Flood Hazard Mitigation Plan for COLORADO

February 1998

Department of Natural Resources
Colorado Water Conservation Board
in cooperation with
Department of Local Affairs
Office of Emergency Management

Flood Hazard Mitigation Plan for Colorado

February 1998

Prepared Pursuant to
Section 409, PL 93-288

and the following
Federal/State Disaster Assistance Agreements

FEMA-DR-665-CO (Estes Park Dam-Break Flood 1982)
FEMA-DR-719-CO (Western-Slope Flooding 1984)
FEMA-DR-1186-CO (Flood Disaster in Colorado)

Prepared by the

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Division of Local Government
Office of Emergency Management

Original Plan	January 1983
Status Report No.1	December 1983
Second Program Review	January 1985

PREFACE

The State of Colorado, its political subdivisions, and our citizens are confronted daily with the possibility of flooding and related hazards. Floods have the potential for inflicting tremendous damages with significant losses of life and property, as well as posing a threat to the health, safety, and welfare of Colorado's citizens.

Current growth and population migration require a heightened awareness that the impact of flooding may likely increase over time. Mitigation begins with effective hazard assessments and comprehensive disaster preparedness programs. Mitigation builds upon the foundation of disaster preparedness by implementing strategies which are part of an overall plan to effectively reduce losses from disasters.

The Colorado Office of Emergency Management (OEM) is designated by law as the coordinating agency for disaster preparedness, response, recovery, and mitigation. The Colorado Water Conservation Board (CWCB) is the lead state agency for flood mitigation. These two offices assist other state agencies, local governments, Native American Tribes, and the private sector in addressing hazard identification and mitigation actions.

This flood mitigation plan represents a commitment to mitigate potential losses and damages by isolating the primary causes and recommending courses of action. The intent of the information, ideas and recommendations contained herein is to make a concerted effort to reduce or limit flooding impact on the people of Colorado.

This plan reflects the state's priorities for flood hazard mitigation. These priorities were developed through a private/local/state/federal team process. In order to implement this plan, a number of agencies, entities, and others need to work together to successfully mitigate damages caused by flooding. The goals and objectives outlined in the plan and within the appendices support this effort. Accomplishments can only be realized by joint efforts, dedication and commitment to mitigation.

This plan was prepared in accordance with the Stafford Act and FEMA/State Agreement for Presidential Disaster Declaration DR-1186-CO.

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Chapter 1 - Introduction

1.0 Introduction

1.1 Purpose

In addition to fulfilling the legal obligation under the Stafford Act, this mitigation plan serves:

- To recognize and describe flood hazards and their impact upon the state.
- To identify federal, state and local agencies, capabilities and shortfalls, and assign responsibilities to: (1) develop programs, activities, strategies, and recommendations for mitigation; and (2) monitor and implement pre-disaster and post-disaster mitigation measures.
- To document existing federal, state, and local government programs that relate to flood hazard mitigation.
- To identify and discuss critical issues which, if resolved, would enhance mitigation efforts.
- To identify and establish mitigation goals, objectives, and priorities for governmental actions to reduce flood damages.
- To offer mitigation strategies and measures for the state and local government jurisdictions to use in their planning efforts.
- To guide the State of Colorado and its local jurisdictions in taking action as may be reasonably expected to reduce flood damages.
- To document the flood and recovery process resulting from presidential disaster declarations.

1. 2 Scope

The scope of the plan is statewide. It is not necessarily limited to the declared disaster area because all streams in Colorado have the potential to flood and cause damages, regardless of the cause. Both short-term and long-term opportunities for flood hazard mitigation are considered. Furthermore, ideas for mitigation measures that go beyond existing federal, state or local funding frameworks have been evaluated.

The plan does not attempt to consider mitigation opportunities for some of Colorado's other natural hazards such as drought, winter storms, avalanches, tornadoes, earthquakes, and wildfires. A Wildfire Mitigation Plan, Landslide Mitigation Plan, and Drought Plan have been developed and supplement this Flood Hazard Mitigation Plan. Future floods in Colorado are inevitable, and this plan should be reviewed and updated annually or as necessary following each major disaster.

The Mitigation Plan is not a manual on what state agencies should do when the next flood or dam break occurs. Such response procedures are covered in the "Colorado State Emergency Operations Plan" prepared and updated by the Colorado Office of Emergency Management (see ***Appendix C*** - References).

1.3 Authority

1.3.1 Federal

The requirement for state governments to prepare a Hazard Mitigation Plan following a Presidential Disaster Declaration is stated in Section 409 of Public Law 93-288, Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) as amended by Public Law 100-707, 42 U.S.C. 5121 et seq. and the Hazard Mitigation and Relocation Assistance Act of 1993 and establishes the pre-requisites for state receipt of federal disaster assistance. The Act requires the identification, evaluation, and mitigation of significant hazardous conditions attributed to the most recent disaster. Additional authority is derived from the following:

- Presidential Executive Order 11988, Floodplain Management
- Presidential Executive Order 11990, Protection of Wetlands
- FEMA Regulation, 44 CFR, Part 13, administrative requirements
- FEMA Regulations, 44 CFR, Part 17, Subpart F, drug-free work place
- FEMA Regulations, 44 CFR, Part 206, Subparts M & N
- Final Report of the Interagency Floodplain Management Review Committee - June 1994
- FEMA DR-1186-CO Hazard Mitigation Team Report - October 1997

1.3.2 State

Presidentially declared disasters include a stipulation that the state must initiate the mitigation process. This condition is required by Section 409 of the Stafford Act (as amended) and is also stated in the FEMA-State Agreement for DR-1186-CO Flood Disaster in Colorado, declared August 1, 1997. The governor, through his executive power, directs specific agencies to participate in post-disaster mitigation activities. Additional authority is derived from the following sources:

- ***"Colorado Disaster Emergency Act of 1992"*** (Part 21 of Article 32, Title 24, Colorado Revised Statute, 1988 as amended).
- ***Governor's Office - "Colorado Disaster Emergency Act of 1992"*** (Part 21 of Article 32, Title 24, Colorado Revised Statute, 1988 as amended states the governor, as the executive head of state, has the inherent responsibility, constitutional and statutory authority, to commit state and local resources (personnel, equipment, and finances) for the purpose of ***... meeting the dangers to the state and its people presented by disasters...*** This responsibility is exercised through the director, Office of Emergency Management (OEM), Department of Local Affairs (DOLA). The Governor's Disaster Emergency Council serves as an advisory council to the governor and the director, Office of Emergency Management on all matters pertaining to Declarations of State Disaster Emergencies, and on the response and recovery activities of state government.

