

FLOOD HAZARD MITIGATION PLAN FOR COLORADO



November 2013

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, 2010, and 2013

TABLE OF CONTENTS

1	Prerequisite.....	2
1.1	Formal Adoption by the State	2
1.2	Assurances of Continued Compliance with Federal Requirements	2
2	Planning Process	4
2.1	Documentation of Planning Process.....	4
2.1.1	Description of Plan Preparation Process.....	4
2.1.2	Evolution of the Colorado Flood Hazard Mitigation Plan.....	4
2.1.3	2013 Update Planning Process.....	5
2.1.4	Involvement in Planning Process.....	6
2.1.5	Agency Involvement in Plan Preparation Process	8
2.1.6	Description of Plan Review and Analysis	9
2.2	Coordination among Agencies	10
2.2.1	Involvement of Federal and State Agencies	10
2.2.2	Involvement of Interested Groups	10
2.2.3	Changes in Coordination.....	11
2.3	Program Integration.....	12
2.3.1	Integration of Mitigation Planning with other State Planning Efforts	12
2.3.2	Integration of Mitigation Planning with FEMA Mitigation Programs and Initiatives	13
3	Risk Assessment	15
3.1	Identifying Flood Hazards.....	15
3.1.1	Description of Flood Hazards Affecting State.....	16
3.2	Flood Hazard Profile	22
3.2.1	Location of Flood Hazards in Colorado.....	22
3.2.2	Flood History in Colorado	30
3.2.3	Probability of Future Floods	44
3.3	Assessing Vulnerability by Jurisdiction	44
3.3.1	Vulnerability Based on Local and State Risk Assessments.....	46
3.3.2	Jurisdictions Most Threatened and Most Vulnerable to Damage or Loss	47

3.3.3	Process Used to Analyze Information from Local Risk Assessments	47
3.3.4	Changes in Development Patterns	60
3.4	Estimating Potential Losses by Jurisdiction	61
3.4.1	Overview and Analysis of Potential Losses.....	61
3.4.2	Potential Losses Based on Estimates in Local and State Risk Assessments	62
3.4.3	Impacts on Losses from Changes in Development.....	74
3.5	Assessing Vulnerability of State Facilities.....	75
3.5.1	Types of State Owned/Operated Facilities	75
3.5.2	Estimating Potential Losses of State Facilities	77
4	Mitigation Strategy	83
4.1	Hazard Mitigation Goals	83
4.1.1	Description of State Mitigation Goals	83
4.1.1	Reassessment of Goals for Validity or Need for Revision	83
4.2	State Capability Assessment	84
4.2.1	Pre-disaster Hazard Management Policies, Programs, Capabilities	84
4.2.2	Post-disaster Hazard Management Policies, Programs, Capabilities.....	88
4.2.3	State Policies Related to Development in Flood Prone Areas	89
4.2.4	State Funding Capabilities for Flood Hazard Mitigation Projects.....	90
4.2.5	Changes in Hazard Management Capabilities of the State	91
4.3	Local Capability Assessment	96
4.3.1	Local Mitigation Policies, Programs and Capabilities.....	96
4.3.2	Effectiveness of Local Mitigation Policies, Programs and Capabilities.....	100
4.4	Mitigation Actions.....	101
4.4.1	Identification of Actions under State Consideration.....	101
4.4.2	Evaluation of Actions and Activities	120
4.4.3	Prioritization of Actions and Activities	120
4.4.4	Contribution of Each Activity to Overall State Flood Mitigation Strategy	122
4.4.5	Integration of Local Plans into Mitigation Strategy	122
4.5	Funding Sources	123
4.5.1	Identification of Current Federal, State, Local Funding Sources	123

4.5.2	Sources of Funding Used to Implement Previous Mitigation Activities	124
4.5.3	Identification of Potential Federal, State, Local Funding Sources	128
5	Coordination Of Local Mitigation Planning	130
5.1	Local Funding and Technical Assistance	130
5.1.1	Description of State Process to Support Local Plan Development.....	130
5.1.2	Funding/Technical Assistance Provided in Past Three Years	130
5.2	Local Plan Integration	136
5.2.1	Process and Timeframe to Review Local Plans.....	136
5.2.2	Process and Timeframe to Coordinate and Link Local Plans to State Mitigation Plan	137
5.3	Prioritizing Local Assistance.....	138
5.3.1	Description of Criteria for Prioritizing Planning and Project Grants	138
5.3.2	Cost-Benefit Review of Non-Planning Grants	138
5.3.3	Criteria Considers High Risk, Repetitive Loss, Intense Development Pressure.....	138
6	Plan Maintenance Process.....	139
6.1	Monitoring, Evaluating and Updating the Plan.....	139
6.1.1	Method and Schedule for Monitoring Plan.....	139
6.1.2	Method and Schedule for Evaluating Plan.....	142
6.1.3	Method and Schedule for Updating Plan	142
6.1.4	Evaluation of Methods, Schedule, Elements and Processes Identified in Previous Plan	143
6.2	Monitoring Progress of Mitigation Activities	143
6.2.1	Monitoring Mitigation Measures and Project Closeouts	143
6.2.2	Reviewing Progress on Achieving Goals in Mitigation Strategy	144
6.2.3	Changes in System for Tracking Mitigation Activities	144
6.2.4	System for Reviewing Progress on Implementing Activities and Projects of Mitigation Strategy	145
6.2.5	Implementation of Previously Planned Mitigation Actions.....	145

LIST OF FIGURES

Figure 1	Flooding from Levee Overtopping	20
Figure 2	Major River Basins	23
Figure 3	Mapped DFIRM Flood Zones in Colorado 2013.....	27
Figure 4	Mapped DFIRM Flood Zones in Colorado in 2010.....	28
Figure 5	HAZUS-MH 1% Annual Chance Floodplains in Colorado	29
Figure 6	Colorado Levees: Protected Population and Area	30
Figure 7	Weather Conditions that Led to September 2013 Flooding	33
Figure 8	1976 Big Thompson River Flood Explanation	36
Figure 9	Big Thompson River Debris Flows	42
Figure 10	Projected Population and Growth Impact Score by County	61
Figure 11	Total Building Loss by County based on HAZUS	63
Figure 12	Percent Building Damage by County based on HAZUS	64
Figure 13	Per Capita Loss by County based on HAZUS	65
Figure 14	Displaced Population by County based on HAZUS	66
Figure 15	NFIP Claims and Amount Paid in Colorado Since 1978 by County	73
Figure 16	NFIP Colorado Policies and Total Coverage by County	74
Figure 17	Location of State Assets in Floodplains by County.....	76
Figure 18	Colorado DFIRM Status by County – October 2013.....	94
Figure 19	Risk MAP Status by Watershed as of October 2013	96

LIST OF TABLES

Table 1	Key Planning Meetings of the 2013 Revision Process	6
Table 2	Participants and Acknowledgments	7
Table 3	Changes in the 2013 Plan Revision	9
Table 4	Notable Flood Events In Colorado: 1864-2013	31
Table 5	September 2013 Flooding Impact Rank by County	34
Table 6	EMAP Consequence/Impact Analysis: Flood	45
Table 7	Local Hazard Mitigation Plans Identifying Flooding as a Planning Priority.....	47
Table 8	Vulnerabilities Identified in Local Multi-Hazard Mitigation Plans.....	52
Table 9	Colorado Flood Loss Estimates based on HAZUS-MH.....	67
Table 10	NFIP Repetitive Loss Claims in Colorado: 1978-2013*	70
Table 11	FEMA National Flood Insurance Program (NFIP) Policy and Claims Report Colorado: 1978-2013*	71
Table 12	State Assets Potentially at Risk to Flooding (Effective DFIRM 1% and 0.2% Annual Chance and HAZUS 1% Annual Chance)	77
Table 13	State Assets Potentially at Risk to 1% Annual Chance of Flooding Based on Available DFIRM	78
Table 14	State Assets Potentially at Risk to 0.2% Annual Chance of Flooding Based on Available DFIRM	78
Table 15	State Assets Potentially at Risk based on HAZUS Flood Modeling Where DFIRM is Not Available.....	79
Table 16	State Assets in 1% Annual Chance DFIRM and HAZUS Flood Hazard Areas by Department.....	80
Table 17	State Assets in 0.2% Annual Chance DFIRM and HAZUS Flood Hazard Areas by Department	80
Table 18	September 2013 Flood Damage to State Facilities	82
Table 19	State Programs and Capabilities Related to Flood Hazards.....	88
Table 20	DFIRM Status as of October 2013.....	93

Table 21	Local Multi-Hazard Mitigation Plans	97
Table 22	Typical Flood Mitigation Capabilities from Local Multi-Hazard Mitigation Plans.....	98
Table 23	State Flood Hazard Mitigation Goals and Actions	103
Table 24	Priority Schedule for Flood Mitigation Actions/Activities/Projects.....	122
Table 25	Number of Mitigation Actions in Local Multi-Hazard Mitigation Plans by CRS Category	123
Table 26	Flood Mitigation Funding in Colorado: 2005-2013.....	125
Table 27	Funding/Technical Assistance Provided by the CWCB	130
Table 28	Community Assistance Visits 2007 - July 2013	133

LIST OF APPENDICES

Appendix A International Code Council (ICC) Adoption by Jurisdiction

Appendix B Local Multi-Hazard Mitigation Plans Mitigation Capabilities and Strategies Raw Data (electronic appendix)

EXECUTIVE SUMMARY

The Colorado Flood Hazard Mitigation Plan summarizes the State of Colorado's 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 in between or after 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 2013 State of Colorado Natural Hazards Mitigation Plan (NHMP), the NHMP is hereby approved and adopted by the State of Colorado – Department of Public Safety and 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 Office of Emergency Management (OEM) to execute their responsibilities with respect to disaster preparedness, response, recovery, and mitigation.

The 2013 State of Colorado Natural Hazards Mitigation Plan was approved and adopted by the State of Colorado, Department of Public Safety, and Office of the Governor. For this 2013 Plan Revision, it will be the responsibility of the Office 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 in November 2013.

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 Technical Assistance Partnership (Flood TAP) 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 OEM took the lead on both the 2010 and 2013 updates of the State of Colorado 2007 NHMP umbrella document. The original umbrella document was created in 2001, was updated in 2004, 2007, 2010, and 2013 and was designed as a way to tie together various hazard-specific documents that had been developed over the previous years.

The OEM coordinated with other agencies on concurrent state planning and risk management efforts, including the natural hazard specific annexes that are of key importance to the umbrella document. The Colorado Water Conservation Board (CWCB) took the lead on the 2010 and 2013 updates to the Flood Hazard Mitigation Plan, under the direction of the Community Assistance Program (CAP) Coordinator. A consulting firm (AMEC Environment and Infrastructure) was selected to coordinate and facilitate the 2010 and 2013 updated to the Plan. The 2010 update was a comprehensive revision which included the development of a more detailed vulnerability assessment.

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, 2007, and 2010 as part of the NHMP update process. The 2007 and 2010 versions of this plan contain the narrative of the planning process followed at those times, which mirrored that of the umbrella NHMP, and is not repeated herein. The following description of the planning process is focused on the 2013 plan update process.

2.1.3 2013 Update Planning Process

In 2013 the Plan underwent an update as part of the three year state plan update cycle. The major objectives of this revision included:

- Updating the Plan to meet current DMA 2000 and EMAP planning standards
- Update of the flood hazard vulnerability assessment with revised estimates of risks and potential losses, with a focus on state assets
- Updating the flood hazard mitigation strategy
- Updating information on historical flood events in Colorado, including the 2013 flood disaster declaration
- Capturing initiatives and projects completed or initiated within the past three years at state and local levels that contribute to flood loss reduction

The results of this effort are reflected in this updated 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 2013 update process.

Flood Technical Assistance Partnership

The development, implementation, and maintenance of the Flood Plan are the responsibility of the Flood TAP. The Flood TAP is made up of representatives of the principal state agencies and organization with authorities, responsibilities, or expertise related to flood hazard mitigation and preparedness programs. The Flood TAP was born out of coordination meetings between COEM, CWCB and FEMA in 2010 related to joint efforts on all aspects of flood including preparedness and mitigation. The partnership expanded further in 2011 in response to coordination on post-wildfire flood issues. COEM has a lead role in coordination and facilitation of the group in partnership with CWCB and FEMA. The purpose statement of the Flood TAP is:

“Enhancement of collaboration between agencies responsible for comprehensive flood preparedness and floodplain management to improve customer service and help each other fulfill our common missions.”

The Flood TAP is a standing committee that meets on a regular basis, typically every month. The Flood TAP was used as the advisory committee during the 2013 Plan update process. Formation of the Flood TAP 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 Flood TAP participated in two major planning meetings between August and October 2013 summarized in the following table.

Table 1 Key Planning Meetings of the 2013 Revision Process

Meeting	Date	Purpose
1. Project Kickoff	August 5, 2013	<ul style="list-style-type: none"> • Review Disaster Mitigation Act planning requirements, scope of work, and schedule • Review role of Flood TAP • Discuss data collection needs • Discuss stakeholder involvement
2. Risk Assessment and Mitigation Strategy Update (in conjunction with the SHMT)	October 28, 2013	<ul style="list-style-type: none"> • 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, of the Flood TAP members and CWCB staff provided input on the draft plan during October and November of 2013 via email and an FTP site. Additionally, some members of the Flood TAP participated on the SHMT and other meetings related to the NHMP update. This included a meeting on November 1, 2013. 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 Flood TAP. CWCB and other agencies conducted internal meetings relative to the existing and proposed mitigation actions and their prioritization. The plan was presented at a public forum on November 19, 2013 when it was formally approved by the board of the Colorado Water Conservation Board.

2.1.4 Involvement in Planning Process

In keeping with the tenant of whole community partnerships, Flood TAP representation encompasses local, state, and federal governments, special districts and professional organizations. The following is a list of partnering organizations that comprise the Flood TAP:

- Department of Natural Resources - Colorado Water Conservation Board (CWCB)
- Department of Natural Resources - Colorado Division of Water Resources (CDWR)
- Department of Public Safety - Colorado Office of Emergency Management (COEM)
- Department of Public Safety - Colorado Office of Preparedness (COP)
- Colorado Association of Stormwater and Floodplain Managers (CASFM)
- City of Fort Collins (CoFC)
- Urban Drainage and Flood Control and District (UDFCD)
- Federal Emergency Management Agency (FEMA)

During the update to the Plan, several individuals representing these agencies participated on the Flood TAP and provided information and assistance to promote the development of the document. In addition to the core Flood TAP participation the following agencies/entities have been participants in this plan’s development over the years, and were engaged in 2013 through

the umbrella NHMP planning effort:

State

- Department of Agriculture – State Conservation Board
- Department of Transportation
- Colorado State University – Colorado Climate Center
- Colorado School of Mines – Colorado Geological Survey
- Department of Public Safety – Colorado Office of Emergency Management
- Department of Local Affairs – Colorado Division of Local Government
- Department of Natural Resources – Colorado State Forest Service
- Department of Natural Resources – Parks and Wildlife
- 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 Flood TAP members were involved in the planning process through:

- Attending and participating in Flood TAP 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 Flood TAP 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
Pat Williams	City and County of Denver
Brian Varrella	City of Fort Collins
Dave Bennetts	Colorado Association of Stormwater and Floodplain Managers
Bill McCormick	Colorado Dam Safety
Kallie Bauer	Colorado Dam Safety
Lori Torikai	Colorado Dam Safety
Cindy Lair	Colorado Department of Agriculture, State Conservation Board
Barry Cress	Colorado Department of Local Affairs, Division of Local Government
Kerry Kimble	Colorado Department of Public Safety – Office of

Name	Agency
	Preparedness
John Hunyadi	Colorado Division of Water Resources
Deanna Butterbaugh	Colorado Office of Emergency Management
Iain Hyde	Colorado Office of Emergency Management
Ken Brink	Colorado Office of Emergency Management
Marilyn Gally	Colorado Office of Emergency Management
Patricia Gavelda	Colorado Office of Emergency Management
Scott Baldwin	Colorado Office of Emergency Management
Tony Reidell	Colorado Office of Emergency Management
Kerry Kimble	Colorado Office of Preparedness
Chris Sturm	Colorado Water Conservation Board
Jamie Prochno	Colorado Water Conservation Board
Joe Busto	Colorado Water Conservation Board
Kevin Houck	Colorado Water Conservation Board
Thuy Patton	Colorado Water Conservation Board
Tom Browning	Colorado Water Conservation Board
Dawn Gladwell	FEMA Region VIII
John LaBrune	FEMA Region VIII
Julie Baxter	FEMA Region VIII
Michael K. Gease	FEMA Region VIII
Zeke Peters	Unaffiliated
Bill DeGroot	Urban Drainage and Flood Control District
David Mallory	Urban Drainage and Flood Control District
Jeff Brislawn	AMEC Environment and Infrastructure

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 2010. This worksheet also solicited input on the status of existing mitigation actions outlined in the 2010 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. Flood TAP 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 participated in meetings and provided data on flood insurance policies and claims.

2.1.6 Description of Plan Review and Analysis

During the 2013 Plan revision, the Flood TAP 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 Flood TAP 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 2013 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 Flood TAP 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 from the Flood TAP during a period in late October-early November 2013.

Table 3 Changes in the 2013 Plan Revision

Plan Element	Highlights of Update/Revision
Prerequisite Adoption by the State	<ul style="list-style-type: none"> • Language updated for 2013 • Added approval by CWCB Board
Planning Process Documentation of the Planning Process Coordination Among Agencies Program Integration	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Added information on flood events in Colorado since 2010 • Added data from National Flood Hazard Layer (NFHL) • Includes updated rollup of information in local mitigation plans
Mitigation Strategy Hazard Mitigation Goals State Capability Assessment Local Capability Assessment Mitigation Actions Funding Sources	<ul style="list-style-type: none"> • Goals reassessed to reflect current priorities. Minor revisions to Goal 4 • Mitigation Action table expanded and organized by revised goals • Actions revised and prioritized • New actions developed • Updated capability assessment review • Funding sources updated

Plan Element	Highlights of Update/Revision
Coordination of Local Mitigation Planning Local Funding and Technical Assistance Local Plan Integration Prioritizing Local Assistance	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 the update to the Plan. The agencies are identified in the previous sections. Both federal and state agencies were represented on the Flood TAP 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 Flood TAP 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 identified 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
- City of Fort Collins

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
- Urban Drainage and Flood Control District

The Urban Drainage and Flood Control District (UDFCD) is an important partner and stakeholder in flood mitigation in Colorado and active participant on the Flood TAP. UDFCD serves a significant percentage of the state’s population with a wide range of flood mitigation efforts. More information on UDFCD programs and their contributions to flood mitigation are noted in Section 4.3.

2.2.3 Changes in Coordination

The Flood Technical Assistance Partnership mentioned previously has helped formalize coordination on all things flood related at the state, federal and local level. The Flood TAP has assumed the role of what was previously referred to in the 2010 plan as the Flood Mitigation Advisory Committee (FMAC). The former Flood Task Force has also been absorbed into the Flood TAP and the spring and summer meetings of the Water Availability Task Force. In 2012 the former Colorado Division of Emergency Management was moved from DOLA into the DPS Division of Homeland Security and Emergency Management - Office of Emergency Management (OEM). Additional coordination between the CWCB, OEM and the Department of Public Safety occurred following wildfire events that contributed to higher flash flood risk in 2012 and 2013.

Other interagency coordination occurred as part of multi-agency “Stream Teams” formed following the 2013 flood. The Stream Teams integrated state and federal agencies to assess stream channel migration, rehabilitation and other watershed needs as a result of the flooding in September. FEMA initiated the formation of the Team, but state and federal officials determined

that it would be best led by the state. CWCB staff is currently leading the Team. Team members include staff from federal agencies (U.S. Army Corps of Engineers, FEMA, NRCS, Federal Highway Administration), state agencies (CWCB, DWR, CPW, Office of Emergency Management, CDOT, CDPHE -WQCD), and local governments (city and county). The Team met with local communities and held weekly conference calls following the floods.

Colorado also started a Silver Jackets chapter in 2013. The Silver Jackets program provides an opportunity to consistently bring together multiple state, federal, and sometimes tribal and local agencies to learn from one another and apply their knowledge to reduce flood risk. The CWCB, OEM, U.S. Army Corps of Engineers and the Federal Emergency Management Agency (FEMA), will be utilizing Silver Jackets common forum to address the state's flood risk management priorities. The Colorado Silver Jackets group held their first kick-off meeting in May of 2013.

NOAA, through a direct partnership with the CWCB, worked to update the regional rainfall atlas in 2013 which replaced a document that had not been updated since 1973. The CWCB has also had increased coordination with FEMA and USGS on LiDAR acquisition and the Colorado Office of Information Technology regarding GIS data.

CWCB flood and watershed protection staff also participate in the Water Quality and Quantity (or 'QQ') Committee. This committee includes membership from DNR, CWCB, DWR, CDPHE-WQCD, Denver Water, Department of Agriculture, and USGS. The CWCB has also had increased coordination with CDOT regarding implementation of flood standards in the past few years.

The granting agency for the Colorado Flood Mitigation Assistance (FMA) program was transferred from the CWCB to OEM in 2009. CWCB continues to provide technical assistance and related efforts to support OEM and the local applicants on future applications. Additionally, OEM 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 and RiskMAP programs

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. Watershed health and specifically the impact that wildfires and post-wildfire flooding can have on drinking water resources and infrastructure is a consideration within the State Water Plan and related Basin Implementation Plans that are in development in 2013-2014.

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.

The CWCB is also working on efforts to increase local participation in the NFIP’s Community Rating System (CRS). This effort is described further in Section 4.2.1.

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 operated the Map Modernization Program between 2004 and 2009. This was a five year program with a nationwide budget of \$1 billion. The next phase of the Map Modernization Program, Risk MAP, has been underway since 2010. Risk MAP combines flood hazard mapping, risk assessment tools and hazard mitigation planning into one seamless program. The budget for Risk MAP is determined on an annual basis. Colorado continues to provide cost-sharing leverage for DFIRM and future Risk MAP projects. Colorado's Risk MAP program is discussed in more detail in Section 4.2.5.

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? 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 1% annual chance flood event is the standard national measurement for flood mitigation actions and insurance. The 1% annual chance flood, also referred to as the 100-year 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...”¹ 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 1% annual chance flood and another while two other 1% annual chance floods may be separated by 150 years. The 0.2% annual chance flood, or 500-year flood, event is another measurement which “has a 0.2% chance (or 1 in 500) chance of occurring in a given year”.²

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

¹ <http://pubs.usgs.gov/gip/106/>

² (http://pubs.usgs.gov/gip/106/pdf/100-year-flood_041210web.pdf)

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.

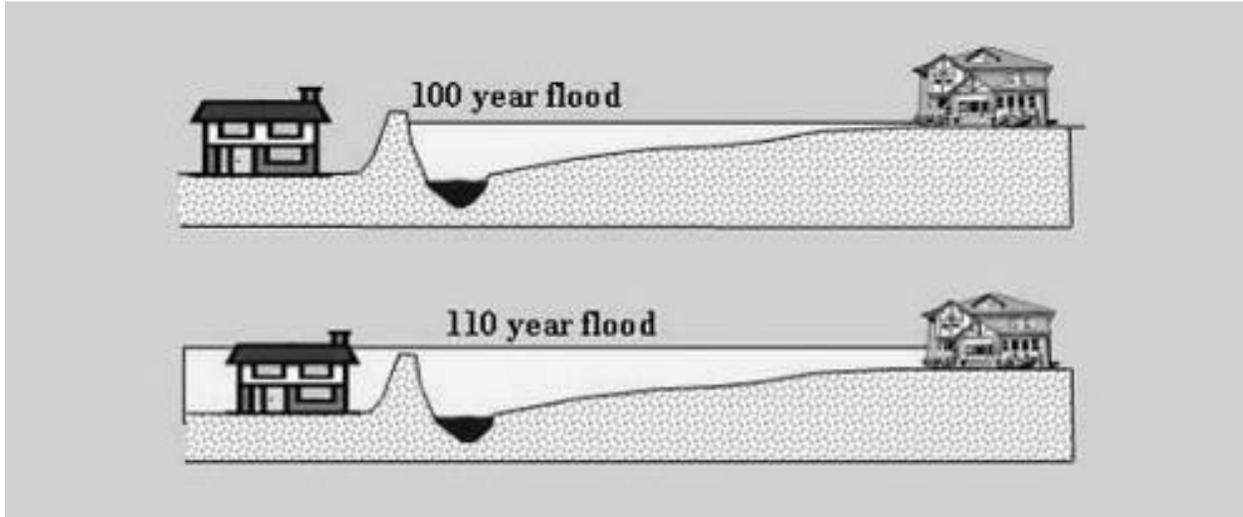
Levee Failure Floods

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, Debris Flows and Erosion Hazards

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.

Avulsion and erosion hazards can result from floods and change the nature, location, and severity of future floods. Avulsion refers to the abandonment of an existing river channel and formation of a new river channel. This process can occur during floods powerful enough to exceed a river's stability threshold. The Town of Jamestown in particular was impacted by avulsions caused by the September 2013 flooding. In many places, the river scoured to bedrock dropping the base of the stream 6 feet or more. In other locations, major avulsions occurred resulting in the channel shifting a considerable distance. Alluvial channels, such as reaches of James and Little James Creeks located in Jamestown, form in response to both valley slope and flood regime. They require areas of relatively less slope and an infrequent flood regime that works to gradually decrease stream base level. Flood events like those observed in September 2013 create a dramatic drop in stream base level, and in response, the surrounding channels will now work to adjust to that change. In some cases, avulsion and erosion cause more damage than inundation when bridges, roads, and other structures are undermined from scour. The loss of infrastructure

is extremely costly to repair or replace in long-term recovery efforts.

