plan)	22 + 11 scour bridges	$5,079,000	

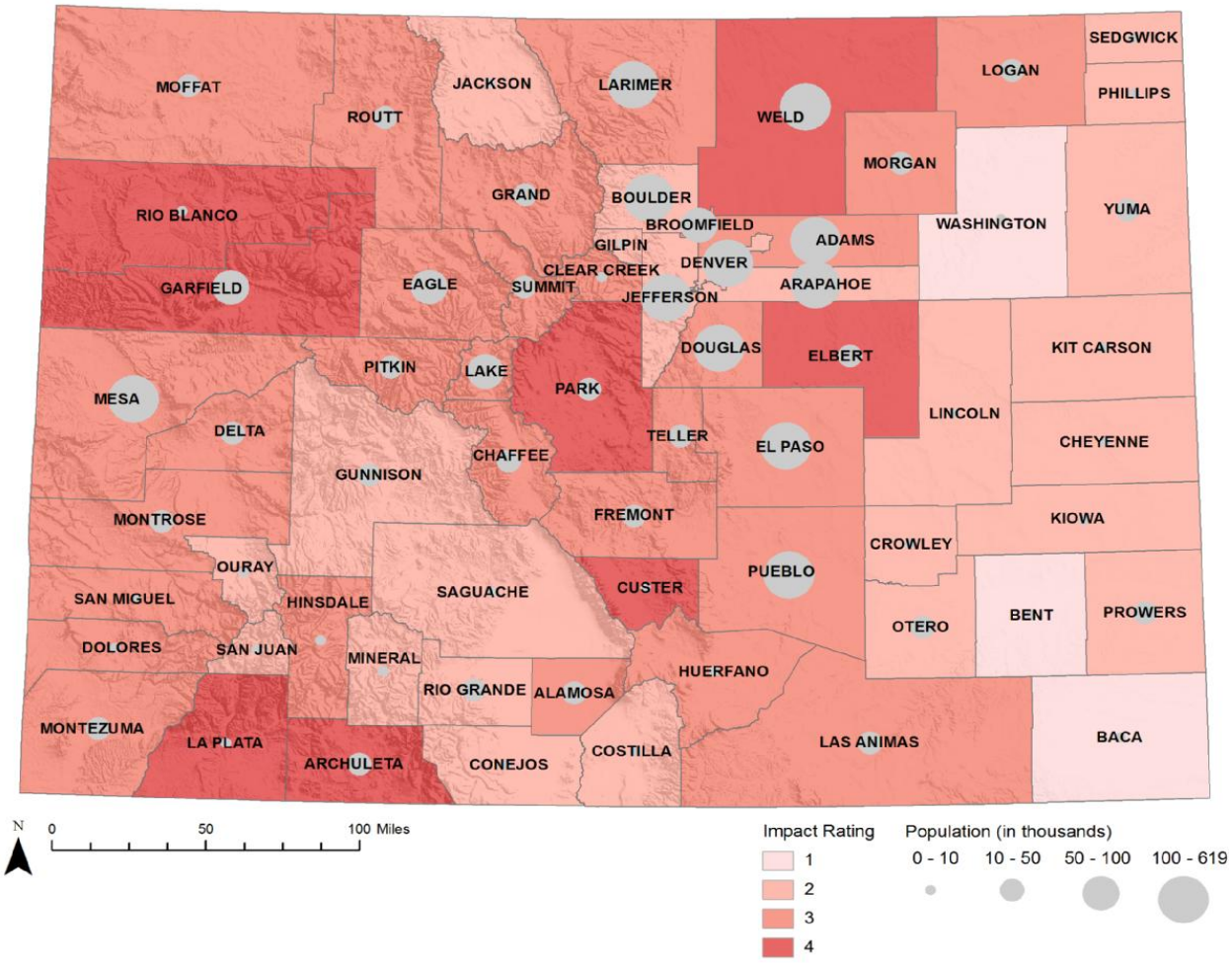
County	Level of Risk Identified in Local Plan	Population Affected	# of Structures Affected	# of Critical Facilities Affected	Potential Loss (total $ value)	Comments
Summit	High	1,024		8	$85,229,000	"The risk of flooding to future development should be minimized by the floodplain management programs of the County and its municipalities, if properly enforced. Risk could be further reduced by strengthening floodplain ordinances and floodplain management programs beyond minimum NFIP requirements." (page 109)
Teller	Medium	291	19	9	$16,009,000	"Any new construction in mapped flood hazard areas built in accordance with local floodplain management ordinances should be elevated to the 100-year flood, at a minimum. Thus vulnerability to flooding is not considered to be increasing with development. However, there are areas that are not mapped that could still be floodprone. Flooding risk in the northwestern county areas has increased due to the loss of ground cover from the Hayman Fire. Development accesses have been flooded and washed out as a result. Sedimentation and siltation of streambeds as well as ponds and reservoirs has accordingly increased, and thus are more prone to overtopping and flooding during high rainfall events." (page 116)
Washington	High	328 (displaced)	16 (per 2008 State Plan)	1 + 5 scour bridges	$6,798,000	
Weld	High	8,307 (displaced)	172 (per 2008 State Plan)	167 +12 scour bridges	$199,438,000	See pages 17-18 in the Weld County Planning Element for information on development trends
Yuma		715 (displaced)	404 (per 2008 State Plan)	32 + 3 scour bridges	$29,543,000	

3.3.4 Changes in Development Patterns

As part of the Plan revision process, changes in growth and development were examined in the context of flood vulnerability. Changes in growth and development naturally affect loss estimates and vulnerability. When the population in a hazard area increases, so too does the vulnerability of the people and property unless mitigation measures are taken. When the population of a hazard area decreases, the burden of managing agencies and assuming loss to communal property may exceed the resources of the declining population.

Information in this section of the document is intended to reflect changes in development for jurisdictions in flood hazard prone areas. Changes in development patterns can generally be related to changes in population. Consequently, census data was utilized to identify the potential changes. The 2004 update to the NHMP 2001 umbrella document contained population data, based on the 2000 census, and the percent change in population since 1990. The Department of Local Affairs (DOLA) updated this information in 2008. The raw data for this census study can be found in Section 3.3.4 Changes in Development Patterns in the State of Colorado Drought Mitigation Plan annex to the State NHMP and is not repeated here. Figure 8 illustrates the results of the population growth vulnerability analysis. This map shows "impact rankings" of 1 through 4 that correlate to projected growth rates of 0-9%, 10-49%, 50-99%, and 100% or greater, respectively, as a percentage increase from 2009 to 2035. Counties with already large populations and high projected growth include Weld, El Paso, and Garfield Counties. Weld and El Paso County are in the top 10 flood risk counties (see Section 3.4.2).

Figure 8 Current Population and Growth Impact Score by County



3.4 Estimating Potential Losses by Jurisdiction

3.4.1 Overview and Analysis of Potential Losses

Estimates of potential vulnerability and losses associated with flood hazards reflect both the population and structures within the 100-year floodplain. Methods utilized to develop the estimates were presented previously in this document and are summarized below.

3.4.2 Potential Losses Based on Estimates in Local and State Risk Assessments

Flood Analysis

Planning level flood loss estimates were made available for every county in Colorado with the

2010 update to the Colorado Hazard Mitigation Plan. FEMA used HAZUS-MH MR2 to model the 100-year floodplain and perform associated building and population risk assessments. HAZUS-MH is FEMA's GIS-based natural hazard loss estimation software. The HAZUS-MH flood model results included analysis for each of the 64 counties modeling streams draining a 10 square mile minimum drainage area, using 30 meter (1 arc second) Digital Elevation Models (DEM). Hydrology and hydraulic processes utilize the DEMs, along with flows from USGS regional regression equations and stream gauge data, to determine reach discharges and to model the floodplain. Losses are then calculated using HAZUS-MH national baseline inventories (buildings and population) at the census block level.

HAZUS-MH produces a flood polygon and flood-depth grid that represents the 100-year floodplain. The 100-year floodplain represents a flood that has a 1% chance of being equaled or exceeded in any single year. While not as accurate as official flood maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program. HAZUS-MH generated damage estimates are directly related to depth of flooding and are based on FEMA's depth-damage functions. For example, a two-foot flood generally results in about 20% damage to the structure (which translates to 20% of the structure's replacement value). The HAZUS-MH flood analysis results provide number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. Building damage can cause additional losses to a community as a whole by restricting the building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses.

Potential losses derived from HAZUS-MH used default national databases and may contain inaccuracies; loss estimates should be used for planning level applications only. The damaged building counts generated are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. There could also be errors and inadequacies associated with the hydrologic and hydraulic modeling of the HAZUS-MH model. In rural Colorado, census blocks are large and often sparsely populated or developed; this may create inaccurate loss estimates. HAZUS-MH assumes population and building inventory to be evenly distributed over a census block; flooding may occur in a small section of the census block where there are not actually any buildings or people, but the model assumes that there is damage to that block. In addition, excessive flood depths may occur due to problems with a DEM or with modeling lake flooding. Errors in the extent and depth of the floodplain may also be present from the use of 30 meter digital elevation models. HAZUS-MH Level II analyses based on local building inventory, higher resolution terrain models, and DFIRMs could be used in the future to refine and improve the accuracy of the results. In addition, the CWCB has an inventory of local flood mapping efforts and flood studies that could supplement future analyses.

HAZUS Reports and Maps

A series of maps and analysis results were compiled for the state. The HAZUS Flood Loss by

County table includes building and contents value loss estimates as well as displaced population and shelter needs estimates. The Statewide Building Loss (Figure 9), Displaced Population (Figure 10), Percent Building Loss (Figure 11), and Per Capita Loss (Figure 12) maps show flood analysis estimates by county.