1.3.3 Local Government

Local governments play an essential role in implementing effective mitigation, both before and after disaster events. In a post-disaster environment, locally affected areas are also expected to participate in mitigation evaluation. Local government participation with federal and state agencies in the Colorado Hazard Mitigation Team process is crucial. Recommendations on alleviating or eliminating a repetitive problem often focus on local assessment as to the cause of damage and depend on a local applicant for implementation.

Both OEM and the Colorado Water Conservation Board (CWCB) have suggested communities prepare a flood hazard mitigation plan for their jurisdiction This is a logical extension of the mitigation planning process initiated on a national scale by the federal government. A carefully drafted plan can be an extremely valuable resource to formulate annual work programs, budgets and policy positions.

1.4 Goals and Objectives

The Colorado Flood Hazard Plan is the cornerstone for establishing and guiding a statewide effort to reduce or eliminate the impact on life, property, and the environment from the flood hazard. The costs of responding to and recovering from repetitive flooding increases with each event. However, it is possible to break the cycle of recurring damage by evaluating the root cause and choosing a logical and realistic course of action from among potential alternative solutions to eliminate or reduce either the cause or its impact.

The implementation of mitigation measures is challenging due to additional costs and assuring cost effectiveness of the measures. Mitigation measures can be difficult to initiate because of social/economic and/or political oppositions. Perceptions of benefit vs. threat diminish greatly as an event fades from thought. However, mitigation successes can be accomplished by preparing accurate assessment information regarding hazards and when mitigation is supported by strong leadership and a commitment for positive change.

Government officials at all levels must understand that without proactive mitigation action by all applicable government agencies the costs associated with a natural disaster will increase. If no mitigation is done, the accumulated costs of future disasters will far exceed the cost of mitigation efforts applied now.

1.5 Definitions

The following definitions are offered as a guide toward better understanding the similarities and subtle differences between the major concepts discussed in this plan, all developed to reduce flood damages (additional definitions and acronyms are listed in ***Appendix D***).

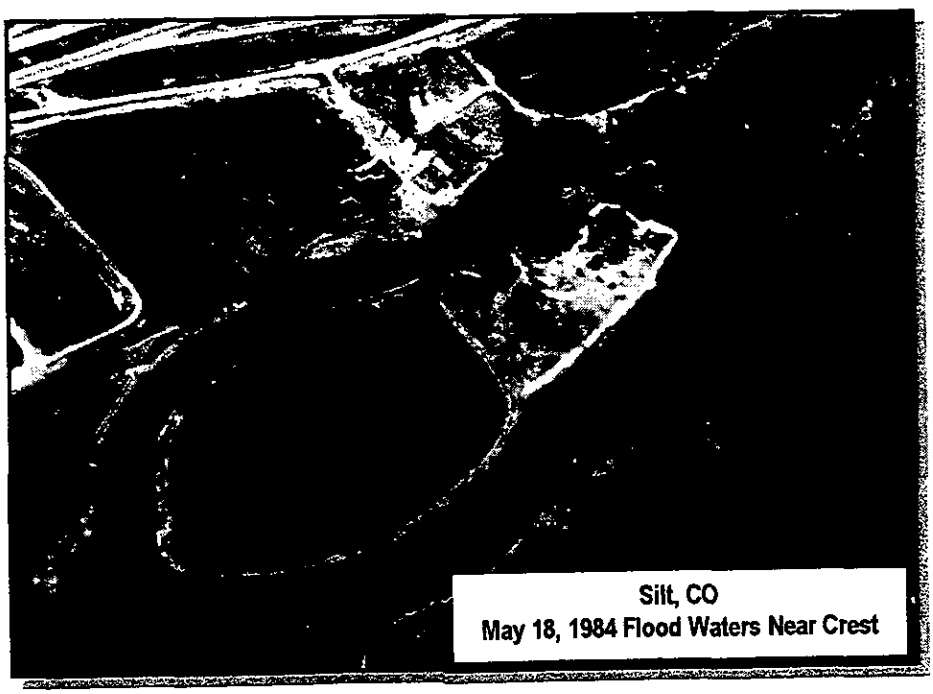
Hazard Mitigation - A plan to alleviate by softening and making less severe the effects of a major disaster or emergency and of future disasters in the affected areas, including reduction or avoidance. Hazard mitigation can reduce the severity of the effects of flood emergency on people and property by reducing the cause or occurrence of the hazard; reducing exposure to the hazard; or reducing the effects through preparedness, response and recovery measures. Hazard mitigation is a management strategy in which current actions and expenditures to reduce the occurrence or severity of potential flood disasters are balanced with potential losses from future floods.

Floodplain Management - A comprehensive approach to reduce the damaging effects of floods, preserve and enhance natural values and provide for optimal use of land and water resources within the floodplain. Its goal is to strike a balance between the values obtainable from the use of floodplains and the potential losses to individuals and society arising from such use. Various floodplain management strategies are organized in ***Chapter 5***.