Post-Wildfire Floods

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 following severe wildfires and to regularly update the maps.

3.2 Flood Hazard Profile

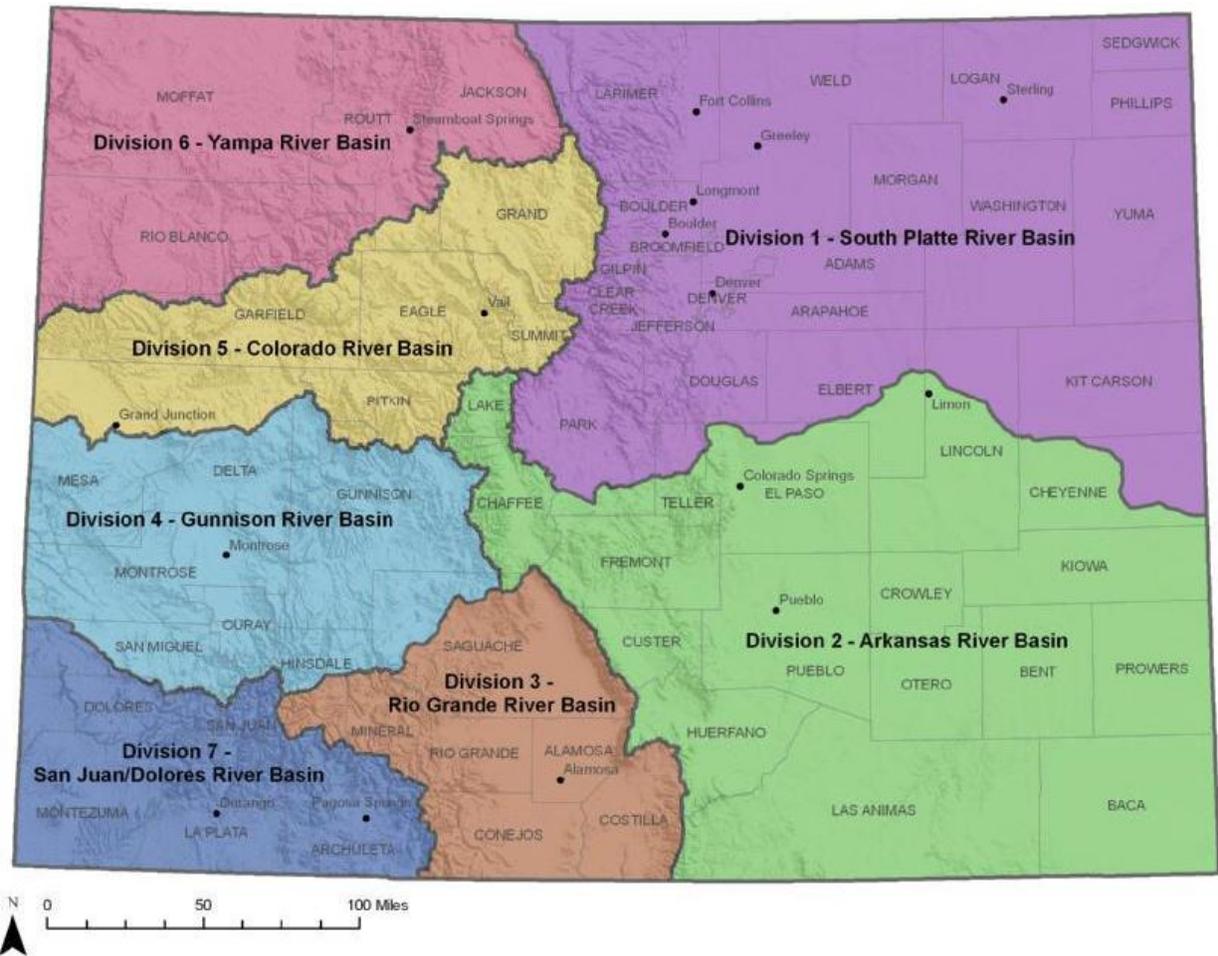
The relationship between flood hazards and population identifies patterns of risk. Such relationships are not new to Colorado. Flooding has occurred here long before people settled in high-risk areas. Risk grows from the increasing overlap between flooding as a natural phenomena and a growing population.

People become vulnerable to hazards when they choose (knowingly or unknowingly) to live near the areas prone to flooding. Vulnerability is also related to preparedness. People who prepare for the occurrence of a flood 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 flood events, the proximity of people to these occurrences, and the degree to which these people are prepared to cope with these natural cycles.

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 270 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 634,265 people and Aurora with 339,030 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 have 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.³

³ <http://cwcbeblink.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 431,834 people and Pueblo with a population of about 107,772. 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.⁴

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 9,433 people, and Monte Vista, with 4,431 people. Historic damages for the basin were estimated at \$12.1 million as of a 2006 study by the CWCB.⁵

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.⁶

⁴ <http://cwcweblink.state.co.us/WebLink/0/doc/113226/Page1.aspx?searchid=f1b625c0-5b1f-4ece-8425-37f76b227b96>

⁵ <http://cwcweblink.state.co.us/weblink/docview.aspx?id=113231&searchhandle=30039>

⁶ 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.⁷

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.⁸

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

⁷ <http://cwbweblink.state.co.us/weblink/0/doc/125202/Page1.aspx?searchid=613f0ec8-2c8d-4d1f-a8c7-45025da55104>

⁸ ftp://dwrftp.state.co.us/cdss/swm/in/YampBasinInfo_20091019.pdf

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.⁹

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.¹⁰

Floodplains

Colorado's mapped floodplains are presented in the figures below. Figure 3 represents DFIRM data from the National Flood Hazard Layer (NFHL) as of September 2013. The NFHL is a database that contains DFIRM data produced from FEMA's Map Modernization and RiskMAP programs. The data are based on effective and available DFIRMs and LOMRs. Figure 3 depicts the 1% and 0.2% annual chance flood zones based on the NFHL as of April 16, 2013. Weld County data is based on the Preliminary DFIRM dated May 31, 2013. Figure 4 illustrates the 1% and 0.2% annual chance DFIRM flood zones in the state that were effective as of July 2010. The difference between the two maps represents the progress made over the past three years in digital flood hazard mapping in Colorado.

In 2010, a FEMA HAZUS-MH study was integrated into the Plan Update. HAZUS-MH is a

⁹ ftp://dwrftp.state.co.us/cdss/swm/in/WhiteBasinInfo_20091102.pdf

¹⁰ ftp://dwrftp.state.co.us/cdss/swm/in/SanJuanInfo_20051101.pdf

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 Flood TAP with a greater understanding of the potential impacts of flooding in Colorado communities. The HAZUS flood zones are shown below in Figure 5. More discussion on the HAZUS analysis is included in Section 3.4.2.

Figure 3 Mapped DFIRM Flood Zones in Colorado 2013

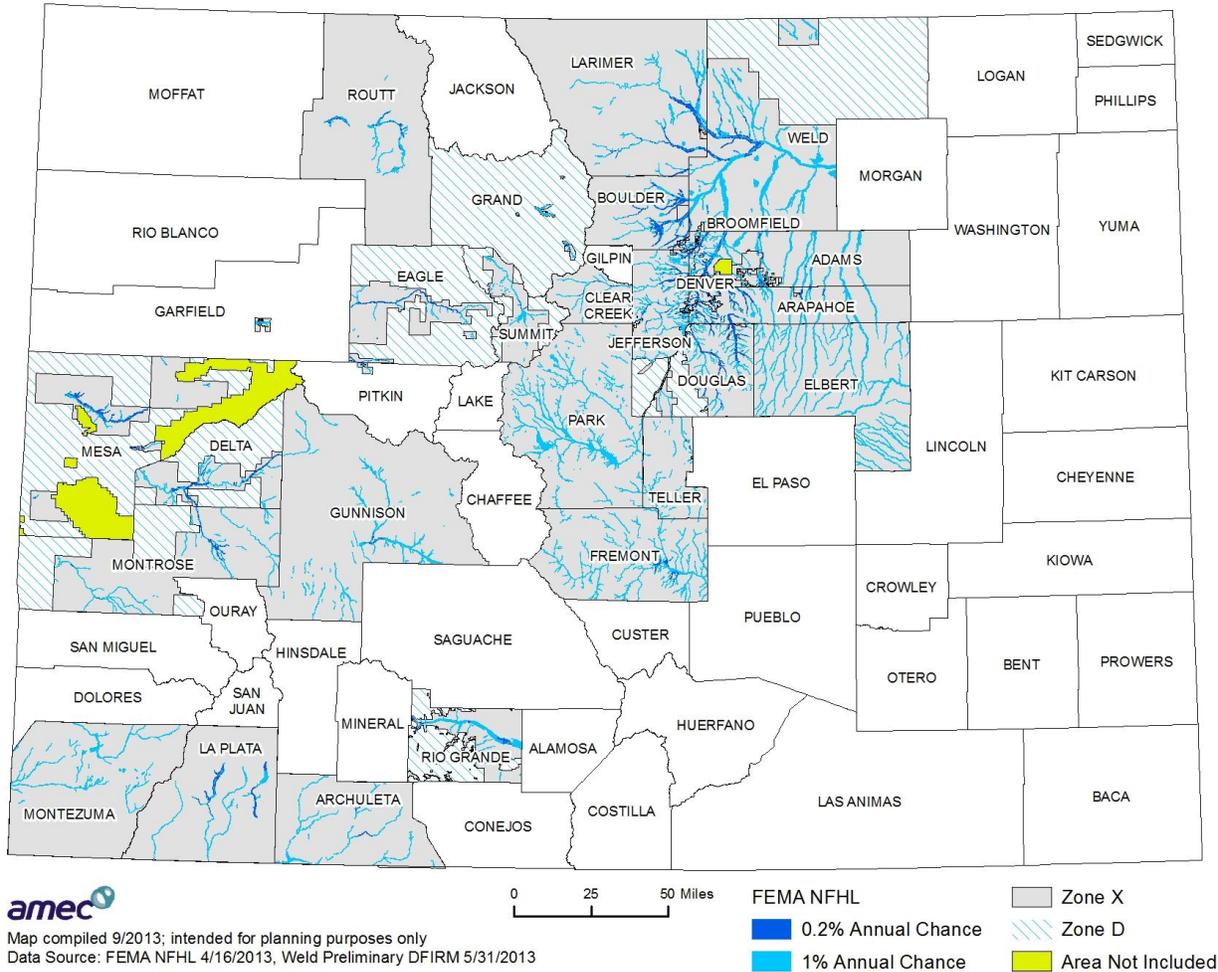
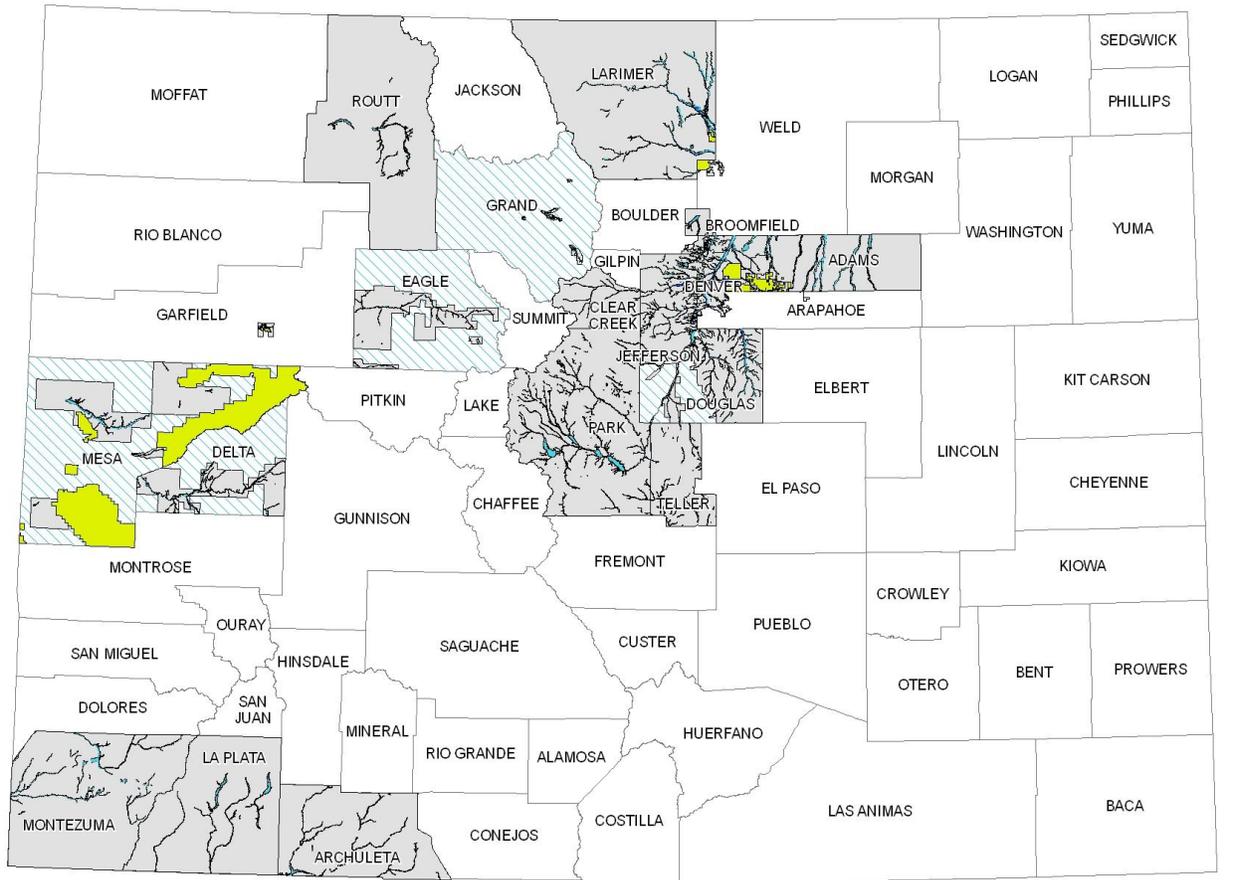
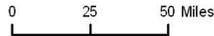


Figure 4 Mapped DFIRM Flood Zones in Colorado in 2010



Map compiled 7/2010; intended for planning purposes only
Data Source: FEMA DFIRM



FEMA DFIRM

0.2% Annual Chance

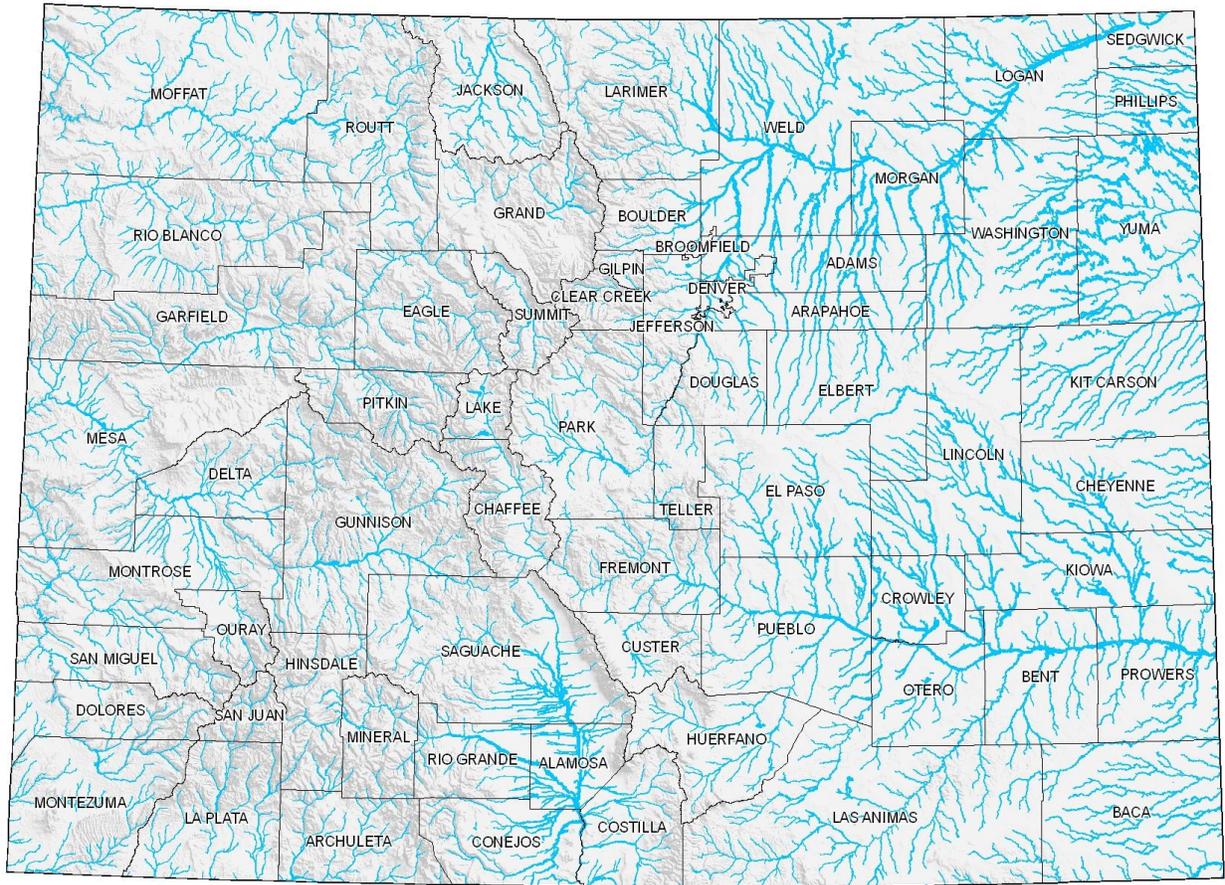
1% Annual Chance

Zone D

Zone X

Area Not Included

Figure 5 HAZUS-MH 1% Annual Chance Floodplains in Colorado



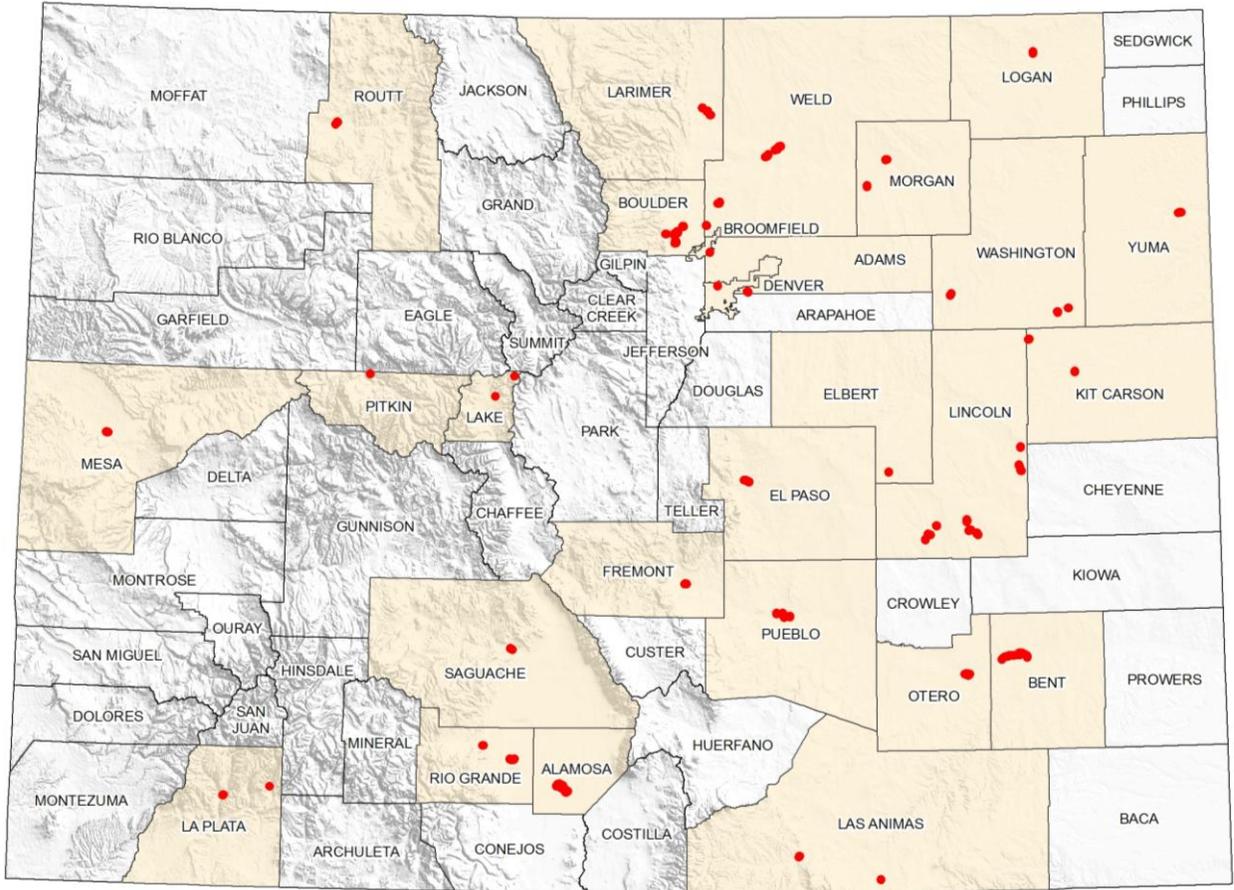
Map compiled 6/2010; intended for planning purposes only
 Data Source: FEMA Region VIII, HAZUS-MR2 MH

0 25 50 Miles

HAZUS 100-year Flood
 Counties

This 2010 Plan update marks the first time that levee failure was identified as a component of the flood hazard within Colorado. Figure 6 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 6 Colorado Levees: Protected Population and Area



Map compiled 10/2013; intended for planning purposes only
 Data Source: FEMA Region VIII Master Levee Inventory Nov 2012

0 25 50 Miles

■ Levee Centerlines
 ■ Counties w/Levees

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 2013 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 \$2.9 billion in damages (2013 dollars) was sustained in the Denver metro area. Note that the damage estimates for the September 2013 flood event are preliminary.

Table 4 Notable Flood Events In Colorado: 1864-2013

Year	Location	Deaths	Damages (2013\$)
1864	Cherry Creek (Denver)	0	\$7,909,480
1896	Bear Creek (Morrison)	27	\$9,039,406
1911	San Juan River (by Pagosa Springs and San Luis Valley)	2	\$7,909,480
1912	Cherry Creek (Denver)	2	\$176,268,427
1921	Arkansas River (Pueblo)	78	\$1,116,366,705
1935	Monument Creek (Colorado Springs)	18	\$76,834,955
1935	Kiowa Creek near Kiowa	9	\$22,598,516
1942	South Platte River Basin	?	\$12,203,199
1955	Purgatorie River (Trinidad)	2	\$53,106,513
1956*	Denver, Jefferson, Arapahoe Counties		unknown
1957	Western Colorado	0	\$25,988,294
1965*	South Platte River (Denver)	8	\$2,937,807,117
1965	Arkansas River Basin	16	\$301,690,192
1969*	South Platte River Basin	0	\$31,637,922
1970*	Southwest Colorado	0	\$19,208,739
1973*	South Platte River (Denver)	10	\$570,612,535
1976*	Big Thompson River (Larimer)	144	\$124,291,839
1982*	Fall River (Estes Park)	3	\$72,315,251
1983	North Central Counties	10	\$38,417,477
1984*	West & Northwest Counties	2	\$68,925,474
1993	Western Slope	0	\$3,050,800
1995	Western Slope & South Platte	21	\$76,834,955
1997*	Fort Collins & 13 East Counties	6	\$458,625,795
1999*	Col. Springs, 12 East Counties	0	\$146,890,355
2000-6	Statewide Various Events	5	\$125,421,765
2006	Beaver, Brush Hollow and Eightmile Creeks (Fremont County)	0	\$2,147,614
2006	Horse Creek, West Creek (Douglas)	0	\$14,281,634
2006	Vallecito Creek (La Plata)	0	\$1,073,807
2007	Chalk Creek Canyon (Chaffee)	0	\$1,073,807
2007	Chalk Creek Canyon (mudflows)	0	\$2,147,614
2009	Six Mile Creek	0	\$344,692
2010	Statewide flooding (various events)	0	\$846,160
2013	Front Range and Northeast Counties	9	\$2,000,000,000 est. as of October 2013
Totals		372	\$8,505,870,518

Sources: Colorado Flood Hazard Mitigation Plan 2007, NCDC, SHELDUS

NOAA NWS (<http://www.crh.noaa.gov/bou/?n=floods>)

*Denotes federal disaster declaration event

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.

In July 2011 after 2 inches of rain fell in less than an hour in the Fourmile Fire burn area, a 4-foot surge of water rushed down Boulder Creek. At least one home was damaged and debris was deposited on many roads.

El Paso and Larimer counties dealt with flash flooding from heavy rains during the summer of 2012 and 2013 as a result of rainfall on areas burned by the Waldo Canyon and High Park Fires, respectively.