Figure 9 Total Building Loss by County based on HAZUS

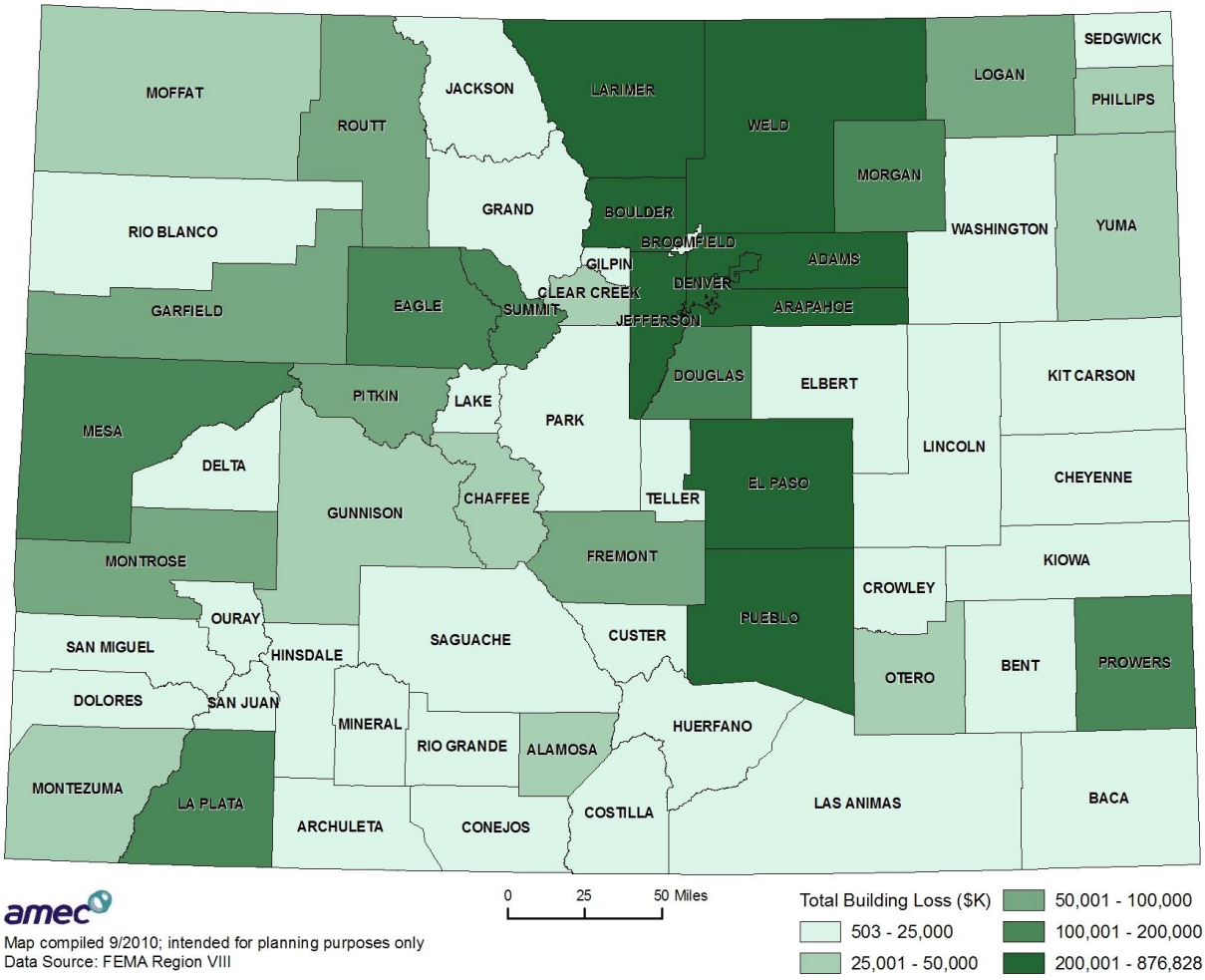


Figure 10 Percent Building Damage by County based on HAZUS

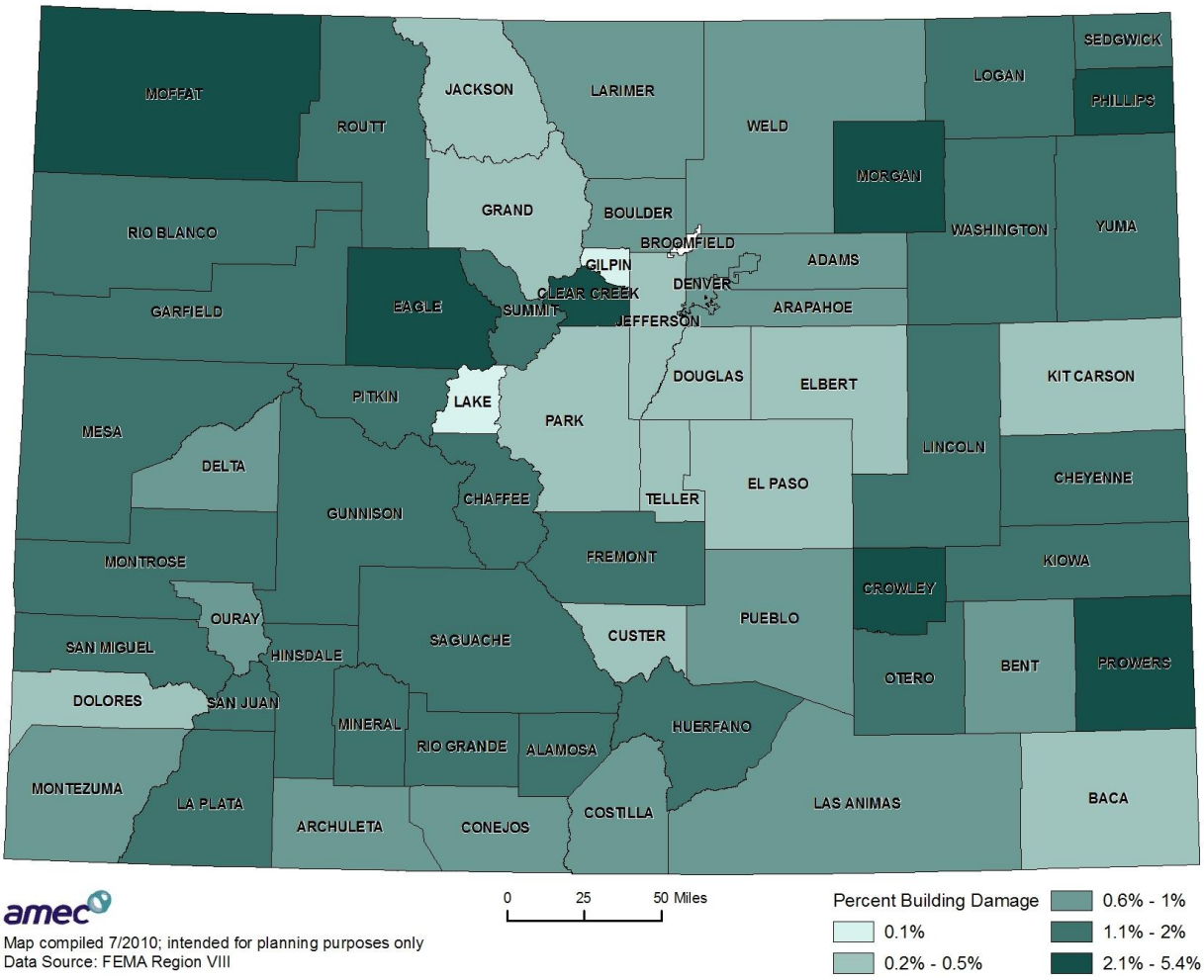


Figure 11 Per Capita Loss by County based on HAZUS

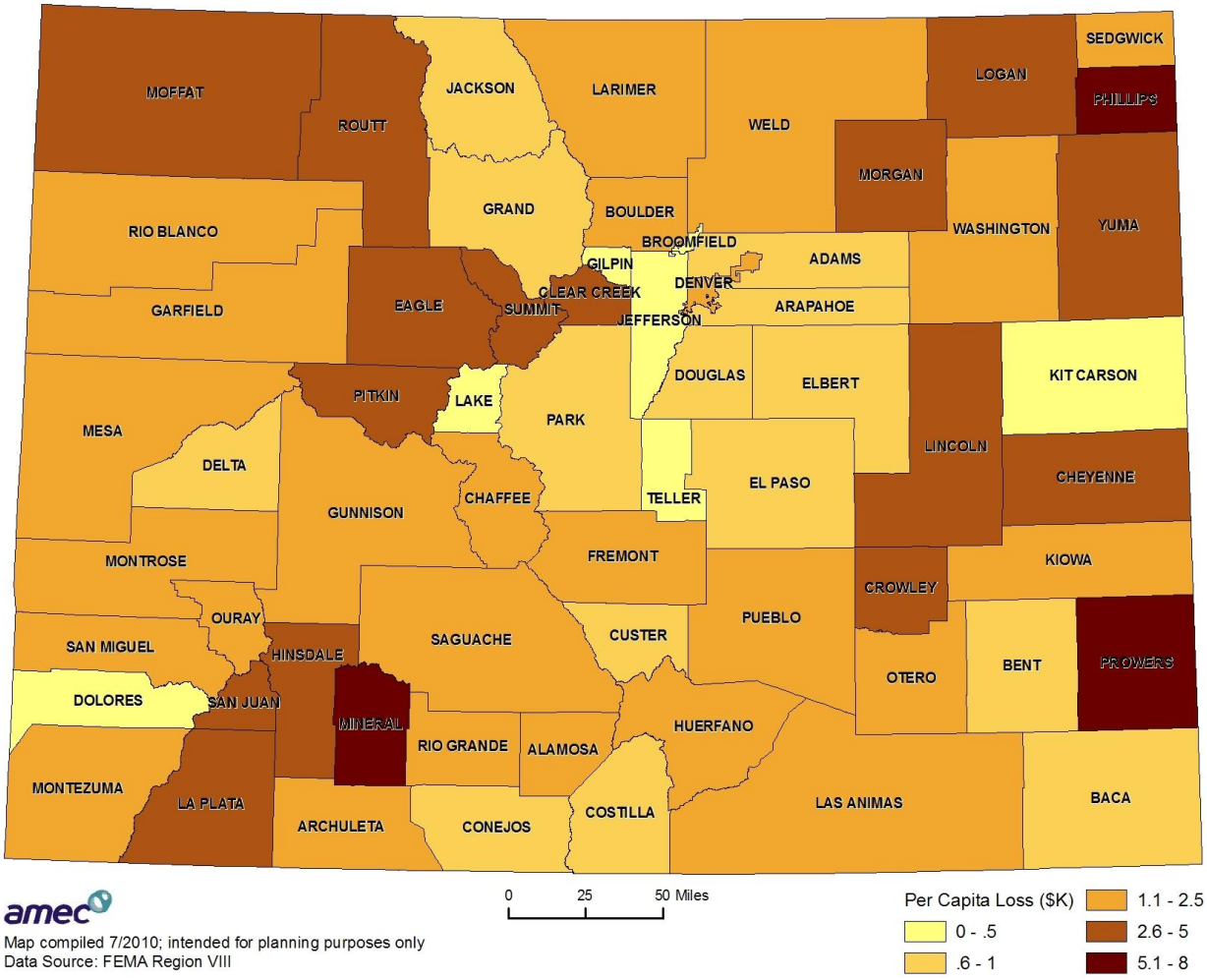


Figure 12 Displaced Population by County based on HAZUS

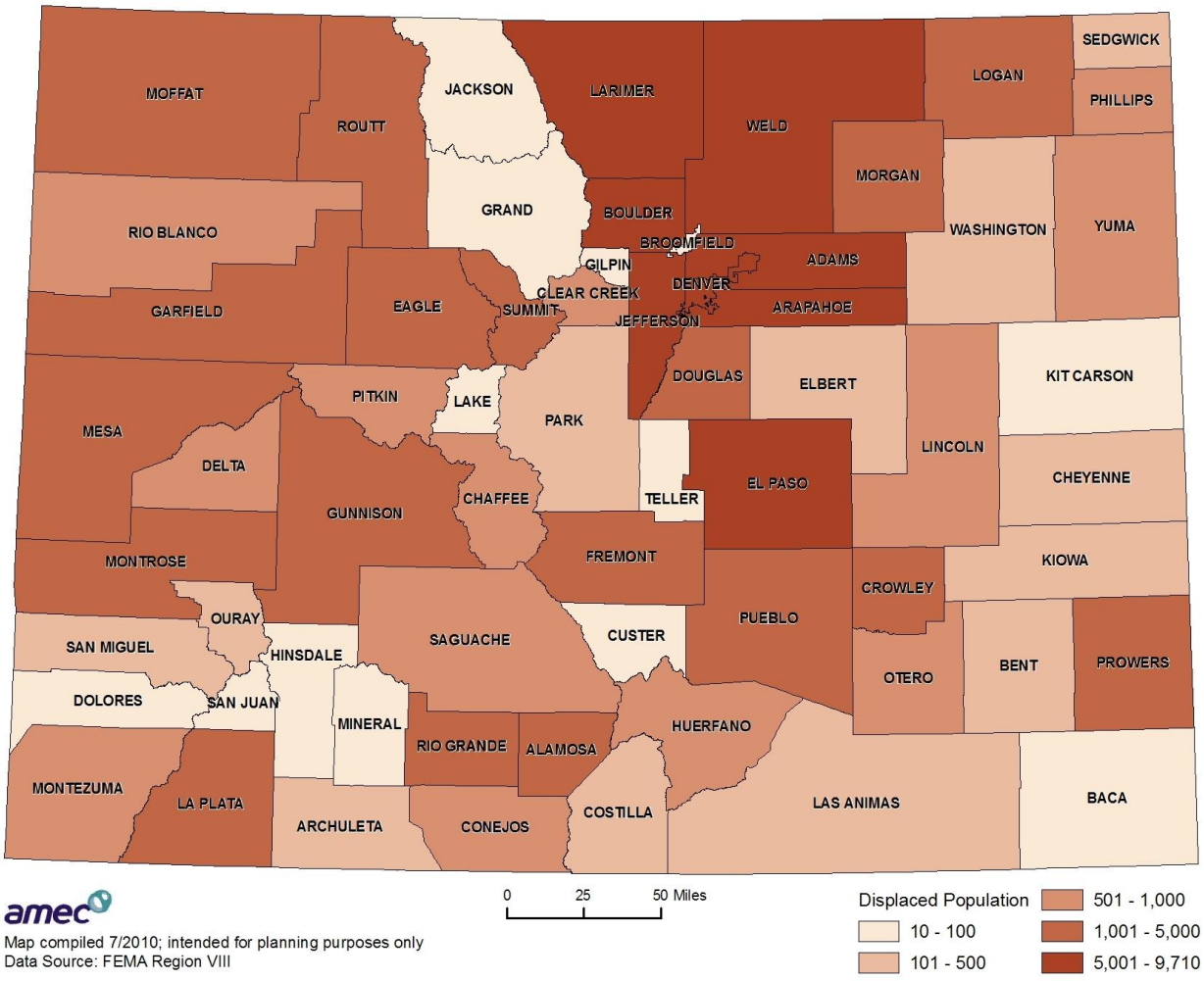


Table 8 Colorado Flood Loss Estimates based on HAZUS-MH

County	2000 Population	Building Damage Count	Building Damage Loss ($K)	Building Exposure ($K)	% Building Damage	Contents Damage Loss ($K)	Contents Exposure ($K)	% Contents Loss	Total Direct Econ Bldg Loss ($K)	Per Capita Loss ($K)	Public Short Term Shelter	Displaced Population	% Public Short Term
Adams	346,529	1072	$131,458	$20,685,685	0.6%	$169,831	$13,596,898	1.2%	$315,824	$1	8,248	9,647	85%
Alamosa	14,884	203	$14,864	$1,105,190	1.3%	$21,602	$830,022	2.6%	$37,320	$3	2,256	2,964	76%
Arapahoe	500,785	1331	$201,054	$40,140,439	0.5%	$223,885	$25,487,721	0.9%	$434,547	$1	8,269	9,658	86%
Archuleta	10,659	35	$6,991	$774,539	0.9%	$7,591	$485,824	1.6%	$14,884	$1	56	325	17%
Baca	4,495	0	$1,111	$277,735	0.4%	$1,146	$187,841	0.6%	$2,367	$1	-	72	0%
Bent	5,883	22	$2,831	$306,702	0.9%	$2,526	$189,588	1.3%	$5,503	$1	69	298	23%
Boulder	267,415	852	$129,562	$22,991,294	0.6%	$207,505	$15,181,025	1.4%	$351,951	$1	7,499	9,422	80%
Broomfield	44,445	12	$979	$3,502,752	0.0%	$746	$2,777,466	0.0%	$1,737	$0	63	63	100%
Chaffee	16,520	112	$14,925	$1,237,112	1.2%	$17,541	$800,191	2.2%	$33,170	$2	439	991	44%
Cheyenne	2,204	24	$2,787	$149,843	1.9%	$4,018	$104,797	3.8%	$6,941	$3	59	209	28%
Clear Creek	9,440	108	$18,295	$911,784	2.0%	$20,341	$562,769	3.6%	$39,315	$4	346	850	41%
Conejos	8,355	17	$3,425	$388,318	0.9%	$3,273	$234,652	1.4%	$6,996	$1	122	563	22%
Costilla	3,647	0	$1,012	$191,457	0.5%	$1,186	$118,033	1.0%	$2,291	$1	7	168	4%
Crowley	5,434	51	$5,892	$212,008	2.8%	$9,639	$125,060	7.7%	$15,848	$3	1,082	1,525	71%
Custer	3,693	1	$1,527	$357,357	0.4%	$1,669	$218,517	0.8%	$3,285	$1	2	60	3%
Delta	28,421	55	$8,878	$1,605,744	0.6%	$11,324	$1,037,552	1.1%	$21,018	$1	320	785	41%
Denver	554,446	1104	$266,862	$47,186,525	0.6%	$561,600	$32,988,605	1.7%	$876,828	$2	8,183	9,225	89%
Dolores	1,837	0	$302	$127,783	0.2%	$195	$82,413	0.2%	$503	$0	-	11	0%
Douglas	199,753	267	$44,437	$16,307,379	0.3%	$57,176	$9,819,750	0.6%	$104,844	$1	1,410	1,890	75%
Eagle	43,027	469	$92,789	$3,715,136	2.5%	$92,954	$2,343,401	4.0%	$189,248	$4	2,385	3,470	69%
El Paso	533,428	1119	$122,930	$36,710,097	0.3%	$157,755	$23,385,752	0.7%	$288,573	$1	5,451	7,518	73%
Elbert	21,445	13	$5,095	$1,426,895	0.4%	$6,109	$860,636	0.7%	$11,489	$1	46	272	17%
Fremont	47,209	261	$30,549	$2,388,634	1.3%	$41,259	$1,520,011	2.7%	$74,825	$2	1,364	2,466	55%
Garfield	45,521	181	$31,400	$2,836,135	1.1%	$36,605	$1,879,843	1.9%	$69,818	$2	973	1,712	57%
Gilpin	4,823	0	$466	$569,760	0.1%	$797	$328,259	0.2%	$1,284	$0	-	10	0%
Grand	12,711	13	$2,880	$1,749,662	0.2%	$3,064	$1,025,224	0.3%	$6,054	$0	5	85	6%
Gunnison	13,947	197	$17,083	$1,435,639	1.2%	$15,458	$911,557	1.7%	$33,102	$2	745	1,226	61%
Hinsdale	800	8	$1,697	$154,301	1.1%	$1,693	$87,606	1.9%	$3,425	$4	9	92	10%
Huerfano	7,845	69	$9,141	$593,297	1.5%	$9,377	$378,770	2.5%	$18,908	$2	384	688	56%
Jackson	1,589	1	$476	$132,912	0.4%	$586	$84,522	0.7%	$1,110	$1	2	61	3%
Jefferson	530,966	1712	$113,076	$41,665,206	0.3%	$122,577	$25,932,280	0.5%	$241,700	$0	5,310	7,449	71%
Kiowa	1,537	5	$1,176	$104,998	1.1%	$1,115	$70,650	1.6%	$2,365	$2	13	130	10%
Kit Carson	7,813	0	$1,364	$502,866	0.3%	$1,351	$359,407	0.4%	$2,840	$0	-	92	0%
La Plata	45,157	315	$43,963	$3,316,138	1.3%	$71,967	$2,217,049	3.2%	$119,551	$3	1,274	2,156	59%
Lake	7,679	1	$427	$520,474	0.1%	$343	$338,206	0.1%	$784	$0	23	46	50%
Larimer	259,472	1130	$127,265	$17,916,891	0.7%	$183,465	$11,613,908	1.6%	$325,676	$1	5,876	8,039	73%

County	2000 Population	Building Damage Count	Building Damage Loss ($K)	Building Exposure ($K)	% Building Damage	Contents Damage Loss ($K)	Contents Exposure ($K)	% Contents Loss	Total Direct Econ Bldg Loss ($K)	Per Capita Loss ($K)	Public Short Term Shelter	Displaced Population	% Public Short Term
Las Animas	15,341	37	$9,270	$997,324	0.9%	$13,833	$659,477	2.1%	$23,726	$2	89	433	21%
Lincoln	5,927	42	$5,677	$348,181	1.6%	$9,057	$224,737	4.0%	$15,719	$3	272	635	43%
Logan	20,921	295	$23,589	$1,369,759	1.7%	$31,339	$964,442	3.2%	$57,330	$3	2,698	4,037	67%
Mesa	119,281	578	$73,824	$7,034,521	1.0%	$99,659	$4,684,262	2.1%	$182,282	$2	2,779	3,881	72%
Mineral	809	10	$2,391	$130,808	1.8%	$1,785	$74,760	2.4%	$4,212	$5	6	59	10%
Moffat	13,154	190	$15,436	$743,297	2.1%	$29,785	$482,195	6.2%	$46,953	$4	1,378	1,852	74%
Montezuma	24,035	129	$12,290	$1,242,312	1.0%	$15,925	$843,410	1.9%	$29,388	$1	398	939	42%
Montrose	34,572	266	$23,403	$2,038,878	1.1%	$27,405	$1,434,451	1.9%	$52,521	$2	1,518	2,418	63%
Morgan	27,543	524	$40,769	$1,442,052	2.8%	$57,269	$959,835	6.0%	$101,225	$4	1,692	3,626	47%
Otero	19,972	148	$17,758	$1,283,942	1.4%	$21,929	$870,526	2.5%	$40,756	$2	427	992	43%
Ouray	3,882	11	$3,468	$364,844	1.0%	$3,745	$241,286	1.6%	$7,372	$2	11	156	7%
Park	15,580	5	$3,500	$1,509,529	0.2%	$3,891	$844,169	0.5%	$7,557	$0	8	134	6%
Phillips	4,472	117	$9,100	$295,557	3.1%	$15,838	$208,149	7.6%	$26,349	$6	386	1,000	39%
Pitkin	14,810	77	$24,470	$2,055,063	1.2%	$31,033	$1,367,081	2.3%	$56,508	$4	316	686	46%
Prowers	14,206	607	$45,131	$837,687	5.4%	$63,218	$564,841	11.2%	$112,838	$8	2,797	4,286	65%
Pueblo	144,955	519	$86,413	$8,819,700	1.0%	$177,651	$5,739,885	3.1%	$274,837	$2	1,916	2,750	70%
Rio Blanco	5,945	41	$6,095	$496,773	1.2%	$5,892	$341,682	1.7%	$12,346	$2	216	521	41%
Rio Grande	12,304	78	$9,090	$832,189	1.1%	$8,453	$556,390	1.5%	$17,952	$1	414	1,242	33%
Routt	20,255	185	$24,604	$1,959,119	1.3%	$32,718	$1,258,893	2.6%	$59,098	$3	964	1,488	65%
Saguache	6,224	47	$4,072	$318,446	1.3%	$5,724	$199,769	2.9%	$10,144	$2	174	635	27%
San Juan	586	8	$938	$84,277	1.1%	$973	$51,968	1.9%	$1,962	$3	13	100	13%
San Miguel	6,951	52	$8,314	$751,657	1.1%	$6,565	$470,095	1.4%	$15,099	$2	244	386	63%
Sedgwick	2,668	35	$2,770	$213,736	1.3%	$2,669	$153,540	1.7%	$5,608	$2	120	405	30%
Summit	24,225	290	$49,684	$3,489,235	1.4%	$50,077	$2,030,518	2.5%	$102,222	$4	698	1,250	56%
Teller	21,425	5	$2,447	$1,731,011	0.1%	$2,510	$1,048,608	0.2%	$5,040	$0	3	63	5%
Washington	4,861	11	$4,166	$305,030	1.4%	$4,248	$196,035	2.2%	$8,634	$2	63	468	13%
Weld	180,546	875	$92,101	$10,617,021	0.9%	$120,522	$7,139,034	1.7%	$222,542	$1	5,477	8,929	61%
Yuma	9,859	40	$10,949	$608,667	1.8%	$16,979	$426,802	4.0%	$29,350	$3	91	560	16%

Source: FEMA Region VIII

The jurisdictions most threatened and most vulnerable to damage or loss are presented in Figures 9 through 12 and Table 8. Based on the analysis of the HAZUS-MH level 1 flood loss modeling results the following conclusions were reached:

- Vulnerability to total direct economic building loss was determined to be highest in Denver, Arapahoe, Boulder, Larimer, Adams, El Paso, Pueblo, Jefferson, Weld, and Eagle Counties.
- Percent building damage would be highest in Prowers, Phillips, Morgan, Crowley, Eagle, Moffat, Clear Creek, Cheyenne, and Mineral.
- Arapahoe, Adams, Boulder, Denver, Weld, Larimer, El Paso, Jefferson, and Prowers face the highest risk of displaced population. These counties contain the major population centers in the state, thus, the potential displaced population is higher in these areas.
- The counties with the highest per capita loss include Prowers, Phillips, Mineral, Eagle, Hinsdale, Summit, Clear Creek, Pitkin, Morgan, and Moffat.

NFIP Claims Analysis

Vulnerability to flood hazards was also assessed using NFIP data on repetitive losses, flood insurance policies and claims, and population in flood hazard areas. Information presented in Table 9 provides a profile of the repetitive damages and losses in Colorado communities from January 1978 through January 2010. According to FEMA NFIP information, the State of Colorado has 54 repetitive loss structures. Structures are located in 18 counties as indicated in Table 9. Jefferson, El Paso, and Denver County and their incorporated cities had the highest number of repetitive loss properties.

Table 10 presents a summary of NFIP policies and claims in Colorado since the NFIP's inception in 1978. During the analysis, the data was sorted by county according to the highest number of policies, the highest number of claims, and the most claims insurance money received from the NFIP. Figure 13 indicates that the counties with the most claims were, in order, Jefferson, El Paso, Larimer, Adams, Denver, Otero, Arapahoe, Pueblo, Fremont and Logan. Figure 14 indicates that the highest numbers of policies were held by residents in Boulder, El Paso, Jefferson, Larimer, Denver, Adams, Arapahoe, La Plata, San Miguel, and Eagle Counties. Finally, the counties of Larimer, Otero, Jefferson, El Paso, La Plata, Douglas, Denver, Adams, Boulder, and Mesa had received the most insurance money from the NFIP. Jefferson, Larimer, and El Paso County were each within the top five of every analysis of the NFIP claims data. Overall, the Denver metro and Colorado Springs areas had the highest vulnerability based on this information.

Table 9 NFIP Repetitive Loss Claims in Colorado: 1978-2010

Community	# of Properties	Type of Property	Total # of Claims	Total Value of Claims
Arapahoe County	2	Both single family	4	$81,752.86
Boulder County	1	Single family	2	$3,969.19
Boulder, City of	2	Other residential, non-residential	4	$10,611.37
Canon City	2	2 single family	4	$10,760.95
Clear Creek County	1	Single family	2	$9,260.05
Colorado Springs, City of	6	1 non-residential, 5 single family	14	$92,308.37
Delta County	1	Single family	3	$16,161.26
Denver, City and County of	4	2 non-residential, 2 single family	10	$152,007.30
Durango, City of	1	Non-residential	2	$18,012.59
El Paso County	4	1 other, 3 single family	10	$106,724.99
Fort Collins, City of	1	Single family	2	$11,284.61
Gunnison County	1	Single family	2	$39,722.72
Jefferson County	2	Single family, non-residential	5	$16,014.21
La Junta, City of	3	2 non-residential, 1 single family	6	$138,143.67
Lakewood, City of	8	2 non-residential, 6 single family	21	$234,424.08
Larimer County	1	2-4 family	2	$7,616.66
Littleton, City of	1	Other residential	2	$4,030.57
Logan County	1	Single family	2	$6,184.62
Manitou Springs, City of	2	2 single family	4	$44,038.32
Mesa County	1	Single family	2	$4,239.63
Pitkin County	1	Single family	2	$7,499.21
Pueblo, City of	1	Non-residential	2	$9,675.08
Rio Blanco County	1	Single family	2	$11,384.20
Steamboat Springs, City of	1	Single family	2	$3,061.26
Sterling, City of	1	Non-residential	2	$6,250.78
Weld County	1	Single family	2	$16,357.20
Westminster, City of	3	2 non-residential, 1 single family	11	$215,141.26
TOTALS	**54**		**126**	**$1,276,637.01**

Source: FEMA, March 2010

Table 10 FEMA National Flood Insurance Program (NFIP) Policy and Claims Report Colorado: 1978-2010

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Adams	1,203	$271,951,900	$1,081,813	154	$391,584
Alamosa	93	$19,713,300	$51,205	17	$10,441
Arapahoe	775	$182,179,500	$533,273	84	$63,357
Archuleta	119	$30,476,400	$82,847	4	$1,863
Bent	8	$903,500	$4,296	2	$2,690
Boulder	4,240	$932,377,200	$3,123,770	16	$281,952
Broomfield	47	$13,678,300	$38,191	8	$416
Chaffee	136	$33,424,300	$124,833	5	$2,317
Clear Creek	147	$31,449,200	$153,004	21	$28,310
Conejos	10	$1,538,200	$9,888	3	$0
Costilla	7	$1,273,000	$3,176	0	$0
Crowley	2	$575,000	$1,054	0	$0
Delta	78	$13,875,200	$53,949	19	$92,296
Denver	1,235	$300,977,500	$1,400,849	129	$414,972
Dolores	5	$1,163,500	$4,071	1	$270
Douglas	212	$52,967,500	$117,344	18	$450,965
Eagle	524	$133,600,000	$295,556	27	$127,691
El Paso	1,834	$374,542,000	$1,569,163	316	$660,274
Elbert	9	$2,358,000	$9,373	0	$0
Fremont	445	$76,079,000	$312,129	56	$125,772
Garfield	260	$66,897,300	$199,164	23	$77,005
Gilpin	19	$8,832,000	$75,485	8	$9,794
Grand	261	$36,261,800	$87,469	1	$5,960
Gunnison	343	$77,034,200	$210,752	41	$151,239
Hinsdale	32	$8,459,500	$15,210	1	$0
Huerfano	103	$11,211,700	$68,661	5	$1,885
Jefferson	1,753	$405,888,800	$1,603,593	352	$1,092,054
La Plata	733	$195,242,200	$487,134	29	$461,572
Lake	9	$2,193,200	$6,354	0	$0
Larimer	1,285	$308,285,000	$986,662	202	$2,246,646
Las Animas	56	$11,452,100	$67,273	3	$10,992
Lincoln	18	$2,372,600	$12,873	5	$4,362
Logan	403	$50,781,000	$332,019	52	$199,629
Mesa	228	$50,978,600	$170,133	40	$252,611
Mineral	6	$3,163,300	$20,639	1	$268
Moffat	15	$3,221,700	$6,118	0	$0

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Montezuma	178	$35,674,300	$148,704	3	$2,487
Montrose	131	$20,328,500	$74,643	4	$22,440
Morgan	210	$19,987,400	$139,304	26	$53,036
Otero	149	$14,054,100	$117,676	121	$1,677,760
Ouray	64	$17,157,000	$38,773	6	$33,046
Park	9	$7,135,500	$19,351	2	$343
Phillips	8	$1,173,900	$5,912	2	$7,402
Pitkin	379	$93,174,200	$254,081	24	$208,106
Prowers	51	$8,668,000	$32,383	20	$16,233
Pueblo	199	$45,334,800	$166,475	76	$190,234
Rio Blanco	46	$6,176,400	$45,160	9	$23,952
Rio Grande	180	$35,609,300	$125,420	6	$2,651
Routt	406	$86,817,000	$252,146	20	$55,981
Saguache	2	$144,900	$1,261	0	$0
San Juan	4	$1,260,000	$2,476	1	$1,144
San Miguel	529	$120,349,200	$313,889	15	$115,603
Summit	377	$80,086,500	$219,553	19	$39,004
Teller	39	$9,466,000	$26,757	6	$2,429
Washington	1	$19,000	$931	0	$0
Weld	498	$104,463,200	$388,387	49	$160,123
Yuma	19	$2,767,300	$12,046	2	$1,848
State Total	**19,117**	$4,197,483,200	$14,847,390	**2,080**	$9,485,116