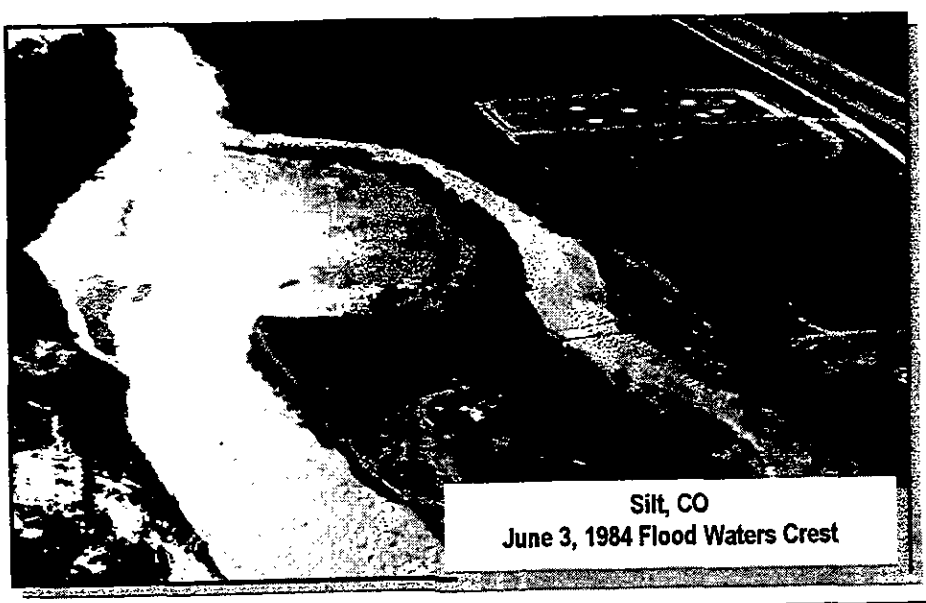
Dam Safety - A program to inventory, classify and inspect dams to identify hazardous conditions and ensure proper maintenance through corrective orders for the purpose of protecting human life and property. A dam (including the waters impounded by such dam) constitutes a threat to human life or property if it might be endangered by overtopping, seepage, settlement, erosion, sediment, cracking, earth movement, earthquakes, failure of bulkheads, flashboards, gates on conduits, or other conditions.

Emergency Preparedness - A program to reduce vulnerability of people and communities of this state to damage, injury, and loss of life and property resulting from natural or man made catastrophes (see ***Appendix D).***

Geologic Hazard Management - A program to recognize hazardous geologic processes and conditions and their potential adverse effects on existing or proposed works of man. Upon identification of such geologic hazard constraints, a second phase of management requires effective statutory and administrative procedures and actions to minimize loss of life and property through prudent controls and mitigation.



Silt, CO
May 18, 1984 Flood Waters Near Crest



Silt, CO
June 3, 1984 Flood Waters Crest

Chapter 2 - Hazard Identification and Evaluation

2.1 People and Hazards

Relationships between flood hazards and population identify patterns of risk, as shown in ***figure 2-1***. Relationships between patterns of risk and steps taken toward preparedness explain degrees of vulnerability to which various Coloradans are exposed.

Such relationships are not new to Colorado. The natural phenomena involved have occurred here long before people settled near them and were impacted by them. Risk grows from the increasingly close association between natural phenomena and a growing population.

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

Today, flood prone areas have been identified in 268 cities and towns and in all of the 63 counties in Colorado. Using information supplied from local units of government, there are estimated to be approximately 250,000 people now living in Colorado's floodplains. The Colorado Water Conservation Board (CWCB) estimates that approximately 65,000 homes and 15,000 commercial and industrial business structures are located in Colorado's floodplains. The total value of property, including structures and contents, exposed to the 100-year flood in Colorado is estimated to be over $11 billion dollars. Cumulative flood losses from the turn of the century to 1993 from the state's most damaging floods are $3.3 billion (1995 dollars).

Webster's Definitions

Flood:	**a temporary condition of inundation of normally dry land areas**
Hazard:	**a source of danger**
Mitigate:	**to cause to become less harsh or hostile, to make less severe**

2.2 Types of Hazards

2.2.1 Floods

Floods in Colorado occur on "riverine" systems consisting of a basin (or watershed) and a hierarchical order of stream channels which convey the normal flow of water through the watershed. The area adjacent to the channel is the floodplain. 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.

Colorado Flood Facts

Counties/Cities/Towns with Flood Prone Areas	268
Population of 100-Year Floodplain	250,000
Homes in 100-Year Floodplain	65,000
Commercial/Industrial Businesses in 100-year Floodplain	15,000
Total Value of Property in 100-Year Floodplain	$11 Billion
Cumulative Flood Losses from Turn of Century to 1997	$ 3.3 Billion

Source: CWCB *Figure 2-1*

The causes of floods relate directly to the accumulation of water from precipitation or the failure of man-made 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***

Rainfall and melting snow in the mountains feed four major river systems with headwaters in Colorado. These are the Missouri, Arkansas, Rio Grande, and Colorado River basins. These basins encompass many small streams and rivers as shown in ***Figure 2.2.***

Precipitation in each basin is related to the seasons and two major sources of moisture. Summer showers and thunderstorms that occur from June through September primarily are caused by moisture from the Gulf of Mexico or the Pacific Ocean. During the fall, occasional general rainstorms and thunderstorms occur from wet and warm cyclonic air masses, which move in from the southern Pacific Ocean. Winter and spring rain and snow storms are generally a result of moist air masses which originate in the cooler northern Pacific Ocean and move inland across the Pacific Northwest.