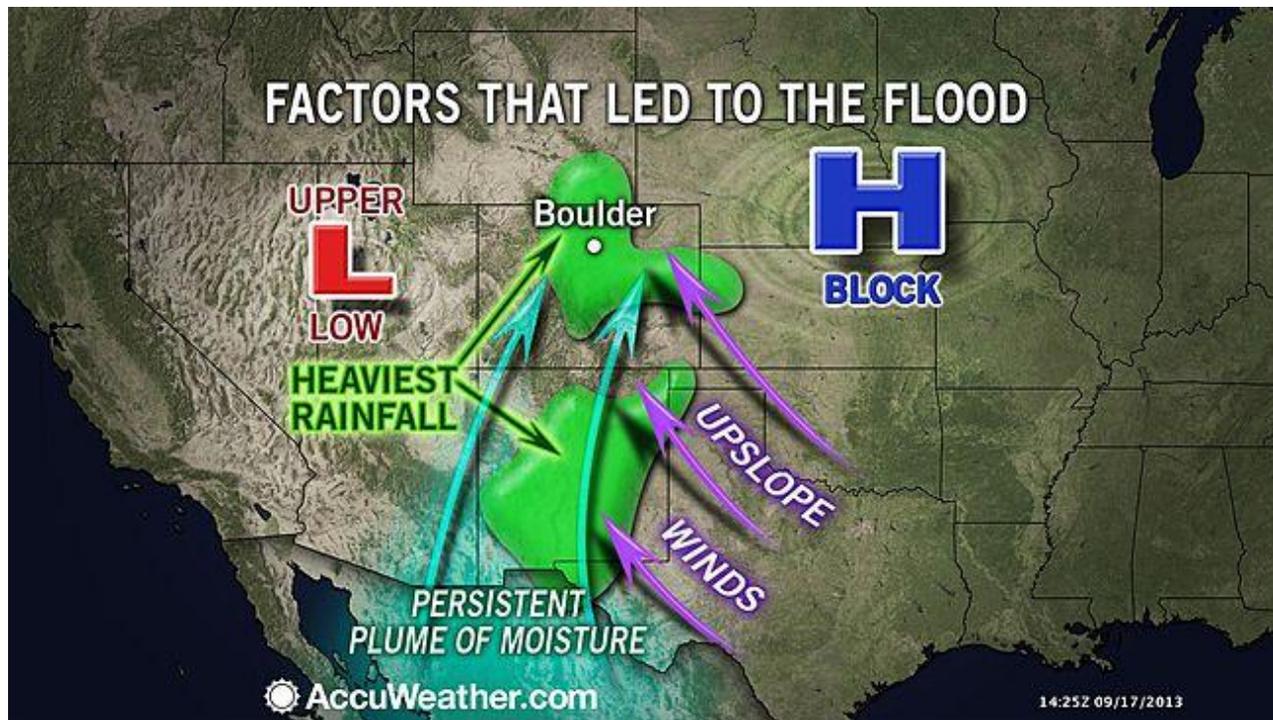
September 2013 Flood Event

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

“The key weather players during the September 2013 flooding event were a large swath of tropical moisture over the Rockies (referred to as the Monsoon by locals), a large area of high pressure over the Midwest and a storm in the upper atmosphere over the Great Basin. The moisture over the Rockies was literally being squeezed from both sides by the high to the east and the dry air rotating in from the Great Basin around the upper-level storm. This squeezing resulted in a much more vertical profile of moisture than would have occurred without either system present. The high over the Midwest also drove additional air thousands of feet uphill from the Plains to the foothills and Rockies. This action released extra moisture and further enhanced the rainfall. The high over the Midwest acted like a giant roadblock and turned what would have been a several-hour event into a week-long ordeal. The result was a plume of heavy rain that re-fired on an almost daily basis from New Mexico to Colorado and southern Wyoming. While the Flood of 1976 was more intense over a small area and the Flood of 1965 was intense

and lasted for days, the Flood of 2013 lasted nearly a week and covered hundreds of square miles in multiple states. Rainfall exceeded 12 inches at a number of locations.”¹¹

Figure 7 Weather Conditions that Led to September 2013 Flooding



Source: <http://www.accuweather.com/en/weather-news/colorado-flooding-why-so-bad/17861732>

As of October 2013, damages from the floods were estimated at over \$2 billion. Nine people were killed by the floods, mudslides, and debris flows. Twenty counties were included in the disaster designation and received public assistance or a combination of individual and public assistance. Designated counties that received both types of assistance included Larimer, Weld, Logan, Morgan, Boulder, Clear Creek, Jefferson, Adams, Arapahoe, Fremont, and El Paso. Counties that received public assistance only included Sedgwick, Washington, Lincoln, Crowley, Pueblo, Lake, Gilpin, Denver, and Broomfield. Boulder County was the most impacted, with several communities being isolated for weeks after the storms due to road damages and closures. Devastating damage occurred in Lyons, Longmont, Jamestown, and other communities in Boulder County. Thousands of homes and buildings were damaged or destroyed, forcing several thousand people and pets to evacuate. Many bridges, roads, and railroads were also damaged or destroyed. Highways 72, 36, 7, 119, 287, 34, and others suffered significant damage, in addition to county roads and bridges and private bridges. Some sections of these highways and roads were closed for several weeks after the floods, displacing thousands of residents in the Front

¹¹ <http://www.accuweather.com/en/weather-news/colorado-flooding-why-so-bad/17861732>

Range foothills. The floods also caused crop damage, particularly in agricultural communities in northeast Colorado.

Table 5 summarizes FEMA Region VIII flood impact data from the FEMA Modeling Impact Task Force (MOTF). The MOTF is a group of modeling and risk analyst experts from FEMA Regions VIII (Denver) and IV (Atlanta) that is activated in support of major disaster response operations. The table lists affected counties and their impact rank, estimated NFIP claims, and total number of damaged households, as of October 2013. The impact rank was estimated using a jurisdiction loss ratio which was derived from dividing the number of directly damaged households by the total number of households for each jurisdiction. The highest jurisdiction loss ratios were in Jamestown (~34%), Lyons (~27%), City of Boulder (~14%) and County of Boulder (~12%). Final damage and impact assessments will be captured in future updates to this plan after the damages and losses are fully accounted for.

The September 2013 flooding caused significant impacts to the oil and gas industry in the state. Thousands of facilities were impacted by standing or flowing water. Fortunately, many wells were shut down prior to the storm to help prevent environmental contamination.¹² The Colorado Oil and Gas Association (COGA) began assessing thousands of facilities once rescue operations and immediate emergency response were complete. The tests did not find any pollutants associated with oil and gas spills but did find high levels of E. coli, particularly in the Boulder Creek and Big Thompson River watersheds.¹³

Table 5 September 2013 Flooding Impact Rank by County

County	Impact Rank	# of Estimated NFIP Claims	\$ Value of Estimated NFIP Claims	Total # of Damaged Households
Adams	High	7	\$48,500	659
Arapahoe	High	35	\$536,500	1,897
Boulder	Very High	1,350	\$18,643,640	9,815
Broomfield	Low	1	\$0	0
Clear Creek	Very High	5	\$82,500	100
Crowley	Low	0	\$0	0
Denver	Low	4	\$94,000	0
El Paso	High	162	\$2,109,500	724
Fremont	Moderate	4	\$71,000	9
Gilpin	Low	0	\$0	0
Jefferson	Moderate	48	\$615,400	541

¹² <http://denver.cbslocal.com/2013/09/16/flood-waters-impact-oil-gas-wells-impact-unclear/>

¹³ <http://www.coga.org/index.php/Events/ColoradoFloods#sthash.5513rO2X.dpbs>

County	Impact Rank	# of Estimated NFIP Claims	\$ Value of Estimated NFIP Claims	Total # of Damaged Households
Lake	Low	0	\$0	0
Larimer	Very High	267	\$2,836,400	1,216
Lincoln	Low	0	\$0	0
Logan	Very High	17	\$133,000	104
Morgan	Moderate	8	\$80,500	12
Pueblo	Low	2	\$21,500	0
Sedgwick	Low	0	\$0	0
Washington	Low	0	\$0	0
Weld	Very High	90	\$1,000,500	1,185
Total	High	2,000	\$26,272,940	16,262

Source: FEMA Region VIII as of October 25, 2013

*Very High: Greater than 1% of households damaged

High: Greater than 0.25% and less than or equal to 1% of households damaged

Moderate: Greater than 0% and less than or equal to 0.25% of households damaged

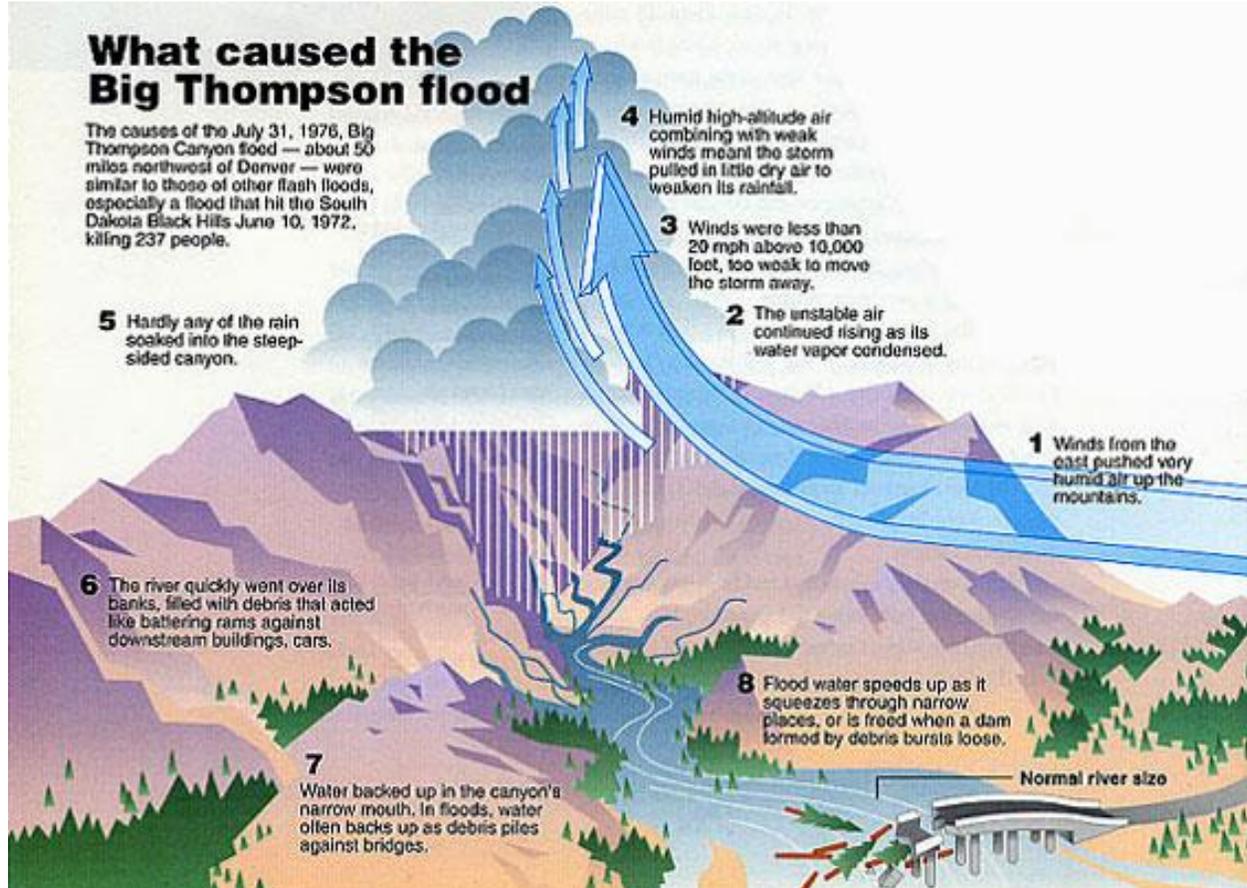
Low: 0% of households damaged

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 8). 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.”¹⁴ The Big Thompson flood remains the deadliest natural disaster in Colorado to date.

¹⁴ <http://www.noaanews.noaa.gov/stories/s688.htm>

Figure 8 1976 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.

In July 2011, a thunderstorm dropped as much as 3 inches of rain in 90 minutes in parts of Denver. Dozens of people were rescued from cars stranded in the flooded streets.

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.

Rivers in the South Platte, North Platte, Yampa/White, Colorado, and Gunnison watersheds experienced snowmelt runoff in 2011 that had not been seen in several years or even decades. High snowpack combined with runoff from a cool and wet May resulted in many smaller

watersheds reading well above normal levels on June 1st. Had it not been for the cool temperatures and gradual snowmelt the flood season could have been far worse. The Elk River near Steamboat Springs set a new record flow at 7,400 cubic feet per second on June 6th, which is in excess of a 1% annual chance event. Other rivers that experienced very high flows included the Colorado River, the Yampa River, the Eagle River, the Gunnison River, Tenmile Creek, the Blue River, and the Fraser River. The Colorado River peaked at 48,000 cfs at the Utah State Line, which was the highest recorded flow since 1984.¹⁵

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

¹⁵ http://cwcb.state.co.us/water-management/flood/Documents/Floodstage_Nov2011.pdf

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.

The Riverside Park levee failed in Evans during the September 2013 flooding. The floodwaters created a 70-foot gap in the levee. The flood put the sewage treatment plant out of operation, leaving residents unable to shower or flush their toilets for over a week.¹⁶

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-

¹⁶ Ashleigh Walters. "Evans residents can now flush toilets." ABC 7 News Colorado. September 21, 2013. <http://www.thedenverchannel.com/news/local-news/evans-residents-can-now-flush-toilets>

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.

Nine low-risk dams were breached during the September 2013 flooding, and many small ponds that are not inspected by the state overflowed. Five small dams in the Big Elk Meadows area of Larimer County failed. Several dams in Boulder County were overtopped, but fortunately none of these experienced structural failure.¹⁷ The storm resulted in spillway flows from roughly 70 reservoirs in the state. None of the high or significant hazard dams failed. Following the flooding, the dam safety branch of Colorado's Division of Water Resources headed the largest emergency dam inspection initiative in Colorado history.¹⁸ Emergency measures were taken at 14 locations to clear out clogged outlet ditches to prevent more overflows or structural failures. Dams with structural deficiencies were restricted to little to no water storage.

Alluvial Fans, Debris Flows and Erosion

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 or streambank erosion. Massive sediment deposits literally buried some homes and other structures, seen in Figure 9.

¹⁷ http://www.denverpost.com/environment/ci_24080336/dams-break-at-rocky-mountain-arsenal-and-larimer

¹⁸ http://www.denverpost.com/news/ci_24153355/colorado-launching-massive-emergency-dam-inspection-progam

Figure 9 **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.¹⁹

Debris flows and erosion associated with channel migration in many areas caused more damage than the floodwaters during the September 2013 floods. Debris flows and mudslides killed a man in Jamestown on September 12, 2013. His home was crushed by 12 feet of rocks and mud. The 2013 floods also created problems with erosion and sedimentation. Erosion damaged or destroyed many state highways, roads and bridges. Houses located along stream channels were also damaged or threatened by erosion. CDOT has gradually reopened roads after completing temporary repair projects, but full restoration will take years to complete. Erosion and sediment distribution can drastically change the course of rivers and streams or clog stream channels,

¹⁹ <http://geosurvey.state.co.us/Default.aspx?tabid=378>)

altering the floodplain.

Post-Wildfire Floods

Flooding in Colorado has been exacerbated by wildfires in recent years. The Boulder area was afflicted by the Flagstaff fire in 2012 and the Fourmile Canyon fire in 2010. The Black Forest (2013), Waldo Canyon (2012), and High Park (2012) fires were devastating to watersheds in the Colorado Springs and Fort Collins areas. In July and August 2013 deadly flash floods and mudslides caused several million dollars in damages and claimed one life in Manitou Springs, located just south of the Waldo Canyon fire burn area. In all these cases, scorched soils and lack of vegetation made burn areas more susceptible to severe flash flooding and mudslides. There are several initiatives among local, state, and federal agencies to mitigate the potential impact of flash floods and mudslides in post-burn areas. For example, USFS, CDOT, Colorado Springs Utilities, and local government have constructed or planned retaining walls, sediment ponds, catchment basins, and debris fences in the Colorado Springs area.

2012 was the most devastating wildfire season in Colorado since 2002. Several separate fires occurred between June and August, including large magnitude fires that threatened or destroyed hundreds of homes. The Waldo Canyon and High Park fires were the most destructive. A combination of a dry winter and an atypically hot, dry summer created dangerous wildfire conditions. Wildfires kill vegetation that anchors soil and absorbs rain and snowmelt waters. Without these protections in place post-wildfire areas are highly susceptible to flash floods and mudslides, especially along steep slopes. These conditions contributed to the severe magnitude of the September 2013 floods and other flood and mudslide events, such as the mudslides in Manitou Springs in July and August 2013.

Mudslides and flash flooding in Manitou Springs caused several million dollars in damages in July and August 2013 and one fatality in August 2013. Highway 24, which runs through Manitou Springs, was previously closed due to mudslides in July 2012. Mudslides also occurred in the Fourmile Canyon burn area in Boulder County in 2011, and along Highway 14 in Larimer County in the Poudre Canyon during July 2012 and July 2013. Rain events do not have to be unusually heavy or sustained to cause mudslides in post-burn areas. The mudslides can carry massive boulders and trees, causing more damage to structures and roads. The potential for mudslides and flash floods after wildfires can last for several years.

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 in addition to the North Fork Volunteer Fire Department

Station #1 and a new ambulance and tanker truck. Sediment and debris piled up in the North Fork of the South Platte River and in Strontia Springs Reservoir. Problems from sediment deposition, lack of vegetation and hydrophobic soils continue to be an issue even 15 years later.²⁰

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 1959 and 2013, Colorado experienced eleven major flood disasters as indicated below:

- 1956 (DR-59): Front Range
- 1965 (DR-200): 33 Front Range communities
- 1969 (DR-261): 15 Front Range communities
- 1970 (DR-293): Southwestern Colorado
- 1973 (DR-396 and DR-385)): 13 Front Range communities
- 1976 (DR-517): 2 Front Range communities
- 1982 (DR-665): Larimer County (dam failure)
- 1984 (DR-719): 15 Western Slope counties
- 1997 (DR-1186): 13 Eastern Colorado counties
- 1999 (DR-1276): 12 Southeastern Colorado counties
- 2013 (DR-4145): 11 Front Range and Northeastern Colorado counties including Adams, Arapahoe, Boulder, Clear Creek, El Paso, Fremont, Jefferson, Larimer, Logan, Morgan, and Weld

Based on this flood history, Colorado experiences a major flood disaster roughly once every five years. The state faces an approximately 19% 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

²⁰ http://www.landandwater.com/features/vol41no1/vol41no1_1.html

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 6 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 6 EMAP Consequence/Impact Analysis: Flood

EMAP Risk Assessment Subject Area	Detrimental Impacts
Health and Safety of Persons in the Area at Time of Incident	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Damage to facilities/personnel in incident area may require temporary relocation of some operations.
Property, Facilities, and Infrastructure	<ul style="list-style-type: none"> • 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. These facilities have no flood hazard mitigation plans as of 2013.

EMAP Risk Assessment Subject Area	Detrimental Impacts
Delivery of Services	<ul style="list-style-type: none"> • Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services. • OEM 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.
The Environment	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Local economy and finances adversely affected, possibly for an extended period of time depending on damage and length of investigation.
Regulatory and Contractual Obligations	<ul style="list-style-type: none"> • Regulatory waivers may be needed locally. • Fulfillment of some contracts may be difficult. Impact may temporarily reduce deliveries.
Public Confidence in the Jurisdiction’s Governance	<ul style="list-style-type: none"> • Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective. • State must balance <i>over</i> and <i>under</i> response to the hazard. • Regarding levees, localized impact expected to adversely affect confidence in local, state, and federal government, regardless of the levee owner.

The Division of Water Resources as of fall 2013 was in the process of completing a social vulnerability assessment based on dam failure inundation. The intent of the project was to develop information to improve DWR’s decision making support system by reassessing prioritization of dam safety and emergency management activities. The results of this study should be available for future updates to this plan.

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 October 2013, 4 regional plans, 32 county-level mitigation plans, 2 city-level plans, 1 university plan, 2 tribal plans, and 1 fire rescue authority plan in Colorado 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 7.

Table 7 Local Hazard Mitigation Plans Identifying Flooding as a Planning Priority

Name of Plan	Community	Flood Hazard Priority	Comment
<i>Alamosa County Multi-Hazard Mitigation Plan</i>	Alamosa County and incorporated jurisdictions	High	
<i>Archuleta County Multi-Hazard Mitigation Plan</i>	Archuleta County, incorporated jurisdictions, and special districts	High	
<i>Boulder County Multi-Hazard Mitigation Plan</i>	Boulder County and incorporated jurisdictions and selected special districts (except City of Boulder)	High	
<i>City of Boulder Multi-Hazard Mitigation Plan</i>	City of Boulder	High	
<i>University of Colorado (CU) Boulder Multi-Hazard Mitigation Disaster Resistant University Plan</i>	CU Boulder	High	
<i>City of Colorado Springs Pre-Disaster Mitigation Plan Update</i>	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
<i>Conejos County Multi-Hazard Mitigation Plan</i>	Conejos County and incorporated jurisdictions	Medium	
<i>Costilla County Multi-Jurisdictional Multi-Hazard Mitigation Plan</i>	Costilla County and incorporated jurisdictions	Moderate	

Name of Plan	Community	Flood Hazard Priority	Comment
<i>Delta County Multi-Hazard Mitigation Plan</i>	Delta County, incorporated jurisdictions and selected special districts	High	
<i>Denver Regional Natural Hazard Mitigation Plan</i>	Adams, Arapahoe, Broomfield, Clear Creek, Denver, Douglas, and Gilpin Counties (and incorporated jurisdictions)	High (across entire planning area)	
<i>Pre-Disaster Mitigation Plan for: Dolores County, Town of Dove Creek, and Town of Rico</i>	Dolores County and incorporated jurisdictions	High	
<i>Eagle County Pre-Disaster Mitigation Plan</i>	Eagle County and incorporated jurisdictions	Medium	
<i>Elbert County Multi-Hazard Mitigation Plan Update</i>	Elbert County, incorporated jurisdictions and selected special districts	High	Ranking for the county, not individual jurisdictions
<i>El Paso County All-Hazards Pre-Disaster Mitigation Plan</i>	Unincorporated El Paso County	Included in Plan	The plan identifies and assesses flood related risks; develops flood related mitigation actions
<i>Garfield County Natural Hazards Mitigation Plan</i>	Garfield County and incorporated jurisdictions	Included in Plan	
<i>Grand County Multi-Hazard Mitigation Plan</i>	Grand County, incorporated jurisdictions, and special districts	Medium	
<i>Gunnison County Natural Hazard Mitigation Plan</i>	Gunnison County, incorporated jurisdictions, and special districts	High	
<i>Hinsdale County All-Hazard Mitigation Plan</i>	Hinsdale County	"Low Risk"	Plan expired in 2009
<i>Multi-Jurisdictional All-Hazards Pre-Disaster Mitigation Plan for Huerfano County</i>	Huerfano County and incorporated jurisdictions	Medium	
<i>Jefferson County Multi-Hazard Mitigation Plan</i>	Jefferson County and incorporated jurisdictions	High	
<i>Lake County Pre-Disaster Mitigation Plan</i>	Lake County and incorporated jurisdictions	Medium	In review
<i>La Plata County Hazard Mitigation Plan</i>	La Plata County and incorporated jurisdictions	High	Approval pending adoption
<i>Mesa County Hazard Mitigation Plan</i>	Mesa County and incorporated jurisdictions	High	
<i>Mineral County Multi-Hazard Mitigation Plan</i>	Mineral County and incorporated jurisdictions	High	
<i>Montrose County Pre-Disaster Hazard Mitigation Plan</i>	Montrose County, City of Montrose, Town of Olathe	Significance: Medium Severity: High Probability: Moderate	

Name of Plan	Community	Flood Hazard Priority	Comment
<i>Northeast Colorado Regional Hazard Mitigation Plan</i>	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	
	Yuma County and incorporated jurisdictions	High	
<i>Northern Colorado Regional Hazard Mitigation Plan</i>	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
<i>Ouray County Multi-Hazard Mitigation Plan</i>	Ouray County and incorporated jurisdictions	High	
<i>Park County Multi-Jurisdictional Multi-Hazard Mitigation Plan</i>	Park County, incorporated jurisdictions and selected special districts	High	
<i>Pitkin County Pre-Disaster Mitigation Plan Update</i>	Pitkin County and incorporated jurisdictions	High	
<i>Natural Hazard Mitigation Plan for Pueblo County</i>	Pueblo County and incorporated jurisdictions	High	
<i>Rio Blanco County Pre-Disaster Natural Hazards Strategic Mitigation Plan</i>	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
<i>Rio Grande County Multi-Hazard Mitigation Plan</i>	Rio Grande County and incorporated jurisdictions	High	
<i>Routt County Multi-Hazard Mitigation Plan</i>	Routt County and incorporated jurisdictions	Included in Plan	
<i>Saguache County Multi-Hazard Mitigation Plan</i>	Saguache County and incorporated jurisdictions	Medium	
<i>San Miguel County All-Hazard Mitigation Plan</i>	San Miguel County and incorporated jurisdictions	High	

Name of Plan	Community	Flood Hazard Priority	Comment
<i>South Metropolitan Fire Recue Authority Hazard Mitigation Plan</i>	South Metro Fire Rescue Authority	Low	
<i>Southeast Colorado Regional Hazard Mitigation Plan</i>	Baca County and incorporated jurisdictions	Medium	Approval pending adoption
	Bent County and incorporated jurisdictions	Medium	
	Crowley County and incorporated jurisdictions	Medium	
	Kiowa County and incorporated jurisdictions	Medium	
	Otero County and incorporated jurisdictions	Medium	
	Prowers County and incorporated jurisdictions	Medium	
<i>Southern Ute Tribal Hazard Mitigation Plan</i>	Southern Ute Indian Tribe	High	
<i>Summit County Multi-Hazard Mitigation Plan</i>	Summit County and incorporated jurisdictions	High	
<i>Teller County Multi-Hazard Mitigation Plan</i>	Teller County and incorporated jurisdictions	Medium	
<i>Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for Upper Arkansas Area</i>	Chaffee, Custer, Fremont, and Lake Counties (and incorporated jurisdictions)	Flash Flood 2 nd of 22 Hazards; Seasonal Flood 7 th of 22 Hazards	Expired in 2009
<i>Ute Mountain Ute Tribal Hazard Mitigation Plan</i>	Ute Mountain Ute Tribe	High	

Source: Colorado Division of Emergency Management

The results in Table 7 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 8, 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 8 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 8. Numbers for Archuleta, Grand, Gunnison, Ouray, and Summit counties combine the 1% and 0.2% annual chance flood loss estimates.