Source: FEMA, NFIP, 2010

Figure 13 NFIP Claims in Colorado Since 1978

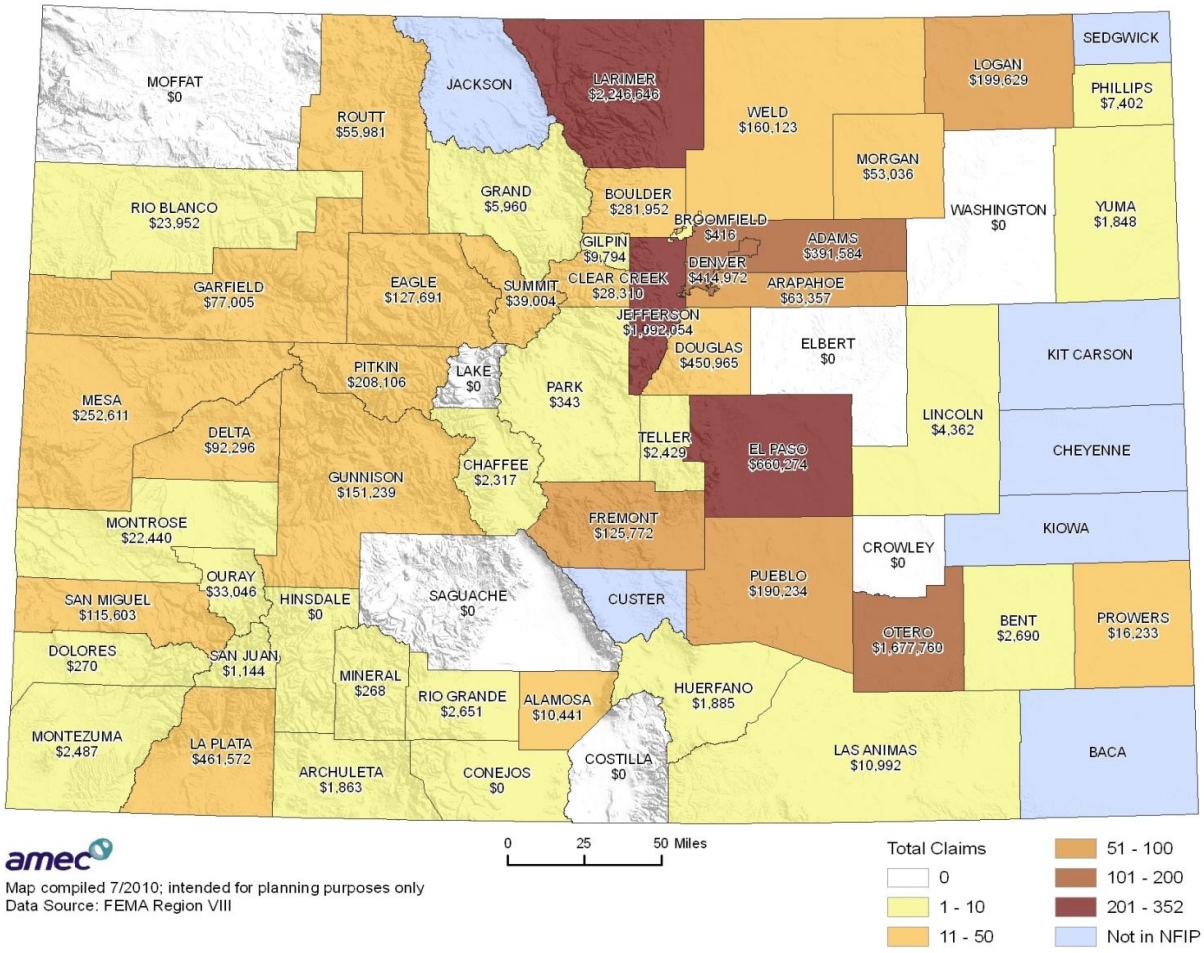
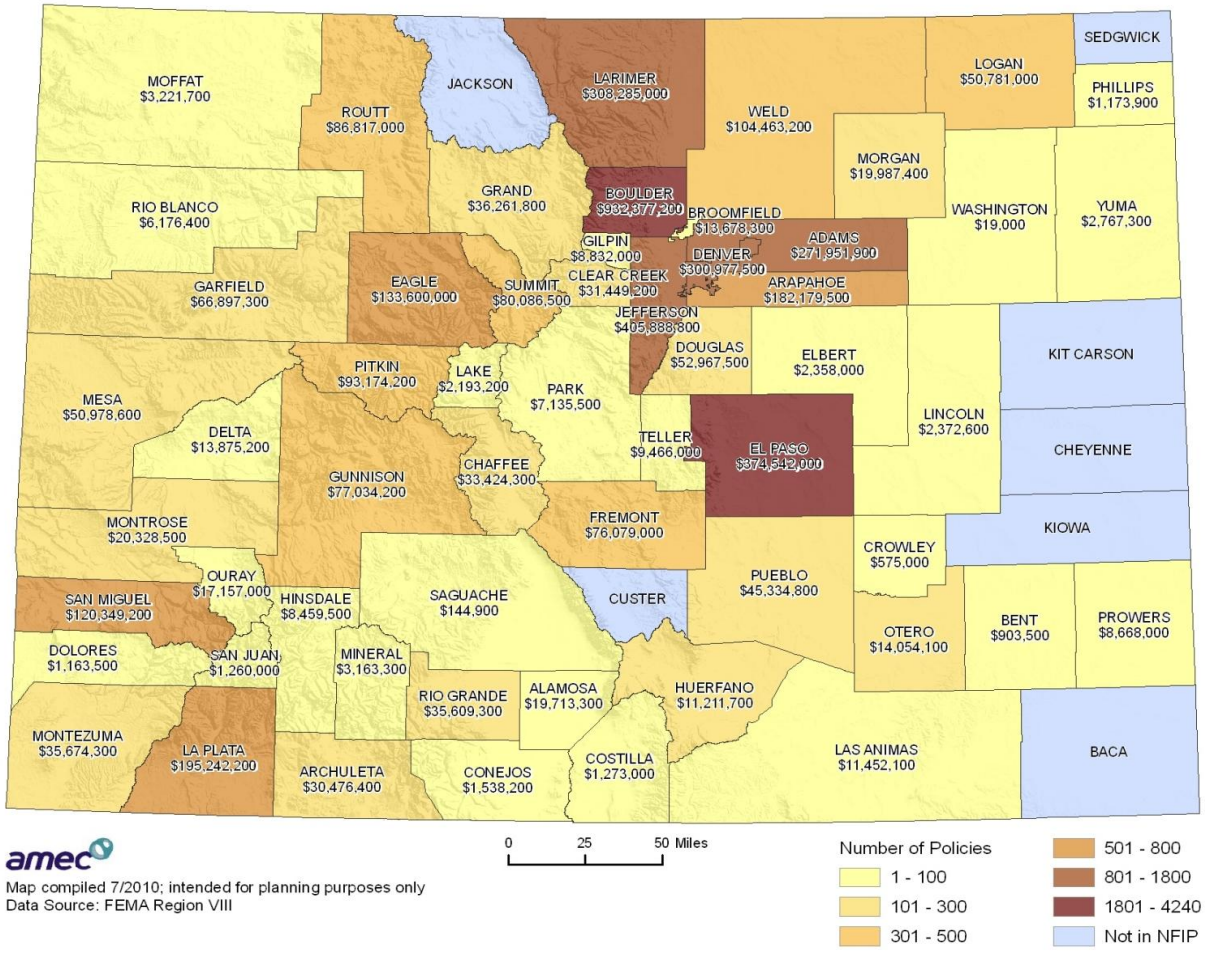


Figure 14 NFIP Colorado Policies and Total Coverage



3.4.3 Impacts on Losses from Changes in Development

There is a close correlation between development patterns, population growth, and the cost of disasters. In general, counties with growing populations and growing development have an increased vulnerability to hazards not defined by specific geographic areas. As growth occurs within a community, less land is available for development. This tendency promotes the development of land that is more prone to flood hazards. As the population grows, it is anticipated that the losses from future floods will likely increase without additional flood mitigation measures.

In theory, this would mean that Colorado counties, such as Weld, El Paso, and Garfield would have to contend with increased vulnerability to flooding. Growth pressures could exacerbate vulnerability in other sectors, such as building loss. For example, Weld County is among the counties that face the highest impacts from growth and is also one of the top 10 counties in terms of vulnerability to direct economic building loss and displaced population. Other counties that are met with both high growth pressures and socioeconomic vulnerability include Adams,

Larimer, El Paso, Pueblo, Eagle, Moffat, and Clear Creek.

Counties that must deal with such pressures can help alleviate their risk by participating in flood mitigation programs such as the NFIP. While an increase in development may occur, flood risk can be reduced by enforcing building elevation standards or not building new structures within identified risk areas. However, vulnerability is potentially even greater for counties such as Grand and Custer that face pressures from growth and development but do not participate in the NFIP.

3.5 Assessing Vulnerability of State Facilities

Vulnerability to state facilities and other assets from flood is primarily due to direct damage of the structure and contents. The at-risk critical assets, impacts, and approximate value of assets are shown in Table 12. These at-risk state assets were reviewed and incorporated into the state assets assessment (the results of which are summarized in Section 3.5.2 Estimating Potential Losses of State Facilities).

The following sections describe the types of facilities included in this assessment and present an overview of estimated monetary losses, where available.

3.5.1 Types of State Owned/Operated Facilities

The 2004 update to the NHMP 2001 umbrella document specifically identified the types of State owned or operated critical facilities located in flood hazard areas. The Colorado Office of Risk Management and the Colorado DEM updated this information in 2007 and 2010. In order to determine vulnerability to state assets, this GIS layer of state facilities was overlaid on digital flood hazard maps, where available. State assets located in floodplain areas are presented on Figure 15 and in Table 11 along with the value of the assets. In addition, bridges that were determined to be at risk from scour during flooding events were also identified. A summary of the state critical assets at risk from a 100-year flooding event is presented in Table 12.

In the 2007 Plan update, approximately $122 million in assets (e.g., buildings, vehicles, contents) were identified as being at risk. Assuming a worst-case scenario in which all assets were assumed to be at risk during a 100-year flood event, the total potential loss to assets became $122 million. In addition, the potential losses associated with bridges that were determined to be at risk from scour during flooding events were estimated. Statewide, 358 bridges were determined to be scour critical with a total replacement cost of $237 million.

The 2010 Plan update found that the total number and exposure value of state assets at risk was 472 assets and $828,498,232 based on HAZUS analysis. The 1% annual chance DFIRM analysis indicated that 222 assets with a value of $122,065,379 were threatened by flooding. The 0.2% annual chance DFIRM flood analysis indicated that 109 assets worth a total of $211,397,961 are potentially at risk to these larger flood events.

Figure 15 Location of State Assets in Floodplains by County

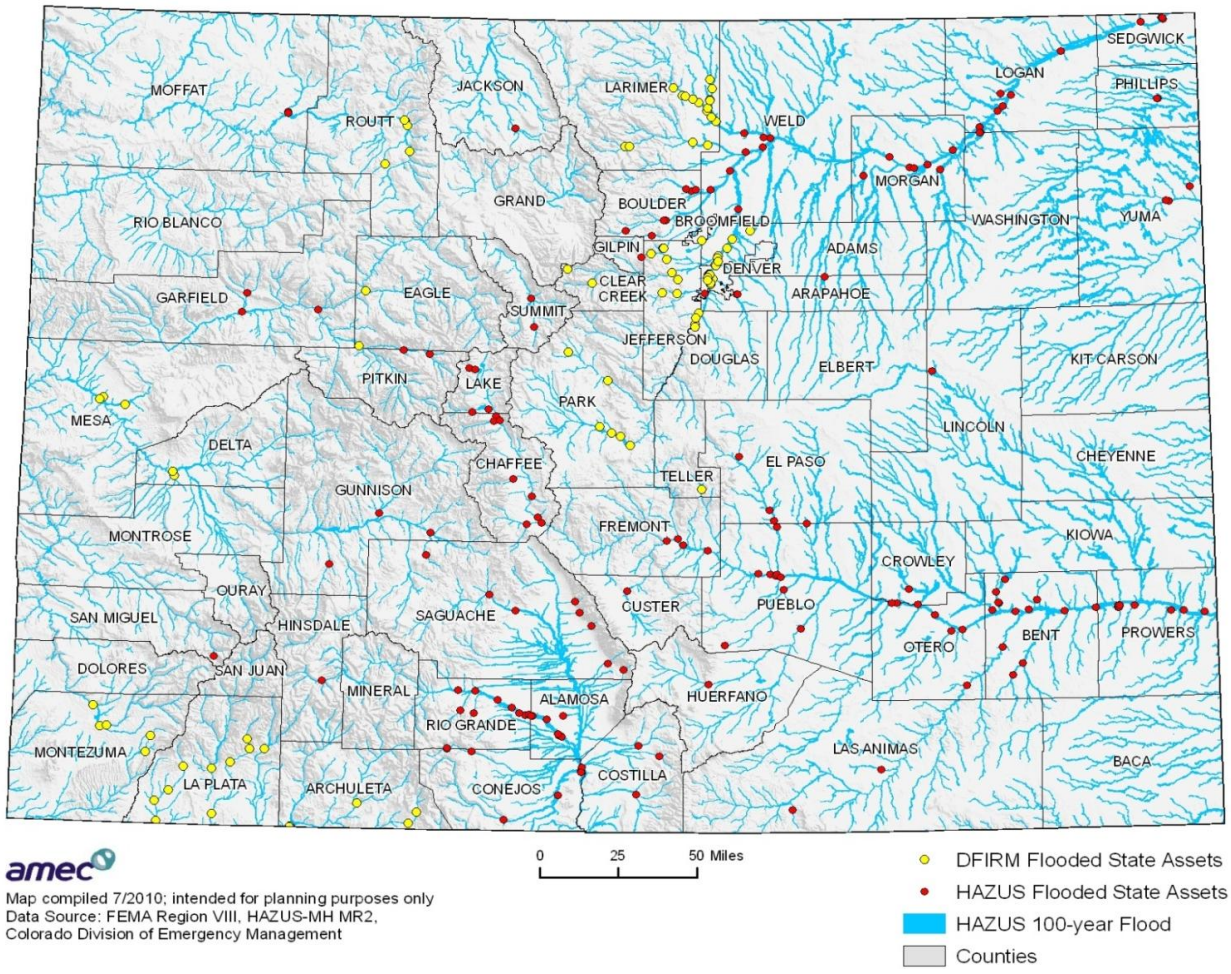


Table 11 State Assets Potentially at Risk to Flooding (Effective DFIRM and HAZUS)

Occupancy	# of Assets	Owned	1-Story	2+Story	Total Value
Other	293	215	264	2	$455,625,455
Education	32	15	5	13	$232,831,771
Dept of Corrections	184	184	147	34	$227,564,873
Residences/Housing	29	25	22	7	$91,764,050
Garage	40	40	38	2	$63,372,510
Office	44	25	25	7	$34,575,453
Armory	2	2	2	-	$9,248,139
Office/Classroom	1	-	-	1	$9,172,215
Museum	8	8	7	1	$5,277,396
Shop	14	14	13	-	$5,234,843
Recreation	8	5	2	3	$4,288,272

Occupancy	# of Assets	Owned	1-Story	2+Story	Total Value
Leased Equipment	1	-	-	-	$3,981,094
Shed	32	31	31	-	$3,365,789
Storage	33	31	29	3	$3,274,689
Office of Information Technology	5	-	5	-	$2,823,276
Office/Lab	1	1	1	-	$1,847,848
Machine Storage	1	1	1	-	$1,756,436
Fish Hatchery	3	3	2	1	$1,351,495
State Patrol	6	3	6	-	$1,079,724
Shelter	2	2	2	-	$622,467
Animal Science	10	10	10	-	$410,339
Sand Shed	5	4	5	-	$368,494
Warehouse	1	-	-	-	$357,703
Monitoring Stations	10	9	5	1	$351,548
Pesticide Storage	3	3	3	-	$216,910
Parole Office	2	-	2	-	$193,284
Restrooms	6	6	6	-	$188,200
Not Occupied	8	8	8	-	$180,030
Containment Structure	5	3	-	-	$177,224
Laboratory	1	-	-	-	$118,223
Nature Center	3	2	2	-	$109,358
Workforce Center	3	-	-	-	$87,099
Shop/Storage	1	1	1	-	$45,435
Fertilizer Storage	1	1	1	-	$37,696
Utilities	1	-	1	-	$22,100
National Monument	2	2	2	-	$20,130
Power Plant	1	-	-	1	$20,001
Total	**802**	**654**	**648**	**76**	**$1,161,961,571**

Table 12 State Assets Potentially at Risk to Flooding Summarized by Agency

Departments	# of Assets	Total Value
Transportation	119	$467,581,606
Higher Education	71	$276,399,833
Corrections	190	$232,589,526
University of Colorado	10	$104,274,511
Natural Resources	338	$60,149,480
Military Affairs	2	$9,248,139
Colorado State University	31	$6,151,960

Departments	# of Assets	Total Value
Office of Governor	8	$2,963,721
Public Safety	6	$1,079,724
Public Health	15	$944,583
Revenue	5	$426,875
Labor & Employment	3	$87,099
Regulatory Agencies	3	$43,440
Local Affairs	1	$18,106
Human Services	1	$2,969
Total	**803**	**$1,161,961,571**

3.5.2 Estimating Potential Losses of State Facilities

In order to determine potential losses to state facilities, a GIS layer of state facilities was overlaid on digital flood hazard maps, where available. An exposure analysis was used for this analysis. Exposure analyses are different from loss estimates in that they present facilities that may be exposed to flood hazards, but do not attempt to estimate the amount of damages that could potentially be incurred during a flood event.

Both the DFIRM (1% and 0.2% annual chance) and HAZUS-MH modeled base flood extents were used. The value of state assets located in the floodplain based on these analyses is presented in Table 13, Table 14, and Table 15 below.

Table 13 State Assets Potentially at Risk to 1% Annual Chance of Flooding

Occupancy	# of Assets	Value Total
Animal Science	2	$140,311
Armory	2	$9,248,139
Containment Structure	2	$45,470
Dept of Corrections	44	$29,821,027
Education	4	$21,362,634
Fertilizer Storage	1	$37,696
Garage	8	$21,016,419
Laboratory	1	$118,223
Leased Equipment	1	$3,981,094
Machine Storage	1	$1,756,436
Monitoring Stations	2	$172,496
Museum	6	$990,111
Office	16	$8,587,079
Office of Information Technology	2	$2,359,991
Office/Lab	1	$1,847,848

Occupancy	# of Assets	Value Total
Other	95	$15,184,747
Parole Office	1	$165,672
Pesticide Storage	3	$216,910
Residences/Housing	7	$1,135,830
Shed	5	$379,037
Shelter	2	$622,467
Shop	3	$1,522,005
Storage	10	$966,604
Warehouse	1	$357,703
Workforce Center	1	$29,429
Total	**221**	**$122,065,379**

Table 14 State Assets Potentially at Risk to 0.2% Annual Chance of Flooding

Occupancy	# of Assets	Value Total
Animal Science	1	$7,579
Containment Structure	1	$42,174
Education	22	$175,714,514
Fish Hatchery	2	$1,277,335
Garage	10	$1,781,400
Monitoring Stations	5	$150,634
Museum	1	$607,545
Nature Center	3	$109,358
Not Occupied	8	$180,030
Office	5	$20,250,137
Other	31	$5,550,580
Parole Office	1	$27,612
Recreation	4	$3,977,630
Residences/Housing	2	$519,108
Shed	7	$359,341
Shop	2	$608,734
Shop/Storage	1	$45,435
Storage	3	$188,816
Total	**109**	**$211,397,961**

Table 15 State Assets Potentially at Risk based on HAZUS Flood Modeling

Occupancy	# of Assets	Value Total
Animal Science	7	$262,450

Occupancy	# of Assets	Value Total
Containment Structure	2	$89,580
Dept of Corrections	140	$197,743,845
Education	6	$35,754,623
Fish Hatchery	1	$74,160
Garage	22	$40,574,691
Monitoring Stations	3	$28,418
Museum	1	$3,679,740
National Monument	2	$20,130
Office	23	$5,738,237
Office of Information Technology	3	$463,285
Office/Classroom	1	$9,172,215
Other	167	$434,890,128
Power Plant	1	$20,001
Recreation	4	$310,642
Residences/Housing	20	$90,109,112
Restrooms	6	$188,200
Sand Shed	5	$368,494
Shed	20	$2,627,412
Shop	9	$3,104,104
State Patrol	6	$1,079,724
Storage	20	$2,119,269
Utilities	1	$22,100
Workforce Center	2	$57,670
Total	**472**	**$828,498,232**

The results indicate that there are substantial numbers of state assets potentially exposed to flood damage in Colorado. When grouped by state agency the departments of Transportation, Corrections, Higher Education, and Natural Resources have the greatest exposure. Also of concern from a life safety standpoint is the 29 state owned or leased residential/housing facilities that are potentially flood prone. This analysis does not take into account mitigation that may be present at each facility, such as construction at or above the base flood elevation. This study indicates that there are a number of facilities worthy of further investigation to determine true vulnerability. A more refined flood loss estimation could be determined based on estimated depth of flooding at a particular facility. The road and bridge infrastructure is also prone to flood impacts and resulting disruptions, which can have considerable economic impacts. CDOT is tracking and mitigating scour critical bridges, an action item that is discussed in the following section.

4 MITIGATION STRATEGY

4.1 Hazard Mitigation Goals

4.1.1 Description of State Mitigation Goals

The purpose of this section is to describe the goals of Colorado's Flood Hazard Mitigation Program. In order to be effective, these goals must be comprehensive and complement both state and local mitigation plans. The flood mitigation goals are closely related to the overall NHMP goals, which are as follows:

- Reduce the loss of life and personal injuries from natural hazard events
- Reduce damage to state critical, essential, and necessary assets
- Reduce damage to local government assets
- Reduce state and local costs of disaster response and recovery
- Minimize economic losses
- Reduce damage to personal property

The goals of the 2010 flood hazard mitigation plan, presented below, were updated by the FMAC and are intended to promote the reduction of future damages from flood hazards.

1) Reduce flood Impacts to Colorado's economy, people, state assets, and environment
2) Promote awareness and education of flood hazards and watershed protection
3) Promote the development of hazard mitigation plans with multiple objectives
4) Coordinate and provide technical assistance for State, local and watershed planning efforts
5) Continue to update and develop floodplain maps for risk assessment, planning and awareness applications
6) Promote and encourage the adoption of model codes and higher standards that emphasize hazard mitigation

4.1.1 Reassessment of Goals for Validity or Need for Revision

As indicated previously, the FMAC convened in June 2010 to provide information necessary to update the 2007 version of the Plan. The objectives of the FMAC meetings included reviewing goals and priorities, identifying strategies for protecting assets, and updating progress on mitigation projects already listed in the plan. A separate meeting with key CWCB staff was held during the 2010 update to review and revise the goals established in the 2007 Plan. Many of the 2007 Plan goals were found to be too narrow in scope, and therefore were removed as goals but kept as objectives of the updated 2010 goals. Goal #1 was added to promote a reduction in loss of life and property damage associated with flood hazards. Actions for each of the goals have been updated and can be referenced in Section 4.4.

The 2007 Flood Hazard Mitigation Plan Goals are listed below with justifications for the updates

and revisions made in 2010

1) Encourage the use of public funds by state and local governments for housing and public buildings in non-hazardous areas.
   - Removed as a goal but kept as a specific objective of new goal # 1

2) Promote appropriate land use decisions to minimize the vulnerability of development to floods.
   - Removed as a goal but kept as a specific objective of new goal #1.

3) Educate the public and government officials and their staffs about flood hazards and mitigation.
   - Simplified wording and broadened in goal #2

4) Identify adverse impacts to public health and the environment and encourage the mitigation of these impacts when considering the expenditure of public funds.
   - Captured in new goal #1

5) Encourage the design and engineering of infrastructure to take into consideration the mitigation of potential natural hazard impacts.
   - Captured in new goal #1

6) Promote the adoption of model codes and standards (such as UBC and IBC) that emphasize hazard mitigation and reduced use of hazardous areas for development.
   - Revised, now goal #6

7) Promote the development of flood mitigation plans.
   - Revised and modernized, now goal # 3

8) Publish flood documentation report.
   - Removed, but kept as specific action item

9) Modernize current floodplain maps.
   - Revised and modernized, now goal # 5

4.2 State Capability Assessment

4.2.1 Pre-disaster Hazard Management Policies, Programs, Capabilities

State departments are responsible, within their statutory authorities, to provide assistance and support to local jurisdictions when they are unable to cope with a disaster emergency situation. Assistance and support is provided both prior to and following the disaster emergency. The state

laws, regulations, authorities, and policies especially pertinent to flood hazards within the State of Colorado are listed below.