Floods caused by failure of manmade structures are a result of:

- ***Hydrologic deficiencies***
- ***Structural deficiencies***
- ***Improper Operation or Sabotage*** *(1 case in CO)*

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

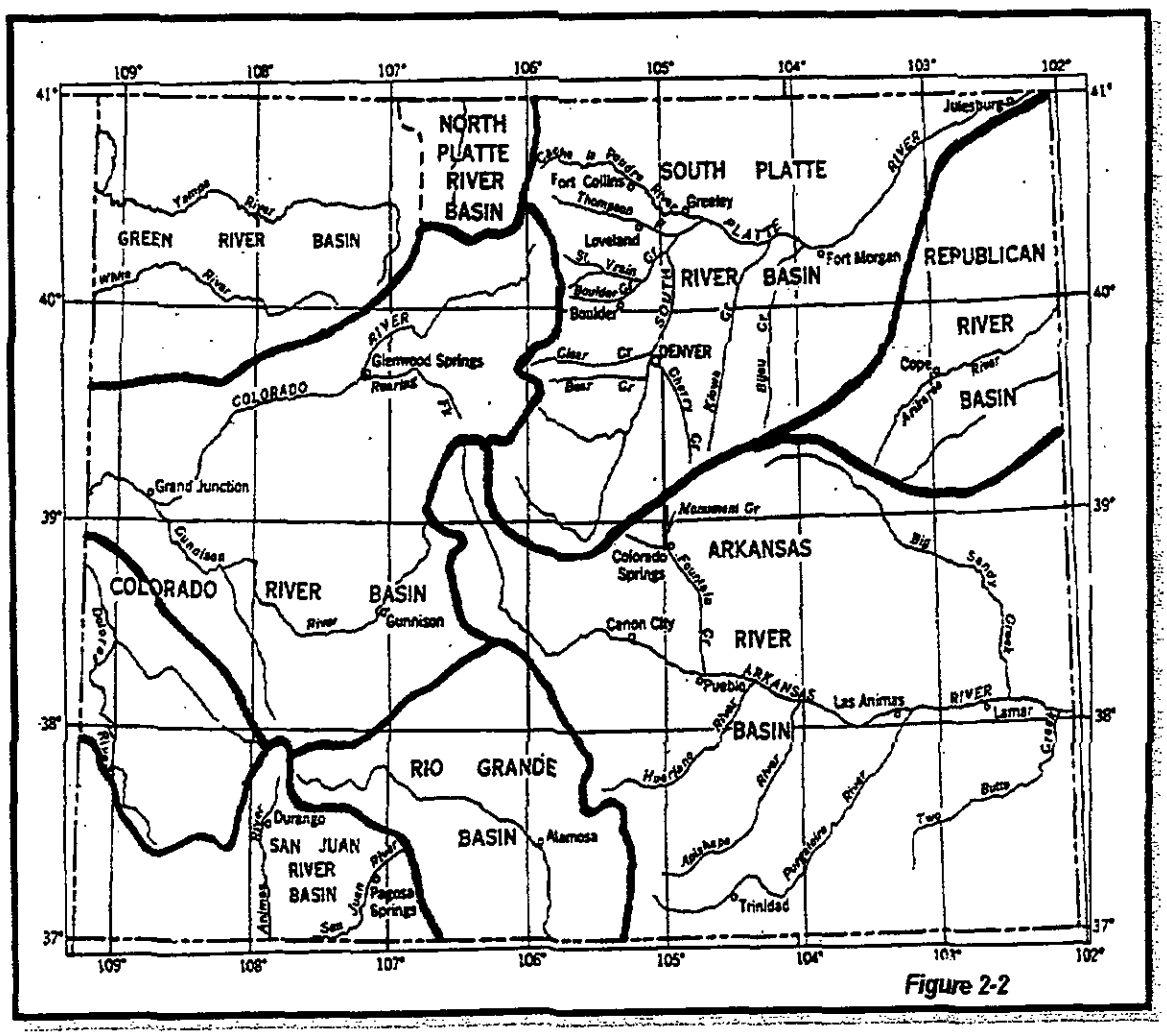


Figure 2-2

2.2.1.1 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.

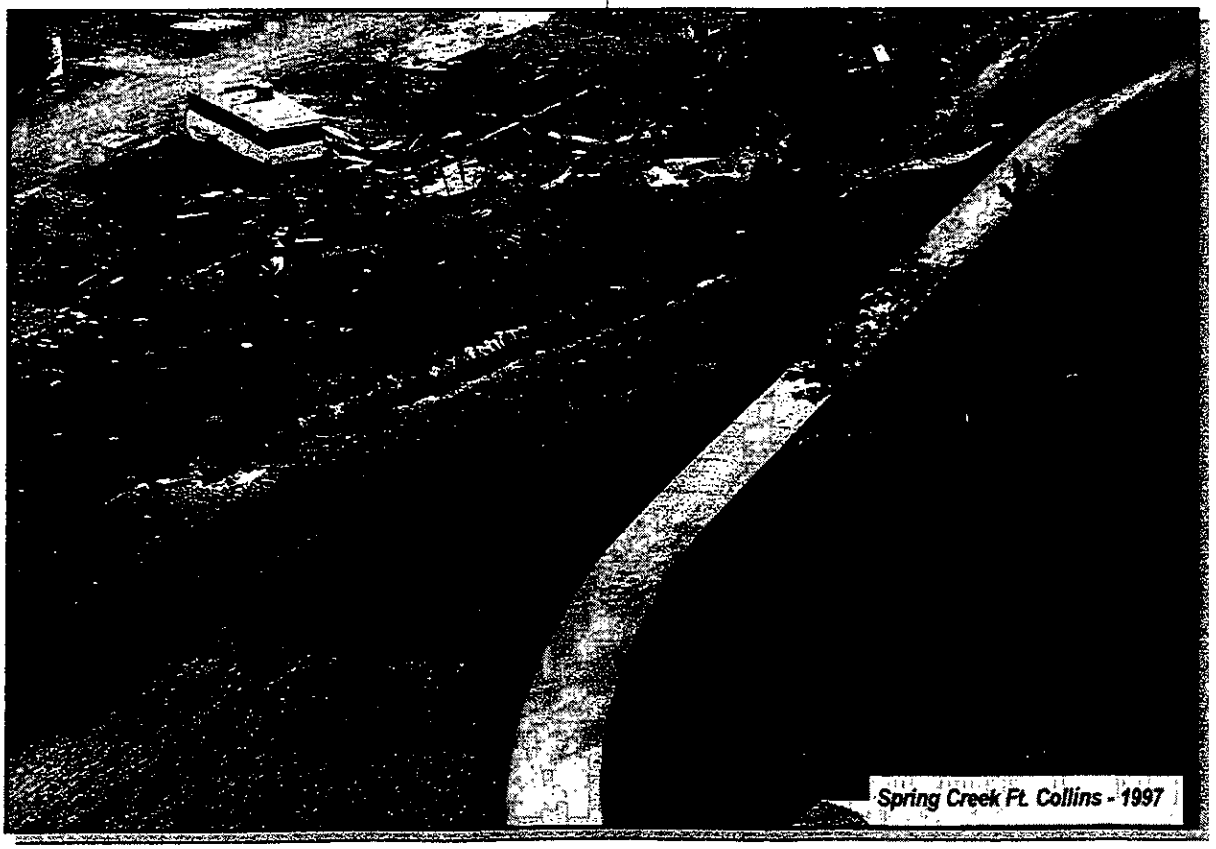
The October 5, 1911, floods in Pagosa Springs and Durango were a result of a general rain system over tributaries of the San Juan River Basin in southwestern Colorado. The June 3, 1921 flood in Pueblo was a result of a general rain system in the Upper Arkansas River Basin. The damaging floods of June 1965 in the Denver-metro area were a result of heavy to torrential rainfall over large portions of the South Platte River Basin, which lasted several days.