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.

The 2013 State Hazard Mitigation Plan update built on and expanded upon the previous State Hazard Mitigation Plan’s risk assessment. In addition to incorporating information from the previous State Hazard Mitigation Plan and subject matter experts, information about Colorado’s hazard risks was obtained by consulting local hazard mitigation plans.

The State Hazard Mitigation Plan update process is closely integrated with local jurisdiction and tribal planning efforts. Similar to the process used to develop the 2010 SHMP, the 2013 plan update includes an analysis and data roll-up of risk assessment information from 42 local hazard mitigation plans (4 regions, 32 counties, 2 cities, 1 university, 2 Tribes, and 1 Fire Rescue Authority).

Any and all information related to the following categories was collected from each local plan and integrated into the risk assessment of the 2013 State Plan update:

- Hazard Rankings
- Loss Estimates
- Mitigation Actions by Hazard Type
- Mitigation Action Categories
- Local Capabilities

Local hazards were given a priority ranking of high, medium, or low. Additionally, the mitigation actions from each local jurisdiction were categorized by priority (high, medium, or low), by hazard, and by mitigation category – prevention, property protection, natural resource protection, education/outreach, emergency services, structural, and/or NFIP participation. The data was then compiled into a spreadsheet to facilitate the detailed review and comparison between jurisdictions and CO Emergency Management Regions. Ultimately, the information was used to categorize mitigation priority areas in each jurisdiction, to identify patterns in mitigation strategies across jurisdictions, and to highlight gaps between local risk perception and vulnerability. The raw data from the local mitigation plan rollup is captured separately in Appendix B.

Table 8 Vulnerabilities Identified in Local Multi-Hazard Mitigation Plans

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
Adams	High	10,000	3,561		\$772,000,000 in building exposure \$505,000,000 in contents exposure	162,000	163	\$31,091,441	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	High					--	--	--	Did not go into detail on flood loss estimates and vulnerabilities
Arapahoe	High	11,100	6,151		\$1,153,000,000 in building exposure \$901,000,000 in contents exposure	229,000	207	\$314,021	While overall development has slowed down, some of the development has occurred in hazard areas such as the wildland urban interface and floodplains. These trends are analyzed further in the following discussions respective to the hazard, where applicable.
Archuleta	High	539	391	3	\$14,715,179	18,356	63	\$40,700,000	
Baca	Medium				\$2,367,000				Loss estimates based on HAZUS Level 1. Further details not available.
Bent	Medium				\$5,503,000	3,566	297	\$5,503,000	Loss estimates based on HAZUS Level 1. Further details not available.
City of Boulder	High	7,851 (1% chance flood zone) 15,144 (0.2% chance flood zone)	2,021 (1% chance flood) 4,588 (0.2% chance flood)	78	\$489,967,000 (1% chance flood) \$1,210,428,000 (0.2% chance flood)	35,785	447	\$12,984,069,000	

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
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 1% annual chance 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)
University of Colorado-Boulder	High					--	40	\$87,370,100	Further details not available
Broomfield	High	20	10		\$1,153,000,000 in building exposure \$901,000,000 in contents exposure	20,000	21	--	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Chaffee	Medium						--	--	Did not go into detail on loss estimates
Cheyenne	Medium	168 (displaced)	1922 (building count)	11 + 1 scour bridge	\$6,151,000	5,237	10	\$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		8	\$1,151,889	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 by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
City of Colorado Springs	High					5,562	2425	\$507,896,000	Further details not available
Conejos	Medium								Further details not available
Costilla	Moderate			1		--	1	\$128,510,217	Did not go into detail on loss estimates
Crowley	Medium				\$15,848,000				Loss estimates based on HAZUS Level 1. Further details not available.
Custer	Medium					--	--	--	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	--	244	\$346,115,893	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Dolores	High					--	--	--	Did not go into detail on loss estimates
Douglas	High	7,800	5,726		\$1,274,000,000 in building exposure \$686,000,000 in contents exposure	--	137	\$22,308,421,382	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Eagle	Medium								Did not go into detail on loss estimates

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
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	Medium					--	--	--	Did not go into detail on loss estimates
Garfield	Included in plan								Further details not available
Gilpin	High	30	10		\$3,000,000 in building exposure \$1,400,000 in contents exposure	--	8	\$1,022,495,344	Exposure estimate calculated from approximate total cost for potentially exposed residential, commercial, industrial, and public buildings in flood hazard areas
Grand	Medium	393	229	2	\$19,103,845	15,615	170	\$5,928,540,055	
Gunnison	High	1,167	645	4	\$53,917,278	15,455		\$4,527,605,019	
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	Medium					--	--	--	Did not go into detail on loss estimates
Jackson									No Plan

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
Jefferson	High	19,623	1,592	16 + 6 scour bridges	\$723,216,000	1,592	11	\$723,216,000	Loss estimate based on HAZUS-MH data
Kiowa	Medium				\$2,365,000				Loss estimates based on HAZUS Level 1. Further details not available.
Kit Carson	Medium	103 (displaced)	0 (according to 2008 State HMP)	0 + 4 scour bridges	\$3,060,000	--	--	\$3,060,000	
Lake	Medium								Did not go into detail on loss estimates
La Plata	High					195	--	\$1,641,338,000	Further details not available
Larimer	Included in plan				\$750,000				Did not go into detail on loss estimates
Las Animas									No plan
Lincoln	High	312 (displaced)	172 (per 2008 State Plan)	42 + 5 scour bridges	\$8,920,000	3,899	39	\$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	11,912	9	\$52,966,000	
Mesa	High					--	--	--	Did not go into detail on loss estimates
Mineral	High					1,565	2	\$6,050,000	Further details not available
Moffat									No plan
Montezuma									No plan

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
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	13,601	11	\$97,477,000	Loss estimates based on HAZUS-MH data
Otero	Medium				\$40,756,000				Loss estimates based on HAZUS Level 1. Further details not available.
Ouray	High	320	247	8	\$26,261,634	2,900		\$1,188,636,905	Loss estimates based on GIS data
Park	Moderate					--	--	--	Detailed information not available
Phillips	High	935 (displaced)	135 (per 2008 State Plan)	68 + 4 scour bridges	\$27,783,000	3,996	68	\$27,783,000	
Pitkin	High					10,913	56	\$1,160,142,000	Did not go into detail on loss estimates
Prowers	Medium				\$112,838,000				Loss estimates based on HAZUS Level 1. Further details not available.
Pueblo	High					1,418	--	\$1,205,174,000	
Rio Blanco	Included in plan								Did not go into detail on loss estimates
Rio Grande	High					--	--	--	Detailed information not available
Routt	Included in plan								Detailed information not available
Saguache	Medium								Detailed information not available
San Juan									No plan

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
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	2,299	22	\$5,079,000	
Southern Ute Tribe	High					138	99	\$54,496,108	Further details not available
Summit	High	1,317	533	2	\$212,724,224	14,467	213	\$17,037,572,299	"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)

County	Level of Risk Identified in Local Plan	Population Affected by Flood	# of Structures Affected by Flood	# of Critical Facilities Affected by Flood	Potential Flood Loss (total \$ value)	Total Number of Structures	Total Number of Critical Facilities	Total Exposure (\$)	Comments
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 1% annual chance 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)
Ute Mountain Ute Tribe	High	5	71		\$176,000	562	--	\$46,312,000	
Washington	High	328 (displaced)	16 (per 2008 State Plan)	1 + 5 scour bridges	\$6,798,000	3,611	1	\$6,798,000	
Weld	High	8,307 (displaced)	172 (per 2008 State Plan)	167 +12 scour bridges	\$199,438,000	2,191,153	167	\$199,438,000	See pages 17-18 in the Weld County Planning Element for information on development trends
Yuma	High	715 (displaced)	404 (per 2008 State Plan)	32 + 3 scour bridges	\$29,543,000	16,380	32	\$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 2013 with data from the 2010 Census. 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 10 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 2010 to 2040. Weld County has both a high current population and high projected growth. Counties with high current populations and moderately high projected growth include Mesa, El Paso, Larimer, Douglas, and Adams. Counties with more moderate or small populations but high projected growth include Park, Summit, Archuleta, Elbert, Custer, and San Miguel. Weld, Larimer, and El Paso County are in the top 10 flood risk counties (see Section 3.4.2).

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 1% annual chance 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. The HAZUS-MH methodology remains a valid planning-level and consistent methodology for analyzing risk at the county level and was not updated in 2013.

HAZUS-MH produces a flood polygon and flood-depth grid that represents the 1% annual chance floodplain. The 1% annual chance 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 11), Displaced Population (Figure 12), Percent Building Loss (Figure 13), and Per Capita Loss (Figure 14) maps show flood analysis estimates by county.

Figure 11 Total Building Loss by County based on HAZUS

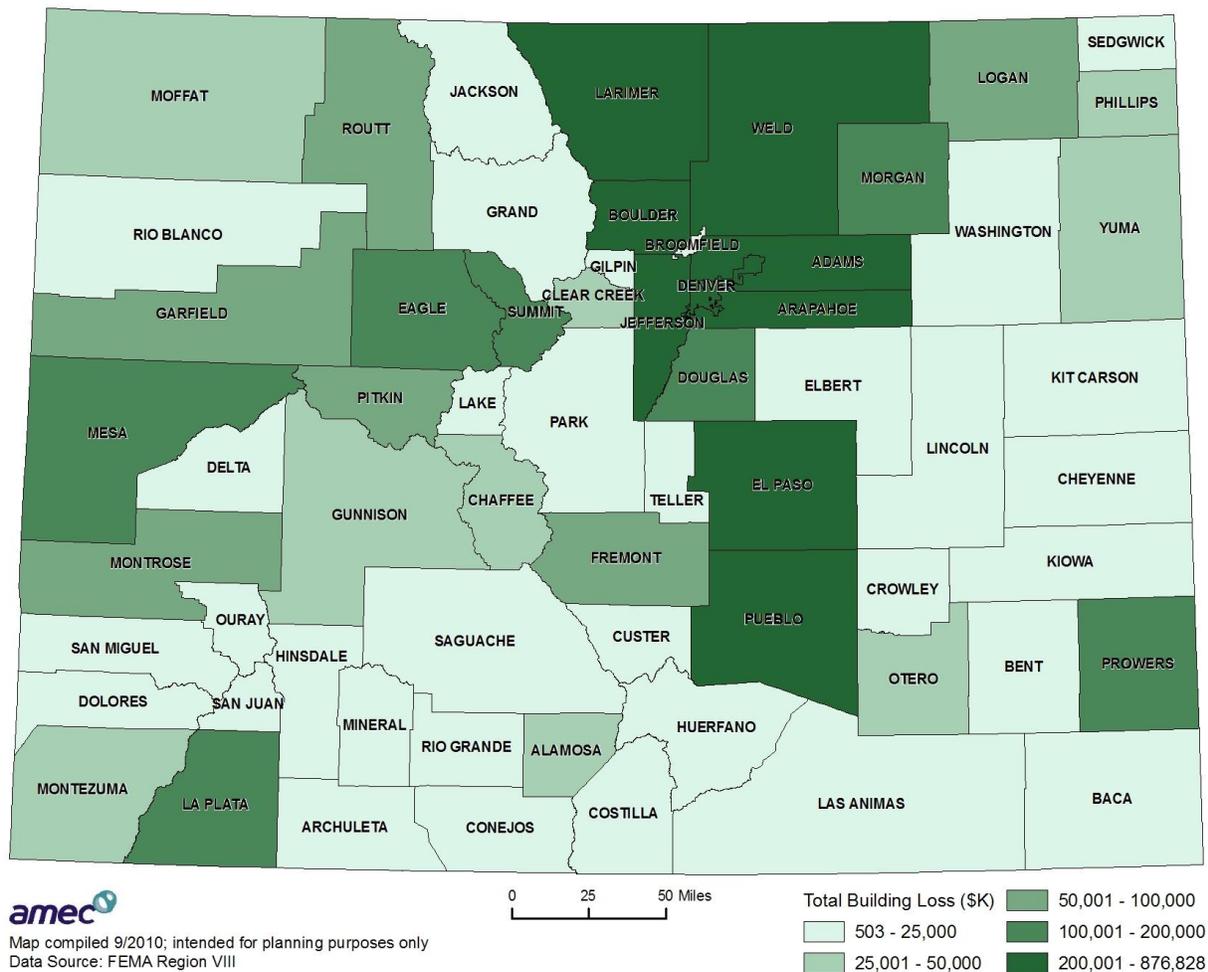
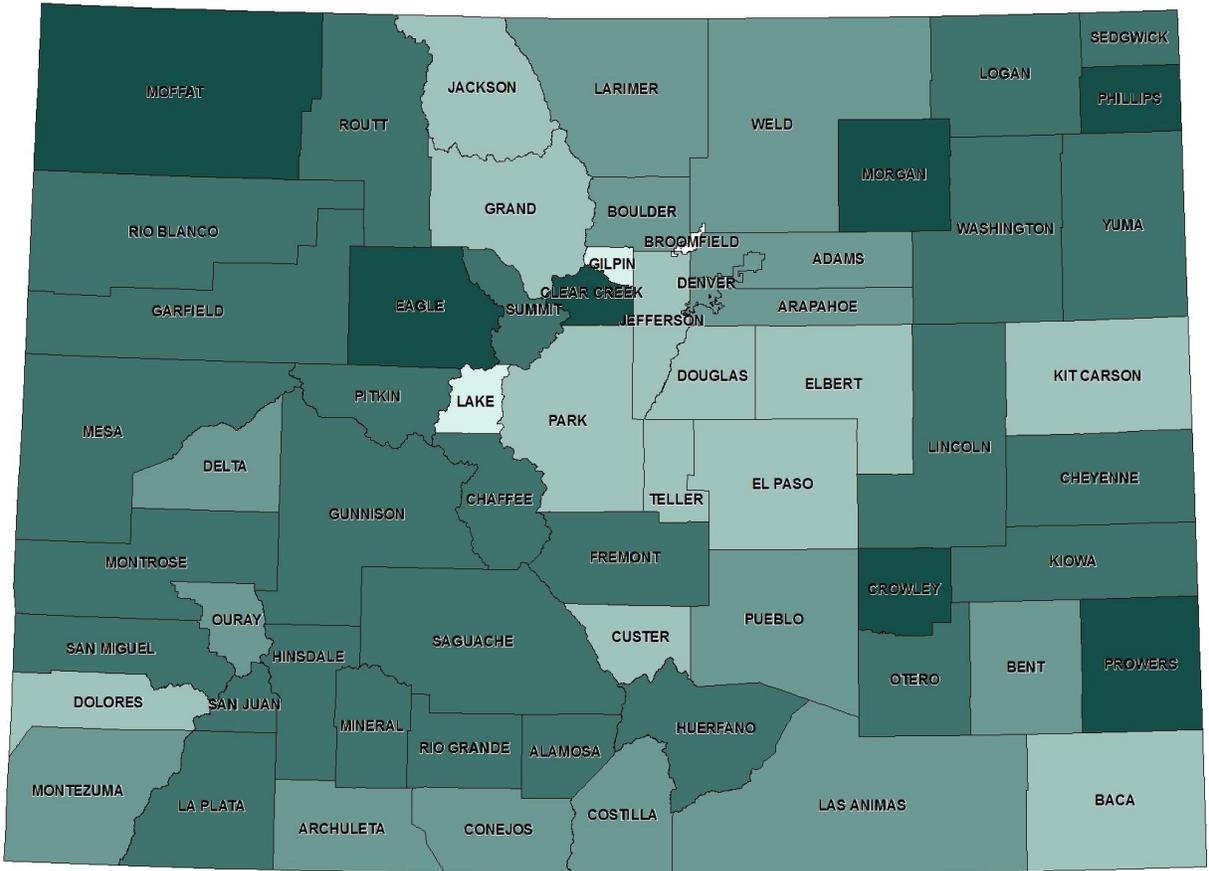


Figure 12 Percent Building Damage by County based on HAZUS



Map compiled 7/2010; intended for planning purposes only
 Data Source: FEMA Region VIII

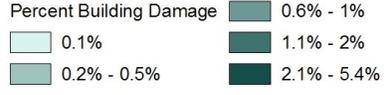
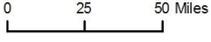
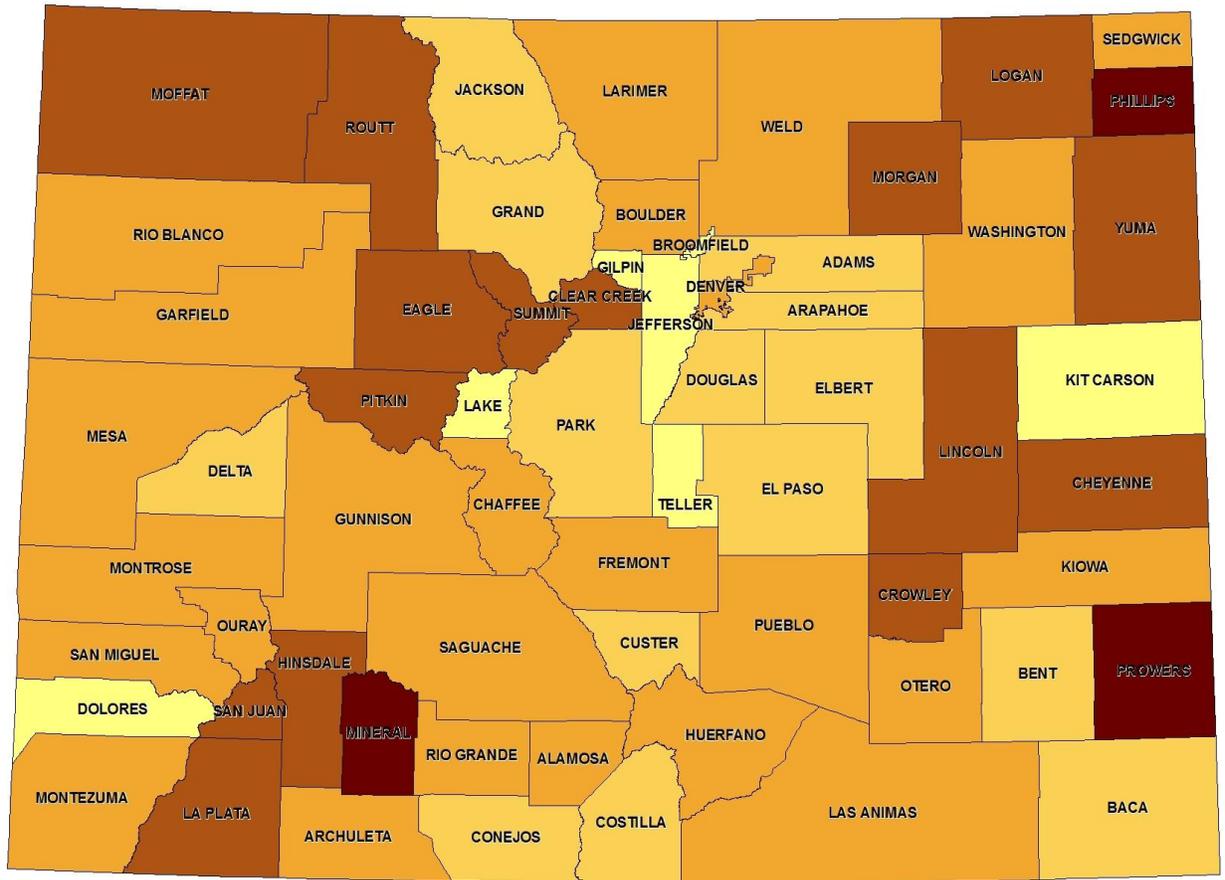


Figure 13 Per Capita Loss by County based on HAZUS



Map compiled 7/2010; intended for planning purposes only
 Data Source: FEMA Region VIII

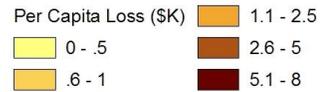
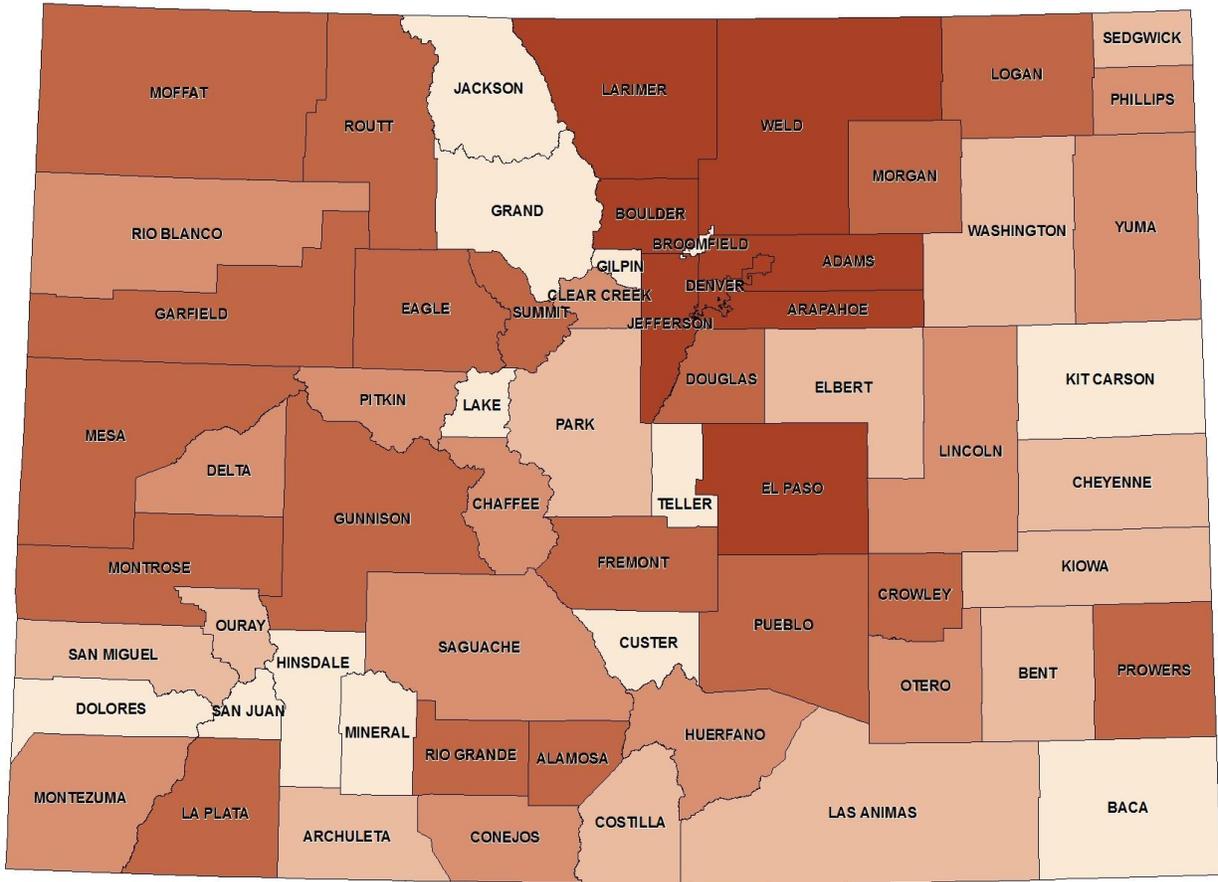
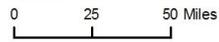


Figure 14 Displaced Population by County based on HAZUS



Map compiled 7/2010; intended for planning purposes only
 Data Source: FEMA Region VIII



Displaced Population	
Lightest Brown	10 - 100
Light Brown	101 - 500
Dark Brown	501 - 1,000
Darkest Brown	1,001 - 5,000
Very Darkest Brown	5,001 - 9,710

Table 9 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 11 through 14 and Table 9. 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 10 provides a profile of the repetitive damages and losses in Colorado communities from January 1978 through August 21, 2013. According to FEMA NFIP information, the State of Colorado has 47 repetitive loss structures. Structures are located in 17 counties as indicated in Table 10. Jefferson and El Paso counties and their incorporated cities had the highest number of repetitive loss properties.