State Engineer's Reports on High Hazard Dams, C.R.S. 37-87-123. The State Engineer develops and distributes reports on high hazard dams. Each report contains the State Engineer's evaluation of the structural integrity and state of repair as of October 1983.

1977 – Executive Order 8504. Requirements and criteria for State participation in the National Flood Insurance Program.

1977 – Executive Order 8491. Evaluation of flood hazard in locating State buildings, roads, and other facilities, and in reviewing and approving sewage and water facilities, and subdivisions.

1977 – Senate Bill 126 – C.R.S. § 24.65.1-403(1), 1973, as amended. An Act authorizing the Colorado Water Conservation Board to coordinate all activities relating to the designation of floodplains in the state in connection with land use planning.

1974 – House Bill 1041, Chapter 106, C.R.S. 1963, as amended. This Act involved comprehensive treatment of hazards and charged local governments with legal responsibility for designation and administration of hazardous areas of state interest.

Areas of State Interest – as determined by local governments. Natural hazard areas and mineral resource areas are two of the four areas of state interest.

Criteria for administration of areas of State interest. "Floodplains shall be administered so as to minimize significant hazards to public health and safety or to property….." The Colorado Water Conservation Board was to develop model hazard area control regulations.

Functions of other state agencies. (1) Pursuant to this article, it is the function of other state agencies to: (a) send recommendations to local governments and the Colorado Land Use Commission relating to designation of matters of state interest on the basis of current and developing information; and (b) provide technical assistance to local governments concerning designation of and guidelines for matters of state interest. (2) Primary responsibility for the recommendation and provision of technical assistance functions described in subsection (1) of this section is upon: (a) the Colorado Water Conservation Board, acting in cooperation with the Colorado Soil Conservation Board, with regard to floodplains; (b)……."

1974 – House Bill 1034, C.R. S. 29-20-201, et seq., 1974, is the "Local Government Land Use Control Enabling Act. The act gives authority to local governments to plan and regulate the use of land within their jurisdictions, including regulating development and activities in hazardous areas.

1970 – Colorado Land Use Act – C.R.S. § 24-65-101, 25-65-105. Model resolutions – subdivisions – improvement notices. (2)(a) The commission shall, after consultation with its

advisory committee, develop model resolutions to serve as guidelines for boards of county commissioners, city councils, town boards, and special districts and authorities in developing land uses and construction controls within designated floodways. (b) The commission shall, in its progress report, due February 1, 1972, designate critical areas in the state where a one hundred-year (storm return frequency) floodway should be identified and shall aid the state agencies and local governments having jurisdiction over such critical areas in adopting a program for such identification. The purpose of identifying a floodway is to insure that life and property are protected, that the expenditure of public funds to clean up flood damage is kept to a minimum, that a high volume of water runoff can be accommodated, and that impediments to this flow are held to a minimum. The commission shall designate critical conservation and recreation areas and recommend state involvement in land use in such areas. (c) The commission shall include a report on land uses and construction within floodways in its interim and final land use planning programs.

1966 – House Bill 1007 – Flood Control – Planning and Zoning. State approval and designation of storm runoff channels and basins.

1963 – C.R.S. § 139-59-7. "The plan shall be made with the general purpose of guiding and accomplishing a coordinated, adjusted, and harmonious development of the municipality and its environs, which will, in accordance with present and future needs, best promote health, safety, …., and general welfare, as well as efficiency and economy in the process of development, including among other things, …, the promotion of safety from fire, and other dangers, …"

1937 – The Colorado Water Conservation Board is created.

In the 2004 update to the NHMP 2001 umbrella document, an evaluation of the effectiveness of the State's capabilities was submitted. Several of the programs identified in the evaluation matrix were adopted into the State's mitigation strategy. Information in Table 16 specifically addresses the state programs and capabilities related to flood hazards.

4.2.2 Post-disaster Hazard Management Policies, Programs, Capabilities

The previous section includes pertinent information and an evaluation of both pre-disaster and post-disaster hazard management policies, programs, and capabilities.

4.2.3 State Policies Related to Development in Flood Prone Areas

Policies and programs related to development in flood prone areas were presented and discussed in the previous sections of this document. In general, these policies and programs reflect regulatory requirements for construction in floodplains. In addition to zoning ordinances, regulations on construction in the floodplains are usually found in one or more of three locations: subdivision ordinance, building code, and/or a separate "stand alone" floodplain

ordinance.

If the zoning for a site allows a structure to be built, then the applicable subdivision and building regulations will impose construction standards to protect buildings from flood damage and prevent the development from aggravating the flood problem.

Table 16 State Programs and Capabilities Related to Flood Hazards

DEPARTMENT	PROGRAM/POLICY REGULATION/PRACTICE	EFFECT ON LOSS REDUCTION*	PROVIDES FUNDS OR ASSISTANCE
Local Affairs	**Community Development Block Grants**	**Support**	**Yes**
Local Government Services in Local Affairs coordinates the overall administration of the federally funded "Small Cities" Community Development Block Grant (CDBG) program. Funds are provided to the department through the U.S. Department of Housing and Urban Development (HUD) and are primarily intended to benefit low-to-moderate income persons through community development efforts. Eligible recipients are all municipalities and counties, except those larger jurisdictions that receive CDBG funding on an "entitlement" basis directly from HUD. These funds have been used for mitigation purposes. Example: After the floods in the Summer of 1999, $1 million was directed to buyouts of damaged properties in Otero County. HMGP and Unmet Needs funds were also used for buyouts.			
Local Affairs	**Colorado Division of Emergency Management**	**Facilitate**	**Yes**
DEM administers the following programs: DHS Hazard Mitigation Grant Program, DHS Pre-Disaster Mitigation Grant Program, DHS Disaster Resistant Universities, the Emergency Management Performance Grant Mitigation Assistance Program, and the Flood Mitigation Assistance program. Funds are used for mitigation projects including plans, studies, construction projects, and mapping.			
Natural Resources	**Dam Safety Program**	**Facilitate**	**Yes**
Funds for the update of local dam emergency preparedness plans comes from DHS' Dam Safety Program. All Class I dams have preparedness plans. Copies are at the State Engineer's Office and DEM.			
Natural Resources	**Map Modernization & Implementation Plan**	**Facilitate**	**Yes**
The Colorado Water Conservation Board administers the program. Funding sources are from DHS, the state, and local funds. The Map Modernization Implementation Plan for Colorado and the Business Case Plan-Final Draft Fiscal Years 2004-2008 may be accessed on the state website at http://www.cwcb.state.co.us. The Urban Drainage and Flood Control District is one of the Cooperating Technical Partners in the program.			
Local Affairs	**Flood Mitigation Assistance Program**	**Facilitate**	**Yes**
This program is administered by the Colorado Division of Emergency Management. Two grants are available from the DHS Federal Emergency Management Agency (FEMA) for reducing flood risk in local communities. The Flood Mitigation Assistance Program (FMAP) offers grants for developing a local flood hazard mitigation plan and for completing flood mitigation projects to reduce flood risk in communities.			
Natural Resources	**National Flood Insurance Program**	**Facilitate**	**TA**
Assistance on floodplain issues is provided through the Community Assistance Program (CAP), administered by the Colorado Water Conservation Board. Funding for the State to provide technical assistance is provided through DHS with match funds from the State.			

*Support: Programs, plans, policies, regulations, funding, or practices that help implement mitigation measures
Facilitate: Programs, plans, policies, regulations, funding, or practices that make implementing mitigation measures easier
Hinder: Programs, plans, policies, regulations, funding, or practices that pose obstacles to implementing mitigation measures

Subdivision regulations govern how land will be subdivided into individual lots, often requiring that every lot have a buildable area above flood level. These regulations set construction and

location standards for the infrastructure provided by the developer, including roads, sidewalks, utility lines, storm sewers, and drainage-ways

The building code should establish flood protection standards for all construction. These should include criteria to ensure that the foundation will withstand flood forces and that all portions of the building subject to damage are above, or otherwise protected from, flooding.

Some Colorado communities have adopted the Building Officials and Code Administrators' (BOCA) National Building Code. The 1997 edition sets standards for protecting foundations against flood damage, including requirements for soil testing and prepared fill. It should be noted that one of the goals for flood hazard mitigation is the promotion and adoption of model codes and standards (such as the UBC and IBC).

Most communities with a flood problem in Colorado participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for participating communities' subdivision regulations and building codes. Communities are encouraged to adopt local ordinances, which are more stringent than the state or federal criteria. This is especially important in areas with older maps that may not reflect the current hazard. These could include prohibiting damage-prone uses (such as garages, sheds, parking lots, and roadways) from the floodway or requiring structures to be elevated one or more feet above the base flood elevation.

As with any regulatory program, property owners may not be aware of the need for permits, or may resist getting permits, especially after a flood. Because many existing floodplain maps are out of date, caution should be exercised when utilizing them for regulations. Conservative safety factors are highly recommended. Some of the requirements, such as floodway construction criteria or substantial improvement rules, can be technically complicated. However, assistance is available from FEMA, CWCB, and DEM.

CWCB supports watershed planning and projects designed to restore and protect watersheds. This is more clearly defined in the Board's Policy Implementation Objectives, which include multi-objective planning, project development, and stream restoration. In order to achieve this objective, the Board participates with partners to plan and undertake multi-objective projects designed to reduce flood hazards, stabilize and restore stream channels, provide habitat, reduce erosion, and increase the capacity to utilize water. Inter- and Intra-agency coordination, communication, and prioritization are essential components of this objective. Board Staff along with the Watershed Protection and Flood Mitigation Section achieve these goals through administration of the Colorado Watershed Restoration Program, the Colorado Healthy Rivers Fund, and the Fish and Wildlife Resources Fund. The Board administers the Colorado Healthy Rivers Fund in cooperation with the Colorado Water Quality Control Division.

4.2.4 State Funding Capabilities for Flood Hazard Mitigation Projects

The State funding sources and capabilities for flood hazard mitigation projects were presented in previous sections of this document. The funding programs are summarized below:

Department of Local Affairs (DOLA):

- Community Development Block Grants
- Unmet Needs Program

Division of Emergency Management:

- Hazard Mitigation Grant Program
- Pre-Disaster Mitigation Grant Program
- Disaster Resistance Universities
- Emergency Management Performance Grant Mitigation Assistance Program
- Flood Mitigation Assistance program

Colorado Water Conservation Board:

- Map Modernization and Implementation Program
- Watershed Restoration Program
- CWCB Flood Technical Services Fund
- Community Assistance Program (Technical Assistance)

Department of Natural Resources:

- Dam Safety Program (local dam emergency action plans)

4.2.5 Changes in Hazard Management Capabilities of the State

The State funding sources and capabilities for flood hazard mitigation projects were presented in previous sections of this document. Hazard management capabilities have been increased by the activities associated with the items listed below.

- Development and approval of a state-wide criteria manual for floodplain and stormwater management
- Implementation and progress associated with the Flood Map Modernization Program
- Training workshops and seminars developed and presented by the CWCB CAP Coordinator regarding floodplain management within the state. In order to help facilitate CAP activities, an additional $13,726 was approved for use during FEMA FY2009.
- Training workshops to local emergency managers developed and presented by the DEM
- Training provided to state and local emergency managers and local insurance agents to promote their certification as Certified Floodplain Managers (CFM)

CWCB is also in the process of updating the State's Floodplain Rules and Regulations. If passed, the update would raise statewide floodplain management standards above the minimum standards required by the NFIP. The three primary floodplain management provisions include:

- A one-foot freeboard for all new and substantially changed structures
- A half foot floodway to be regulated on all stream reaches for which a half foot mapped floodway exists. This will include a requirement that new map updates shall use a half foot surcharge, as opposed to the historically used one foot surcharge.
- A two-foot freeboard standard for new and substantially improved critical facilities. Prohibition of basement construction for structures removed from the floodplain through a Letter of Map Revision based on Fill (LOMR-F).

These new regulations are still in the proposal stage as of the date of approval for this Plan. The regulations have not yet been finalized, and CWCB continues to engage with communities statewide to gather input on these proposals.

NFIP policy and claims data were also used to develop the vulnerability assessment in the Plan. In 1994, there were 9,893 flood insurance policies. In September 2003, there were 15,261 flood insurance policies statewide with an insured value of $2,477,325,600. As of September 2007, Colorado had 17,788 flood insurance policies statewide with an insured value of $3,626,858,400. In 2010, the State had 19,117 policies with $4,197,483,200 in total coverage. The trend shows that NFIP policies and coverage are steadily increasing.

Over the past few years, CWCB has worked with other hazard mitigation organizations to develop a prototype program called the Flood Decision Support System. The Flood Decision Support System, or FloodDSS, provides a variety of flood mitigation stakeholders with a well-organized database of statewide flood hazard information. This program was originally designed to assist with the development of digital flood insurance rate maps (DFIRMs), but its utility as a hazard mitigation tool has grown beyond its original purpose. In addition to providing users with DFIRMs, the Flood DSS also contains data on weather modification, stream restoration, levees, dams, and more. Such information is gathered statewide and incorporated into the Flood DSS to create a larger picture of flood hazards in Colorado. The Flood DSS is integrated with Colorado's Decision Support Systems (CDSS) which focus on the individual river basins in the state. These DSS programs can provide users with clearer, timelier information to enable better decision-making in regards to flood hazard mitigation and management. (Source: Colorado Water Conservation Board)

DEM and the Division of Housing collaborated with other state, federal and private nonprofit agencies to establish a State-led Disaster Housing Task Force. This Task Force works to assess the State's post-disaster housing capabilities and to develop recommendations for preparedness and response actions. This includes identifying housing options outside of hazard areas including floodplains.

Since the 2007 Plan update, the Colorado State Legislature authorized four new positions within DEM's Mitigation and Recovery section to enhance DEM's capability to provide technical assistance to local and tribal governments, as well as State agency partners on mitigation planning. This will also enable DEM to offer greater assistance for developing and

implementing mitigation projects throughout the State.

DEM has provided funding for a CWCB project to study improvements in early warning capabilities by placing a mobile radar truck in southwest Colorado. The project will demonstrate how more localized radar will improve storm prediction and early warning capabilities as compared to NWS facilities in Grand Junction. As part of the project, data from mobile radar will be transmitted in real-time to the NWS Grand Junction office to improve their prediction capabilities. As part of this project, NOAA and local communities are also funding the installation of a network of stream gages to further enhance prediction capabilities.

CWCB has prepared an implementation plan for the map modernization of Colorado communities. One of the objectives of this program is to compile digital data into a statewide base map database for use as a scoping and assessment tool, and to facilitate flood hazard mapping activities. Most of the 64 counties in Colorado have been identified for flood hazard mapping activities in the Colorado Flood Map Modernization Business Case Plan-Final Draft, Fiscal Years 2004-2008. The present status of the Map Modernization Program in Colorado is depicted in Table 17 and Figure 16.

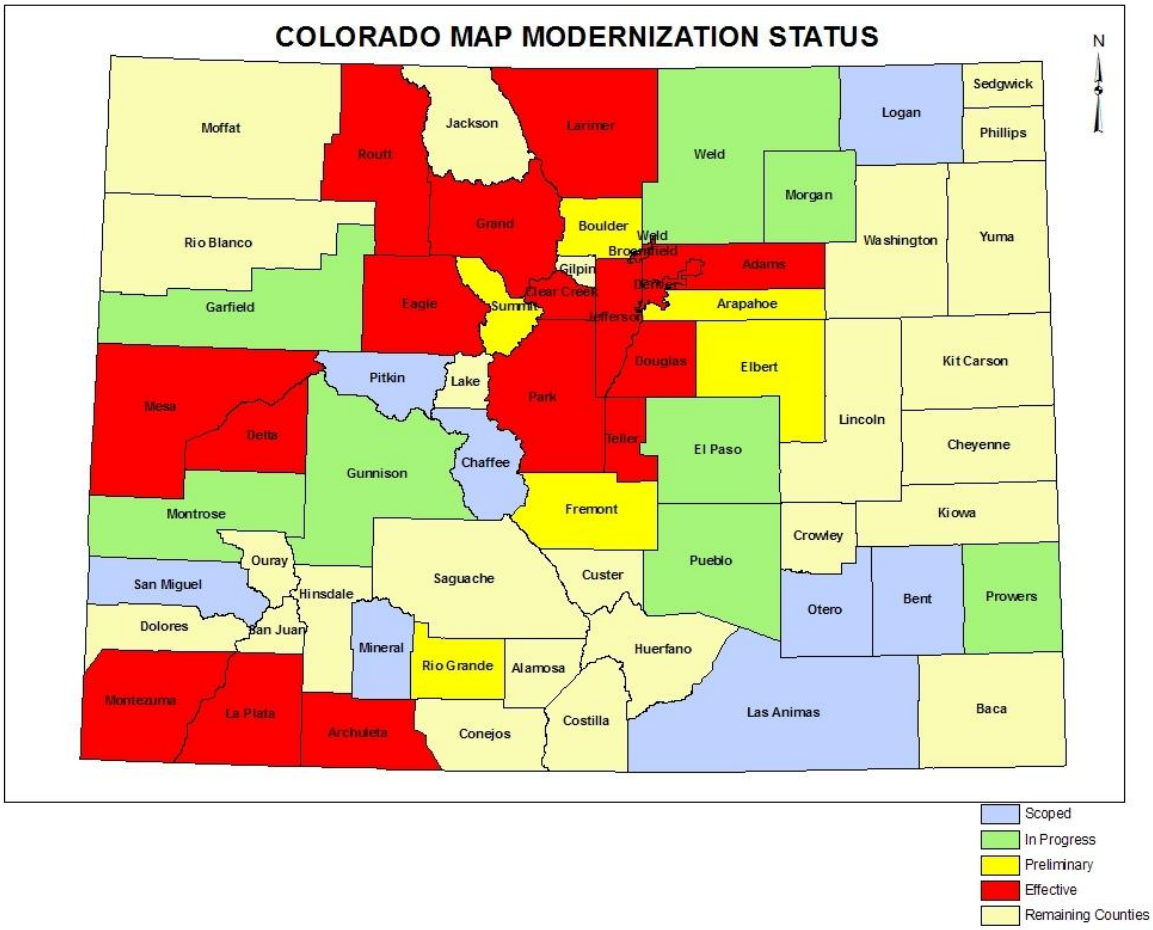
Table 17 June 2010 Status of the Map Modernization Program in Colorado

COUNTY	STATUS	RANK	COUNTY	STATUS	RANK
Denver	Effective	2	Rio Grande	Preliminary	102
Jefferson	Effective	3	Elbert	Preliminary	103
El Paso	In progress	4	Lake	No study	110
Arapahoe	Preliminary	5	Park	Effective	112
Adams	Effective	6	Clear Creek	Effective	119
Boulder	Preliminary	9	Archuleta	Effective	121
Larimer	Effective	10	Huerfano	No study	122
Pueblo	In progress	13	Saguache	No study	131
Weld	In progress	15	Yuma	No study	144
Douglas	Effective	18	Kit Carson	No study	148
Mesa	Effective	20	Lincoln	No study	149
Fremont	Preliminary	31	Grand	Effective	158
Garfield	In progress	36	Bent	Scoped	160
Broomfield	Effective	37	San Miguel	Scoped	162
La Plata	Effective	38	Gilpin	No study	174
Logan	Scoped	42	Ouray	No study	175
Morgan	In progress	43	Rio Blanco	No study	176
Routt	Effective	46	Conejos	No study	179
Otero	Scoped	57	Phillips	No study	192
Delta	Effective	59	Custer	No study	194
Montrose	In progress	60	Costilla	No study	197

COUNTY	STATUS	RANK	COUNTY	STATUS	RANK
Montezuma	Effective	68	Crowley	No study	214
Summit	Preliminary	69	Dolores	No study	216
Alamosa	No study	70	Hinsdale	No study	248
Eagle	Effective	73	Mineral	Scoped	250
Moffat	No study	75	Sedgwick	No study	251
Gunnison	In Progress	76	Washington	No study	254
Prowers	In Progress	81	Jackson	No study	267
Las Animas	Scoped	83	Baca	No study	274
Chaffee	Scoped	84	San Juan	No study	278
Pitkin	Scoped	86	Kiowa	No study	283
Teller	Effective	88	Cheyenne	No study	288

Source: Colorado Water Conservation Board 2010

Figure 16 Colorado Map Modernization Status by County – June 2010



4.3 Local Capability Assessment

Local governments in Colorado have long had policies, programs, and capabilities in place related to flood mitigation. A summary of local governments' flood mitigation capabilities is presented in this section.

4.3.1 Local Mitigation Policies, Programs and Capabilities

Data in this section were gathered by reviewing the 26 existing local hazard mitigation plans encompassing 42 Colorado counties. A list of the communities that have multi-hazard mitigation plans is presented in Table 18. The local plans were reviewed for information on existing mitigation capabilities including regulations, codes, emergency warning systems, evacuation plans, public information programs, GIS/mapping, master plans, flood insurance programs, and potential projects. Table 19 illustrates which activities were identified in local hazard mitigation plans. The policies, programs, and capabilities highlighted below are not an exhaustive list, as some of the local hazard mitigation plans only date back to 2004. Local capabilities to handle floods may have changed since the writing of a portion of these plans. Additionally, some of these plans have expired or are in the process of being updated. Currently, only 42 counties in Colorado have developed and adopted a hazard mitigation plan. The comprehensive raw data for this section can be found in Appendix B.

Table 18 Local and Regional Government Multi-Hazard Mitigation Plans

Jurisdiction	
Boulder County	Mesa County
City of Boulder	Montrose County
City of Colorado Springs	Northeast Colorado Region
Costilla County	Northern Colorado Region
Delta County	Ouray County
Dolores County	Park County
DRCOG Region	Pitkin and Eagle County Multijurisdictional
Elbert County	Prowers County
El Paso County	Rio Blanco County
Grand County	San Miguel County
Gunnison County	Summit County
Hinsdale County	Teller County
Jefferson County	Upper Arkansas Area Council of Governments

Source: CWCB & DOLA websites

Table 19 Flood Mitigation Capabilities from Local Multi-Hazard Mitigation Plans

Flood Mitigation Capability	# of Counties
Building codes, land development regulations, etc.	30
Early warning systems	24
Participation in NFIP	23
Outreach and education	19
Channel modifications, storm drainage improvements, etc.	19
Hazard studies and mapping	16
Erosion and sediment control	15
Critical facilities protection	10
Elevation and floodproofing	9
Designated StormReady	6
CRS Participation	4
Property acquisition/relocation	3

International Code Council (ICC) construction regulations are also used as a form of flood hazard mitigation. In Colorado, these codes are adopted at the local level. Appendix A illustrates the communities that have adopted codes according to the ICC.