2.2.1.2 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 type 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. The widely publicized Big Thompson Canyon flood disaster of July 31, 1976, was a result of an intense thunderstorm cell, which dropped up to 10 inches of rain in a few hours over the basin.

On May 15-16, 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



Spring Creek Ft. Collins - 1997

20th Century "Monster" Rain Storms Front Range

Storm Name	Date	Maximum Rainfall
Livermore/Boxelder	May 20-21, 1904	8" +
Pueblo/Penrose	June 2-6, 1921	6-12"
Cherry Creek/Hale	May 30-31, 1935	12-24"
N. Colo. Front Range	Sept. 2-3, 1938	6-10"
Rye (S. Front Range)	May 18-20, 1955	6-13"
Plum Creek (and others)	June 16-17, 1965	14-16"
Big Elk Meadows	May 4-8, 1969	6-14"
Big Thompson	July 31, 1976	12"
Frijole Creek	July 2-3, 1981	8-16"
Fort Collins	July 27-28, 1997	14.5"
Pawnee Creek	July 29-30, 1997	15.1"

Source: "Colorado Extreme Storm Precipitation Data Study" by Tom McKee and Nolan Doesken, Colorado Climate Center, CSU May 1997
Figure 2-3

mobile home park on the creek's edge with losses estimated at $1 million.

In July of 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 protecting the northern half of town worked.

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 26-29, 1993, general rainstorms caused flooding in Archuleta and La Plata counties. 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 its 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, significant flooding impacted the lower South Platte, the lower Arkansas and the Roaring Fork Rivers. Most damages were experienced by agricultural landowners. In response to the floods, the Colorado General Assembly authorized Multi-Objective Floodplain Management studies for all three rivers. The intent of the studies is to develop viable, politically acceptable flood mitigation recommendations, which will reduce future flood damages. Currently, all three studies are ongoing with recommendations for flood mitigation measures expected by the end of 1998.

2.2.1.2.1 1997 - Flood Event Description

During the summer months, all of Colorado is subject to convective thunderstorms. When sufficient humidity is present in the atmosphere, some of these storms produce large amounts of rainfall in short time periods. The source of the humidity is typically moisture from the Gulf of Mexico and the central plain states which, under certain weather patterns, can drift into eastern Colorado. Also, in mid and late summer, a monsoon wind circulation brings moisture, originating from either or both the Baja California area and/or the Gulf of Mexico, northward up across

1997 Flood Event Greatest Impact Areas

Larimer County
- *Spring Creek drainage in Fort Collins*
- *Fairbrooke and Clearview Drainage channels in western Fort Collins*
- *West Vine Drainage area in northwestern Ft. Collins*
- *Colorado State University local drainage area*

Morgan County
- *Shaefer Draw north and into the Town of Weldona*

Logan County
- *Pawnee Creek northwest/ west of Sterling in Atwood, and the City of Sterling*

Additional Declared Counties
- *Numerous streams and watercourses contributed to flood damages in Lincoln, Prowers, Crowley, Kiowa, Weld, Baca, Otero, Clear Creek, Phillips and Elbert counties.*

Figure 2-4

Mexico into the Southwest. The moisture source is responsible for many of the summer thunderstorms over Colorado's mountains and western valleys.

In late July 1997, tropical moisture was streaming northward across Mexico and the Southwest into Colorado. At the same time, a large high-pressure system stalled over the central high plains of the United States. The system's clockwise rotation pumped very humid air from the central plains and Gulf of Mexico into eastern Colorado. A cold front associated with the high-pressure area over the northern plains, provided a trigger to set off thunderstorms as moist air masses converged over Colorado.