Table 11 presents a summary of NFIP policies and claims in Colorado since the NFIP's inception in 1978 through August 21, 2013. Note that Table 10 does not include information from DR-4145 (September 2013 flood disaster). 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 15 indicates that the counties with the most claims were, in order, El Paso, Jefferson, Larimer, Boulder, Adams, Denver, Otero, Pueblo, Fremont, and Arapahoe. Figure 16 indicates that the highest numbers of policies were held by residents in Boulder, El Paso, Denver, Larimer, Adams, Jefferson, La Plata, Arapahoe, San Miguel, and Eagle Counties. Finally, the counties of Larimer, Otero, Jefferson, El Paso, La Plata, Denver, Douglas, Boulder, Adams, and Routt received the most insurance money from the NFIP since 1978. Jefferson, Larimer, and El Paso County were each within the top six of every analysis of the NFIP claims data. Overall, the Denver metro, Fort Collins, and Colorado Springs areas had the highest vulnerability based on this information.

In October 2013 FEMA reported that the NFIP received 1,967 claims from Colorado residents affected by the September flooding. 446 claims amounting to \$4.2 million had been paid.

Table 10 NFIP Repetitive Loss Claims in Colorado: 1978-2013*

Community	Total # of Claims	# of Properties	Total Value of Claims
Arapahoe County	2	1	\$70,175
Boulder County	2	1	\$49,111
Boulder, City of	2	1	\$8,553
Canon City	2	1	\$3,464
Clear Creek County	2	1	\$9,260
Colorado Springs, City of	16	7	\$147,664
Delta County	3	1	\$16,161
Denver, City and County of	4	1	\$81,974
Durango, City of	2	1	\$18,013
El Paso County	11	4	\$116,624
Fort Collins, City of	2	1	\$11,285
Gunnison County	2	1	\$39,723
Jefferson County	6	3	\$204,196
La Junta, City of	4	2	\$118,332
Lakewood, City of	21	8	\$234,424
Larimer County	2	1	\$7,617
Littleton, City of	2	1	\$4,031
Logan County	2	1	\$6,185
Manitou Springs, City of	4	2	\$44,038
Mesa County	2	1	\$4,240
Pueblo, City of	2	1	\$9,675
Rio Blanco County	2	1	\$11,384
Steamboat Springs, City of	2	1	\$3,061
Sterling, City of	2	1	\$6,251
Weld County	4	2	\$46,007
Westminster, City of	2	1	\$15,300
TOTALS	107	47	\$1,286,748

Source: FEMA

*As of August 21, 2013

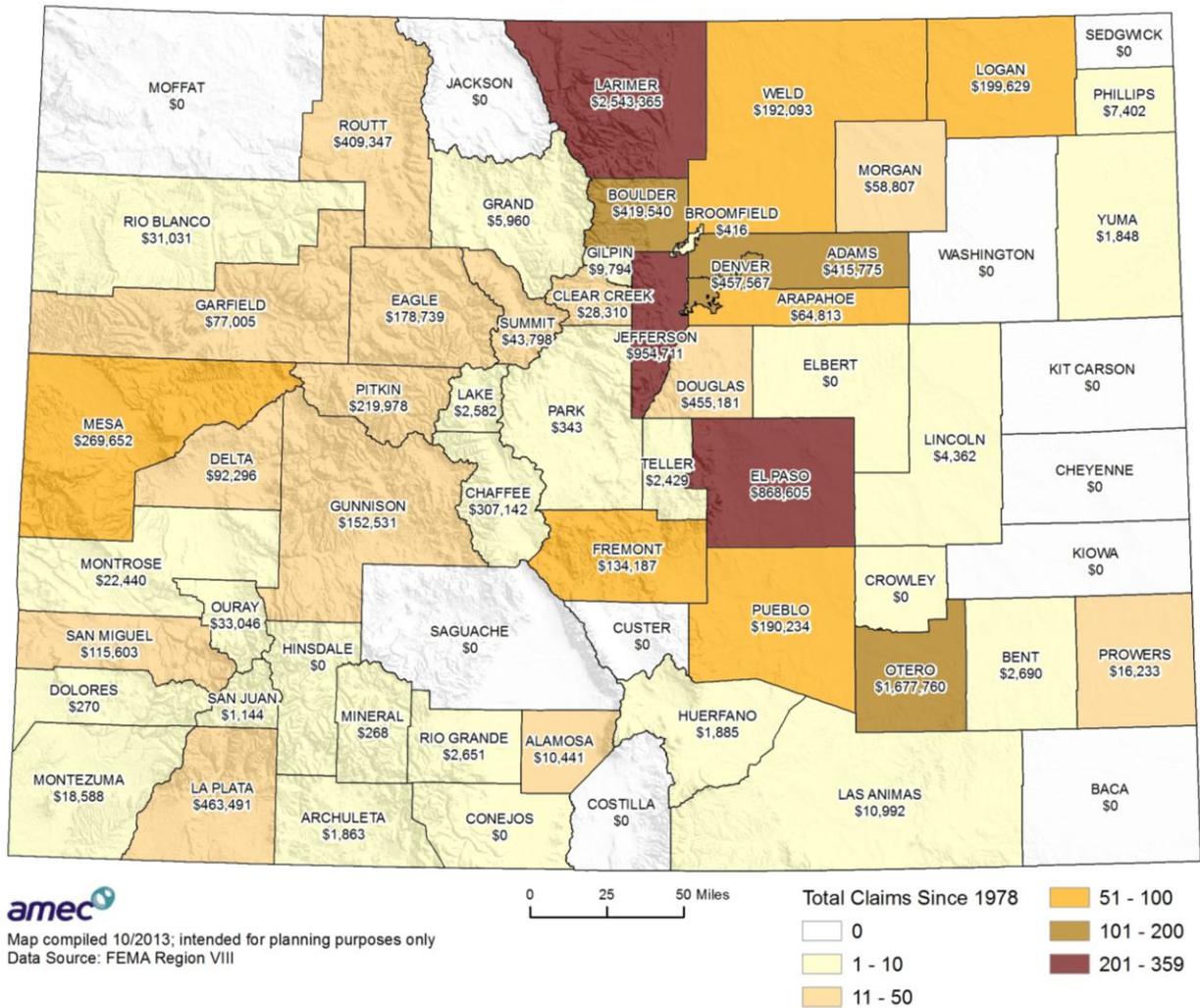
**Table 11 FEMA National Flood Insurance Program (NFIP) Policy and Claims Report
Colorado: 1978-2013***

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Adams	1,282	\$288,025,200	\$1,232,931	169	\$415,775
Alamosa	60	\$13,556,700	\$34,327	18	\$10,441
Arapahoe	582	\$145,593,000	\$398,381	57	\$64,813
Archuleta	114	\$28,679,200	\$78,008	4	\$1,863
Bent	9	\$935,500	\$5,808	2	\$2,690
Boulder	4,757	\$1,125,134,900	\$4,005,100	189	\$419,540
Broomfield	71	\$19,824,300	\$61,506	9	\$416
Chaffee	116	\$29,200,200	\$90,809	6	\$307,142
Clear Creek	126	\$26,438,500	\$142,801	22	\$28,310
Conejos	8	\$1,439,500	\$9,907	3	\$0
Costilla	11	\$1,649,600	\$7,852	0	\$0
Crowley	1	\$140,000	\$282	0	\$0
Delta	58	\$12,472,600	\$45,420	19	\$92,296
Denver	1,418	\$307,742,300	\$1,456,826	140	\$457,567
Dolores	2	\$694,400	\$1,096	1	\$270
Douglas	340	\$80,738,600	\$166,014	28	\$455,181
Eagle	491	\$130,195,800	\$335,600	32	\$178,739
El Paso	3,858	\$873,274,500	\$2,664,778	359	\$868,605
Elbert	32	\$6,672,400	\$22,952	1	\$0
Fremont	430	\$77,301,300	\$324,789	58	\$134,187
Garfield	221	\$54,638,800	\$170,892	23	\$77,005
Gilpin	26	\$10,537,200	\$97,826	7	\$9,794
Grand	158	\$28,492,600	\$99,292	2	\$5,960
Gunnison	263	\$60,694,800	\$186,324	43	\$152,531
Hinsdale	29	\$7,975,300	\$18,981	1	\$0
Huerfano	98	\$10,423,100	\$78,296	5	\$1,885
Jefferson	1,264	\$295,567,800	\$1,219,664	285	\$954,711
La Plata	724	\$194,901,700	\$515,657	29	\$463,491
Lake	5	\$865,000	\$5,618	1	\$2,582
Larimer	1,368	\$344,316,400	\$1,092,704	218	\$2,543,365
Las Animas	31	\$5,598,400	\$34,160	3	\$10,992
Lincoln	16	\$2,200,600	\$12,566	5	\$4,362
Logan	355	\$45,426,600	\$349,127	54	\$199,629
Mesa	361	\$77,818,800	\$214,179	51	\$269,652
Mineral	21	\$4,461,100	\$32,126	1	\$268
Moffat	22	\$4,556,400	\$11,991	0	\$0

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Montezuma	160	\$37,569,500	\$175,983	5	\$18,588
Montrose	135	\$22,141,700	\$100,764	4	\$22,440
Morgan	175	\$17,004,200	\$128,334	28	\$58,807
Otero	103	\$10,358,600	\$100,147	121	\$1,677,760
Ouray	62	\$16,231,600	\$39,517	6	\$33,046
Park	30	\$6,760,600	\$17,058	2	\$343
Phillips	11	\$2,380,800	\$13,008	2	\$7,402
Pitkin	264	\$63,441,600	\$204,707	26	\$219,978
Prowers	76	\$12,135,100	\$67,875	20	\$16,233
Pueblo	196	\$44,006,300	\$127,315	77	\$190,234
Rio Blanco	32	\$6,168,500	\$25,548	10	\$31,031
Rio Grande	162	\$34,110,000	\$123,727	6	\$2,651
Routt	326	\$79,409,800	\$250,919	32	\$409,347
Saguache	2	\$145,000	\$1,272	0	\$0
San Juan	5	\$1,369,000	\$3,401	1	\$1,144
San Miguel	543	\$128,046,500	\$357,716	15	\$115,603
Sedgwick	2	\$392,000	\$667	0	\$0
Summit	444	\$102,998,800	\$213,658	24	\$43,798
Teller	69	\$17,184,700	\$52,376	6	\$2,429
Washington	1	\$50,000	\$572	0	\$0
Weld	431	\$88,833,800	\$429,795	53	\$192,093
Yuma	20	\$3,699,900	\$16,156	2	\$1,848
State Total	21,977	\$5,012,621,100	\$17,675,105	2,286	\$11,178,837

Source: FEMA, NFIP
*As of August 21, 2013

Figure 15 NFIP Claims and Amount Paid in Colorado Since 1978 by County



of vulnerability to direct economic building loss and displaced population. Other counties that are met with both high growth pressures and socioeconomic vulnerability include Archuleta, Custer, Elbert, Park, San Miguel, Summit, and Weld.

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 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 (ORM) and the Colorado OEM updated this information in 2007, and 2010; valuations for state assets in potential flood hazard areas were updated with input from ORM in 2013. 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 17 and in Table 12 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.

During each update of this plan an opportunity exists to refine flood loss estimates to state owned/operated facilities as new digital floodplain data becomes available and facility databases improve. DFIRM data was used where available in the NFHL as the basis for the analysis. In the absence of DFIRM HAZUS was used as a proxy, though it should be noted that HAZUS flood hazard mapping is approximate. The 2013 Plan update analysis indicated that the total number and exposure value of state assets potentially at risk was 770 assets and \$1,278,507,976, based on DFIRM 1% and 0.2% annual chance and HAZUS 1% annual chance flood hazards. The analysis indicated that 262 assets with a value of \$214,516,754 are threatened by flooding within DFIRM 1% annual chance zones, where available. The 0.2% annual chance DFIRM flood analysis indicated that 123 assets worth a total of \$365,067,325 are potentially at risk to these

larger but less frequent flood events. This analysis is a refinement and improvement on that done during the 2010 Plan update. In general the number and value of state assets at risk has decreased. This is partly due to refined mapping. During the 2013 update it was observed that 25 state-owned or leased properties that used to be in FEMA special flood hazard areas were no longer occupied by state agencies. While it is not clear that flood risk was a factor in the decisions to vacate those properties, it is worth noting that flood exposure to the state has decreased regardless.

Figure 17 Location of State Assets in Floodplains by County

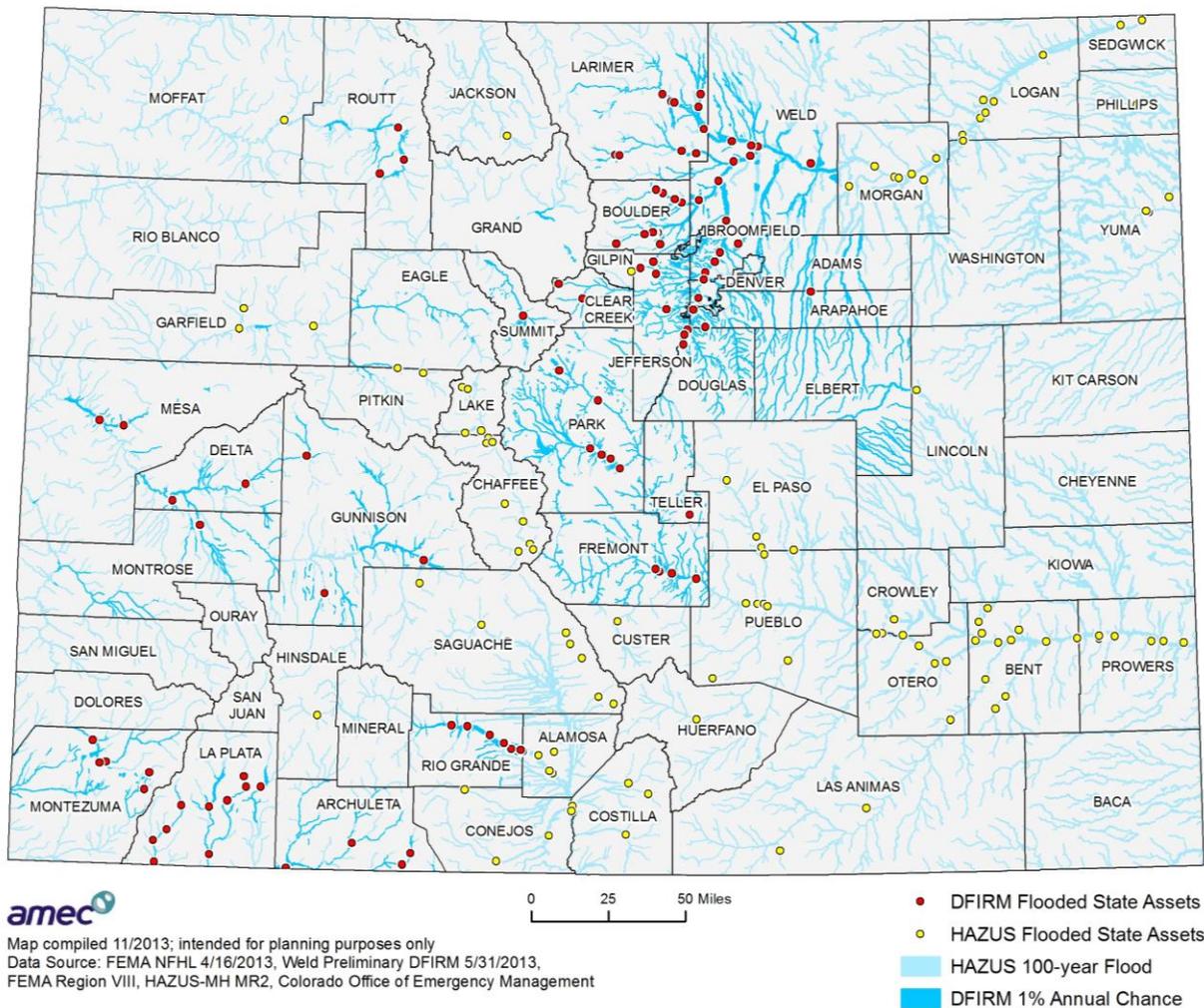


Table 12 State Assets Potentially at Risk to Flooding (Effective DFIRM 1% and 0.2% Annual Chance and HAZUS 1% Annual Chance)

Occupancy	# of Assets	Owned	1-Story	2+Story	Total Value
Animal Science	9	9	9	-	\$382,870
Communications	2	-	2	-	\$317,296
Containment Structure	3	2	-	-	\$87,644
Dept of Corrections	184	184	142	39	\$313,643,551
Education	18	8	4	9	\$202,639,076
Fish Hatchery	4	3	2	1	\$1,427,183
Garage	37	36	35	2	\$73,600,260
Laboratory	3	1	1	1	\$18,684,251
Monitoring Station	14	13	8	1	\$474,983
Museum	8	8	7	1	\$5,246,955
National Monument	2	2	2	-	\$20,130
Office	53	28	33	11	\$131,124,509
Office of Information Technology	2	-	2	-	\$2,359,991
Other	232	150	207	2	\$435,127,634
Pesticide Storage	3	3	3	-	\$216,910
Power Plant	1	-	-	1	\$20,001
Pump House	4	4	4	-	\$233,825
Recreation	9	6	3	3	\$5,999,017
Residences/Housing	39	28	30	9	\$66,008,865
Restroom	38	37	38	-	\$2,765,460
Shed	38	36	37	-	\$5,214,010
Shelter	2	2	2	-	\$622,467
Shop	15	15	13	-	\$5,594,698
Public Safety	1	1	1	-	\$690,601
Storage	39	35	30	3	\$5,573,804
Warehouse	8	8	8	-	\$414,915
Water Treatment	2	1	2	-	\$17,069
Total	770	620	625	83	\$1,278,507,976

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 16 and Table 17 groups the assets at risk in the 1% and 0.2% flood zones by grouped by department.

Table 13 State Assets Potentially at Risk to 1% Annual Chance of Flooding Based on Available DFIRM

Occupancy	# of Assets	Value Total
Animal Science	1	\$112,841
Communications	1	\$217,296
Containment Structure	2	\$45,470
Dept of Corrections	42	\$29,525,993
Fish Hatchery	1	\$0
Garage	8	\$12,421,735
Laboratory	1	\$18,481,928
Monitoring Station	6	\$279,749
Museum	6	\$990,090
Office	19	\$71,912,461
Other	88	\$7,453,506
Pesticide Storage	3	\$216,910
Residences/Housing	19	\$61,581,292
Restroom	26	\$1,504,070
Shed	13	\$3,055,812
Shelter	2	\$622,467
Shop	4	\$1,843,219
State Patrol	1	\$690,601
Storage	18	\$3,554,076
Water Treatment	1	\$7,238
Total	262	\$214,516,754

Table 14 State Assets Potentially at Risk to 0.2% Annual Chance of Flooding Based on Available DFIRM

Occupancy	# of Assets	Value Total
Animal Science	1	\$7,579
Communications	1	\$100,000
Containment Structure	1	\$42,174
Dept of Corrections	13	\$113,011,527
Education	13	\$161,921,173
Fish Hatchery	2	\$1,284,383

Occupancy	# of Assets	Value Total
Garage	11	\$21,134,293
Laboratory	1	\$118,223
Monitoring Station	6	\$182,133
Museum	1	\$577,125
Office	11	\$54,302,939
Office of Information Technology	2	\$2,359,991
Other	25	\$3,330,892
Pump House	2	\$173,187
Recreation	4	\$3,977,630
Residences/Housing	6	\$745,134
Restroom	2	\$4,048
Shed	15	\$1,018,662
Shop	2	\$582,814
Storage	4	\$193,417
Total	123	\$365,067,325

Table 15 State Assets Potentially at Risk based on HAZUS Flood Modeling Where DFIRM is Not Available

Occupancy	# of Assets	Value Total
Animal Science	7	\$262,450
Dept of Corrections	129	\$171,106,031
Education	5	\$40,717,903
Fish Hatchery	1	\$142,800
Garage	18	\$40,044,232
Laboratory	1	\$84,100
Monitoring Station	2	\$13,101
Museum	1	\$3,679,740
National Monument	2	\$20,130
Office	23	\$4,909,109
Other	119	\$424,343,236
Power Plant	1	\$20,001
Pump House	2	\$60,638
Recreation	5	\$2,021,387
Residences/Housing	14	\$3,682,439
Restroom	10	\$1,257,342
Shed	10	\$1,139,536
Shop	9	\$3,168,665
Storage	17	\$1,826,311

Occupancy	# of Assets	Value Total
Warehouse	8	\$414,915
Water Treatment	1	\$9,831
Total	385	\$698,923,897

Table 16 State Assets in 1% Annual Chance DFIRM and HAZUS Flood Hazard Areas by Department

Department	2010 Count	2010 Value Total	2013 Count	2013 Value Total
Dept of Corrections	188	\$232,396,242	171	\$200,632,024
Fish Hatchery	1	\$0	1	\$0
Higher Education	71	\$206,486,472	70	\$213,413,770
Human Services	1	\$19,763	1	\$19,763
Labor & Employment	3	\$87,099	1	\$35,000
Local Affairs	1	\$18,106	1	\$72,424
Natural Resources	316	\$34,094,829	310	\$32,444,288
Office of Governor	4	\$680,581	4	\$680,581
Public Health	13	\$402,730	13	\$375,869
Public Safety	6	\$1,079,724	6	\$1,151,122
Regulatory Agencies	2	\$28,960	0	\$0
Revenue	5	\$426,875	4	\$220,951
Transportation	72	\$463,842,857	65	\$464,394,859
Total	683	\$939,564,238	647	\$913,440,651

Table 17 State Assets in 0.2% Annual Chance DFIRM and HAZUS Flood Hazard Areas by Department

Department	2010 Count	2010 Value Total	2013 Count	2013 Value Total
Dept of Corrections	16	\$73,972,706	13	\$113,011,527
Higher Education	37	\$131,733,164	35	\$187,314,613
Natural Resources	25	\$24,152,929	25	\$40,440,362
Office of Governor	5	\$2,598,936	5	\$2,598,936
Public Health	7	\$692,967	7	\$692,966
Public Safety	2	\$17,111,500	2	\$17,211,682
Regulatory Agencies	2	\$28,960	1	\$14,480
Revenue	2	\$182,082	2	\$206,406
Transportation	45	\$3,558,343	33	\$3,576,353
Total	141	\$254,031,586	123	\$365,067,325

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. 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 state's road and bridge infrastructure is also prone to flood impacts and resulting disruptions, which can have considerable economic impacts. 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 (based on the National Bridge Inventory within HAZUS) with a total replacement cost of \$237 million. The 2013 flood provides a benchmark for road and bridge infrastructure losses associated with a large scale flood event. While the final damages were still being accounted for during the writing of this plan initial estimates indicated \$40 million to roads and \$112 million to bridges as of September 19, 2013.²¹ This damage includes 200 miles of roads within multiple counties.²² The total estimated cost to make permanent repairs to roads and bridges was \$475 million as of September 29, 2013. CDOT has been tracking and mitigating scour critical bridges, an action item that is discussed in the following section.

Table 18 lists the damage to state assets from the 2013 flooding, organized by total estimated damage. Larimer and Weld counties had the highest number of impacted assets with eight in each county. Damages to these assets, not including transportation infrastructure, was roughly \$8.7 million.