Information related to flood mitigation projects, evacuation plans, emergency warning systems, etc., can also be found in local hazard mitigation plans. Local communities were originally encouraged by DEM to start their flood hazard mitigation plans and have them completed for the original November 1, 2003 deadline associated with the umbrella NHMP document. DEM and CWCB are encouraging communities across the state to start or update plans.

The Denver Water Board is also mobilizing significant resources for sediment control programs to mitigate flooding. Currently, the Denver Water Board is removing excess sediment from the upper reaches of the South Platte River, which was heavily impacted by the Hayman fire. A similar project is underway to remove at least 625,000 cubic yards of sediment from the Strontia Springs Reservoir. (http://www.denverwater.org/Recreation/WatertonCanyon/FAQs/)

Based on a 2001 DEM regulations survey, Crowley, Custer, Elbert, Kiowa, Kit Carson, Mineral, and Saguache did not have local floodplain regulations. The latest NFIP Community Status Book Report indicates that Custer County and Grand County do not participate in the NFIP. Custer County was sanctioned in June 1978 and Grand County was recently sanctioned in January 2009. Other non-participating jurisdictions include the towns of Aguilar, Bennett, Coal Creek, Dinosaur, Elizabeth, Empire, Hugo, Kit Carson, Nucla, Pitkin, Sawpit, Starkville, and Williamsburg, and Hot Sulphur Springs, according to the most current Colorado NFIP Community Status Book report. However, the CWCB worked with the Town of Aguilar and is

in the process of working with Custer County to submit NFIP enrollment documentation to FEMA. The Colorado Community Status Book Report can be found on the FEMA website at http://www.fema.gov/fema/csb.shtm.

In addition to the capabilities listed above, many local Colorado jurisdictions are served by Certified Floodplain Managers (CFMs). The CFM program offers a standardized floodplain education and management system that can give many people the expertise to help reduce the damages caused by flooding. Colorado currently has 364 active CFMs (one of the highest numbers of any state in the nation), and a substantial number of individuals join the program each year. Fifty-nine people became CFMs in 2007. In 2008, 78 men and women earned their CFM title. Eighty-six people joined the program in 2009, and 19 more obtained their certification in 2010 thus far. The knowledge and expertise afforded by the CFM program can help enable better decision-making in regards to flood hazard mitigation.

4.3.2 Effectiveness of Local Mitigation Policies, Programs and Capabilities

The effectiveness of the local mitigation policies, programs, and capabilities can be reflected by the continued progress of the local communities in the development and administration of local floodplain regulations, reduction of population and structures in the floodplain, and the implementation of both planning and flood control projects. In 2007, Cheyenne, Crowley, Custer, Elbert, Kiowa, Kit Carson, and Saguache Counties were identified as not having local floodplain regulations. In order to participate in the NFIP, communities must have local floodplain regulations in place. The 2010 Community Status Book Report indicates that Elbert County has adopted local floodplain regulations since the 2007 Colorado State Flood Mitigation Plan given their participation in the NFIP (CWCB is working with Custer County to develop the necessary documentation to apply for NFIP participation).

Fourteen local entities have completed both planning and projects associated with flood mitigation since the 2007 Plan update. These entities include:

- Boulder County
- City of Boulder
- Costilla County
- Delta County
- Elbert County
- El Paso County
- Grand County
- Montrose County
- Northern Colorado Region
- Ouray County
- Park County

- San Miguel County
- Summit County
- Teller County

Other jurisdictions are in the midst of the planning process now, including:

- Archuleta County
- Jefferson County
- Southeast Colorado Region (six counties)
- San Luis Valley Region (five counties)
- DRCOG Region (plan update)

Finally, funds available through the FMA program have been utilized for both planning and projects for flood mitigation. Table 23 in Section 4.5.2 of this Plan illustrates which entities have received FMA funding since the 2007 Plan Update.

4.4 Mitigation Actions

4.4.1 Identification of Actions under State Consideration

There are many ways to mitigate against flood hazards. When deciding upon a course of action or mitigation method, it is important to consider the benefits and costs of a particular strategy in relation to how effective the strategy is and what a given community can feasibly implement. For example, warnings and land use application, such as floodplain regulations and acquisition of open space, are particularly cost-effective mitigation activities especially when compared to other available strategies, such as relief, insurance, and project measures. Effective land use, for example, can provide high net benefits and significantly lower future catastrophic loss potentials in a given community. Other adjustments, except warnings, generally cost more and yield the possibility for repeated catastrophic loss. Although land use decisions are often controversial, when they are carefully planned and implemented, enormous savings in life and property can be realized in time. In Colorado, flood warning systems and effective land use decisions are implemented mainly by action at the local level. Therefore, this plan emphasizes mitigation activities that will essentially support local efforts.

The goals, recommendations, and actions for this plan were derived from several sources in the planning process. Goals and objectives from the 2004 update to the NHMP 2001 umbrella document were reviewed. Additional goals were identified as needed. Finally, recommendations and actions were developed. The following recommendations are captured in Table 20 and represent the collaborative efforts of the FMAC. Many of the recommendations can be implemented immediately; others must be viewed as long-term measures. The information below identifies the goals, recommendations related to each goal, and the action associated with each recommendation. Additional fields to track the progress of implementation were added to this table in 2010.

Table 20 FMAC Flood Hazard Mitigation Goals and Actions

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment										
Recommendation	Who (lead)	Action	Progress				Priority			Comments (on status, implementation and/or funding)
			Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
Seek ratification of State Executive Orders 8504, 8491 and legislation such as H.B. 1041 and incorporate into the Colorado Flood Hazard Mitigation Plan. In addition promulgate rules and regulations to administer the legislation if necessary.	CWCB	Confirm governor's agreement Contact by Governor's office with responsible state agencies with legislative sponsor and begin drafting bill Perform updates to FHMP as warranted	X						X	
Identify Long-Term Safe Affordable Housing Outside Hazard Areas Using Manufactured Housing Where Applicable and Volunteer Agency Construction	DOLA	Contact local emergency managers to solicit involvement utilizing risk analysis in 1999 409 Plan, identify flood-safe areas in Colorado's NFIP communities		X					X	The Division of Housing and Division of Emergency Management, along with other State, Federal and private non-profit partners have established a State-Led Disaster Housing Task Force. The Task Force will work to assess state disaster housing capabilities and develop recommendations for preparedness and response actions. This will include identifying housing options outside of hazard areas such as floodplains.
Work with the state Real Estate Services Division and State Buildings to ensure that facilities proposals and infrastructure take natural hazards into account when state projects are in the approval process.	CWCB	Review and comment on project proposals.		X			X			Adopted IBC
Encourage small communities to develop centralized sewer and water systems in areas that will not be impacted by flooding and relocate or floodproof existing treatment plants and/or lagoons, where possible.	CDPHE	Develop educational outreach program		X					X	Outreach materials are being distributed to locals with assistance from American Recovery and Reinvestment Act funding.

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment										
Recommendation	Who (lead)	Action	Progress				Priority			Comments (on status, implementation and/or funding)
			Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
Promote the design and operation of flood control systems and other related infrastructure to convey floodwaters safely.	DWR CWCB	Establish section in state criteria manual	X				X			This is addressed in the State's Stormwater and Drainage Criteria Manual
Promote the sustainability and access of critical infrastructure during disaster events to the 100-year flood event.	DEM CWCB DWR CDOT DOLA	Develop educational outreach program		X			X			In accordance with Department of Homeland Security's Target Capabilities List DEM Recovery and Mitigation Staff are currently working with other state partners, including CDPHE and CDOT to develop best practices for the "Restoration of Lifelines" following hazard events. This includes developing capabilities for comprehensively identifying at risk critical infrastructure. The CWCB is also promoting as a component of the higher statewide flood standards. CWCB is in the process of developing State regulations with higher flood protection standards for Critical Infrastructure. DLG created the position of Sustainability Coordinator, is leading the state's Sustainable Mainstreets Initiative, and has created the sustainability self-assessment tool.

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Improve emergency warning systems and encourage the installation of additional sensors and reporting devices to improve high flow measurement capabilities along floodprone streams in high risk areas.	DEM CWCB DWR	Activities in progress	X	X				X		DEM has provided funding for a CWCB project to study improvements in early warning capabilities by placing a mobile radar truck in Southwest Colorado. The project will demonstrate how more localized radar will improve storm prediction and early warning capabilities as compared to NWS facilities in Grand Junction. As a part of the project, data from the mobile radar will be transmitted in real-time to the NWS Grand Junction office to improve their prediction capabilities. As a part of this project, NOAA and local communities are also funding the installation of a network of stream gages to further enhance prediction capabilities.
In floodplains that have already been urbanized, encourage and support a combination of structural and non-structural elements to reduce the risks from floods and other hazards.	CWCB DEM	Activities in progress		X			X			DEM has provided funding through the PDM and FMA grant programs as well as technical assistance for flood hazard reduction projects in urban areas. These projects include drainage retention/detention ponds, improved drainage infrastructure and channel stabilization.
Continue to identify and mitigate bridges with 'scour critical' ratings to reduce vulnerability of bridge infrastructure to flood events.	CDOT	Activities in progress		X						New action in 2010 to capture ongoing effort

GOAL 2: Promote awareness and education of flood hazards and watershed protection						
Recommendation	**Who (lead)**	**Action**	**Progress**	**Priority**		**Comments (on status, implementation and/or funding)**

			Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
Encourage use of watershed-based GIS maps in future land use planning and development review.	CWCB DWR	Compile a current and sufficient volume of watershed-based GIS mapping information		X			X			CWCB's development of the FloodDSS includes some level of watershed based mapping.
Increase awareness of the designated 100-year floodplain in permitting new developments and structures	CWCB	Contact local floodplain and emergency managers and provide current information and technical data		X			X			
Enhance the natural and beneficial functions of floodplains by promoting an increased awareness of wetland and habitat resources and their benefits to flood hazard mitigation.	CWCB DWR	Gather information materials Set schedule to develop guidance document Solicit input from states with similar initiatives		X			X			This is part of the ongoing mission of the CWCB Watershed Restoration Program. The CWCB has provided funding and technical assistance for projects that promote natural and beneficial functions of floodplains.
Provide flood hazard mitigation education for entities such as local water and wastewater management officials, local building officials, and road and bridge officials through state programs such as the FEMA-funded Community Assistance Program and other educational programs within state agencies such as the DEM and the CWCB.	CWCB DEM	Gather information materials Set schedule to deliver workshops Promote the public awareness of appropriate web sites and information		X			X			DEM Mitigation Staff assist local communities in facilitating hazard mitigation planning meetings, which include officials from various state and local departments and agencies. Additionally, DEM teaches local mitigation planning workshops that include flooding considerations. A workshop is scheduled for fall 2010 on flood hazard mitigation planning and how to obtain CRS Flood Planning (Activity 510) credits from the process.
Improve access to information regarding floodplain management, flood hazard mitigation and flood insurance through approaches such as the use of hyper-links between state agency websites, bibliographies of available materials, etc.	CWCB DEM DWR	Post two public notices every March Establish webmaster duties Assign duties Gather information materials		X			X			Upon request, DEM works with CWCB to provide communities with information on the NFIP, including repetitive loss information to incorporate into local planning and hazard mitigation grant application efforts. In 2010 the CWCB intends to develop improvements to their website that would facilitate access to floodplain management information.

GOAL 2: Promote awareness and education of flood hazards and watershed protection										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Develop a hazard mitigation education program for public officials at annual conferences and workshops conducted by Colorado Association of Stormwater and Floodplain Managers (CASFM), Colorado Municipal League (CML), Colorado Counties Inc. (CCI), the Colorado Emergency Management Association (CEMA), the American Planning Association (APA), and the American Public Works Association (APWA)	DNR DEM CWCB	Establish webmaster duties Assign duties Gather information materials		X				X		G318 courses (Hazard Mitigation Planning) and CRS workshops have been held at various locations around the state. Outreach and related activities occur annually at the conferences noted.
Promote public education on wildfire impacts to flood hazard potential in post-burn areas.	CWCB State Forest Service	Gather informational materials Publish articles in newsletters and releases		X				X		CWCB has additional information on this initiative.
Provide newsletter articles, other relevant information on flood hazard mitigation and other forms of information exchange to professional organizations and local governments.	DEM CWCB	Obtain agencies/entities PIO information		X			X			DEM provides local agencies with examples of mitigation "best practices" to assist in local planning and mitigation project activities, including information on flood reduction strategies.
Develop a flood hazard awareness and education program utilizing programs already in place.	DEM CWCB	Conduct workshops and provide educational materials	X	X				X		DEM staff spoke at the 2009 CASFM conference about mitigation planning and its relation to flood hazards. DEM has also asked project managers of flood reduction mitigation projects to speak at the annual Governor's Emergency Management Conference to discuss best practices and provide advice to other communities interested in pursuing mitigation projects. DEM provides Level 1 HAZUS runs to counties upon request.

GOAL 2: Promote awareness and education of flood hazards and watershed protection										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Promote the concept of people accepting fiscal responsibility for the consequences of living in flood prone areas.	DEM, CWCB DNR DLG	Provide education materials to local governments and the public.	X	X				X		DEM encourages participation in the NFIP and refers interested communities to the CWCB for further information. The Division of Local Government (DLG) advises local governments of the risks and funding program restrictions associated with development and infrastructure in floodplains.
Promote: 1) the development of contingency plans for household hazardous materials, 2) anchoring/locating containers of hazardous materials, and 3) safely transporting these materials during flood events.	CDPHE DEM	Develop educational program for local emergency personnel Identify inventories of hazardous materials	X					X		CDPHE Provides HHW guidance on their website (http://www.cdphe.state.co.us/hm/hhw/index.htm). CDPHE also provides leadership for Emergency Support Function #8 (Health, Medical and Mortuary). Colorado State Patrol provides leadership for Emergency Support Function #10 (Oil and Hazardous Materials Response). Both agencies provide guidance on issues related to hazardous materials.
Publish 14-day report of major flood events that presents the flood hydraulics and hydrology characteristics of the event and detail potential flood mitigation activities.	CWCB USACE USGS	Prepare field report following flood events		X			X			Reports were generated following flooding in 2007, 2008, and 2010 and can be accessed on the CWCB website.
Publish annual flood report combined with previous flood reports.	CWCB	Prepare comprehensive report covering major flood events Document precipitation values, stream hydrology, inundation areas, and compilation of damages	X	X			X			The CWCB completes this report and discusses the annual summary of flood events at each CASFM conference.

GOAL 2: Promote awareness and education of flood hazards and watershed protection										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Develop floodproofing manual for Colorado communities to provide guidance to local officials and property owners on the various floodproofing methods and techniques used in Colorado and other parts of the country when implementing flood protection measures.	CWCB			X				X		New action in 2010
Develop a Youth Flood Education and Outreach program curriculum for K-12 students incorporating flood messages into school education and community outreach programs.	CWCB	Purchase flood simulation model to be used as an educational tool to help students understand various watershed management topics Coordinate with school district personnel to determine best mode of communication in schools		X				X		New action in 2010
Develop online Certified Floodplain Manager (CFM) review course that offers study reference and guide for local officials and floodplain management professionals who may not be able to attend a CFM review class.	CWCB			X				X		New action in 2010

GOAL 3: Promote the development of hazard mitigation plans with multiple objectives										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Work with local emergency planners and floodplain administrators to identify critical infrastructure, housing, businesses and all other structures in the floodplains in their communities. Incorporate the information into local emergency response plans.	DEM CWCB	Activities in progress		X			X			Local multi-hazard mitigation plans include the identification of critical facilities and other development in areas at risk to hazards. DEM provides funding and technical assistance to complete these plans.
Promote the development of flood mitigation plans through the FMAP, PDM, and Flood Response programs.	CWCB DEM	Conduct statewide workshops Solicit applicants for planning grant funds Encourage adoption of plans by communities		X			X			DEM and CWCB provide funding and technical assistance for local multi-hazard and flood mitigation plans.
Maintain database of communities with approved plans.	CWCB DEM	Ongoing		X				X		The Flood DSS will incorporate approved plans. DEM posts approved mitigation plans on their website. CWCB has a laser fiche repository of mitigation plans on their website.

GOAL 4: Coordinate and provide technical assistance for State, local and watershed planning efforts										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Promote regional intergovernmental cooperation concerning watershed-based planning and floodplain management using a strategic planning process with goals and recommendations.	CWCB DEM DWR	Contact local governments and determine level of interest Gather informational materials Set schedule to deliver strategic planning		X			X			Where feasible, DEM has assisted communities in their efforts to develop multi-jurisdictional hazard mitigation plans with flood elements. One essential element to the mitigation planning process is bringing a diverse group of stakeholders from various government agencies, private non-profits, interested citizens and all participating jurisdictions. The CWCB provides technical assistance and promotes multi-objective, watershed based planning efforts.
Provide technical comments and recommendations on proposed state and federal legislation related to floodplains.	CWCB DOLA	In Progress		X				X		
Develop guidance and criteria for mapping and regulating mudflow/debris-flow areas.	CWCB	In Progress Review CWCB guidance & criteria for traditional floodplain mapping Establish work schedule to undertake mudflow/debris-flow guidance & criteria	X (partial)		X			X		This has been partially addressed, but more funding is needed for this effort.

GOAL 4: Coordinate and provide technical assistance for State, local and watershed planning efforts										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Optimize potential state and federal funding sources to support mitigation initiatives which are part of the Colorado Flood Hazard Mitigation Plan.	CWCB DEM	In Progress		X			X			DEM administers FEMA's Pre-Disaster Mitigation, Flood Mitigation Assistance and Emergency Management Performance Grant programs. PDM and FMA are competitive grant funds. Since the start of 2007, DEM has assisted local communities in securing $3,205,974 in PDM project funding for flood reduction projects, $329,825 in PDM planning funding for local multi-hazard mitigation plans (which all include flood elements), and $269,023in FMA planning grants for local flood hazard mitigation plans (which are integrated into multi-hazard mitigation plans). DEM has also provided state agencies and local governments with EMPG funding for drainage studies and education programs related to flood hazards.
Review the adequacy of existing stream gage networks and make recommendations for future maintenance and improvements.	CWCB DWR	Inventory existing stream gage network and produce report Annual improvements to selected stream gages	x	X			X			

GOAL 5: Continue to update and develop floodplain maps for risk assessment, planning and awareness applications										
Recommendation	Who (lead)	Action	Progress				Priority			Comments (on status, implementation and/or funding)
			Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
Create user-friendly floodplain map system through website design	CWCB	In Progress	X	X			X			The first phase of the Flood DSS will be complete in the fall of 2010. Outreach efforts will follow, with possible second phase improvements that will be based on user feedback Map Mod website.
Through flood hazard reduction workshops, promote the use of a "hazard overlay" concept for GIS mapping using information developed by the Colorado Geological Survey (CGS) for Garfield County as a model.	CGS CWCB DEM	Conduct statewide workshops	X	X				X		DEM Mitigation staff provides technical assistance to local governments on multi-hazard mitigation plans. Additionally, DEM staff provides technical assistance on developing stand alone Risk Assessments, which include comprehensive mapping with “hazard overlays”. A similar project is taking place through the FloodDSS. A workshop is scheduled for the 2010 CASFM Conference.
Digitize existing 100-year floodplain maps.	CWCB	In Progress		X			X			See the discussion on DFIRM mapping progress in this plan.
Promote compatibility of Federal, State, and local GIS capabilities.	CWCB	In Progress		X			X			

GOAL 6: Promote and encourage the adoption of model codes and higher standards that emphasize hazard mitigation										
Recommendation	**Who (lead)**	**Action**	**Progress**				**Priority**			**Comments (on status, implementation and/or funding)**
			Complete	**Ongoing**	**Deferred**	**Deleted**	**High**	**Medium**	**Low**	
Support the concept of communities using land use or construction permitting processes consistent with hazard reduction principles.	DEM CWCB DLG	In progress*		X			X			As a part of its technical assistance services, DEM provides background information and a comprehensive list of possible mitigation actions. This list includes suggestions for enhancing codes and land use regulations and integrating hazard mitigation plans into local land use and comprehensive planning efforts. DLG has developed various tools to support local communities' hazard reduction through land use regulations and other means.
Promote development of master drainage plans for state properties.	CWCB OEM	Survey state institutions to determine existing criteria		X					X	DEM funds small flood studies through its EMPG program, though it does not fund full master drainage studies.
Update State's Floodplain Rules and Regulations to include one-foot freeboard for all new and substantially changed structures, a ½ foot floodway for all stream reaches for which a ½ foot mapped floodway exists for new map updates, a two-foot freeboard for all new and substantially improved critical facilities, and a prohibition of basement construction for structures removed from the floodplain through a Letter of Map Revision based on Fill (LOMR-F).	CWCB	Meet with local communities to incorporate the State's higher regulatory standards into local ordinances.		X			X			These suggested regulation changes are still in the proposal stage. CWCB is engaging communities across Colorado to gather their input on the proposals. New action in 2010 to continue ongoing efforts.
Development of a benefit-cost analysis to support the State's proposed Floodplain Rules and Regulations.	CWCB	ICON Engineering under contract to work on this effort					X			New action in 2010.

GOAL 6: Promote and encourage the adoption of model codes and higher standards that emphasize hazard mitigation										
Recommendation	Who (lead)	Action	Progress				Priority			Comments (on status, implementation and/or funding)
			Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
Implement a statewide CRS strategy	CWCB	Develop statewide CRS committee/interest group					X			New action in 2010 to capture ongoing effort.

4.4.2 Evaluation of Actions and Activities

Under the guidance of the DEM, the plan will be reviewed every three years for consistency with the mitigation programs and updated and evaluated every three years, as required. A State team, chosen at the discretion of the emergency management director, will be convened to identify which objectives are still relevant, which actions have been completed, and which actions should be carried over in the next revision. Mitigation reports will continue to be published in the DEM monthly reports to the director of DOLA as necessary. Quarterly reports for projects using FEMA funds are sent to FEMA. All applications for FEMA funds intending to be expended on mitigation projects include assurances that the state will comply with all applicable federal statutes and regulations. Specifically with respect to this flood hazard mitigation plan, accomplishments are monitored through the CWCB and the DWR and frequently published in reports, including, but not limited to "Flood Talk" and "The State Engineer's Annual Dam Safety Report." Many activities are covered by local media and can be accesses via websites or in local newspapers.