In the 3-4 days preceding July 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 27th, 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, July 28th. Several inches of new rain were

1997 Flood Damage

Public Assistance Program
$16,955,750

Individual Assistance Program
$7,925,000

As of October 1997 - Figure 2-6

Seventeen Most Damaging Floods in Colorado - *Figure 2-5*

Date		Major Stream or Location	Deaths	Damages
July	1896	Bear Creek at Morrison	27	$ -------
Oct.	1911	San Juan River near Pagosa Springs	2	100,000
July	1912	Cherry Creek at Denver	2	1,000,000
June	1921	Arkansas River at Pueblo	78	19,000,000
May	1935	Monument Creek at Colorado Springs	18	1,760,000
May	1935	Kiowa Creek near Kiowa	9	------
May	1955	Purgatory River at Trinidad	2	4,000,000
June	1965	South Platte River at Denver	8	500,000,000
June	1965	Arkansas River Basin	16	46,700,000
May	1969	South Platte River Basin	0	5,000,000
Sept.	1970	Southwest Colorado	0	4,000,000
May	1973	South Platte River at Denver	10	121,500,000
July	1976	Big Thompson River and Canyon	144	35,500,000
July	1982	Fall River at Estes Park	3	30,680,000
June	1983	North Central Counties	10	17,500,000
May-June	1984	Western and Northwestern Counties	2	31,000,000
May-June	1993	Flooding Western Slope	0	1,794830
July	1997	Fort Collins, Larimer, Weld, Logan, Phillips, Morgan, Elbert, Lincoln, Crowley, Kiowa, Otero, Prowers, Baca, and Clear Creek Counties	6	200,000,000

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 Rd. 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 July 30th (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 - August 12, 1997) storm systems drenched other areas in northeastern Colorado as well a 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.

2.2.1.2.2 1997 - Surface and Hydrology

Larimer, Logan, Weld, Morgan and Clear Creek counties have drainage tributaries to the South Platte River. In addition, portions of Elbert and Lincoln counties have tributaries to the South Platte River. The river basin has a drainage area of about 24,300 square miles and is located in three states, Colorado (79 percent of the basin); Nebraska (15 percent of the basin); and Wyoming (6 percent of the basin).

The basin has a continental climate modified by topography, in which there is large temperature ranges and irregular seasonal and annual precipitation. Mean temperatures increase from west to east and on the plains from north to south. Areas along the Continental Divide average 30 inches or more of precipitation annually, which includes snowfall in excess of 300 inches in contrast, annual precipitation on the plains east of Denver, Colorado, and in the South Park area in the southwest part of the basin, ranges from 7 to 5 inches. Most of the precipitation on the plains occurs as rain, which falls between April and September.

Rangeland is present across all areas of the basin except over the high mountain forests. Agricultural land is restricted mostly to the plains. Urban or built-up land is present primarily along the Front Range urban corridor in Colorado.

Phillips County and parts of Lincoln and Elbert counties have drainage tributaries to the Republican River. The Republican River is, in turn, tributary to the Kansas River in Kansas. The Republican River Basin in Colorado consists primarily of rangeland with some farming and ranching communities scattered throughout the basin.

The Arkansas River Basin is very similar to the South Platte River Basin in topography, geology and hydrology. Annual mean temperatures are slightly higher than the Platte Basin. Annual rainfall amounts average between 7 and 15 inches, except in the mountainous areas of the basin. Land use is similar, as well, and consists mainly of agriculture.

Crowley, Kiowa, Otero and Prowers counties are drainage tributaries to the Arkansas River. In addition, portions of Elbert, Lincoln and Baca counties are within the Arkansas River Basin.

A very small part of the incident area lies within the Cimmaron River Basin. The southern portion of Baca County has drainage tributaries to the Cimmaron River. The Cimmaron River flows from Colorado into Kansas and then into Oklahoma where it ultimately joins the Arkansas River in Tulsa. The Cimmaron River Basin is similar in topography and climate to the Arkansas River Basin.

2.2.1.3 Snowmelt Floods

Snowmelt floods result from the melting of the winter snowpack in the high mountain areas. Snowmelt floods typically begin as spring runoff appears, after the first spring warming trend. If the trend continues up to 8-10 consecutive days in a basin where the snowpack has a water content more than about 150 percent 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 varieties 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.

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.

2.2.1.4 Rain on Snow Floods

Rain on snowmelt 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 spring 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.

Flooding along the Colorado River in Grand Junction in July of 1884, along Clear Creek at Georgetown in June of 1965 and along the Gunnison and Colorado rivers at Grand Junction in June of 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 5-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. The stone riprap at Paonia's wastewater treatment plant experienced severe damage as did the bank armoring at Huff Addition 31 (a subdivision). A photo

PAONIA, CO 1984 Figure 2-7

taken at this subdivison in 1984 is displayed on the previous page. This site has a history of severe damage and resulting costs to local, state, and federal governments.

2.2.1.5 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. In 1955, 1962, and 1983, flooding in Rangely resulted from ice jams, as did 1973 flooding in Meeker.

2.2.1.6 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 downrush 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 depend 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.

There are approximately 27,000 dams in the State of Colorado. This includes 2,292 dams, which are under the jurisdiction of the state engineer, several thousand low dams for small capacity reservoirs known as "Livestock Water Tanks" (which are not normally inspected), and potential artificial impoundments created by highway embankments constructed across drainage ways. A dam must be at least 10 feet high or its reservoir must have a surface area of at least 20 acres or a storage capacity of at least 100 acre-feet to fall under the review of the state's dam safety program. Of the 2,292 inspected dams, 120 are federally owned, and 2,172 are nonfederally owned.

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.

In 1982, the failure of the Lawn Lake Dam, a privately owned dam on National Park property, caused $31 million in damages in Larimer County and Estes Park. A lawsuit awarded $480,000 to the family of one of the four persons killed in the disaster. The most unusual flood from the failure of a man-man 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, which extended under the lake.

2.2.2 Geologic Hazards Closely Associated with Flooding

Most geologic hazards are related one way or another to water. However, those selected for specific attention in the Mitigation Plan for 1984 are only those most often or directly associated with flooding, heavy runoff or dam failures (either as a cause or an effect).