²¹ <http://www.reuters.com/article/2013/09/19/us-usa-colorado-flooding-idUSBRE98H1BA20130919>

²² http://www.denverpost.com/news/ci_24127630/colorado-floods-millions-aid-will-barely-begin-fix

Table 18 September 2013 Flood Damage to State Facilities

Facility	Location	County	Total Estimated Damage
Dept. of Natural Resources - North Forks SWA	Drake	Larimer	\$898,600
Dept of Transportation - Maintenance Yard	Drake	Larimer	\$808,819
Dept. of Natural Resources - Big Thompson Pond SWA	Loveland	Larimer	\$802,055
Dept. of Natural Resources - El Dorado Canyon State Park	Eldorado Springs	Boulder	\$706,859
Dept. of Natural Resources - Simpsons Pond SWA	Loveland	Larimer	\$687,470
Dept. of Natural Resources - St. Vrain St. Park	Firestone	Weld	\$625,000
Dept of Transportation - Maintenance Yard	Evans	Weld	\$616,000
Dept. of Natural Resources - Bellvue Hatchery	Bellvue	Larimer	\$610,629
Dept. of Natural Resources - Golden Gate Canyon State Park	Golden	Gilpin	\$526,280
Dept. of Public Safety	Evans	Weld	\$425,000
Dept. of Natural Resources - Centennial Valley SWA	Kersey	Weld	\$382,585
Dept. of Natural Resources - Forks SWA	Loveland	Larimer	\$332,310
Dept. of Transportation - Guardrails, signage, barriers. Only \$250,000 covered by State Risk Management	Statewide		\$250,000
Dept. of Natural Resources - Cherry Creek State Park	Aurora	Arapahoe	\$245,800
Dept. of Transportation - Maintenance Building	Crook	Logan	\$150,000
Dept of Corrections International Management Training Facility	Canon City	Fremont	\$115,000
Dept. of Natural Resources - Brower SWA	Evans	Weld	\$97,834
Dept. of Natural Resources - State Wildlife Area	Henderson	Adams	\$95,000
Dept. of Natural Resources - Cherokee SWA	Livermore	Larimer	\$75,000
Dept. of Natural Resources - Mitani-Tokuyasu SWA	Greeley	Weld	\$51,550
Dept. of Natural Resources - Webster SWA	La Salle	Weld	\$46,450
Dept. of Natural Resources - Chatfield State Park	Littleton	Douglas	\$41,820
Colorado School for the Deaf and Blind	Colorado Springs	El Paso	\$35,000
Dept. of Natural Resources - Arkansas Headwater	Salida	Chafee	\$30,000
Dept. of Natural Resources - Narrows SWA	Loveland	Larimer	\$29,660
Dept. of Corrections - Colorado Correctional Center	Golden	Jefferson	\$15,000
Dept. of Corrections - Denver Reception and Diagnostic Center	Denver	Denver	\$10,000
Dept. of Corrections - Denver Women's Correctional Facility	Denver	Denver	\$10,000
Pikes Peak Community College	Colorado Springs	El Paso	\$5,000
Dept. of Natural Resources - Frank SWA	Windsor	Weld	\$2,830
TOTAL			\$8,727,551

Source: COEM and Office of Risk Management as of October 10, 2013

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 reviewed by the Flood TAP 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 planning, technical assistance, and financial resources 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 Flood TAP convened in August and October 2013 to provide information necessary to update the 2010 version of the Plan. The objectives of the Flood TAP 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 2013 update to review and revise the mitigation action established in the 2010 Plan. Actions for each of the goals have been updated and can be referenced in Section 4.4.

The goals of this plan have been modified over the years to ensure they reflect current state priorities. Except for a minor change to goal number 4 (the words 'planning' and 'and financial

resources' were inserted by request of the Flood TAP), no changes were made to the goals during the 2013 update process. 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 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 19 specifically addresses the state programs and capabilities related to flood hazards.

Rules and Regulations for Regulatory Floodplains in Colorado

According to the Rules and Regulations for Regulatory Floodplains in Colorado (or the “Rules”), the purpose of the document is “to provide uniform standards for regulatory floodplains (or floodplains) in Colorado, to provide standards for activities that may impact regulatory floodplains in Colorado, and to stipulate the process by which floodplains will be designated and approved by the CWCB. The Rules are of statewide concern to the State of Colorado and the Colorado Water Conservation Board in order to prevent flooding and the negative impacts of floods, as well as to assure public health, safety, welfare and property by limiting development in floodplains” (pg. 3). The Rules apply to the entire state and with the intent to assist Colorado communities with sound floodplain management practices. The Rules also apply to floodplain management activities conducted by state and federal agencies and financed in part or full by

state funds. In November 2010 the CWCB updated the Rules with stricter standards. The new standards became effective on January 14, 2011, and communities in Colorado have until January 14, 2014 to update their local ordinances to comply with the new standards. See the discussion under Section 4.2.5 for details on the new standards. As of 2013 it is too early to gauge the effectiveness of the new standards, but the 2013 floods have demonstrated the importance of higher standards in reducing future flood losses. As a result of the flood FEMA is conducting a loss avoidance study to gauge the effectiveness of local floodplain management policies on loss reduction. This should prove to be a valuable reference in future updates to this plan.

National Flood Insurance Program (NFIP)

The Federal Disaster Protection Act of 1973 requires state and local governments to participate in the NFIP as a condition to the receipt of any federal loan or grant for construction projects in flood prone areas. Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives. The first objective is that new buildings must be protected at a minimum to the 1% annual chance (or 100-year) flood level. The second objective is that new development must not cause an increase in flood damage to other property. In 2012, the Biggert-Waters Reform Act was signed and contains many reforms that will impact the NFIP moving forward. These changes include the phasing out of subsidies for properties in high risk areas, new insurance policies to be issued at full-risk rates, and grandfathered rates being phased out over five years.

As of October 2013, 248 Colorado communities participate in the NFIP, with 241 in the regular program and 7 in the emergency program. Twenty-four NFIP participating communities have no special flood hazard areas and thirty communities have only minimal flood hazard areas in their community. As of October 28, 2013, there were 17 sanctioned communities that have identified flood hazards but do not participate in the program. Over \$11 million dollars in flood insurance claims has been paid within Colorado over the period of 1978-August 2013.

Colorado now requires higher regulatory standards above the minimum NFIP requirements. As of January 2014 the Rules will require an additional one foot above the base flood elevation as the standard in local flood ordinances. This improvement provides additional protection for structures during floods greater than the 1% annual chance flood and is an important and effective flood mitigation strategy across the state for future development (see Section 4.2.5).

The CWCB is responsible for managing the National Flood Insurance Program in Colorado. Additional program information can be found at: <http://cwcb.state.co.us/water-management/flood/Pages/FloodplainManagement.aspx>.

Community Rating System (CRS)

The Community Rating System is a voluntary incentive program within the National Flood Insurance Program (NFIP). Through participation in this program, communities can receive

discounts on flood insurance premiums by conducting flood mitigation activities that reduce their long term risk and exceed NFIP minimum requirements. Technical assistance for this program is provided by the CWCB. Additional program information can be found at: <http://www.fema.gov/business/nfip/crs.shtm>.

4.2.2 Post-disaster Hazard Management Policies, Programs, Capabilities

The previous section includes pertinent information primarily on pre-disaster hazard management policies, programs, and capabilities. The following table summarizes additional state pre and post disaster programs by department and evaluates their effect on loss reduction. The majority of these are pre-disaster programs with the exception of the Community Development Block Grants and Hazard Mitigation Grant Program. More post-disaster policies and capabilities will be identified and evaluated during the recovery from the September 2013 floods.

Table 19 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 Office of Emergency Management	Facilitate	Yes
OEM administers the following programs: DHS Hazard Mitigation Grant Program, DHS Pre-Disaster Mitigation Grant Program, DHS Disaster Resistant Universities, DHS Hazard Mitigation Grant Program, 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 come from DHS' Dam Safety Program. All Class I dams have preparedness plans. Copies are at the State Engineer's Office and OEM.			
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.			
Public Safety	Flood Mitigation Assistance Program	Facilitate	Yes

DEPARTMENT	PROGRAM/POLICY REGULATION/PRACTICE	EFFECT ON LOSS REDUCTION*	PROVIDES FUNDS OR ASSISTANCE
This program is administered by the Colorado Office 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 (FMA) 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

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 previously in Section 4.2.1 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.

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 OEM.

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. Most of these programs are pre-disaster related; those programs that are post-disaster related are indicated with an asterisk (*):

Department of Local Affairs (DOLA):

- Community Development Block Grants*
- Unmet Needs Program*

Office of Emergency Management:

- Hazard Mitigation Assistance Grants including:
 - Hazard Mitigation Grant Program*
 - Pre-Disaster Mitigation Grant Program
 - Flood Mitigation Assistance program
- Disaster Resistance Universities
- Emergency Management Performance Grant 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 and Risk MAP 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 OEM
- Training provided to state and local emergency managers and local insurance agents to promote their certification as Certified Floodplain Managers (CFM)

CWCB updated the Rules and Regulations for Regulatory Floodplains in Colorado with higher flood protection standards above the minimum required by the NFIP. The primary floodplain management provisions include:

- A one-foot freeboard for all new and substantially changed structures in 1% annual chance floodplains, with the exception of critical facilities.
- Two feet of freeboard shall be provided to all new and substantially changed critical facilities (as defined in the Rules) in 1% annual chance floodplains.
- In areas with base flood elevations defined, floodway surcharge criteria shall be reduced to 0.5 feet (from 1.0 feet) for all new studies begun after January 14, 2011. Exceptions to this requirement exist and are discussed in the Rules. The process for determining floodways and regulations associated with the floodways remain unchanged.
- Communities shall regulate construction in areas removed from FEMA's regulatory floodplain through a LOMR Based on Fill by requiring new and substantially improved structures built on these lands to maintain a lowest floor one foot above the base flood

elevation, consistent with development in other regulatory floodplains.

CWCB is working with local communities for final implementation. CWCB has conducted workshops on the new Rules to inform local communities of the changes. CWCB provide free technical assistance to help communities meet the January 2014 deadline for updating their ordinances based on the new standards. As of October 2013, 25% of communities had adopted the new Rules, with more adoptions pending.

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. As of August 21, 2013 there were 21,977 policies and \$5,012,621,100 in total coverage in Colorado. The trend shows that NFIP policies and coverage are steadily increasing.

Since 2009 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 Flood DSS, 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. There is interest in enhancing access to the DSS through the development of a Smartphone application (Source: Colorado Water Conservation Board).

OEM 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 OEM's Mitigation and Recovery section to enhance OEM's capability to provide technical assistance to local and tribal governments, as well as state agency partners on mitigation planning. This will also enable OEM to offer greater assistance for developing and implementing mitigation projects throughout the state.

OEM 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 gauges to further enhance prediction capabilities.

Floodplain Mapping

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 DFIRM flood hazard mapping in Colorado is depicted in Table 20 and Figure 18.

Table 20 DFIRM Status as of October 2013

County	Status	County	Status
Adams	Effective	Kit Carson	No study
Alamosa	Scoped	La Plata	Effective
Arapahoe	Effective	Lake	No study
Archuleta	Effective	Larimer	Effective
Baca	No study	Las Animas	Scoped
Bent	Scoped	Lincoln	No study
Boulder	Effective	Logan	In progress
Broomfield	Effective	Mesa	Effective
Chaffee	In progress	Mineral	Scoped
Cheyenne	No study	Moffat	No study
Clear Creek	Effective	Montezuma	Effective
Conejos	No study	Montrose	In progress
Costilla	No study	Morgan	In progress
Crowley	No study	Otero	Scoped
Custer	No study	Ouray	No study
Delta	Effective	Park	Effective
Denver	Effective	Phillips	No study
Dolores	No study	Pitkin	In progress
Douglas	Effective	Prowers	In Progress
Eagle	Effective	Pueblo	In progress
El Paso	In progress	Rio Blanco	Scoped
Elbert	Effective	Rio Grande	Effective

CWCB's business plan for the Map Modernization program has been replaced by Risk MAP. Risk MAP builds on data and maps produced by the Map Modernization program. Currently the outreach efforts for Risk Map are supported through meetings, letters, emails, conference calls, presentations, and information provided on CWCB websites. The CWCB sends out letters and/or emails to community officials and representatives to initiate contact and inform them of upcoming meetings. Coordination and communication continues throughout the project timeline as needed until after the Preliminary map products are sent out for review and the final meeting has taken place. Once comments are received from the communities on the preliminary map products, comments are reviewed and a comment resolution is sent out to address all community comments. The CWCB may also coordinate post preliminary efforts if needed or requested by a community should any mapping issues arise during the appeal or compliance period.

The CWCB launched the Colorado Flood Risk website (<http://coloradofloodrisk.state.co.us>) to provide communities an overview of the Risk Map program. Information regarding current and upcoming projects is provided on the site. Valuable tools for communities to provide input to the map updates are available on the website and communities who have a desire to participate may submit their interest through the Flood Risk website. In addition, updates to FEMA's levee guidance will be posted along with any other pertinent information related to map updates in Colorado.

Between 2010 and 2013 FEMA provided \$2,930,823, the state provided \$613,135, and local communities provided \$237,925 to fund Risk MAP projects in Colorado. Risk MAP projects are done on a watershed basis. Risk MAP status by watershed is depicted in the figure below as of October 2013. According to the Colorado Risk Map Business Plan Update 2013 with the initiative of Risk Map and new program measures that need to be met for Region VIII, the top three unmet mapping needs for Colorado are the Upper Gunnison, Upper White, and the Middle South Platte-Cherry Creek watersheds.

activities were identified in local hazard mitigation plans in 2010. 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, 46 counties of the 64 in Colorado have developed and adopted a hazard mitigation plan. Eight other counties have plans that are approved pending adoption. The comprehensive raw data for this section can be found in Appendix B.

Table 21 Local Multi-Hazard Mitigation Plans

Jurisdiction	Status	Jurisdiction	Status
Adams	Approved	Kiowa	Approval Pending Adoption
Alamosa	Approved	Kit Carson	Approved
Arapahoe	Approved	La Plata	Approval Pending Adoption
Archuleta	Approved	Lake	In Review
Baca	Approval Pending Adoption	Larimer	Approved
Bent	Approval Pending Adoption	Lincoln	Approved
Boulder	Approved	Logan	Approved
Boulder City	Approved	Mesa	Approved
Broomfield	Approved	Mineral (Unincorporated)	Approved
Chaffee	Expired	Montrose (Unincorporated)	Approved
Cheyenne	Approved	Morgan	Approved
Clear Creek	Approved	Otero	Approval Pending Adoption
Colorado Springs City	Approved	Ouray	Approved
Colorado University Boulder	Expired	Park	Approved
Conejos	Approved	Phillips	Approved
Costilla	Expired	Pitkin	Approved
Crowley	Approval Pending Adoption	Prowers	Approval Pending Adoption
Custer	Expired	Pueblo	Approved
Delta	Approved	Rio Blanco	Expired
Denver	Approved	Rio Grande	Approved
Dolores	Expired	Routt	Approved
Douglas	Approved	Saguache	Approved
Eagle	Approved	San Miguel	Approved
El Paso (Unincorporated)	Approved	Sedgwick	Approved
Elbert	Approved	South Metro Fire Rescue Authority (Douglas)	Approved
Fremont	Expired	Southern Ute Indian Tribe (La Plata)	Awaiting Revisions
Garfield	Approved	Summit	Approved

Jurisdiction	Status	Jurisdiction	Status
Gilpin	Approved	Teller	Approved
Grand	Expired	Ute Mountain Ute (Montezuma)	Approved
Gunnison	Approval Pending Adoption	Washington	Approved
Hinsdale	Expired	Weld	Approved
Huerfano	Approved	Yuma	Approved
Jefferson	Approved		

Source: COEM and FEMA Region VIII

Previous efforts to analyze flood mitigation capabilities from local plans in 2010 are shown below as an indication of the policies and projects used at the local level in Colorado.

Table 22 Typical 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	20
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	1
CRS Participation	4
Property acquisition/relocation	11

Based on 2010 local hazard mitigation plan analysis

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 OEM to start their flood hazard mitigation plans and have them completed for the original November 1, 2003 deadline associated with the umbrella NHMP document. OEM and CWCB are encouraging communities across the state to start or update plans.

The Denver Water Board has mobilized significant resources for sediment control programs to mitigate flooding and reduce reservoir siltation. The Denver Water Board has been removing excess sediment from the upper reaches of the South Platte River, which was heavily impacted by the Hayman fire. Between 2010 and 2012, Denver Water removed at least 625,000 cubic yards of sediment from the Strontia Springs Reservoir. (<http://www.thedenverchannel.com/news/waterton-canyon-reopens-after-19-month-closure>) Much of the sediment in the Reservoir built up in the aftermath of the Buffalo Creek and Hayman wildfires. Sedimentation can increase the cost of water treatment, degrade water quality, and create operational problems. By removing the sediment Denver Water hoped to reduce these impacts.

UDFCD assists with funding and managing several flood mitigation initiatives in Colorado including drainageway and watershed master plans; converting and updating DFIRMs; assisting local governments with floodplain regulations; reviewing and commenting on proposed development in or near floodplains; and public education on flood hazards in local areas. Over 170 watershed master plans have been completed. The District's Information Services and Flood Warning Program includes assisting local governments develop flood warning plans and installing flood detection networks. Daily forecasts and data from the detection networks are posted on the UDFCD website. The District's GIS system designs and tracks flood mitigation projects and supports regional mapping initiatives. The Design, Control and Maintenance Program works with local governments and agencies on implementing drainage improvements and maintaining drainage facilities. The Floodplain Management Program at UDFCD promotes floodplain preservation to local governments and developers with the idea that the benefits of a preserved floodplain (recreation, wildlife habitat, etc.) can be marketed by developers as amenities to their projects, but they also become long term assets to the communities.

Based on a 2001 OEM 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 Bennett, Blue Rive, Bow Mar, Dinosaur, Elizabeth, Empire, Hot Sulphur Springs, Hugo, Kit Carson, Lakeside, Nucla, Pitkin, Sawpit, Starkville, Ward, and Williamsburg, 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 online at <http://www.fema.gov/cis/CO.pdf>.

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. As of October 2013 Colorado has 391 active CFMs (up from 364 in 2010 and one of the highest numbers of any state in the nation), and a substantial number of

individuals join the program each year. 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 showed that Elbert County had adopted local floodplain regulations and joined the NFIP, as one indication of progress. The CWCB continues to encourage NFIP participation at the local level and assists with the development of the necessary documentation to apply for the NFIP.

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

Funds available through the FMA program have been utilized for both planning and projects for flood mitigation. Table 26 in Section 4.5.2 of this Plan illustrates which entities have received

FMA funding since 2007.

The CRS program is helping with flood insurance affordability at the local level. As of May 1, 2013, there were 52 Colorado communities (36 cities and 16 counties) participating in CRS. Flood insurance premium increases as a result of the 2012 Biggert-Waters Reform Act may provide an incentive for more communities to participate. Several changes were also made to the 2012 CRS Coordinator's Manual that may impact CRS activities in Colorado. Some communities will receive increased credit for their existing CRS activities, while others could see a decrease. For instance, some mapping activity credits are being reduced.

The economic downturn that began in 2008 and continues has resulted in floodplain management challenges for some Colorado communities. Economic development pressures and interests have competed with sound floodplain management practices in some communities. The flood event of 2013 should help raise awareness of the importance of flood mitigation and sound floodplain management for the near future.

The lack of DFIRM mapping, and accurate flood hazard mapping, remains an issue in some communities. Cuts in federal funding for mapping have not helped this situation. Communities need maps to effectively implement floodplain regulations. The implementation of the Biggert Waters Act of 2012 and fears of exorbitant flood insurance premiums has resulted in resistance to more accurate floodplain mapping at the local level in some cases. The 2012 Biggert-Waters Reform Act will affect homeowner's insurance premium rates, particularly on second homes, with affordability potentially becoming an issue in high-risk areas unless properties are mitigated.

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 Flood TAP and other state agencies over the years. 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. The status of projects was updated in 2013 based on a process described in Section 4.4.2.

Table 23 State Flood Hazard Mitigation Goals and Actions

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
1.1	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	
1.2	Identify Long-Term Safe Affordable Housing Outside Hazard Areas Using Manufactured Housing Where Applicable and Volunteer Agency Construction	DOLA OEM	Identify lessons learned and needs from the 2013 September floods		X					X	The Division of Housing and Office 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. Disaster housing needs were significant following the September 2013 floods.
1.3	Work with the state agencies to ensure that facilities proposals and infrastructure take natural hazards into account when state projects are in the approval process.	CWCB CDOT	Review and comment on project proposals.		X			X			Adopted IBC; Revised in 2013 to reflect review process in place for efforts funded by federal housing grant programs.
1.4	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. Encouraged by WQCD programs.

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
1.5	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; an update to this manual is needed (see action 1.6)
1.6	Update State Stormwater and Drainage Criteria Manual.	CWCB	The Stormwater and Drainage Criteria Manual is out of date and needs to be revised.						X		New in 2013
1.7	Promote the sustainability and access of critical infrastructure during disaster events to the 100-year flood event.	CDOT OEM CWCB DWR DOLA CDPHE CASFM UDFCD Local Gov's	Develop educational outreach program. In accordance with Department of Homeland Security's Target Capabilities List OEM 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 this as a component of the higher statewide flood standards. CWCB developed State regulations with higher flood protection standards for Critical Infrastructure.		X			X			OEM continues to refine the State Recovery Plan that includes an Infrastructure Systems Recovery Support Function. OEM also continues to work with CWCB by incorporating critical facility vulnerability and capability assessments into any local mitigation plan receiving CWCB funding support. The Office of Preparedness has completed the process of hiring and Infrastructure Planner that will provide additional multi-hazard implementation capabilities to critical facility-related initiatives. DOLA-DLG created the position of Sustainability Coordinator, is leading the state's Sustainable Mainstreets Initiative, and has created the sustainability self-assessment tool. CWCB is working with local communities for final implementation of the State Flood Rule that becomes effective January 2014.

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
1.8	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.	OEM CWCB DWR UDFCD	Activities in progress	X	X			X			CWCB and OEM provided funding for a CWCB project to study improvements in early warning capabilities by placing mobile radar trucks in Southwest Colorado and the Rio Grande Valley. This specific project was completed and demonstrated how more localized radar will improve storm prediction and early warning capabilities as compared to NWS facilities in Grand Junction. Data from the mobile radar is 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. Since 2012 for State declared disasters, OEM requests disaster recovery funding from the Disaster Emergency Fund that may be used by impacted jurisdictions to enhance stream emergency warning systems through additional sensors and reporting devices.
1.9	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 OEM UDFCD FEMA Region VIII	Activities in progress		X			X			Since 2010, 83% of HMA project awards facilitated by OEM were focused on flood hazard reduction. These projects include drainage retention/detention ponds, improved drainage infrastructure and channel stabilization.

GOAL 1: Reduce flood impacts to Colorado's economy, people, state assets, and environment											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
1.10	Continue to identify and mitigate bridges with 'scour critical' ratings to reduce vulnerability of bridge infrastructure to flood events.	CDOT FEMA Region VIII	Activities in progress	X	X						The CDOT POA Bridge Scour project finished the first phase of work in which 243 scour critical bridges were identified. The bridges were categorized into low, moderate and high priority scour. Three million dollars from the RAMP Asset program have been dedicated for phase two of the POA and the consultant notice to proceed has been issued. Phase two work includes final hydraulic and scour analysis and countermeasure design for the 27 high priority bridges. A design prioritization plan will be developed to maximize construction delivery efficiency.
1.11	Incorporate flood mitigation strategy into long-term recovery	OEM	Look for opportunities in the recovery from 2013 floods						X		New in 2013
1.12	Develop strategy through Flood TAP to identify or target potential HMGP or FMA projects following the 2013 floods	OEM							X		New in 2013
1.13	Provide post-flood information for better interim management of floodplain following events	CWCB FEMA Region VIII	Consider erosion zones for areas of potential stream movement. Gather and compile high water marks for the purposes of recovery mapping.					X			New in 2013
1.14	Develop a statewide debris management plan.	CDPHE OEM	Include details on managing various types of hazardous waste, contaminated silt, etc.						X		New in 2013

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.1	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. Risk Map program evaluates flood hazards on a watershed basis. Post-September 2013 flooding activities include generating LiDAR datasets.
2.2	Increase awareness of the designated 100-year floodplain in permitting new developments and structures	CWCB CASFM FEMA Region VIII	Contact local floodplain and emergency managers and provide current information and technical data		X			X			Progress made during the September 2013 flooding. CWCB put together a document with information on obtaining post flood permits.
2.3	Enhance the natural and beneficial functions of floodplains by promoting an increased awareness of stream ecosystem function and its benefits to flood hazard mitigation.	CWCB DWR CPW CASFM UDFCD FEMA Region VIII	Gather information materials Solicit input from states with similar initiatives Use existing guidance document Work with CPW staff to provide the biological and ecological expertise		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 stream ecosystems. This includes wetlands and habitat resources along with other things. Implementation should include Colorado Watershed Restoration Program initiatives from the 2013 flood.

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.4	Improve access to information regarding floodplain management, mapping, 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 OEM DWR UDFCD FEMA Region VIII	Post two public notices every March Establish webmaster duties Assign duties Gather information materials		X			X			Upon request, OEM 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. The CWCB has developed improvements to their website that would facilitate access to floodplain management information. For 2012 and 2013 Flood Awareness weeks, OEM, CWCB, and FEMA partnered to distribute daily flood related articles related to post wildfire flood, CWCB's DSS tool, flood mitigation products, and other related items. These articles were posted on OEM's blog page, webpage, and notice distributed via Twitter. The CWCB also posts information related to digital flood map status on the Colorado Risk MAP webpage (http://coloradofloodrisk.state.co.us/Pages/RiskMAPHome.aspx)

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.5	Develop a hazard mitigation education program for public officials such as local water and wastewater management officials, local building officials, and road and bridge officials at annual conferences and workshops.	OEM DNR CWCB DWR UDFCD CASFM FEMA Region VIII	Promote at workshops and conferences 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) Establish webmaster duties Assign duties Gather information materials Set schedule to deliver workshops Promote the public awareness of appropriate web sites and information		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. CWCB staff have participated in workshops and presentations at CML, CCI, CEMA, and other associations. OEM has continued to improve informational table displays and related materials, to include a notebook of best project practices, a brochure on team technical assistance, and related handouts. OEM Mitigation Staff assist local communities in facilitating hazard mitigation planning meetings, which include officials from various state and local departments and agencies. Additionally, OEM teaches local mitigation planning workshops that include flooding considerations. A workshop was held in fall 2010 on flood hazard mitigation planning and how to obtain CRS Flood Planning (Activity 510) credits from the process. Since 2010, OEM has held 5 mitigation courses for local emergency managers that provide information on flood mitigation. OEM, CWCB, and FEMA cooperatively developed informational articles about the benefits of close working relationships between Floodplain Managers and Emergency Managers. OEM developed a crosswalk tool for how to maximize CRS planning credit through the multi-hazard mitigation planning process. OEM staff spoke at the 2009 CASFM conference about mitigation planning and its relation to flood hazards. OEM 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. OEM provides Level 1 HAZUS runs to counties upon request.
	State of Colorado Flood Hazard Mitigation Plan November 2013										Conference to discuss best practices and provide advice to other communities interested in pursuing mitigation projects. OEM provides Level 1 HAZUS runs to counties upon request.