Actions in this plan will be specifically evaluated under the following process. If an activity is still deemed relevant and viable at the time of the update, it will remain in the plan. If the activity is deemed completed or infeasible for cost or another reason, the review team/committee can review the value of the action and remove it. A very brief one-page summary of significant actions taken during the three-year period can be included with each update.

4.4.3 Prioritization of Actions and Activities

Once the mitigation actions were identified, the FMAC members were provided with several sets of decision-making tools, including FEMA's recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits).

- Social: Does the measure treat people fairly?
- Technical: Will it work? (Does it solve the problem? Is it feasible?)
- Administrative: Is there capacity to implement and manage the project?
- Political: Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- Legal: Does your organization have the authority to implement? Is it legal? Are there liability implications?
- Economic: Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- Environmental: Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority (the 'economic' factor of STAPLE/E).

Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does the action address hazards or areas with the highest risk (from Risk Assessment)?
- Does the action protect state assets or infrastructure?
- Does the action improve the State capability to manage and implement mitigation (from Capability Assessment)?

The action identification and prioritization process is the first step in laying out, in broad terms, what needs to be done to minimize the impact of the flood hazard in the state. Some of the actions can be accomplished with minimal cost or integrated into the work plans of the lead agency. While cost-effectiveness is required for FEMA funding of projects, many of the projects identified are non-structural. Thus, the cost-effectiveness is difficult to quantify. The detailed engineering studies, implementation costs, and benefit-cost analysis of specific projects will come at future points in the process. Additional discussion on this topic is included in Chapter 6 Plan Maintenance Process. Results of the prioritization efforts are summarized in Table 21. The implementation of actions, activities and projects related to the Flood Hazard Mitigation Plan will be evaluated in accordance with the priorities established in the table below.

Other factors may be included to determine the priority associated with implementation of actions, activities and projects related to the Flood Hazard Mitigation Plan. These factors include, but are not limited to, the following:

- Benefit-cost ratio
- Availability of matching funds
- Mitigation of repetitive loss structures

Table 21 Priority Schedule for Flood Mitigation Actions/Activities/Projects.

Action/Activity/Project Associated with Mitigation of:	Priority
Loss of life/sustaining injuries	1
Damage to state critical infrastructure	2
Damage to local critical infrastructure	3
Economic loss at the state level	4
Economic loss at the local level	5
Damage to state non-critical infrastructure	6
Damage to local non-critical infrastructure	7
Damage to private property	8
Damage to private nonprofit property	9
Economic loss at the residential level	10

4.4.4 Contribution of Each Activity to Overall State Flood Mitigation Strategy

The recommended State flood mitigation goals and activities were presented in Table 20 in the section entitled "Identification of Actions under State Consideration". Recommended activities are listed in accordance with the goals established for the flood mitigation strategy. For each recommended activity, actions have been identified to achieve the recommendation. These recommended activities and goals were also developed with the overall State Natural Hazard Mitigation Plan goals in mind.

4.4.5 Integration of Local Plans into Mitigation Strategy

FEMA recommends that the mitigation actions identified should be linked to local mitigation plans, where specific local actions and projects are identified; however, the absence of information on this piece will not cause FEMA to disapprove the plan. During the 2010 revision, 26 local and regional multi-hazard mitigation plans encompassing 42 counties were reviewed to identify flood-related mitigation projects. Table 22 contains mitigation actions that local jurisdictions identified in their plans intended to mitigate the effects of flooding. This data originated from local multi-hazard mitigation plans in effect in counties and cities in Colorado as of July 2010. The specific actions listed in the table below were identified from a similar study conducted for the 2007 Colorado Flood Plan update. By connecting these local actions with the State Plan, the State can identify opportunities for targeted technical assistance and funding needs and assist with the implementation of these activities. The data for this study can be found in Appendix B, where it is summarized by county. Appendix B can be used by the State to guide technical and/or financial assistance.

Table 22 Flood Mitigation Actions from Local Multi-Hazard Mitigation Plans

Proposed Mitigation Action	# of Counties
Conduct hazard studies, new mapping	39
Channel modifications, storm drainage improvements, etc.	37
Outreach and education programs	33
Critical facilities protection	30
Develop/enhance early warning systems	29
Continue NFIP Compliance	29
Encourage further NFIP participation	18
Building codes, land development regulations, etc.	15
Property acquisition/relocation	14
Erosion and sediment control	11
Pursue StormReady designation	10
Elevation/floodproofing	9

Proposed Mitigation Action	# of Counties
Consider joining CRS	2
Improve CRS rating	1

4.5 Funding Sources

4.5.1 Identification of Current Federal, State, Local Funding Sources

Mitigation funding is available from the Federal Emergency Management Agency (FEMA) to support a few mitigation projects each year. Specifically, funding is available the Flood Mitigation Assistance (FMA) and Pre-Disaster Mitigation (PDM) grant programs. Currently, PDM is capped at $3 million. It is the role of the preparedness and mitigation staff of DEM to help communities locate potential sources of available federal and state funding. As grants from different sources are posted, DEM staff advertises to the communities and special districts. If a disaster occurs, the State will utilize Hazard Mitigation Grant Program (HMGP) and Public Assistance (PA) mitigation funds. PA mitigation funds will be used in accordance with program requirements and will be used for damaged facilities. HMGP funds may be used primarily in the affected area or may be used statewide at the Governor's and/or his representative's (GAR's) discretion. Local governments will continue to pursue grants from federal agencies to purchase equipment, training, and planning. Department of Homeland Security funds are part of the State strategy to fund interoperability and communications. FEMA and DWR provide funds to local dam owners to update and improve emergency preparedness plans. PDM, FMA, HMPG and other funds have been utilized for pre-disaster plans. Additional information regarding the funding available from both federal and state agencies is summarized in Table 24.

Large projects continue to be completed with federal and state funds and technical assistance from federal agencies other than FEMA. Examples include, but are not limited to, the U.S. Department of Transportation, the USDI Bureau of Land Management, USDI National Park Service, the USDA Forest Service, and the U.S. Army Corps of Engineers. The USDA Natural Resource Conservation Service has programs for projects both exigent and not, including the Emergency Watershed Protection Program. The Small Business Administration has provided funding related to several Presidential, USDA, and SBA administrative declarations in recent years. U.S. ACE General Investigations and Continuing Authorities Programs provide opportunities for water resources projects, studies, design and engineering, and technical expertise.

The governor can move funds into the State Disaster Emergency Fund to fund emergency types of activities. The local agencies have the required TABOR (Taxpayers Bill of Rights) reserves for use during emergencies. Local districts have used taxing mechanisms, such as mill levies, to support prevention activities. Local entities also actively pursue grant opportunities through federal and state agencies.

Education projects, outreach programs, repeater sites, early detection and warning/notification

systems, generators for backup power, are very popular flood mitigation methods in Colorado. Local communities are constantly seeking sources of funding to maintain programs and install or upgrade systems. Unfortunately, funds for these types of projects are limited and the need strongly outweighs the availability. Even if communities receive initial funding, continuation of programs creates new financial needs on already very tight budgets with competing demands. Despite this, Colorado communities have made great strides and progress in prevention and preparedness activities and continue to do more each year by taking advantage of limited opportunities. For example, several communities benefited years ago from a grant program through USDA designed to fund repeater sites in remote locations, thereby serving communities with need but without means to get warnings pertinent to their immediate area. DEM staff promoted the grant opportunity and worked with communities on grant applications.

The State has loan and grant programs for which prevention activities are eligible. Funding sources traditionally used have been energy impact funds, gaming funds, general funds, and severance tax. Many agencies have grant programs, including, but not limited to, the State Forest Service, Water Conservation Board, Division of Water Resources, Division of Emergency Management, and the Soil Conservation Service.

4.5.2 Sources of Funding Used to Implement Previous Mitigation Activities

Since approval of the 2007 update to the NHMP, Colorado flood mitigation activities have been funded by the Flood Mitigation Assistance (FMA) program, the Pre-Disaster Mitigation (PDM) program, the Hazard Mitigation Grant Program (HMGP), the Severance Tax Multi-Objective Watershed Protection program, the Colorado Watershed Restoration Program, the Colorado Healthy Rivers Fund, the Fish and Wildlife Resources Fund, and the Energy and Mineral Impact Assistance Program. Table 23 illustrates how these funding sources have been used to facilitate flood hazard mitigation programs around Colorado. The grant amount for each project has been provided where known. Several of these projects used significant local funding to supplement state and federal funding. Since the beginning of 2007, DEM assisted local communities in securing $3,205,974 in PDM project funding, $329,825 in PDM planning funding for local multi-hazard mitigation plans, and $269,023 in FMA planning grants for local flood hazard mitigation plans. Furthermore, DEM provided state agencies and local governments with Emergency Management Performance Grant (EMPG) funding for drainage studies and education programs related to flood hazards.

Table 23 Flood Mitigation Funding in Colorado: 2005-2010

Flood Management Assistance (FMA) Program	
2005:	Flood Mitigation Project, City of Sterling Flood Mitigation Planning Project, City of Pagosa Springs Flood Mitigation Planning Project, Costilla County State-wide Flood Mitigation Planning Projects

2006:	Detention Pond Project, Town of Gilcrest Flood Mitigation Planning Project, Summit County	
2007:	Flood Hazard Mitigation Plan, City of Fort Collins Flood Mitigation Project (South Platte River), City of Denver Additional mitigation project activities that have been submitted (but not presently approved) to obtain funding from the FMA program include Flood Mitigation Projects for the Town of Erie and the City of Colorado Springs. Flood Hazard Mitigation Plan, Huerfano County	
2008:	San Luis Valley Hazard Mitigation Plan Flood Element DRCOG Regional Hazard Mitigation Plan Flood Element	
2009:	Southeast Colorado Regional Hazard Mitigation Plan Flood Element Archuleta County Multi-Hazard Mitigation Plan Flood Element Colorado Springs Multi-Hazard Mitigation Plan Flood Element	
	Pre-Disaster Mitigation (PDM) Program	
2005:	Drainage Project, City of Grand Junction Drainage/Detention Pond Project, City and County of Denver	
2006:	Channel Stabilization, City of Colorado Springs	
2008:	Coal Creek Flood Hazard Mitigation Project Northeast Regional Hazard Mitigation Plan City of Arvada Property Acquisition Clark Reservoir Sedimentation Mitigation/Coal Creek Diversion Capacity Project, Larimer County	
2009:	Colorado Springs Multi-Hazard Mitigation Plan Update	
	Hazard Mitigation Grant Program (HMGP)	
2008:	Greeley Water Line Protection at Windsor Lake	
	Severance Tax Multi-Objective Watershed Protection	
2008:	Lefthand Creek OHV River Restoration Project, James Creek Watershed Initiative River Corridor Properties Survey, Town of Rico Ski Creek Restoration, Rocky Mountain Field Institute Midway Streambank Stabilization, North Fork River Improvement Association	$15,000 $25,000 $15,000 $15,000
2009:	Uncompahgre Watershed Plan, Friends of the River Uncompahgre Representative Reach Floodplain Study, Lower Blanco Property Owners Association Mancos Streambank Stabilization, Mancos Conservation District	$5,000 $5,000 $61,488
2010:	Rapid Riparian Assessment, Coal Creek Watershed Initiative Watershed Plan Update, North Fork River Improvement Association Diversion Dam Reconstruction Design, Gunnison River Festival Squirrel Creek Restoration Monitoring, Saguache County Sustainable Env. & Eco. Development Council Lightner Creek Watershed Assessment I, San Juan Citizens Alliance	$22,250 $9,240 $4,955 $5,000 $5,000
	Colorado Watershed Restoration Program	
2009:	Bank Stabilization & Riparian Revegetation, Colorado Open Lands Riparian Maintenance & Monitoring, Eagle River Watershed Council Channel Restoration – Trout Habitat Improvement, Boulder Flycasters Floodplain/Channel Design Planning, Lake Fork Watershed Stakeholders Diversion Structure Assessment & Project Prioritization, Mancos Conservation Dist. Bank Stabilization & Riparian Revegetation, Coalition for the Upper South Platte Greenway Master Plan, Westerly Creek Connection Mine Mitigation, Bank Stabilization & Riparian Protection, Kerber Creek Restoration	$28,520 $50,000 $30,000 $95,000 $30,500 $50,000 $37,500 $12,000

2010:	Bank Stabilization & Riparian Revegetation, Colorado Open Lands	$18,480
	Bank Stabilization & Riparian Revegetation, North Fork River Improvement Assoc.	$38,000
	Bank Stabilization & Riparian Revegetation, Eagle River Watershed Council	$25,000
	Mine Remediation, Channel Stabilization & Riparian Revegetation, Coal Creek Watershed Coalition	$19,150
	River Restoration Design & Demonstration Projects, South Suburban Parks & Recreation Dist.	$46,118
	Bank Stabilization & Riparian Revegetation, Wildlands Restoration Volunteers	$57,331
	Irrigation Diversion Reconstruction, Gunnison River Festival (Gunnison County)	$25,000
Colorado Healthy Rivers Fund		
2007:	River Restoration, Coalition for the Upper South Platte	$25,000
	Irrigation Diversion Reconstruction, North Fork River Improvement Association	$9,800
	Watershed Plan, Mancos Conservation District	$15,000
2008:	Watershed Plan, Uncompahgre River Stewardship Alliance	$10,000
	Watershed Plan, Roaring Fork Conservancy	$10,000
	Watershed Plan, Friends of Bear Creek	$10,000
2009:	Open Space/Conservation Easement Acquisition, Rio Grande Headwaters Land Trust	$15,000
	Channel Morphology Assessment, Park County & Colorado Open Lands	$12,000
	River Restoration, Rocky Mountain Field Institute	$25,000
	Irrigation Diversion Reconstruction, North Fork River Improvement Association	$15,000
	River Restoration, Fountain Creek Restoration Committee	$50,000
	Sedimentation Mitigation & River Restoration, Arkansas Headwaters Recreation Area	$25,000
2010:	Riparian Restoration, Wildlands Restoration Volunteers	$19,220
	Stormwater Management, Coal Creek Watershed Coalition	$10,756
	Watershed Plan, Friends of the River Uncompahgre	$15,000
	Watershed Plan Education and Outreach, Roaring Fork Conservancy	$18,000
	Ecotype Specific Riparian Plant Development, Tamarisk Coalition	$10,000
	Riparian Restoration, Eagle River Watershed Council	$10,000
	River Restoration, Town of Vail	$6,000
Fish and Wildlife Resources Fund		
2008:	Rio Blanco River Restoration Phase III, Rio Blanco Property Owners Assoc.	$30,000
2009:	Rio Blanco River Restoration Phase IV, Rio Blanco Property Owners Assoc.	$132,000
	Clear Springs Ranch Fish Passage, Colorado Springs Utilities	$70,000
2010:	Hartland Diversion Dam Reconstruction, Painted Sky RC&D Council, Inc.	$560,000
Energy and Mineral Impact Assistance Program		
2007:	Fort Lupton Storm Drainage Improvement	$269,000
	Sanford Drainage Study	$14,000
2008:	Fruita Stormwater Drainage Improvements	$500,000
	Windsor Drainage Basin	$78,000
	Fort Morgan Downtown Infrastructure Design – Phase I	$175,000
2009:	Grand Lake Stormwater Filtration	$155,370
	Olathe Stormwater Drainage Management Study	$145,000
	Cokedale Drainage System Improvements	$150,000

(Source: DEM, CWCB, DLG)

4.5.3 Identification of Potential Federal, State, Local Funding Sources

Other potential sources of funding have been identified, and have been included in the information presented in the section above.

5 COORDINATION OF LOCAL MITIGATION PLANNING

5.1 Local Funding and Technical Assistance

5.1.1 Description of State Process to Support Local Plan Development

Local plan development is required as a condition for receiving any Federal disaster grant funding (under the HMGP) to evaluate the impact of natural hazards within designated disaster areas, and to identify actions that will reduce the effects of such hazards. The process utilized by the state to support the local plan development is described in the State of Colorado Hazard Mitigation Grant Program Administrative Plan prepared by the DEM. In general, the mitigation staff of the DEM is responsible to provide technical assistance and training to local governments to assist them in developing local mitigation plans and project applications. The mitigation staff is also responsible to review and submit all local mitigation plans to FEMA.

5.1.2 Funding/Technical Assistance Provided in Past Three Years

Since approval of the 2004 update to the NHMP, funding and technical assistance has been provided to several local entities. Over the past three years CWCB and DEM have frequently worked together to provide funding and technical assistance for mitigation planning efforts that include a robust flood risk assessment and mitigation strategies. This partnership has resulted in strengthened and coordinated technical assistance and has helped to provide local communities with the means and motivation to assess flooding risks and identify potential projects. This work has culminated in the completion of several hazard plans between 2004 and 2010. Workshops and seminars have been presented through the Community Assistance Program (CAP) to assist communities with the development of flood mitigation planning documents. In addition, as indicated previously, funding available from the FMA Program has been accessed to develop flood mitigation planning documents. These funds have been utilized to address flood mitigation planning statewide. Table 24 illustrates many of the projects that were completed with funding and technical assistance from the CWCB.

Table 24 Funding/Technical Assistance Provided by the CWCB

Project	Comments
Costilla County	CWCB assisted in financing the creation of a countywide all-hazard mitigation plan. This plan was produced according to FEMA standards for the Flood Mitigation Assistance Program and Pre-Disaster Mitigation Program. The plan was subsequently adopted by the County and its municipalities, and enabled these entities to be eligible for mitigation grants from these programs.
Pikes Peak Area Council of Governments	Financed a stream migration and sediment transport study performed by the US Geological Survey. This study analyzed the erosive and sedimentation properties of materials found in Fountain Creek. Results continue to be used in the ongoing development of watershed programs and projects to halt the massive sediment transport observed throughout the waterway.
Larimer County	CWCB assisted in financing the preliminary design for the Clark Reservoir, a critical component for solving many of the flooding problems known to exist in the Boxelder Creek watershed. Upon completion of this preliminary design, a Pre-Disaster Mitigation project

Project	Comments
	application was prepared and submitted to FEMA. The project was selected for a $3 million FEMA grant, and its construction will begin in 2011.
Town of Granada	CWCB provided technical and financial assistance in repairing the levee protecting the Town from Wolf Creek. The levee had received an unacceptable rating by the Corps of Engineers and would have been dropped from their PL 84-99 program unless it was brought back into compliance. Through this project, the levee became compliant again through a subsequent inspection with a Minimally Acceptable rating.
SLVGIS/GPS Authority	CWCB assisted in financing the creation of a 5-county all-hazard mitigation plan covering Alamosa, Saguache, Mineral, Conejos, and Rio Grande counties in the San Luis Valley. This plan is being produced according to FEMA standards for the Flood Mitigation Assistance Program and Pre-Disaster Mitigation Program, and is nearing completion. The plan will be adopted by the Counties and their municipalities, and will enable these entities to be eligible for mitigation grants from these programs.
Town of Severance	CWCB assisted the Town in a study to analyze possible solutions to floodplain problems created by the presence of an uncertifiable levee through the Town. The end goal was to pursue a FEMA mitigation grant to construct the chosen solution. Although a number of possible scenarios were considered, there were no cost-effective (as determined by FEMA's Benefit-Cost Analysis program) alternatives available
HDR Engineering	An annual program in which HDR Engineering provides a number of daily meteorological products for the public and local governments to use for better flood preparedness. The products include a daily rainfall reconstruction for the state for the previous day, a daily evaluation of flood threats facing the entire state, and a twice-weekly medium range outlook analyzing flood risks for the state for the coming two weeks. This program runs during the primary flood season – May through September.
NOAA Mobile Radar	An experimental program was run in the Gunnison area to identify radar gaps through this mountainous area, which is not well-covered by existing Doppler Radar. The program involved using a locally parked truck equipped with a full-scale radar instrument. The radar collected was merged with the radar products from the National Weather Service's Grand Junction office. Results will be used to analyze shortcomings in flood and snowpack predictions and identify possible solutions to these deficiencies.
Kleinfelder	Flood documentation services. The consultant is sent out to gather data following flood events around the state. This data includes media coverage, estimates of damages, flood frequency estimates, and other pertinent information. This data can then be used for multiple purposes.
Michael Baker	Floodplain Information Reports were prepared for Routt, Denver, Jefferson, and Elbert Counties for use in further analyzing floodplain characteristics for approximate floodplains in these areas. Most importantly, hydrology quantifications were prepared for stream reaches that are shown as approximate floodplains on FEMA flood maps. This information assists in local floodplain management, further updates of floodplain maps, and allows the CWCB to meet statutory requirements for floodplain designations.
Denver Regional Council of Governments	CWCB assisted in financing the creation of a multi-county all-hazard mitigation plan covering the counties incorporated within the Denver Regional Council of Governments – primarily the Denver metropolitan area. This plan is being produced according to FEMA standards for the Flood Mitigation Assistance Program and Pre-Disaster Mitigation Program, and is nearing completion. The plan will be adopted by the Counties and their municipalities, and will enable these entities to be eligible for mitigation grants from these programs.
Elbert County	CWCB assisted in funding a study to identify possible solutions to drainage and flood problems in the unincorporated town of Elbert. This project is still in process, but it is hoped that its results will lead to identified solutions to these problems and a possible application to FEMA's mitigation assistance programs for construction funds.
5-2-1 Drainage Authority	Funds were provided for the creation of a basinwide stormwater master plan for the Adobe Creek basin. This master plan identifies the flood hazard using existing information and develops a sequential plan to address these problems through capital improvements. Eventually, results from the existing conditions of this plan will be used for actual floodplain management and identified solutions will be used to develop a Capital Improvement Plan for the watershed.
Archuleta County	CWCB assisted in financing the creation of a countywide all-hazard mitigation plan covering Archuleta County and its municipalities. This plan is being produced according to FEMA standards for the Flood Mitigation Assistance Program and Pre-Disaster Mitigation Program, and is still in progress. The plan will be adopted by the Counties and their municipalities, and

Project	Comments
	will enable these entities to be eligible for mitigation grants from these programs.
Bent County	CWCB assisted in financing the creation of a 6-county all-hazard mitigation plan covering Bent, Prowers, Kiowa, Baca, Crowley, and Otero counties in the southeastern plains. This plan is being produced according to FEMA standards for the Flood Mitigation Assistance Program and Pre-Disaster Mitigation Program, and is in progress. The plan will be adopted by the Counties and their municipalities, and will enable these entities to be eligible for mitigation grants from these programs.
5-2-1 Drainage Authority	Funds were provided for the final design of a stormwater detention pond located north of Interstate 70 that will intercept flood waters in the Bosley Wash watershed. This reservoir was previously developed in a basin master plan produced in the early 2000's. Due to local funding constraints, this project has not yet been constructed, but all plans and specifications have been finalized, allowing this to be a viable "off the shelf" project when a funding source is identified. The reservoir, once constructed, will mitigate most of the problems in the Bosley Wash watershed by reducing the flows significantly in the lower basin.