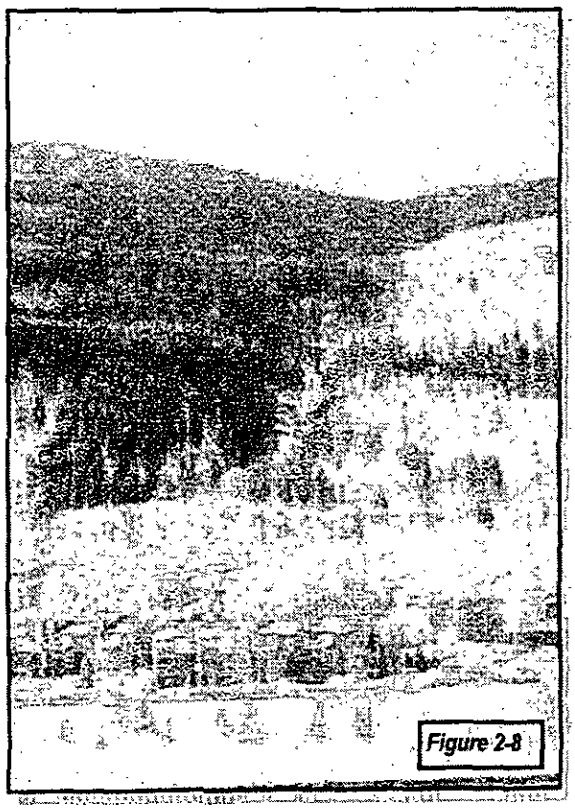


Figure 2-8

2.2.2.1 Mud and Debris Flows

Mudflows and debris flows, as defined in Colorado Statutes are essentially synonymous with mudslides as used by FEMA and other federal agencies. These are common events in mountainous areas of Colorado where they most often occur in steep ravines of first or second order streams. Events occurring in larger stream basins are usually less frequent but can affect much larger areas. Factors predisposing an area to mud and debris flow occurrences include basin size, geometry, and geology, combined with high antecedent soil moisture. The actual events are initiated by heavy runoff from either intense rainfall ("cloud bursts") or sudden heavy snowmelt. Rainstorm initiated events tend to involve smaller areas and shorter duration as they are limited to the basin(s) affected by a single thunderstorm cell. Those caused by snowmelt can be more extensive in area and can continue as a threat for several weeks. They are influenced by more general snowpack condition and temperature fluctuations.

Mud and debris flow events result in plugs of high velocity, high-density mud, rock, and woody debris that scour the middle and lower channel reaches and move considerable distances across the depositional area known as a debris fan.

During a given event, one or several successive plugs can form and descend upon the fan. A pulse of heavily sediment-laden floodwater follows each plug. Any works of man encountered on the fan surface can be destroyed or seriously damaged. Within the fan area the plugs or resulting streams of mud, rock, and debris can shift position quite unpredictably during a single event or from one event to the next.

Colorado's vulnerability to the hazard results from the fact that our climate, geology and terrain combine to make many areas of the state subject to mud and debris flow hazards. The high potential for damage is due to the fact that dozens of Colorado communities are in hazard locations. In addition numerous, attractive, but potentially hazardous, development sites remain throughout Colorado.

A debris fan is a sloping wedge-shaped heterogeneous deposit of rock, soil, and woody debris at the junction of a smaller stream with the valley of a larger one. The fan is created by periodic high-velocity mud and debris flows (mudslides) that come down the stream channel and are deposited on the fan.

Debris fans offer attractive but potentially hazardous development sites in many mountain valleys since they are well above the valley floor and the main stream floodplain (see ***Figure 2-8*** Vail, CO).

2.2.2.2 Catastrophic Landslides

Catastrophic landslides are herein defined as those landslides that have the potential to affect valley lands, populations, and facilities on a far greater scale than the event itself. The mechanisms by which the widespread effects can occur include:

- ***damming and backwater effects from the landslide deposits,***
- ***breaching by erosion of such a landslide formed dam with consequent downstream flooding, and***
- ***massive landslide deposits that enter and displace water of an existing reservoir thereby producing downstream flooding by dam failure or overtopping.***

A prototype incident of the catastrophic landslide type was the Thistle, Utah, slide of 1983. Several different types of landslides common in Colorado have demonstrated the potential for blocking of major streams with resulting backwater and other serious effects. These include large rock fall sheets, rockslides, earthflows,

and complex landslides. The most common characteristics are the large volume of slide material and the ability to move considerable distances. An exception to this generalization is the rockslide, which is sometimes capable of blocking a canyon location without moving an unusual distance from its site of origin.

The most serious threat of large and catastrophic landslide events in Colorado is probably from accelerated movement of marginally stable old slides. There are hundreds of large old slides in Colorado and 30 or more that show evidence of current activity.

A typical catastrophic landslide scenario for a reactivated old landslide is as follows: 1) A large landslide/ earthflow complex occupied the wide tributary valley seen in the right middle ground at sometime in the past few thousand years; 2) Man has developed the valley floor with transportation and utility facilities and town sites. 3) Slide movement is reactivated as a result of disruptions by construction and increased soil moisture from "normal" climatic fluctuations. 4) Millions of cubic yards of slide materials move continuously into the valley despite efforts to stop or divert the flow. 5) Movement continues until it is stopped by piling up against the opposite valley side. 6) By this time the valley is blocked to a height of several hundred feet, all utility and transportation facilities are severed and the stream in the main valley is dammed. 7) Emergency response officials are faced with immediate decisions relating to backwater flooding, downstream flooding when the slide is overtopped, restoratio of essential services, and evacuation of people from affected homes and townsites.

2.3 Historic Damages

2.3.1 Flood Damages

Compilations of exact data on the history of floods in Colorado since settlement began are lacking. The earliest known floods are reported to have occurred in 1826 in the Arkansas River and Republican River basins. Between 20 and 30 large magnitude floods (in terms of peak discharge) occur somewhere in Colorado every year.

The 17 most damaging floods in Colorado recorded history are listed in **Figure 2-5.** The most lives lost due to a single flood event occurred in the Big Thompson Canyon on July 31, 1976, when 144 people were killed.