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.6	Promote public education on post- wildfire flood hazard potential in burned watersheds.	CWCB State Forest Service CPW FEMA Region VIII	Gather informational materials Publish articles in newsletters and releases Utilize CPW aquatics researchers to assist in technical guidance on post-wildfire public information as it relates to sediment and erosion control and the benefits to aquatic systems.		X			X			CWCB has conducted workshops and participated in public outreach meetings in areas impacted by wildfires, particularly since the 2012 Waldo Canyon and High Park Fires and 2010 Fourmile fire.
2.7	Provide newsletter articles, other relevant information on flood hazard mitigation and other forms of information exchange to professional organizations and local governments.	OEM CWCB UDFCD CASFM FEMA Region VIII	Obtain agencies/entities PIO information		X			X			OEM provides local agencies with examples of mitigation "best practices" to assist in local planning and mitigation project activities, including information on flood reduction strategies. CWCB has a regular column in CASFM's newsletter. In addition, CWCB publishes the Floodstage newsletter.
2.8	Promote the concept of people accepting responsibility for the consequences of living in flood prone areas.	OEM, CWCB DNR DLG FEMA Region VIII	Provide education materials to local governments and the public.	X	X			X			OEM 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. OEM, CWCB, FEMA, and other partners provided post-wildfire flood information (NFIP, enhance flood risk, early warning, property mitigation) through materials and presentations at local workshops, to local community leaders and emergency managers, and web postings.

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.9	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	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.
2.10	Publish documentation 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, 2010, 2011, and 2012 and can be accessed on the CWCB website.
2.11	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.
2.12	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 FEMA Region VIII		X					X		New action in 2010. A new Floodproofing Existing Non-Residential Structures manual is due out soon from FEMA.

GOAL 2: Promote awareness and education of flood hazards and watershed protection											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
2.13	Develop a Youth Flood Education and Outreach program curriculum for K-12 students incorporating flood messages into school education and community outreach programs.	CWCB FEMA Region VIII	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. A flood simulation model has been purchased and used in several schools. The FEMA Region VIII office also has flood simulation models that can be used to assist this effort.
2.14	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 CASFM					X		X		New action in 2010. CWCB and FEMA conducted joint CASFM sponsored floodplain manager 101 workshops and CFM refresher course. Online CFM course explored but decided not to pursue. All PowerPoint's are available on CWCB website however.
2.15	Compile list of lessons learned from 2013 floods and apply to future mitigation and regulatory processes.	OEM CWCB CDOT CDPHE	Compile comprehensive documentation report. Develop recommendations for better management of State's floodplains.		X			X			New in 2013
2.16	Promote flood insurance outside of regulatory floodplains	CWCB	Inform public of risks outside of floodplains, including channel migration/erosion hazards.		X				X		New in 2013;

GOAL 3: Promote the development of hazard mitigation plans with multiple objectives											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
3.1	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.	OEM 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. OEM and CWCB provide funding and technical assistance to complete these plans. OEM and CWCB have partnered to fund development or updates to approximately 20 local multi-hazard mitigation plans, many of which represent multiple communities.
3.2	Promote the development of flood mitigation plans as part of multi-hazard mitigation plans through the FMAP, PDM, and Flood Response programs.	OEM CWCB	Conduct statewide workshops Solicit applicants for planning grant funds Encourage adoption of plans by communities	X	X			X			OEM and CWCB provide funding and technical assistance for local multi-hazard and flood mitigation plans. Currently, OEM has shifted the primary funding of local multi-hazard mitigation plans (to include flood sections) away from PDM and FMA to exclusively the EMPG based on State Mitigation Assistance Program (SMAP) with additional support from CWCB.
3.3	Maintain database of communities with approved plans.	OEM CWCB	Ongoing		X					X	OEM posts approved mitigation plans on their website. CWCB has a laser fiche repository of mitigation plans on their website.

GOAL 4: Coordinate and provide planning, technical assistance, and financial resources for State, local and watershed planning efforts

ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
4.1	Promote regional intergovernmental cooperation concerning watershed-based planning and floodplain management using a strategic planning process with goals and recommendations.	CWCB OEM DWR	Contact local governments and determine level of interest Gather informational materials Set schedule to deliver strategic planning		X			X			The Flood Technical Assistance Partnership formed in 2011 and promotes intergovernmental cooperation at the state level. The CWCB provides technical assistance and promotes multi-objective, watershed based planning efforts. The CWCB also implements watershed based mapping, assessment and planning through the FEMA RiskMAP program. OEM 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.
4.2	Provide technical comments and recommendations on proposed state and federal legislation related to floodplains.	CWCB DOLA	In Progress		X				X		CWCB responded to FEMA's LAMP proposal for levees. CWCB regularly contributes to the CRS committee. CWCB has been educating communities on the Biggert-Waters Flood Insurance Reform act implications.
4.3	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 with a section in the Stormwater and Drainage Criteria Manual, but this manual needs updating. More funding is needed for this effort, possibly through the CO Watershed Restoration Program.

GOAL 4: Coordinate and provide planning, technical assistance, and financial resources for State, local and watershed planning efforts

ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
4.4	Optimize potential state and federal funding sources to support mitigation initiatives which are part of the Colorado Flood Hazard Mitigation Plan.	OEM CWCB	In Progress		X			X			See the section 4.5 of this plan for the list of current and potential federal, state and local funding sources for hazard mitigation. OEM administers FEMA's Pre-Disaster Mitigation, Flood Mitigation Assistance and Emergency Management Performance Grant programs and has helped multiple communities in Colorado leverage these funds. OEM has also provided state agencies and local governments with EMPG funding for drainage studies and education programs related to flood hazards.
4.5	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			The will occur as part of the September 2013 flooding recovery.
4.6	Update crosswalk between CRS planning and local mitigation planning tool.	OEM	The CRS Coordinator's Manual underwent a significant update in 2012-2013. The OEM developed crosswalk needs to be revised to reflect the new manual and activities that can earn additional credits through CRS Activity 510.						X		New in 2013
4.7	Develop multi-hazard database of state and local mitigation goals, objections, and actions by hazard.	OEM CWCB	This will serve as a tool to assist state-level prioritization of mitigation actions, identify statewide or regional action gaps compared to known hazard areas, and serve as a resource for organizations developing or updating mitigation plans.		X			X			New in 2013 This database should be updated regularly as state and local mitigation plans are updated and approved. It should cost roughly \$5,000 in EMPG or HMA funds for annual update and maintenance.

GOAL 4: Coordinate and provide planning, technical assistance, and financial resources for State, local and watershed planning efforts

ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
4.8	Develop a process to identify areas of Colorado where the combination of NFIP policy holders and flood risk indicate the potential for strong FMA projects	OEM CWCB, Flood TAP UDFCD	Develop outreach/communication strategy to approach local floodplain managers, emergency managers, and related professionals on potential FMA projects in their area.						X		<p>New in 2013</p> <p>This is due to a shift in federal funding away from the multi-hazard PDM program, and availability of FMA funding through increasing federal efforts to reduce claims to the NFIP. This effort is also being initiated to strengthen local participation in a traditionally under-applied program in Colorado. This effort is estimated to cost \$100,000 in FMA state management costs for annual technical assistance. The system is to be developed by March 2014, with initial implementation in April-July 2014.</p>

GOAL 5: Continue to update and develop floodplain maps for risk assessment, planning and awareness applications

ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
5.1	Create user-friendly floodplain map system through website design	CWCB	In Progress	X	X			X			The first phase of the Flood DSS is complete and outreach efforts have followed. Second phase efforts may include a smart phone application to enhance user access. The CWCB also posts information related to digital flood map status on the Colorado Risk MAP webpage (http://coloradofloodrisk.state.co.us/Pages/RiskMAPHome.aspx)
5.2	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.	OEM CGS CWCB	Conduct statewide workshops	X	X				X		OEM Mitigation staff provides technical assistance to local governments on multi-hazard mitigation plans. Additionally, OEM staff provides technical assistance on developing stand alone Risk Assessments, which include comprehensive mapping with "hazard overlays". The FloodDSS also utilizes this concept and has been promoted at workshops at CASFM Conferences in 2010, 2011, and 2012.
5.3	Digitize existing 100-year floodplain maps.	CWCB	In Progress		X			X			See the discussion on DFIRM/Risk MAP mapping progress in this plan.
5.4	Promote compatibility of Federal, State, and local GIS capabilities.	CWCB	In Progress		X			X			CWCB is a partner with the Office of Information Technology's efforts in this area.
5.5	Create a Dam Safety Inundation Map Database	DNR-DWR	Create a map that has dam name and location and inundation map.		X			X			New in 2013 Development in progress
5.6	Develop post-fire debris flow hazard maps	CGS CWCB							X		New in 2013
5.7	Provide technical assistance to local communities in the development of future conditions mapping for CRS credit	CWCB							X		New in 2013
5.8	Develop erosion hazard zone mapping as part of 2013 post flood recovery	CWCB						X			New in 2013 A similar project done in southwest Utah could be used as a model.

GOAL 6: Promote and encourage the adoption of model codes and higher standards that emphasize hazard mitigation											
ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
6.1	Support the concept of communities using land use or construction permitting processes consistent with hazard reduction principles.	OEM CWCB DLG UDFCD	In progress		X			X			As a part of its technical assistance services, OEM 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. The Floodplain Management Program at UDFCD promotes floodplain preservation to local governments and developers within the District with the idea that the benefits of a preserved floodplain (recreation, wildlife habitat, etc.) can be marketed by developers as amenities to their projects, but also they become long term assets to the communities.
6.2	Promote development of master drainage plans for state properties.	CWCB OEM	Survey state institutions to determine existing criteria		X					X	CWCB provides funds for watershed master plans with emphasis on post-disaster recovery and mitigation from the 2013 flooding. OEM funds small flood studies through its EMPG program, though it does not fund full master drainage studies.

GOAL 6: Promote and encourage the adoption of model codes and higher standards that emphasize hazard mitigation

ID#	Recommendation	Lead and Partner Agencies	Action	Progress				Priority			Comments (on status, implementation and/or funding)
				Complete	Ongoing	Deferred	Deleted	High	Medium	Low	
6.3	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			CWCB promulgated new rules of higher standards in 2010. CWCB is engaged with communities across Colorado to gather their input on the proposals. Ongoing efforts are in place for communities to locally implement provisions of these rules, which must happen by January 2014 or sanctions will be applied.
6.4	Implement a statewide CRS strategy	CWCB	Develop statewide CRS committee/interest group					X			New action in 2010 to capture ongoing effort. CRS subcommittee of CASFM formed; Subcommittee provided input on revisions to CRS Coordinator's manual in 2012 and 2103.
6.5	Incorporate new state floodplain standards into local standards.	CWCB	Coordinate with local communities and provide technical assistance to incorporate and implement new standards.		X			X			New in 2013 In progress as of October 2013

4.4.2 Evaluation of Actions and Activities

The actions associated with the flood mitigation plan were presented in Table 23 in Section 4.4.1 organized by the major goal they help to achieve. This table was utilized as a tool to review the progress on achieving the goals and recommendations related to the flood hazard mitigation plan during the update process. As actions are reviewed during the update the table is updated to reflect the progress on mitigation action as a measure of achievement of the overarching goals.

The action table was evaluated and updated at Flood TAP meetings in 2013, and shared via email. Progress on the actions is noted in the ‘Progress’ and ‘Comments’ columns. The table includes 54 actions in total. The table indicates that 15 projects are completed, 35 ongoing, eight noted as both completed/ongoing, one deferred, and one deleted as of November 2013. Fifteen new projects were added in 2013 as noted in the ‘Comments’ column. The total number of actions and the number of completed and/or ongoing ones indicates that the State of Colorado and its partner organizations are taking great strides towards meeting flood mitigation goals. Goals 1 and 2 have the greatest number of related actions and most number indicated as completed. The Flood TAP discussed that future updates of this plan should consider reducing the number of actions to a smaller and more manageable number. This could be accomplished by moving some of the completed actions to the State Capabilities discussion or creating an appendix of completed actions. This would focus the list of actions moving forward. Some consolidation of actions occurred as a result of the 2013 evaluation, namely those related to public education and outreach under Goal 2. Also the Flood TAP noted that a number of new mitigation opportunities and lessons learned will be forthcoming during the 2013 flood recovery process. The group agreed that an addendum to this plan should be developed to capture these opportunities and update the mitigation strategy in 2014 (see related action items 1.11, 1.12, and 2.15)

As a result of the 2013 review and evaluation the lead and support agency(ies) associated with each action and priorities were revisited. Lead agencies have been made clearer by designating them in bold text. It was also noted that UDFCD, CASFM and FEMA are key support agencies/entities with many of the listed mitigation actions. These agencies have been added to the table accordingly. An action identification number was also added to facilitate action reference and tracking.

The action review and evaluation process is also outlined in more detail in Section 6.2.2 of this plan.

4.4.3 Prioritization of Actions and Activities

Once the mitigation actions were identified, the Flood TAP 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 24. 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 24 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. By connecting 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. During the local plan rollup in 2013 mitigation actions from reviewed local plans were grouped into categories of mitigation actions which originated from the National Flood Insurance Program’s Community Rating System (CRS). The six categories include:

- **Prevention:** Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural:** Actions that involve the construction of structures to reduce the impact of a hazard.

- **Natural resource protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services:** Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

Table 25 summarizes the number of actions per category. There were also 82 actions categorized under “NFIP Participation.” Details on specific mitigation actions can be found in Appendix B, where they are listed by county. Appendix B can be used by the state to identify potential projects and guide technical and/or financial assistance.

Table 25 Number of Mitigation Actions in Local Multi-Hazard Mitigation Plans by CRS Category

CRS Category	# of Actions
Prevention	347
Property protection	46
Structural	17
Natural resource protection	9
Education Outreach	23
Emergency Services	35

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 OEM to help communities locate potential sources of available federal and state funding. As grants from different sources are posted, OEM 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, EMPG

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 27.

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. Army Corp of Engineers 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. OEM 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, Office of Emergency Management, and the Natural Resources 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 26 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. Furthermore, OEM provided state agencies and local governments with Emergency Management Performance Grant (EMPG) funding for drainage studies and education programs related to flood hazards.

Table 26 Flood Mitigation Funding in Colorado: 2005-2013

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	
2010	Left Hand Creek Flood Project, City of Longmont Stone Creek Floodplain Improvements, Eagle County	\$5,689,013 \$240,000
2011	Flood Mitigation Project at Montview Bridge, City of Aurora	\$2,979,865
2012	NA	
2013	Pleasant Valley Flood Mitigation Project, City of Colorado Springs (application in process) Erosion Mitigation Project, City of Durango (application in process) Sanderson Gulch Reach 1 Improvements, City and County of Denver (application in process)	\$5,538,671 \$1,262,524 \$6,851,732
Pre-Disaster Mitigation (PDM) Program		
2005:	Drainage Project, City of Grand Junction Drainage/Retention 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	

2010:	Fountain Creek Stabilization and Erosion Project	\$4,362,391
2011:	Cottonwood Creek Stabilization at Vincent Drive Bridge, City of Colorado Springs John Law Ditch Flood Risk Reduction, Town of Windsor	\$4,024,318 \$2,224,778
2012:	Greencrest Channel Stabilization, City of Colorado Springs St Vrain River Flood Project, City of Longmont	\$3,870,790 \$5,400,000
2013:	Platte Avenue Bridge Stabilization, City of Colorado Springs (application in process)	\$4,065,061
Hazard Mitigation Grant Program (HMGP)		
2008:	Greeley Water Line Protection at Windsor Lake	
2009:	NA	
2010:	NA	
2011:	NA	
2012:	NA	
2013:	NA	
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
2011:	Diversion Dam Reconstruction Design, Gunnison River Festival Relief Ditch Diversion Reconstruction Design, Gunnison Gorge Anglers – TU Watershed Plan Update, Eagle River Watershed Council Dolores Watershed Tamarisk Removal - Passive Revegetation, Southwest Conservation Corps North Fork South Platte River WARSSS Phase 1 & 2, Colorado Open Lands Boulder Creek Riparian Revegetation, Wildlands Restoration Volunteers Rock Creek Riparian Revegetation, Wildlands Restoration Volunteers Sustaining Colorado Watersheds Sponsorship, Colorado Riparian Association	\$25,000 \$25,000 \$25,000 \$37,500 \$7,000 \$8,395 \$18,000 \$5,000
2012:	Trimble Survey Unit (MRP), Colorado Watershed Assembly Edwards Eagle River Restoration Project, Phase IIB, Eagle River Watershed Council Boulder Creek Riparian Restoration/Invasive Species Removal, Wildlands Restoration Volunteers Dolores River Watershed Tamarisk Removal, Southwest Conservation Corps Diversion Reconstruction, Mancos Conservation District Measurable Results Program, Colorado Watershed Assembly	\$4,175 \$25,000 \$11,940 \$20,000 \$19,990 \$19,271

2013:	Upper Glen Cove Creek Erosion Control, Rocky Mountain Field Institute	\$29,500
	Fourmile Fire Flood Mitigation, Boulder County	\$24,500
	Uncompahgre River Riparian Revegetation, Uncompahgre Watershed Partnership	\$6,000
	Lower Swan River Channel & Wetland Restoration, Swan's Nest HOA & Metropolitan District	\$28,100
	Colorado River Watershed Inventory and Assessment, Eagle River Watershed Council	\$25,000
	Chico Basin Riparian Revegetation, Wildlands Restoration Volunteers	\$8,420
	Diversion Dam Reconstruction Design, Coal Creek Watershed Coalition	\$4,300
Colorado Watershed Restoration Program		
2009:	Bank Stabilization & Riparian Revegetation, Colorado Open Lands	\$28,520
	Riparian Maintenance & Monitoring, Eagle River Watershed Council	\$50,000
	Channel Restoration – Trout Habitat Improvement, Boulder Flycasters	\$30,000
	Floodplain/Channel Design Planning, Lake Fork Watershed Stakeholders	\$95,000
	Diversion Structure Assessment & Project Prioritization, Mancos Conservation Dist.	\$30,500
	Bank Stabilization & Riparian Revegetation, Coalition for the Upper South Platte	\$50,000
	Greenway Master Plan, Westerly Creek Connection	\$37,500
	Mine Mitigation, Bank Stabilization & Riparian Protection, Kerber Creek Restoration	\$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
2011:	Bank Stabilization & Riparian Revegetation, Coalition for the Upper South Platte	\$50,000
	Channel Restoration – Trout Habitat Improvement, Trout Unlimited – West Denver	\$20,300
	Bank Stabilization & Riparian Revegetation, Chatfield Watershed Authority	\$20,000
	Bank Stabilization & Riparian Revegetation, Rocky Mountain Field Institute	\$7,115
	Riparian Revegetation, Wildlands Restoration Volunteers	\$8,200
	Bank Stabilization & Riparian Revegetation, Colorado Mountain College	\$30,000
	Ditch Diversion Reconstruction, Coal Creek Watershed Coalition	\$13,705
	Bank Stabilization & Riparian Revegetation, Trout Unlimited	\$37,000
	Bitch Diversion Reconstruction, Trout Unlimited – Gunnison Gorge Chapter	\$25,000
	Channel Restoration Planning, Animas River Partnership	\$13,220
	Channel Restoration Design, Blue River Watershed Group	\$25,000
	Ditch Diversion Reconstruction, Colorado Water Trust	\$39,325
2012:	Bank Stabilization & Riparian Revegetation, Wildlands Restoration Volunteers	\$65,000
	Channel – Floodplain Restoration/Beaver Habitat Creation, Colorado Open Lands	\$40,000
	Fen Restoration, Mountain Studies Institute	\$17,435
	Forest Road Restoration/Sediment Mitigation, Roaring Fork Conservancy	\$39,579
	Watershed Assessment, Land Trust of the Upper Arkansas	\$15,500
	Bank Stabilization & Riparian Revegetation, NFRIA-WSERC Conservation Center	\$62,100
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
2011:	Riparian Revegetation/Community Education, Groundwork Denver	\$15,000
	Riparian Revegetation, Rio Grande Headwaters Restoration Project	\$5,000
2012:	Sedimentation Mitigation, Coalition for the Upper South Platte	\$25,000
	Invasive Species Removal/Riparian Revegetation, Wildlands Restoration Volunteers	\$10,590
	Water Quality Monitoring, Chatfield Watershed Authority	\$15,000
	Macroinvertebrate Sampling, Colorado Watershed Assembly	\$20,000
	Riparian Vegetation Assessment, Tomichi Creek Stakeholders Group	\$6,000
	Sediment Analysis, Coal Creek Watershed Coalition	\$13,500
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
2011:	Upper South Platte Diversion Reconstruction, Coalition for the Upper South Platte	\$75,000
2012:	Stream Mitigation Banking Protocols, Colorado State University	\$50,000
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: OEM, 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. HMGP funding will likely become a more important source of mitigation funding in the aftermath of the 2013 September flood disaster due to the amount of federal disaster assistance funding associated with the event. CDBG funding may also become a source for matching funds and applied in acquisition projects.

Colorado Flood and Drought Response Fund

Colorado's Flood and Drought Response Fund was created in 2012 and is managed by the CWCB. The Fund can be used for flood and drought preparedness and for response and recovery activities following flood or drought events and disasters. Up to \$300,000 is available through this fund on an annual basis.

National Flood Mitigation Fund

The Act (called the Biggert-Waters Flood Insurance Reform Act of 2012, found in H.R. 4348) consolidates three previous NFIP funded mitigation programs described below into a single program. The combined National Flood Mitigation Fund (NFMF) is to be funded at \$90 million per year. While the old Flood Mitigation Assistance (FMA) and Severe Repetitive Loss (SRL) program were funded annually at up to \$40 million per year each and the Repetitive Flood Claims (RFC) program at up to \$10 million annually, the SRL program was never fully utilized in part due to its complexity. More information can be found at: <http://www.fema.gov/flood-insurance-reform-act-2012>. The new program simplifies and combines the three previous programs and includes the following elements:

- Encourages flood mitigation planning to be integrated into a community's multi-hazard mitigation plan,
- Adds demolition/ rebuild (mitigation reconstruction) as an allowed mitigation activity under all programs,
- Caps the use of mitigation grant funds for mitigation planning activities at \$50,000 (states) and \$25,000 (communities),
- Provides for denial of grant funds if not fully obligated in 5 years, and
- Restructures federal share requirement:
 - Up to 100% for severe repetitive loss structures (4+ Claims of over \$5000 or 2+ claims exceeding value of structure)
 - Up to 90% for repetitive loss structures (2 claims over 10 years averaging at least 25% of value of structure)
 - Up to 75% for other approved mitigation activities.

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 OEM. In general, the mitigation staff of the OEM 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, and in years prior, CWCB and OEM 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 and studies between 2004 and 2013. 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 27 illustrates many of the projects that were completed with funding and technical assistance from the CWCB since 2004.

Table 27 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

Project	Comments
	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 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
Flood Season Flood Forecasting	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.
Flood documentation services.	Kleinfelder has been used as a consultant 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.
Floodplain Information Reports were prepared for Routt, Denver, Jefferson, and Elbert Counties - 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

Project	Comments
	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 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.
Engineering Services Regarding Near-Term Flooding and Debris Flow Mitigation and Drainage Planning for Williams Canyon in Manitou Springs, CO	CWCB assisted in financing engineering services to address near-term impacts posed by flooding and debris flows within Manitou Springs (i.e., impacts anticipated to occur in the remainder of 2013, in 2014 and during the subsequent two to three years when runoff rates from the burned watershed are anticipated to pose the greatest threat to the City). Longer term drainage planning concerns and issues for the City will be taken into consideration during the implementation of this scope of work for near-term measures.
Post-Fire Hydrology, Inundation Mapping and Debris Flow Assessment, Waldo Canyon Fire, El Paso County	CWCB assisted in financing this project is to support emergency management of post-fire <i>Areas of Concern</i> for potential flood inundation in the Waldo Canyon burn scar. To develop this mapping for flood warning and potential evacuation will require use of quality base mapping, development of post-fire hydrology & hydraulic models, and an understanding of potential debris flow. This project affords a great opportunity for public outreach to make the potential hazard understood in the watershed community and encourage partnerships to mitigate those hazards.
Fourmile HEC-HMS Routed Flow Modeling	CWCB assisted with funding for this project to route modeled peak flows from the Fourmile Fire burn area to Boulder Creek and Fourmile Canyon Creek. Major tasks for the project include expanding the HEC-HMS Fourmile Fire model to include all subcatchments within the burn area tributary to Fourmile Creek and Fourmile Canyon Creek; using the expanded model to develop routed flows at the confluence of Fourmile Creek and Boulder Creek and at the upstream end of Fourmile Canyon Creek; and documenting the modeling efforts and results of the previous two tasks in a brief memorandum including necessary graphs and tables.
Cache La Poudre River Watershed RiskMAP Project, High Park Fire Area Flood Hazard Mapping and Mitigation Support	The scope of work for this project includes assistance from CWCB staff to identify post-wildfire needs in the High Park Fire Area and develop a scope of work to determine post-wildfire flood hazards and evaluate flood mitigation alternatives for protecting public infrastructure and homes from loss or damage.