Source: CWCB records

The State's commitment to providing technical assistance to local entities also includes verifying compliance with federal regulations. The NFIP verifies compliance with the CAP by conducting Community Assistance Visits (CAVs). These visits assess "the community's floodplain management program; assist the community and its staff in understanding the NFIP and its requirements; and assist the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered." Communities that participate in the NFIP are generally visited every three to five years. Each state has a designated agency which coordinates with the NFIP/FEMA and conducts the majority of CAVs. The CWCB has this responsibility in Colorado. The number of CAVs conducted annually has remained relatively consistent since 2007. 32 total visits were conducted in 2007, 11 of which were done by FEMA. In 2008, 29 visits occurred with 11 of these visits performed by FEMA. A total of 26 CAVs were conducted in 2009, all of which were done by the CWCB. Twenty-one visits have occurred as of September 2010. The CWCB carried out all of the CAVs for 2010. Table 25 illustrates the CAV visits conducted in Colorado since 2007.

Table 25 Community Assistance Visits 2007 - June 2010

Community	CAV Date	Agency	Community	CAV Date	Agency
Winter Park, Town of	6/11/2007	STATE	Platteville, Town of	6/13/2008	FEMA
Fraser, Town of	6/13/2007	STATE	Weld County	6/13/2008	FEMA
Granby, Town of	6/13/2007	STATE	South Fork, Town of	9/22/2008	STATE
Eagle, Town of	6/18/2007	STATE	Durango, City of	10/8/2008	STATE
Canon City, Town of	6/27/2007	FEMA	Ignacio, Town of	10/9/2008	STATE
Coal Creek, Town of	6/27/2007	FEMA	La Plata County	10/9/2008	STATE
Brookside, Town of	6/28/2007	FEMA	Craig, City of	10/14/2008	STATE
Rockvale, Town of	6/28/2007	FEMA	Dacono, Town of	3/6/2009	STATE
Williamsburg, Town of	6/28/2007	FEMA	Morrison, Town of	3/6/2009	STATE

Community	CAV Date	Agency	Community	CAV Date	Agency
Silverthorne, Town of	7/2/2007	FEMA	Nunn, Town of	3/6/2009	STATE
Central City, City of	7/9/2007	STATE	Greenwood Village, City of	3/9/2009	STATE
Sheridan, City of	7/12/2007	STATE	Edgewater, City of	3/11/2009	STATE
Hinsdale County	7/17/2007	STATE	Jefferson County	3/11/2009	STATE
Lake City, City of	7/17/2007	STATE	Evans, City of	3/12/2009	STATE
Montrose, City of	7/17/2007	STATE	Greeley, City of	3/12/2009	STATE
Boulder County	8/8/2007	FEMA	Pagosa Springs, Town of	5/7/2009	STATE
Cortez, City of	8/21/2007	FEMA	Centennial, City of	6/24/2009	STATE
Dolores, Town of	8/21/2007	FEMA	Carbondale, City of	7/21/2009	STATE
Montezuma County	8/21/2007	FEMA	New Castle, Town of	7/22/2009	STATE
Grand Junction, City of	9/18/2007	STATE	Rifle, City of	7/22/2009	STATE
Mesa County	9/18/2007	STATE	Parachute, Town of	7/23/2009	STATE
Vail, Town of	9/25/2007	STATE	Buena Vista, Town of	7/24/2009	STATE
Glenwood Springs, City of	10/9/2007	STATE	Loveland, City of	8/4/2009	STATE
Timnath, Town of	10/18/2007	FEMA	Telluride, Town of	8/17/2009	STATE
Silt, Town of	10/25/2007	STATE	Ouray, City of	8/18/2009	STATE
Breckenridge, Town of	11/7/2007	STATE	Steamboat Springs, City of	8/24/2009	STATE
Manitou Springs, City of	11/9/2007	STATE	Louisville, City of	9/24/2009	STATE
Julesburg, Town of	11/20/2007	STATE	Superior, Town of	9/24/2009	STATE
Sterling, City of	11/20/2007	STATE	Jamestown, Town of	9/25/2009	STATE
Firestone, Town of	12/4/2007	STATE	Northglenn, City of	10/2/2009	STATE
Fort Lupton, Town of	12/4/2007	STATE	Lafayette, City of	10/26/2009	STATE
Frederick, Town of	12/20/2007	STATE	Longmont, City of	10/26/2009	STATE
Monte Vista, City of	2/5/2008	FEMA	Westminster, City of	11/2/2009	STATE
Erie, Town of	2/7/2008	STATE	Palisade, Town of	3/8/2010	STATE
Larimer County	2/13/2008	FEMA	Collbran, Town of	3/9/2010	STATE
Elizabeth, Town of	2/14/2008	FEMA	De Beque, Town of	3/9/2010	STATE
Severance, Town of	2/20/2008	STATE	Fruita, City of	3/10/2010	STATE
Windsor, City of	2/20/2008	STATE	Grand Junction, City of	3/10/2010	STATE
Brush, City of	2/28/2008	FEMA	Mesa County	3/10/2010	STATE

Community	CAV Date	Agency	Community	CAV Date	Agency
Fort Lupton, Town of	2/28/2008	FEMA	Delta, City of	4/19/2010	STATE
Fort Morgan, City of	2/28/2008	FEMA	Delta County	4/20/2010	STATE
Wiggins, City of	2/28/2008	FEMA	Hotchkiss, Town of	4/21/2010	STATE
Morgan County	2/29/2008	FEMA	Paonia, Town of	4/21/2010	STATE
Steamboat Springs, City of	3/25/2008	STATE	Cedaredge, Town of	4/22/2010	STATE
Arapahoe County	3/29/2008	FEMA	Orchard City, City of	4/22/2010	STATE
Del Norte, Town of	4/2/2008	FEMA	Arapahoe County	5/25/2010	STATE
Pagosa Springs, Town of	4/2/2008	FEMA	Englewood, City of	5/25/2010	STATE
Ault, Town of	4/9/2008	STATE	Littleton, City of	5/26/2010	STATE
Pierce, Town of	5/14/2008	STATE	Sheridan, City of	5/26/2010	STATE
Johnstown, Town of	6/12/2008	FEMA	Deer Trail, City of	5/27/2010	STATE
Mead, Town of	6/12/2008	FEMA	Aurora, City of	6/2/2010	STATE
Milliken, Town of	6/12/2008	FEMA	Glendale, City of	6/2/2010	STATE
Windsor, City of	6/12/2008	FEMA	Cherry Hills Village, City of	6/10/2010	STATE
Eaton, Town of	6/13/2008	FEMA	Columbine Valley, Town of	6/10/2010	STATE

Source: http://www.nd.water.ca.gov/PPAs/FloodplainMgmt/NFIP/

5.2 Local Plan Integration

5.2.1 Process and Timeframe to Review Local Plans

A worksheet was developed and is utilized by the DEM to review each local mitigation plan. This worksheet can be found in Appendix B of the NHMP. The results are summarized in Section 3.3.3 of this document. With respect to flood mitigation planning, the worksheet specifically reviews the following information:

- Population affected by flooding
- Number of structures affected by flooding
- Number of critical facilities affected by flooding
- Potential loss (economic) associated with flooding

The projected vulnerability associated with future development is also identified and reviewed as it pertains to future population, future number of structures, and future potential loss (economic). This includes additional information regarding population shifts, changes in land use, effects of mitigation projects, etc.

The capability of each local entity is identified and reviewed along with the effectiveness

associated with each capability identified below:

- Floodplain regulations
- Zoning ordinances
- Building codes
- Emergency warning systems
- Evacuation plans
- Public information programs
- Environmental education programs
- GIS/Mapping
- Master plans

Included in the review of the local entity capability is the identification of potential flood mitigation projects. The review of local capabilities is summarized in Section 4.3.1 and mitigation projects are summarized in Section 4.4.5. More detail by County is provide in Appendix B; an enhancement to the 2010 plan. These summaries can help the State identify capability gaps and local project needs and ultimately focus technical assistance efforts.

As local plans are submitted to the State, the initial review is conducted by the CWCB CAP coordinator and the DEM mitigation planner. The CAP coordinator and the mitigation planner will utilize the worksheet to conduct the review along with the Plan Review Crosswalk. Comments are provided to the State Hazard Mitigation Officer (SHMO) for review and additional scrutiny. If revisions are necessary, the Plan Review Crosswalk will be returned to the local entity for corrections and resubmittal. Plan review by the State generally takes about 45 days, but is largely dependent on the density of the workload and the size and detail of the plans being reviewed.

5.2.2 Process and Timeframe to Coordinate and Link Local Plans to State Mitigation Plan

Information available from the local flood mitigation plans is compiled and utilized during the development of the state flood hazard mitigation plan. This information is supplemented by data available from other sources (such as FEMA's Community Information System and local emergency managers) to develop the state mitigation plan. The coordination and integration of the local plans into the state mitigation plan is a continuous process. Following the review and approval of the local mitigation plans, pertinent information is identified and compiled that would be necessary to update the state hazard mitigation plan. Local plans that have been approved are obtained in digital form and access is provided via the DEM website. DEM also plans to create a comprehensive inventory of projects identified in local hazard mitigation plans. This inventory will provide benefits including expediting the identification of potential projects eligible for assistance through PDM and FMA, as well as prioritizing assistance in the event that HMGP funding becomes available.

Flood mitigation projects are tracked, from submittal through approval and completion, by the CWCB CAP coordinator on a spreadsheet that provides the following information:

- Local jurisdiction
- Project type (planning, mitigation project, or technical assistance)
- Total project cost
- Non-federal share of the total project cost
- Federal share of total project cost (itemized by planning, mitigation project or technical assistance)
- Date of funding/award
- Performance period/completion date

5.3 Prioritizing Local Assistance

5.3.1 Description of Criteria for Prioritizing Planning and Project Grants

The criteria and process used to prioritize funding assistance requests are described in the Hazard Mitigation Grant Program (HMGP) Administration Plan. When a Notice of Interest (for receipt of financial assistance) is submitted to the state, it must meet certain minimum criteria. These include whether the project: complies with the state's hazard mitigation strategies; meets funding eligibility requirements; is an independent solution to the problem; does not duplicate other funding sources; has a beneficial impact on the declared area; and is cost-effective and environmentally sound. When projects are competing for limited funding, projects are scored and ranked. Under the direction of the State Hazard Mitigation Officer (SHMO) and the Governor's Authorized Representative (GAR), a subcommittee of the State Hazard Mitigation Team (FMAC) convenes to score and rank the projects. The ranking is to be based on criteria derived from 44 CFR 206.434(b), and may or may not be specific to the disaster.

Other considerations that will be weighed by the application review committee in awarding grants include, but are not limited to:

- Relative need (risk) compared to other local entities requesting projects
- Repetitive losses mitigated by project(s)
- Benefit-cost analyses (may include b/c ratios greater than 1 for construction projects)
- Future development patterns and development pressure
- Availability/amount of grant funds along with commitment for matching funds

5.3.2 Cost-Benefit Review of Non-Planning Grants

As noted above, one of the criteria used for eligibility of <u>all</u> projects is whether the project is cost-effective. This applies to projects funded by non-planning grants as well as planning grants.

5.3.3 Criteria Considers High Risk, Repetitive Loss, Intense Development Pressure

As noted above, as part of the criteria used to rank projects, points are given for the following:

- Relative need (risk) compared to other local entities requesting projects
- Risk assessment of local flood hazards
- Repetitive losses mitigated by project(s)
- Future development patterns and development pressure

6 PLAN MAINTENANCE PROCESS

6.1 Monitoring, Evaluating and Updating the Plan

Implementation and maintenance of the Plan is critical to the overall success of hazard mitigation planning. This section describes the State's system for monitoring implementation of mitigation actions and reviewing progress toward meeting Plan goals, and any changes in the system since the previously approved plan.

6.1.1 Method and Schedule for Monitoring Plan

Both state and local involvement continue to be the foundation during the implementation and monitoring phases. The local emergency management offices and state level agencies will also play key roles in effective implementation and monitoring. The CWCB is charged with the overall responsibility for Plan monitoring and evaluation, with assistance from DEM and the FMAC.

The DEM and the CWCB will be responsible for coordinating the implementation and monitoring activities developed through the planning process and detailed in this plan document. They will involve the FMAC, other state agencies, local/county emergency management coordinators (EMCs), and other state and local level organizations. CWCB's responsibilities for monitoring and evaluating the Plan include the following:

- Communicating the schedule and activities for Plan updating and maintenance to the FMAC
- Facilitating meetings of the FMAC
- Assisting other agencies with the implementation of mitigation actions
- Coordinating with agencies between FMAC meetings
- Coordinating and conducting outreach to other stakeholders or interested parties and the public
- Obtaining local mitigation plan data to be used in Plan update cycles
- Conducting all Plan evaluation and monitoring activities that are not otherwise assigned to another agency
- Monitoring, capturing, and communicating mitigation success stories
- Documenting and incorporating the findings of the evaluation and monitoring analyses into the next edition of the Flood Hazard Mitigation Plan
- Updating the FMAC on grant funds available or disbursed for actions
- Engaging and maintaining the interest of the agencies participating on the FMAC
- Monitoring progress of local mitigation plan development and providing technical and financial assistance

In addition to the coordinator role, DEM and CWCB will develop and conduct education and outreach activities to introduce the plan to the residents of the state. Activities will be targeted to

specialized audiences: local level officials, state agencies, and policymakers. These audiences have been a part of the plan development and they will continue their participation through expanded awareness of their stake in its successful implementation. The purpose of this outreach is not to provide technical assistance, but rather to build a widespread understanding of the plan and the importance of mitigation.

The DEM State Hazard Mitigation Officer and the CWCB Community Assistance Program (CAP) Coordinator will conduct coordination activities that will result in the implementation and monitoring of this plan.

Role of State Hazard Mitigation Officer (SHMO) in Hazard Mitigation:

In addition to the previously mentioned roles, The SHMO will activate the State Hazard Mitigation Team and serve as the chair of the team. The SHMO coordinates with the CWCB in the implementation of mitigation recommendations and monitoring activities as determined in the plan. The SHMO is responsible for the review of local flood mitigation plans and submittal to FEMA for approval. Additionally, the SHMO is responsible for the development and utilization of mitigation training materials.

Role of Colorado Water Conservation Board (CWCB) in Hazard Mitigation:

In addition to the above-mentioned activities, there are several duties and responsibilities of the CWCB which include:

- Continue to support the statewide association of local floodplain managers known as CASFM
- Work with other agencies in approving mitigation activities
- Assist in exploring a state funding pool exclusively for flood hazard mitigation
- Serve as communication liaison with regional FEMA personnel
- Assist in the implementation and monitoring of cost-effective and environmentally-acceptable flood mitigation
- Provide technical assistance to county EMCs
- Visit each of the 64 counties on a five-year cycle, monitoring local project progress, as well as monitoring annual maintenance activities
- Develop training materials about mitigation
- Select digital area mapping for recovery operations

Role of Local Government Emergency Managers and Floodplain Coordinators:

Local government emergency management and floodplain coordinators are frequently forced by multiple roles and job demands to deal with mitigation issues and projects. Throughout the mitigation planning process, the county EMCs and floodplain coordinators have played an important role. They are the local level contact and the coordinator of mitigation implementation

and monitoring, programs and activities. In that role, the county EMC is the key communication point between the state and local level and between local community agencies and organizations.

Local government emergency management coordinators and floodplain managers will assist in implementing and monitoring this plan at the local level. Among suggested actions are:

- Working closely and communicating with the DEM staff and the SHMO to implement and monitor mitigation recommendations
- Conducting public awareness and education activities on the value and types of mitigation methods
- Conducting education/outreach activities for community organizations
- Developing, implementing and monitoring the mitigation recommendations appropriate for the county
- Working with other community organizations and agencies on local mitigation projects
- Participating in regional and statewide cooperative mitigation efforts
- Identifying critical facilities and infrastructure at risk from hazards
- Monitoring progress in recommendation implementation through participation on a regional team

As the link between the CAP Coordinator, SHMO, and other community agencies and organizations, the county emergency management coordinator and floodplain manager is the recognized focal point for implementation and monitoring of mitigation activities at the local government level.

The plan will be reviewed every three years for consistency with the mitigation programs and updated and evaluated by the CWCB every three years, as required. A state team, chosen at the discretion of the emergency management director, will be convened to identify which objectives are still relevant, which actions have been completed, and which actions should be carried over in the next update.

Mitigation activities in this plan will be specifically evaluated under the following process. If an activity is still deemed relevant and viable at the time of the update, it will remain in the plan. If the activity is deemed completed or unfeasible for cost or another reason, the review team/committee can review the value of the action and remove it. A very brief one-page summary of significant actions taken during the three-year period will be included with each update.

The DEM mitigation team will utilize public information tools to publicize progress on mitigation actions identified in the State Natural Hazards Mitigation Plan (including the State Flood Mitigation Plan). Additionally, as a part of its effort to continually update statewide risk assessment information and maximize the effectiveness of actions identified in the NHMP, DEM will work with State Agency partners to track progress and provide Agency and Department Directors with regular updates. Quarterly reports for projects using FEMA funds will continue

to be sent to FEMA. All applications for FEMA funds earmarked for mitigation projects include assurances that the State will comply with all applicable federal status and regulations. Mitigation accomplishments will be monitored by CWCB through the CAP Coordinator with pertinent information published in "Flood Talk" and "the State Engineer's Annual Dam Safety Report".

A simplified one-to-two page reporting form will be used by the CWCB to report to the DEM. DEM will monitor the implementation process as a whole at all levels to ensure that progress is being made. Representatives of the DEM and CWCB CAP Coordinator will participate in onsite visits with a goal of reaching each of the Colorado counties over a five-year period. Not only will this give the State a first-hand look at the progress of mitigation implementation in the counties, but it will provide an opportunity for local level officials and the county EMCs to address needs, barriers, problems, and successes in their local mitigation efforts. The visits will be structured so that county EMCs and floodplain administrators are able to demonstrate their mitigation progress. This may also involve meeting with other local mitigation participants, such as the local utilities, county highway officials, or community organizations.

6.1.2 Method and Schedule for Evaluating Plan

The methods and schedule for evaluating the state flood mitigation plan were presented in the previous section. The roles of various entities during the plan development and evaluation were also discussed. It is recommended that the plan update process begin in January of the year the update is due. The next update process should begin in January 2013 with a target completion by September 2013.

The criteria utilized to evaluate the plan will be obtained from the FEMA Standard Plan Review Crosswalk. Information received from FEMA during its review of the Plan will be presented in the comment section of the Plan Review Crosswalk. Each section and element of the Plan Review Crosswalk will be reviewed and additional data requirements or information identified as indicated by the FEMA reviewer. Data requirements and information will be compiled and integrated into revisions associated with the next update to the plan.

In addition, any flood plan should be evaluated after a major flood event.

6.1.3 Method and Schedule for Updating Plan

The methods and schedule for updating the state flood mitigation plan were presented in the previous sections. The roles of various entities during the plan development, evaluation, and update process were also discussed. The next official plan update is scheduled for January 2013.

6.1.4 Evaluation of Methods, Schedule, Elements and Processes Identified in Previous Plan

The overall process defined for monitoring, evaluating and updating the Plan appears to be working. With the 2010 revision this section was made more specific in regards to agency responsibilities, FMAC duties, and timelines. As a result of the 2010 and 2007 review of the existing flood hazard mitigation plan, CWCB staff has identified opportunities to incorporate several expanded elements into future flood planning efforts.

6.2 Monitoring Progress of Mitigation Activities

6.2.1 Monitoring Mitigation Measures and Project Closeouts

The method used to monitor mitigation project completions and closeouts is described in the HMGP Administration Plan. This method will be utilized for monitoring all mitigation projects. Projects must be completed and reconciled within three years for those projects completed following a disaster declaration. For project completions, subgrantees shall submit a letter with all final project documentation and a final inspection report to DEM requesting closeout. The SHMO, mitigation staff, and financial officer are responsible to review all paperwork for completion and determine that all eligible work was completed within the performance period. Site visits and inspections are conducted when deemed necessary. Procedures that will be utilized regarding the transmittal of closeout documents to FEMA are also described in the HMGP Administration Plan.

6.2.2 Reviewing Progress on Achieving Goals in Mitigation Strategy

The goals associated with the flood mitigation plan were presented in Table 20 in Section 4.4.1. Mitigation recommendations were also identified in this table along with the actions taken to achieve the recommendations. This table will be utilized as a tool to review the progress on achieving the goals and recommendations related to the flood hazard mitigation plan. As actions are completed, the table will be updated to reflect the mitigation action and achievement of the recommendation.

The CWCB CAP Coordinator will be responsible for collecting the information necessary to update the progress of the goals and recommendations identified in the table. Much of this information will be provided by representatives of state agencies responsible for flood mitigation activities as well as local emergency managers and floodplain managers.

As mentioned previously, a simplified one-to-two page reporting form will be used by the CWCB to report to the DEM. DEM will monitor the implementation process as a whole at all levels to ensure that progress is being made. Representatives of the DEM and CWCB CAP Coordinator will participate in onsite visits with a goal of reaching each of the Colorado counties over a five-year period. These visits will provide the State with a first-hand look at the progress

of mitigation implementation in the counties and will provide an opportunity for local level officials and the county EMCs to address needs, barriers, problems, and successes in their local mitigation efforts. The visits will be structured so that county EMCs and floodplain administrators are able to demonstrate their mitigation progress. This may also involve meeting with other local mitigation participants, such as the local utilities, county highway officials, or community organizations.

6.2.3 Changes in System for Tracking Mitigation Activities

For FEMA-funded projects, quarterly progress reports are required from subgrantees, which are to reflect project and cost status. These reports are reviewed by mitigation staff and the State Hazard Mitigation Officer, and submitted to FEMA.