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. Thirty-two 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-two visits occurred in 2010. Eleven CAVs were conducted in 2011, twenty-eight in 2012, and nineteen in 2013 as of July 31. Table 28 illustrates the CAV visits conducted in Colorado since 2007. The CWCB has provided assistance to local governments in modification to local floodplain ordinances to conform to the Rules update that goes into effect January 2014.

Table 28 Community Assistance Visits 2007 - July 2013

Community	CAV Date	Agency	Community	CAV Date	Agency
Winter Park, Town of	6/11/2007	STATE	De Beque, Town of	3/9/2010	STATE
Fraser, Town of	6/13/2007	STATE	Fruita, City of	3/10/2010	STATE
Granby, Town of	6/13/2007	STATE	Grand Junction, City of	3/10/2010	STATE
Eagle, Town of	6/18/2007	STATE	Mesa County	3/10/2010	STATE
Canon City, Town of	6/27/2007	FEMA	Delta, City of	4/19/2010	STATE
Coal Creek, Town of	6/27/2007	FEMA	Delta County	4/20/2010	STATE
Brookside, Town of	6/28/2007	FEMA	Hotchkiss, Town of	4/21/2010	STATE
Rockvale, Town of	6/28/2007	FEMA	Paonia, Town of	4/21/2010	STATE
Williamsburg, Town of	6/28/2007	FEMA	Cedaredge, Town of	4/22/2010	STATE
Silverthorne, Town of	7/2/2007	FEMA	Orchard City, City of	4/22/2010	STATE
Central City, City of	7/9/2007	STATE	Arapahoe County	5/25/2010	STATE
Sheridan, City of	7/12/2007	STATE	Englewood, City of	5/25/2010	STATE
Hinsdale County	7/17/2007	STATE	Littleton, City of	5/26/2010	STATE
Lake City, City of	7/17/2007	STATE	Sheridan, City of	5/26/2010	STATE
Montrose, City of	7/17/2007	STATE	Deer Trail, City of	5/27/2010	STATE
Boulder County	8/8/2007	FEMA	Aurora, City of	6/2/2010	STATE
Cortez, City of	8/21/2007	FEMA	Glendale, City of	6/2/2010	STATE
Dolores, Town of	8/21/2007	FEMA	Cherry Hills Village, City of	6/10/2010	STATE
Montezuma County	8/21/2007	FEMA	Columbine Valley, Town of	6/10/2010	STATE
Grand Junction, City of	9/18/2007	STATE	Weld County *	06/25/10	FEMA
Mesa County	9/18/2007	STATE	Mesa County *	07/23/10	STATE
Vail, Town of	9/25/2007	STATE	Morgan County *	07/28/10	STATE
Glenwood Springs, City of	10/9/2007	STATE	Kiowa, Town of	08/10/10	FEMA
Timnath, Town of	10/18/2007	FEMA	Fort Morgan, City of	08/12/10	STATE

Community	CAV Date	Agency	Community	CAV Date	Agency
Silt, Town of	10/25/2007	STATE	Nunn, Town of	08/12/10	STATE
Breckenridge, Town of	11/7/2007	STATE	Wellington, Town of	08/13/10	STATE
Manitou Springs, City of	11/9/2007	STATE	Denver, City And County of	08/20/10	STATE
Julesburg, Town of	11/20/2007	STATE	Wheat Ridge, City of	08/20/10	STATE
Sterling, City of	11/20/2007	STATE	Arvada, City of	09/20/10	STATE
Firestone, Town of	12/4/2007	STATE	Craig, City of	09/30/10	STATE
Fort Lupton, Town of	12/4/2007	STATE	Federal Heights, City of	12/01/10	FEMA
Frederick, Town of	12/20/2007	STATE	Colorado Springs, City of	06/07/11	OTHER
Monte Vista, City of	2/5/2008	FEMA	El Paso County*	06/07/11	OTHER
Erie, Town of	2/7/2008	STATE	Fountain, City of	06/07/11	OTHER
Larimer County	2/13/2008	FEMA	Green Mountain Falls, Town of	06/07/11	OTHER
Elizabeth, Town of	2/14/2008	FEMA	Manitou Springs, City of	06/07/11	OTHER
Severance, Town of	2/20/2008	STATE	Monument, Town of	06/07/11	OTHER
Windsor, City of	2/20/2008	STATE	Palmer Lake, Town of	06/07/11	OTHER
Brush, City of	2/28/2008	FEMA	Elbert County*	06/29/11	OTHER
Fort Lupton, Town of	2/28/2008	FEMA	Westminster, City of	07/21/11	OTHER
Fort Morgan, City of	2/28/2008	FEMA	Evans, City of	07/27/11	OTHER
Wiggins, City of	2/28/2008	FEMA	Archuleta County *	10/25/11	OTHER
Morgan County	2/29/2008	FEMA	Longmont, City of	03/15/12	FEMA
Steamboat Springs, City of	3/25/2008	STATE	Castle Rock, Town of	03/27/12	OTHER
Arapahoe County	3/29/2008	FEMA	Lafayette, City of	04/02/12	OTHER
Del Norte, Town of	4/2/2008	FEMA	Otero County *	04/16/12	OTHER
Pagosa Springs, Town of	4/2/2008	FEMA	La Junta, City of	04/17/12	OTHER
Ault, Town of	4/9/2008	STATE	Prowers County*	04/17/12	OTHER
Pierce, Town of	5/14/2008	STATE	Colorado Springs, City of	04/19/12	OTHER
Johnstown, Town of	6/12/2008	FEMA	Thornton, City of	04/26/12	STATE
Mead, Town of	6/12/2008	FEMA	Aurora, City of	06/06/12	OTHER
Milliken, Town of	6/12/2008	FEMA	Boulder County *	06/07/12	OTHER
Windsor, City of	6/12/2008	FEMA	Brush, City of	06/12/12	OTHER
Eaton, Town of	6/13/2008	FEMA	Fort Morgan, City of	06/12/12	OTHER

Community	CAV Date	Agency	Community	CAV Date	Agency
Platteville, Town of	6/13/2008	FEMA	Morgan County *	06/12/12	OTHER
Weld County	6/13/2008	FEMA	Wiggins, City of	06/12/12	OTHER
South Fork, Town of	9/22/2008	STATE	Logan County *	06/14/12	OTHER
Durango, City of	10/8/2008	STATE	Sterling, City of	06/14/12	OTHER
Ignacio, Town of	10/9/2008	STATE	Pueblo, City of	08/02/12	OTHER
La Plata County	10/9/2008	STATE	Telluride, Town of	08/22/12	STATE
Craig, City of	10/14/2008	STATE	Mesa County *	08/30/12	OTHER
Dacono, Town of	3/6/2009	STATE	Huerfano County*	10/25/12	STATE
Morrison, Town of	3/6/2009	STATE	Las Animas County*	10/26/12	STATE
Nunn, Town of	3/6/2009	STATE	Pueblo County *	10/26/12	STATE
Greenwood Village, City of	3/9/2009	STATE	Frisco, Town of	11/01/12	OTHER
Edgewater, City of	3/11/2009	STATE	Pitkin County*	11/07/12	STATE
Jefferson County	3/11/2009	STATE	Poncha Springs, Town of	12/12/12	STATE
Evans, City of	3/12/2009	STATE	Ouray County *	12/13/12	STATE
Greeley, City of	3/12/2009	STATE	Ridgway, Town of	12/14/12	STATE
Pagosa Springs, Town of	5/7/2009	STATE	San Miguel County *	12/14/12	STATE
Centennial, City of	6/24/2009	STATE	Lakewood, City of	01/23/13	OTHER
Carbondale, City of	7/21/2009	STATE	Eagle County *	03/08/13	STATE
New Castle, Town of	7/22/2009	STATE	Greenwood Village, City of	03/08/13	STATE
Rifle, City of	7/22/2009	STATE	Broomfield, City And County of	03/09/13	STATE
Parachute, Town of	7/23/2009	STATE	Boulder County *	03/12/13	FEMA
Buena Vista, Town of	7/24/2009	STATE	Louisville, City of	03/12/13	OTHER
Loveland, City of	8/4/2009	STATE	Boulder, City of	03/14/13	FEMA
Telluride, Town of	8/17/2009	STATE	Granby, Town of	04/18/13	STATE
Ouray, City of	8/18/2009	STATE	Winter Park, Town of	04/19/13	STATE
Steamboat Springs, City of	8/24/2009	STATE	Hinsdale County*	05/15/13	STATE
Louisville, City of	9/24/2009	STATE	Lake City, City of	05/15/13	STATE
Superior, Town of	9/24/2009	STATE	Rio Blanco County *	05/20/13	STATE
Jamestown, Town of	9/25/2009	STATE	Colorado Springs, City of	06/17/13	OTHER
Northglenn, City of	10/2/2009	STATE	Manitou Springs, City of	06/17/13	OTHER

Community	CAV Date	Agency	Community	CAV Date	Agency
Lafayette, City of	10/26/2009	STATE	Telluride, Town of	06/24/13	OTHER
Longmont, City of	10/26/2009	STATE	Ouray, City of	06/25/13	OTHER
Westminster, City of	11/2/2009	STATE	Estes Park, Town of	07/16/13	OTHER
Palisade, Town of	3/8/2010	STATE	Rio Grande County *	07/30/13	OTHER
Collbran, Town of	3/9/2010	STATE	South Fork, Town of	07/31/13	OTHER

Source: CWCB

5.2 Local Plan Integration

5.2.1 Process and Timeframe to Review Local Plans

A worksheet was developed and is utilized by the OEM 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 provided in Appendix B; an enhancement made 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 OEM 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 OEM website. OEM 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 (SHMT) 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 benefit/cost 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 all 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 OEM and the Flood TAP.

The OEM 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 Flood TAP, 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 Flood TAP
- Assisting other agencies with the implementation of mitigation actions
- Coordinating with agencies between Flood TAP 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 Flood TAP on grant funds available or disbursed for actions
- Engaging and maintaining the interest of the agencies participating on the Flood TAP
- Monitoring progress of local mitigation plan development in coordination with COEM and providing technical and financial assistance related to flood hazards

In addition to the coordinator role, OEM 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 OEM 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 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 stormwater and 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 Emergency Management Coordinators
- 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 OEM 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.

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 OEM 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, OEM 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 OEM. OEM will monitor the implementation process as a whole at all levels to ensure that progress is being made. Representatives of the OEM 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 2016 with a target completion by September 2016. It is also recommended that the mitigation actions are reviewed on an annual basis. The annual review should occur as part of the Flood TAP meeting scheduled in January or prior to flood season. The review should consider upcoming funding opportunities that could be used to implement mitigation actions.

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. This plan was undergoing revision and finalization during the September 2013 floods. The Flood TAP agreed that an addendum to the update should occur in 2014 that more thoroughly assesses the impacts and mitigation opportunities from the September 2013 flooding.

6.1.3 Method and Schedule for Updating Plan

Updates to state hazard mitigation plans are required the DMA every three years. In February 2013 FEMA entered a proposed rule to the Federal Register for changing the state mitigation plan update requirement from three to five years. As an annex to the Colorado Hazard Mitigation Plan, the Flood Mitigation Plan will need to remain aligned with the update schedule of that plan. Updates to the Plan must conform to the latest DMA 2000 and EMAP planning requirements. The next update of the Colorado Hazard Mitigation Plan will need to be reapproved by FEMA by December of 2016, or 2018 if the proposed rule goes into effect. The

CWCB and Flood TAP will aim to complete the Plan by early September of the year the update is due to allow enough time for OEM to integrate it with the Hazard Mitigation Plan and submit to FEMA to review the Plan and for the state to readopt it. The Plan will need to be approved by the CWCB by September of the update year. The Plan will be readopted by the Governor as part of the overall Hazard Mitigation Plan.

OEM will coordinate with the CWCB on the schedule and specific needs for the State Hazard Mitigation Plan update. Funding needs for the next update cycle should be identified and pursued so that the necessary resources are in place in advance of the update year. At the fall Flood TAP meeting prior to the update year the CWCB will issue a schedule for the drought plan update. This schedule will establish a timeline for the following (and other activities as needed):

- Plan update meetings
- Determining involvement and activities of newly participating state agencies (as well as changes in existing ones), including assessment of vulnerabilities, analysis of programs and policies, and identification of new mitigation actions
- Updating the status of mitigation actions identified in the plan
- Contracting consultant assistance, as necessary

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 is revisited with each plan update. With the 2010 revision Section 6 was made more specific in regards to agency responsibilities, Flood TAP duties, and timelines. With the 2013 plan update more specifics were added to Sections 6.1.2 and 6.1.3 on the method and schedule for evaluating and updating the plan.

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 OEM 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 23 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 mitigation actions listed in the plan should be reviewed annually for progress and updated every three years for consistency with the mitigation programs. The Flood TAP or alternately 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.

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 OEM. OEM will monitor the implementation process as a whole at all levels to ensure that progress is being made. Representatives of the OEM 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 23 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 in the Flood Mitigation Plan and NHMP have been implemented over the years as noted in Table 23 in Section 4.4.1 and Section 4.4.2. 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 OEM. OEM has completed many outreach and education initiatives, including speaking on flood mitigation at the CASFM conferences and annually at the Colorado Governor's Emergency Management Conference. CWCB and OEM 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 26 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 as described in Section 4.3.2.

Appendix A International Code Council (ICC) Adoption by Jurisdiction

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCP	IWUIC	IZC	ICC 700
Hot Springs	L	L	L													
Hot Springs Village	L	L														
Jacksonville	L	L	L													
Jonesboro	L	L	L													
Little Rock	L	L	L				L			L	L					
Lowell	L	L	L	L	L		L		L							
Marion	L	L	L													
Mountain Home	L	L	L													
North Little Rock	L	L	L													
Rogers	L	L	L													
Russellville	L	L	L													
Siloam Springs	L	L	L													
Springdale	L	L	L													
Van Buren	L	L	L													
California	X09	X09	X09								X09					
Kern County														L		
La Habra										L						
Marin County														L		
Novato Fire District														L		
Pasadena														L		
Poway														L		
Ventura County														L		
Colorado	S09, L	S06, L	S06, L	S09, L	X09	L	S09, L	L	S09, L	L	L		L	L	L	L
Adams County	L	L	L	L	L		L		L	L	L					
Alamosa	L	L	L	L	L				L							
Alamosa County	L	L	L	L												
Arapahoe County	L	L	L	L	L		L		L							
Archuleta	L	L	L													
Archuleta County	L	L	L	L	L											
Arvada	L	L	L	L	L	L	L		L	L	L		L	L	L	
Arvada Fire District			L													
Aspen	L	L	L	L	L		L		L	L	L					
Aspen Fire Department			L													
Ault	L	L	L	L	L		L		L	L	L					
Aurora	L	L	L	L	L		L		L	L	L					
Avon	L	L	L	L												
Avondale	L	L	L	L						L						
Basalt	L	L	L	L			L		L		L					
Bayfield	L	L	L	L			L									
Bennett	L	L	L	L	L		L		L	L	L					
Black Hawk	L	L	L	L	L		L		L	L	L					
Blue River		L														
Boulder	L	L	L	L	L		L	L	L							
Boulder County	L	L	L	L	L		L	L	L				L	L		
Boulder Rural Fire Protection District			L													
Breckenridge	L	L	L	L	L		L		L							
Brighton	L	L	L	L	L											
Broomfield, City and County	L	L	L	L	L		L		L							
Brush	L	L	L	L	L		L		L							
Buena Vista	L	L														
Canon City	L	L	L	L			L									
Carbondale	L	L	L	L	L		L		L							
Castle Pines North	L	L	L	L	L		L		L							

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCP	IWUIC	IZC	ICC 700
Castle Rock	L	L	L	L	L		L		L		L	L				
Centennial	L	L		L	L		L		L							
Central City	L	L	L	L	L		L		L		L					
Chaffee County	L	L														
Chaffee County Fire Protection District			L													
Cherry Hills Village	L	L	L	L	L		L		L							
Clear Creek County	L	L		L	L		L		L							
Clifton Fire Protection Dist			L													
Coal Creek Canyon Fire Protection District			L											L		
Collbran	L	L		L	L		L		L	L						
Colorado Div. of Housing	L	L		L	L		L		L							
Colorado Examining Brd of Plumbers					X		X									
Colorado Springs	L	L	L	L			L		L		L					
Colorado State Buildings Programs	X			X	X		X		X							
Columbine Valley	L	L		L	L		L			L						
Columbing Valley	L	L		L	L		L			L						
Commerce City	L	L	L	L	L		L		L	L	L		L			
Copper Mountain FPD			L													
Cortez	L	L	L	L	L		L		L	L						
Craig	L	L	L	L	L		L		L	L						
Crested Butte	L	L		L	L		L									
Cripple Creek	L	L	L	L	L		L		L	L	L					
Cunningham Fire Protection District			L													
Dacono	L	L	L	L	L		L			L	L					
DeBeque	L	L		L	L		L		L	L						
Del Norte	L	L		L	L											
Delta	L	L	L	L	L		L		L							
Delta County	L	L														
Denver	L	L	L	L	L				L							
Dillion	L	L	L	L	L		L									
Dillon	L	L	L	L	L		L									
Douglas County	L	L	L	L	L		L		L							
Durango	L	L	L	L	L		L		L							
Eagle	L	L		L	L		L		L							
Eagle County	L	L	L	L	L		L		L							
East Grand Fire Protection District			L													
Eaton	L	L		L	L		L									
Edgewater	L	L	L	L	L		L		L		L					
El Paso County	L	L		L			L		L		L					
Elizabeth	L	L	L	L	L		L		L							
Elk Creek FPD			L											L		
Englewood	L	L	L	L	L		L		L	L						
Erie	L	L	L	L	L		L		L		L					
Estes Park	L	L		L	L		L		L		L					
Evans	L	L	L	L	L		L			L						
Evergreen Fire Protection District			L											L		
Falcon Fire Protection District			L													
Fairmont Fire Protection District			L													
Fairplay	L	L		L	L		L									
Federal Heights	L	L	L	L	L		L		L	L	L		L			
Firestone	L	L	L	L	L		L		L	L	L					

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCP	IWUIC	IZC	ICC 700
Florence	L	L	L	L												
Foothills Fire and Rescue			L											L		
Fort Collins	L	L	L	L	L		L		L	L						L
Fort Lupton	L	L	L	L	L		L		L	L	L					
Fort Morgan	L	L	L	L	L		L		L							
Fountain	L	L	L	L			L		L							
Fraser	L		L													
Frederick	L	L	L	L	L		L									
Fremont County	L	L														
Frisco	L	L	L	L	L		L		L							
Fruita	L	L	L	L	L		L		L	L						
Fruita Fire District			L													
Garfield County	L	L		L	L		L									
Genesee FPD			L											L		
Gilcrest	L	L		L	L		L		L	L	L					
Gilpin County	L	L														
Glendale				L												
Glenwood Springs	L	L	L	L	L		L			L	L					
Glenwood Springs Fire District			L													
Golden	L	L	L	L	L		L		L		L					
Golden Gate Fire			L											L		
Granby	L	L		L	L		L		L							
Grand County	L	L		L	L		L									
Grand Jct Rural FPD			L													
Grand Junction	L	L	L	L	L		L		L	L						
Grand Junction Fire Dept			L													
Grand Lake	L	L	L	L	L		L		L							
Grandby	L	L		L	L		L									
Greeley	L	L	L	L	L		L		L	L	L					
Greenwood Village	L	L	L	L	L		L		L							
Gunnison	L	L	L	L			L		L	L	L					
Gunnison County	L	L		L			L		L							
Gypsum	L	L	L	L			L									
Hayden	L	L		L	L		L		L		L					
Hot Sulphur Springs	L	L		L	L		L									
Hotchkiss	L	L							L							
Hudson	L	L		L	L		L		L	L	L					
Huerfano County	L	L		L					L							
Idaho Springs	L	L	L	L	L		L				L					
Ignacio	L	L	L	L	L		L		L							
Indian Hills FPD			L													
Inter-Canyon Fire Rescue			L											L		
Jamestown	L	L		L	L		L		L							
Jefferson County	L	L	L	L	L		L		L							
Johnstown	L	L	L	L	L		L		L							
Keenesburg	L	L		L	L		L		L	L	L					
Kersey	L	L		L	L		L		L	L	L					
Kremmling	L	L		L	L		L									
La Plata County	L	L	L	L	L		L		L							
Lafayette	L	L		L	L		L		L							
Lake County	L	L		L	L		L				L					
Lake Dillon FPD			L													
Lakewood	L	L	L	L	L		L		L		L					

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCPC	IWUIC	IZC	ICC 700
Lamar	L	L	L	L	L		L		L	L						
Larimer County	L	L		L	L		L		L		L					L
Littleton	L	L	L	L	L		L		L		L					
Littleton FPD			L													
Lochbuie	L	L	L	L	L		L									
Logan County	L	L		L	L		L									
Lone Tree	L	L	L	L	L		L		L							
Longmont	L	L	L	L	L		L		L	L	L					
Louisville	L	L	L	L	L		L		L							
Loveland	L	L	L	L	L		L		L	L	L					
Lower Valley Fire District			L													
Lyons	L	L		L	L		L		L	L	L					
Mancos	L	L							L	L						
Mead	L	L	L	L	L		L		L	L	L					
Meeker	L	L	L	L			L									
Mesa County	L	L		L	L		L									
Mesa County Regional	L	L	L	L	L		L		L	L						
Milliken	L	L	L	L	L		L				L					
Milliken Fire Protection District			L													
Minturn	L	L		L	L											
Moffat County	L	L		L	L		L		L	L						
Monte Vista	L	L		L					L							
Montezuma	L	L		L	L		L									
Montrose	L	L	L	L	L		L		L	L	L		L			
Morgan County	L	L		L												
Morrison	L	L	L	L	L		L		L		L					
Mountain View Fire Protection District			L													
Mountain Village	L	L	L	L	L		L		L	L						
Mt Crested Butte					L											
Nederland	L	L	L	L	L		L		L							
New Castle	L	L	L	L	L		L		L							
North Fork FPD			L											L		
North Metro FPD			L											L		
North Washington FPD			L													
Northglenn	L	L	L	L	L		L		L	L	L					
Nunn	L	L		L	L		L		L	L	L					
Oak Creek	L	L	L	L	L		L		L		L					
Orchard City	L	L	L	L	L		L		L							
Pagosa Springs	L	L	L	L			L									
Palisade	L	L		L	L		L		L	L						
Parachute	L	L	L	L	L		L									
Park County	L	L		L			L									
Parker	L	L	L	L	L		L		L	L	L	L				
Parker Fire Protection District			L													
Pierce	L	L		L	L		L		L	L	L					
Pikes Peak Regional Building Dept.	L	L		L			L		L		L					
Pitkin County	L	L	L	L	L		L		L	L	L					
Platteville	L	L		L	L		L		L	L	L					
Pleasant View Fire Dept.			L													
Poncha Springs	L	L														
Pueblo	L	L	L						L	L						
Pueblo County	L	L							L							

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IgCC	IECC	IPMC	IEBC	ISPSC	ICCP	IWUIC	IZC	ICC 700
Rangely	L			L	L	L				L						
Red Cliff	L	L	L	L	L		L				L					
Red White & Blue Fire Rescue			L													
Rifle	L	L		L	L		L									
Rio Blanco County	L	L		L	L											
Rio Grande County	L	L		L												
Routt County	L	L	L	L	L		L		L		L					
Routt County Regional					L											
Salida	L	L	L	L	L		L		L	L	L					
San Miguel County	L	L		L	L		L		L	L	L					
Severance	L	L		L	L		L		L	L	L					
Sheridan	L	L	L	L	L				L	L	L		L			
Silt	L	L	L	L	L		L			L	L					
Silver Cliff	L	L							L							
Silverthorne	L	L		L	L		L									
Snake River FPD			L													
Snowmass Village	L	L	L	L	L		L		L		L					
South Fork	L	L		L												
South Metro Fire District			L													
South West Adams County Fire & Rescue			L													
Steamboat Springs	L	L	L	L	L		L		L		L					
Sterling	L	L	L	L	L		L		L							
Summit County	L	L		L	L											
Superior	L	L	L	L	L	L	L		L	L					L	
Teller County	L	L		L	L		L		L	L	L					
Telluride	L	L	L				L		L	L						
Thornton	L	L	L	L	L		L		L	L	L					
Timnath	L	L		L	L		L		L	L	L					
Tri-Lakes Monument Fire Rescue	L		L	L	L		L		L					L		
Trinidad	L	L	L	L	L				L							
Vail	L	L	L	L	L		L		L							
Weld County	L	L		L	L		L									
Wellington	L	L		L	L		L		L	L	L					
West Metro Fire Rescue			L													
Westcliffe	L	L		L					L							
Westminster	L	L	L	L	L		L		L		L					
Wheat Ridge	L	L	L	L	L		L		L	L						
Wheat Ridge Fire Protection District	L		L	L	L											
Wiggins	L	L		L												
Windsor	L	L		L	L		L		L	L	L					
Windsor Severance FPD			L													
Winter Park			L													
Yampa	L	L	L	L	L		L		L		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

This appendix is contained in a separate electronic spreadsheet.