As previously discussed, flood mitigation activities (both planning and project activities) will be tracked, from submittal through approval and completion, by the CWCB CAP coordinator on a spreadsheet that provides the following information:

- Local jurisdiction
- Project type (planning, mitigation project, or technical assistance)
- Total project cost
- Non-federal share of the total project cost
- Federal share of total project cost (itemized by planning, mitigation project or technical assistance)
- Date of funding/award
- Performance period/completion date

6.2.4 System for Reviewing Progress on Implementing Activities and Projects of Mitigation Strategy

The procedures utilized for reviewing the progress associated with implementing activities and projects related to the mitigation strategy were discussed in the two previous sections. In summary, the system will include the utilization of Table 20 presented in Section 4.4.1 along with the tracking spreadsheet utilized by the CWCB CAP coordinator.

6.2.5 Implementation of Previously Planned Mitigation Actions

Several actions have been implemented since the 2007 update to the NHMP. Public outreach and training included workshops and seminars through the Community Assistance Program (CAP) to assist communities with the development of flood mitigation planning documents; training for local emergency managers conducted by the DEM in February 2007. DEM completed many outreach and education initiatives since the 2007 Plan update, including speaking on flood mitigation at the CASFM conference in 2009 and annually at the Colorado Governor's Emergency Management Conference. CWCB and DEM worked in a joint effort to

enhance Colorado's early warning systems by studying the benefits of mobile radar stations and by increasing the number of stream gages around the state. In addition, funding available from the FMA Program has been accessed to develop flood mitigation planning documents. Please refer to Table 23 in Section 4.5.2 for a more comprehensive list of FMA and other flood hazard mitigation projects in Colorado. The CWCB has developed a criteria manual to guide local communities in their floodplain and stormwater planning and mitigation activities. Several planning projects have been completed since 2007, as described in Section 4.3.2.

Appendix A International Code Council (ICC) Adoption by Jurisdiction

International Codes - Adoption by Jurisdiction

X = Effective Statewide A = Adopted, but may not yet be effective L = Adoption by Local Governments
S = Supplement 06 = 2006 Edition 04 = 2004 Edition 03 = 2003 Edition 00 = 2000 Edition

ST	Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IECC	IPMC	IEBC	ICCPC	IUWIC	IZC	ICC700	Chart Comments
CO	Colorado	X06	L	X06	X06	X06	L	X06	X06	L	L	L	L	L	L	All State Buildings & Facilities: IBC, IMC, IPC, IFGC, IECC. All Public Schools & Junior Colleges: IBC, IFC, IMC, IPC, IFGC
CO	Adams County	L06	L06	L06	L06	L06		L06	L06		L06					
CO	Alamosa	L03	L03	L03	L03				L06							
CO	Alamosa County	L03	L03		L03											
CO	Arapahoe County	L06	L06		L06	L06		L06	L06							
CO	Archuleta	L	L	L												
CO	Archuleta County	L06	L06	L06		L06										
CO	Arvada	L06	L06	L06	L06	L06	L06	L06	L06	L06	L06	L06	L06	L06		
CO	Arvada Fire District			L06												
CO	Aspen	L03	L03		L03	L03		L03		L03	L03					
CO	Aspen Fire Department			L03												
CO	Ault	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Aurora	L06	L06	L06	L06	L06		L06	L06							
CO	Avon	L03	L03	L03	L03											
CO	Avondale	L	L		L					L						
CO	Basalt	L06	L06	L06	L06			L06	L06		L06					
CO	Bayfield	L03	L03		L03			L03								
CO	Bennett	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Black Hawk	L	L	L	L	L		L	L		L					
CO	Blue River		L													
CO	Boulder	L06	L06	L06	L06	L06		L06	L06							
CO	Boulder County	L06	L06	L06	L06	L06		L06	L06				L06			
CO	Boulder Rural Fire Protection District			L03												
CO	Breckenridge	L06	L06		L06	L06		L06	L06							
CO	Brighton	L03	L03	L03	L03	L03										
CO	Broomfield, City and County	L06	L06	L06	L06	L06		L06	L06							
CO	Brush	L03	L03	L03	L03	L03		L03	L03							
CO	Buena Vista	L00	L00													
CO	Canon City	L00	L00	L00	L00			L00								
CO	Carbondale	L03	L03			L03		L03	L03							
CO	Castle Pines North	L06	L06	L06	L06	L06		L06	L06							
CO	Castle Rock	L06	L06	L06	L06	L06		L06	L06							
CO	Centennial	L06	L06		L06	L06		L06	L06							
CO	Central City	L03	L03	L03	L03	L03		L03	L03							
CO	Chaffee County	L00	L00													
CO	Cherry Hills Village	L06	L06	L06	L06	L06		L06	L06							
CO	Clear Creek County	L03	L03		L03	L03										
CO	Clifton Fire Protection Dist			L												
CO	Coal Creek Canyon Fire Protection District			L03									L03			
CO	Collbran	L06	L06		L06	L06		L06	L06	L06						
CO	Colorado Div. of Fire Safety	L06	L06	L06												
CO	Colorado Div. of Housing	L03	L03		L03	L03		L03	L03							

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CO	Colorado Div. Of Oil and Public Safety	X03		X03	X03											*Applies to all Public Schools*
CO	Colorado Examing Brd of Plumbers					X06		X06								
CO	Colorado Springs	L03	L03	L03	L03			L03	L03		L03					
CO	Colorado State Buildings Programs	X06			X06				X06							*Applies to all state owned buildings and facilities*
CO	Columbine Valley	L	L		L	L		L		L						
CO	Columbing Valley	L03	L03		L03	L03		L03		L03						
CO	Commerce City	L03	L03	L03	L03	L03		L03	L03	L03	L03	L03				
CO	Copper Mountain FPD			L												
CO	Cortez	L06	L06	L06	L06	L06		L06	L06	L06						
CO	Craig	L06	L06	L06	L06	L06		L06	L06	L06						
CO	Crested Butte	L03	L03		L03	L03		L03								
CO	Cripple Creek	L	L	L	L	L		L	L	L	L					
CO	Cunningham Fire Protection District			L06												
CO	Dacono	L06	L06	L06	L06	L06		L06		L06	L06					
CO	DeBeque	L06	L06		L06	L06		L06	L06	L06						
CO	Del Norte	L03	L03		L03	L03										
CO	Delta	L03	L03	L03	L03	L03		L03	L03							
CO	Delta County	L03	L03													
CO	Denver	L06	L06	L06	L06				L06		L06					
CO	Dillion	L	L	L	L	L		L								
CO	Dillon	L00	L00	L06	L00	L00		L00								
CO	Douglas County	L03	L03	L03	L03	L03		L03								
CO	Durango	X06	X06	L03	L06	L06		L06	X06							
CO	Eagle	L03	L03		L03	L03		L03	L03							
CO	Eagle County	L03	L03	L03	L03	L03		L03	L03							
CO	East Grand Fire Protection District			L06												
CO	Eaton	L03	L03		L03	L03		L03								
CO	Edgewater	L06	L06	L06	L06	L06		L06	L06		L06					
CO	El Paso County	L03	L03		L03			L03	L03		L03					
CO	Elizabeth	L06	L06	L06	L06	L06		L06	L06							
CO	Elk Creek FPD			L03									L03			
CO	Englewood	L06	L06	L06	L06	L06		L06	L06							
CO	Erie	L06	L06	L06	L06	L06		L06	L06		L06					
CO	Estes Park	L03	L03		L03	L03		L03	L03		L03					
CO	Evans	L03	L03	L03	L03	L03		L03		L03						
CO	Evergreen Fire Protection District			L06									L03			
CO	Fairmont Fire Protection District			L00												
CO	Fairplay	L06	L06		L06	L06		L06								
CO	Federal Heights	L09	L09	L09	L09	L09		L09	L09	L09	L09	L09				
CO	Firestone	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Florence	L	L	L	L											

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CO	Foothills Fire and Rescue			L03									L03			
CO	Fort Collins	L06	L03	L06	L03	L03		L03	L06	L06						
CO	Fort Lupton	L06	L06		L06	L95		L06	L06	L06	L06					
CO	Fort Morgan	L03	L03	L03	L03	L03		L03	L03							
CO	Fountain	L03	L03		L03			L03	L03							
CO	Fraser	L06		L06												
CO	Frederick	L06	L06	L06	L06	L06		L06								
CO	Fremont County	L03	L03													
CO	Frisco	L06	L06	L06	L06	L06		L06	L06							
CO	Fruita	L06	L06	L06	L06	L06		L06	L06	L06						
CO	Fruita Fire District			L												
CO	Garfield County	L03	L03		L03	L03		L03								
CO	Genessee FPD			L03									L03			
CO	Gilcrest	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Gilpin County	L06	L06													
CO	Glendale				L											
CO	Glenwood Springs	L03	L03	L03	L03	L03		L03		L03	L03					
CO	Glenwood Springs Fire District			L03												
CO	Golden	L09	L09	L09	L09	L09		L09	L09		L09					
CO	Golden Gate Fire			L03									L03			
CO	Granby	L06	L06		L06	L06		L06	L06							
CO	Grand County	L00	L00		L00	L00		L00								
CO	Grand Jct Rural FPD			L												
CO	Grand Junction	L06	L06		L06	L06		L06	L06	L06						
CO	Grand Junction Fire Dept			L												
CO	Grand Lake	L00	L00		L00	L00		L00								
CO	Grandby	L00	L00		L00	L00		L00								
CO	Greeley	L06	L06	L06	L06	L06		L06	L06	L06	L06					
CO	Greenwood Village	L06	L06	L06	L06	L06		L06	L06							
CO	Gunnison	L03	L03	L03	L03	L03		L03	L03	L03	L03	L03				
CO	Gunnison County	L03	L03		L03			L03	L03							
CO	Gypsum	L03	L03	L03	L03			L03								
CO	Hayden	L03	L03		L03	L03		L03	L06		L03					
CO	Hot Sulphur Springs	L00	L00		L00	L00		L00								
CO	Hotchkiss	L06	L06						L06							
CO	Hudson	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Huerfano County	L06	L06		L06				L06							
CO	Idaho Springs	L03	L03	L03	L03	L03		L03			L03					
CO	Ignacio	L03	L03		L03	L03		L03	L03							
CO	Indian Hills FPD			L												
CO	Inter-Canyon Fire Rescue			L03									L03			
CO	Jamestown	L03	L03		L03	L03		L03	L03							
CO	Jefferson County	L09	L09	L09	L09	L09		L09	L09							

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CO	Johnstown	L06	L06	L06	L06	L06		L06	L06							
CO	Keenesburg	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Kersey	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Kremmling	L00	L00		L00	L00		L00								
CO	La Plata County	L03	L03		L03	L03		L03	L03							
CO	Lafayette	L03	L03		L03	L03		L03	L03							
CO	Lake County	L03	L03		L03	L03		L03			L03					
CO	Lake Dillon FPD			L06												
CO	Lakewood	L06	L06	L06	L06	L06		L06	L06							
CO	Lamar	L06	L06	L06	L06	L06		L06	L06	L06						
CO	Larimer County	L06	L06		L06	L06		L06	L06		L06					
CO	Littleton	L03	L03		L03	L03		L03								
CO	Littleton FPD			L03												
CO	Lochbuie	L03	L03	L03	L03	L03		L03								
CO	Logan County	L00	L00		L00	L00		L00								
CO	Lone Tree			L03												
CO	Longmont	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Louisville	L06	L06	L06	L06	L06		L06	L06							
CO	Loveland	L06	L06	L06	L06	L06		L06	L06	L06	L06					
CO	Lower Valley Fire District			L												
CO	Lyons	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Mancos	L	L						L	L						
CO	Mead	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Meeker	L03	L03	L03	L03			L03								
CO	Mesa County Regional	L06	L06		L06	L06		L06	L06	L06						*Includes Palisade, Fruita, Collbran, DeBeque & City of Grand Junction*
CO	Milliken	L03	L03		L03	L03		L03			L03					
CO	Minturn	L00	L00		L00	L00										
CO	Moffat County	L03	L03		L03	L03		L03	L03	L03						
CO	Monte Vista	L03	L03		L03											
CO	Montezuma	L	L		L	L		L								
CO	Montrose	L03	L03	L03	L03	L03		L03	L03	L03	L03	L03				
CO	Morgan County	L03	L03		L03											
CO	Morrison	L06	L06	L06	L06	L06		L06	L06		L06					
CO	Mountain View Fire Protection District			L06												
CO	Mountain Village	L03	L03	L03	L03	L03		L03	L03	L03						
CO	Mt Crested Butte					L										
CO	Nederland	L06	L06	L06	L06	L06		L06	L06							
CO	New Castle	L03	L03	L03	L03	L03		L03								
CO	North Fork FPD			L03									L03			
CO	North Metro FPD			L03									L03			
CO	Northglenn	L06	L06	L06	L06	L06		L06	L06	L06	L06					
CO	Nunn	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Oak Creek					L										

International Codes - Adoption by Jurisdiction

X = Effective Statewide A = Adopted, but may not yet be effective L = Adoption by Local Governments
S = Supplement 06 = 2006 Edition 04 = 2004 Edition 03 = 2003 Edition 00 = 2000 Edition

ST	Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IECC	IPMC	IEBC	ICCPC	IUWIC	IZC	ICC700	Chart Comments
CO	Orchard City	L06	L06	L03	L03	L03		L03	L03							
CO	Pagosa Springs	L06	L06	L06	L06			L06								
CO	Palisade	L06	L06		L06	L06		L06	L06	L06						
CO	Parachute	L03	L03	L03	L03	L03		L03								
CO	Park County	L06	L06		L06			L06								
CO	Parker	L06	L06	L06	L06	L06		L06	L06							
CO	Parker Fire Protection District			L												
CO	Pierce	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Pikes Peak Regional Building Dept.	L03	L03	L03	L03			L03	L03		L03					
CO	Pitkin County	L03	L03		L03	L03		L03	L09		L03					
CO	Platteville	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Pleasant View Fire Dept.			L03												
CO	Poncha Springs	L00	L00													
CO	Pueblo	L03	L						L							
CO	Pueblo County	L03	L03						L03							
CO	Rangely	L00	L00		L00	L00	L00	L00		L00						
CO	Red Cliff	L03	L03	L03	L03	L03		L03			L03					
CO	Red White & Blue Fire Rescue			L06												
CO	Rifle	L03	L03		L03	L03		L03								
CO	Rio Blanco County	L00	L00		L00	L00										
CO	Rio Grande County	L03	L03		L03											
CO	Routt County	L03	L03	L03	L03	L03		L03			L03					
CO	Routt County Regional					L										*Includes Steamboat Springs*
CO	Salida	L06	L06	L06	L06	L06		L06	L06	L06	L06					
CO	San Miguel County	L03	L03		L03			L03	L03		L03					
CO	Severance	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Sheridan	L03	L03	L03					L03	L03	L03					
CO	Silt	L03	L03	L03	L03	L03		L03		L03	L03					
CO	Silverthorne	L03	L03		L03	L03		L03								
CO	Snake River FPD			L												
CO	Snowmass Village	L09	L09	L09	L09	L09		L09	L09		L09					
CO	South Fork	L03	L03		L03											
CO	South Metro Fire District			L06												
CO	South West Adams County Fire & Rescue			L06												
CO	Steamboat Springs	L03	L03	L03	L03	L03		L03			L03					
CO	Sterling	L06	L06	L06	L06			L06	L06							
CO	Summit County	L03	L03		L03	L03										
CO	Superior	L03	L03	L03	L03	L03	L03	L03	L03	L03				L03		
CO	Teller County	L03	L03		L03	L03		L03	L03		L03					
CO	Telluride	L03	L03	L03				L03	L09	L03						
CO	Thornton	L06	L06	L06	L06	L06		L06	L06		L06					

International Codes - Adoption by Jurisdiction																
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ST	Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IECC	IPMC	IEBC	ICCPC	IUWIC	IZC	ICC700	Chart Comments
CO	Timnath	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Tri-Lakes Monument Fire Rescue	L03		L03	L03	L03		L03	L03				L03			
CO	Trinidad	L03	L03	L03	L03				L04S							
CO	Vail	L03	L03	L03	L03	L03		L03	L03							
CO	Weld County	L06	L06		L06	L06		L06			L06					
CO	Wellington	L06	L06		L06	L06		L06	L06	L06	L06					
CO	West Metro Fire Rescue			L03												
CO	Westminster	L06	L06	L06	L06	L06		L06	L06		L06					
CO	Wheat Ridge	L03	L03	L03	L03	L03		L03	L03	L03						
CO	Wheat Ridge Fire Protection District	L03		L03	L03	L03										
CO	Wiggins	L03	L03		L03											
CO	Windsor	L06	L06		L06	L06		L06	L06	L06	L06					
CO	Windsor Severance FPD			L03												
CO	Winter Park			L06												
CO	Yampa					L										

ICC Acronyms

- IBC International Building Code
- IRC International Residential Code
- IFC International Fire Code
- IMC International Mechanical Code
- IPC International Plumbing Code
- IPSDC International Private Sewage Disposal Code
- IFGC International Fuel & Gas Code
- IECC International Energy Conservation Code
- IPMC International Property Maintenance Code
- IEBC International Existing Building Code
- ICCPC International Performance Code
- IUWIC International Urban-Wildland Interface Code
- IZC International Zoning Code
- ICC 700 National Green Building Standard (US)

Appendix B Local Multi-Hazard Mitigation Plans Mitigation Capabilities and Strategies Raw Data

Proposed Mitigation Actions by County

Counties	Conduct studies, new mapping	Outreach or education	Enhance early warning systems	Continued NFIP Compliance	Encourage NFIP participation	StormReady	Consider joining CRS	Improve CRS rating	Regulations on bldg codes, land development	Elevation/ floodproofing	Property acquisition, relocation	Channel modification, storm drainage improvements, etc.	Critical facilities protection	Erosion and sediment control
Adams			x	x					x	x	x	x		
Alamosa														
Arapahoe	x	x	x	x					x	x		x	x	x
Archuleta														
Baca														
Bent														
Boulder	x	x	x	x					x	x	x	x	x	x
Broomfield	x	x	x	x					x	x		x	x	x
Chaffee	x			x								x		
Cheyenne	x	x	x	x	x	x							x	
Clear Creek	x	x	x	x					x	x	x	x	x	x
Conejos														
Costilla	x	x		x			x		x	x	x	x	x	?
Crowley														
Custer	x			x*								x		
Delta	x	x							x			x	x	
Denver	x	x	x	x					x			x	x	
Dolores														
Douglas	x		x						x					
Eagle	x	x	x								x	x	x	
Elbert	x	x	x						x		x	x	x	x
El Paso	x	x	x	x				x	x		x	x	x	x
Fremont	x			x								x		
Garfield														
Gilpin														
Grand														
Gunnison	x	x	x						x			x	x	
Hinsdale	x	x	x						x			x		
Huerfano														
Jackson														
Jefferson	x	x	x	x					x		x	x	x	x
Kiowa														
Kit Carson	x	x	x	x	x	x						x	x	
Lake	x			x								x		
La Plata														
Larimer	x	x	x						x		x	x	x	
Las Animas														
Lincoln	x	x	x	x	x	x							x	
Logan	x	x	x	x	x	x						x	x	
Mesa	x	x	x	x	x						x	x	x	
Mineral														
Moffat														
Montezuma														
Montrose	x	x		x								x		
Morgan	x	x		x	x	x						x	x	
Otero														
Ouray	x	x	x	x	x						x	x	x	
Park	x	x	x	x	x					x	x	x	x	
Phillips	x	x		x	x	x						x	x	
Pitkin	x	x	x								x	x	x	
Prowers	x	x	x		x					x	x	x		x
Pueblo														
Rio Blanco	x				x							x		x
Rio Grande														
Routt														
Saguache														
San Juan														
San Miguel	x	x	x	x	x							x	x	
Sedgwick	x	x	x	x	x	x						x	x	
Summit	x	x		x	x		x					x	x	x
Teller	x	x	x	x	x					x		x	x	x
Washington	x	x	x	x	x	x						x	x	
Weld	x	x	x	x	x	x						x	x	
Yuma	x	x	x	x	x	x						x	x	
TOTAL	**39**	**33**	**29**	**29**	**18**	**10**	**2**	**1**	**15**	**9**	**14**	**37**	**30**	**11**

Existing Mitigation Capabilities by County

Counties	Hazard studies and mapping	Outreach & education	Early warning systems	Participate in NFIP	StormReady	CRS Participation	Regulations on bldg codes, land development	Elevation/ floodproofing	Property acquisition, relocation	Channel modifications, storm drainage improvements, etc.	Critical facilities protection	Erosion and sediment control
Adams			x	x			x	x	x	x		
Alamosa												
Arapahoe	x	x		x			x	x		x		
Archuleta												
Baca												
Bent												
Boulder	x	x	x	x		x	x	x	x	x	x	x
Broomfield	x	x	x	x			x	x		x	x	x
Chaffee												
Cheyenne	x	x	x	x	x		x				x	
Clear Creek	x	x	x	x			x			x	x	x
Conejos												
Costilla	x		x	x			x					
Crowley												
Custer												
Delta	x						x			x		
Denver	x	x	x	x			x			x	x	
Dolores												
Douglas	x		x	x			x					
Eagle												
Elbert												
El Paso	x	x	x	x			x	x				x
Fremont												
Garfield												
Gilpin												
Grand							x					
Gunnison							x				x	x
Hinsdale							x				x	x
Huerfano												
Jackson												
Jefferson	x	x	x	x		x	x	x		x		x
Kiowa												
Kit Carson		x	x		x		x					x
Lake												
La Plata												
Larimer												
Las Animas												
Lincoln		x	x				x					
Logan	x		x	x	x		x			x	x	
Mesa												
Mineral												
Moffat												
Montezuma												
Montrose			x				x			x		
Morgan	x	x	x	x	x		x			x	x	x
Otero												
Ouray							x	x	x	x		
Park		x	x	x			x					x
Phillips	x	x	x	x			x			x		
Pitkin												
Prowers												
Pueblo												
Rio Blanco				x			x					x
Rio Grande												
Routt												
Saguache												
San Juan												
San Miguel		x	x	x		x	x			x		
Sedgwick		x	x	x			x			x		
Summit		x	x	x		x	x	x		x		x
Teller			x	x			x	x		x		x
Washington		x	x	x	x		x					
Weld	x	x	x	x			x			x	x	x
Yuma	x	x	x	x	x		x			x		x
TOTAL	**16**	**19**	**24**	**23**	**6**	**4**	**30**	**9**	**3**	**19**	**10**	**15**