The most damaging flood in Colorado occurred in June 1965 on the South Platte River when almost $500 million in damages were sustained in the Denver-metro area. Since the turn of the century, 331 people have been killed and over $3.3 billion in property damages have resulted

1976 - BIG THOMPSON CANYON - LIVES LOST 144

from the 17 most damaging floods in Colorado. A study completed in 1983 of the largest known floods in various front range drainage basins indicated over 350 people have died since the 1800s as the result of flooding. All streams, regardless of size, have the potential to flood. In many parts of Colorado, spring brings the greatest threat of flooding because of additional water from melting snowpack.

In addition, thunderstorms capable of producing flash floods are most common in May through September. Since the turn the turn of the century, damaging floods in the state have killed 337 people and caused property damage of $3.3 billion (1997 dollars).

The average annual loss in Colorado due to floods is $16 million. Between 1965 and 1997 the president has declared eight major disasters in Colorado as a result of floods. The president has declared areas in Colorado a major disaster during eight of the past 30 years. Most of these disasters were caused by precipitation, but two were caused by dam failure. A summary of these presidentially declared disasters is

Recent Presidential Major Disaster Declarations - Figure 2-9

Year	Location	Cause
1965	Front Range 33 Counties	Sustained Rainfall
1969	Front Range 15 Counties	Sustained Rainfall
1970	Southwest	Sustained Rainfall
1973	(1) Kersey (2) Front Range 13 Counties (3) Southwest 13 Counties	Dam Failure Sustained Rainfall Sustained Rainfall
1976	Big Thompson Front Range 2 Counties	Flash Flooding, Heavy Rainfall Over Short Duration
1982	Lawn Lake Front Range 1 County (Larimer)	Dam Failure
1984	Western Slope 15 Counties	Snowmelt Floods and Mudslides
1997	Front Range 13 Counties	Sustained Rainfall

shown in ***Figure 2-9.***

2.3.2 Mud and Debris Flow Damages

Mud and debris flow damages have been common throughout the history of modern man in Colorado. Many of the older mountain communities were built in part or entirely on the sides of major mountain valleys, which are the usual locations of the debris fans of smaller tributary streams. A debris fan is the depositional landform produced by successive mud and debris flow deposits. The towns of Glenwood Springs, Ouray, Telluride, and Idaho Springs have a long history of damaging debris and mudflows. The town of marble in Gunnison County was nearly destroyed by severe flows in the 1930s and 1940s, and the mining community of Brownville (near Silver Plume in Clear Creek County) was engulfed and destroyed by a series of flows in June of 1912.

Much of the damage and loss of life during the Big Thompson storm and flood of 1976 were caused by multiple debris flows from smaller tributary streams. The 1965, 1969, and 1973 storm and flood events of the Front Range area produced extensive debris avalanching that originated on steep mesa side slopes of Douglas County. During the abnormally heavy spring snowmelt runoff of 1984 in Eagle County the communities of Vail, Beaver Creek, and Redcliff were impacted by numerous debris flow events. In addition to threats to life and residential properties, the mud and debris flow events produce even more widespread effects on transportation and other public facilities requiring extensive and costly cleanup and repair annually throughout Colorado.

Documentation and descriptive material regarding mud and debris flow phenomena in Colorado can be found in Colorado Geological Survey (CGS) publications listed in ***Appendix C.***

Renewed development in mountainous areas of Colorado has increased dramatically in the past thirty years, driven by the demand for new resort communities and second homes. This pressure has led to a tremendous increase in development of lands vulnerable to severe to moderate mud and debris flow hazards. Identification and mitigation of existing hazards and future recognition of hazards in advance of land use decisions could save many lives and millions of dollars in property losses in the years ahead.

Damages in Colorado from debris flows and landslides are known to have amounted to several millions of dollars in 1984. More careful documentation of geologic damages and separation of these from floodwater damage are listed in the Colorado Landslide Hazard Mitigation Plan, Bulletin 48, Colorado Geological Survey, 1988.

2.3.3 Catastrophic Landslide Damages

Catastrophic landslides capable of damming major streams have been relatively rare in Colorado during the historic period. The most serious example is probably the DeBeque Canyon slide of June 1924 which temporarily blocked the Colorado River and resulted in forced relocation of a small community, highway, and railroad. Several other slides have or are encroaching on a stream but have not as yet advanced rapidly enough to cause serious backwater effects. However, there are hundreds of somewhat older inactive or semi-active slides in many areas of the state that could be reactivated or accelerated by increased ground moisture, stream erosion, man-made excavations or nearby earthquakes. There is particular concern that continued increase in soil moisture and snowmelt runoff as experienced in 1983 and 1984 could lead to reactivation of some of these slides such as occurred at Thistle, Utah, in 1983 with serious consequences.

2.3.3.1 Buffalo Creek Flood Event (1996)

On the night of July 12, 1996, a thunderstorm occurred in the area of the community of Buffalo Creek, Colorado. The storm produced heavy precipitation over a short period of time. A flash flood occurred along Buffalo Creek, Sand Draw, Spring Gulch, the North Fork of the South Platte River (North Fork) below its confluence with Buffalo Creek, and several other tributary streams in the area. Two lives were lost as a direct result of the flooding. Roads, bridges, water lines, and other utility lines were damaged or destroyed. Numerous homes, outbuildings, and vehicles were damaged or destroyed as well. A large quantity of sediment and debris was carried from the watershed and deposited along the affected stream reaches.

Although the geographic area affected was smaller than in some other floods, the July 12 Buffalo Creek flood event was truly a disaster. Other smaller scale floods have occurred in Buffalo Creek between June and September of 1996 as well.

In May of 1996, less than two months before the July 12 flood event, a wildland fire burned about 12,000 acres of forested area in the Buffalo Creek vicinity. The fire burned intensely and quickly, leaving behind charred timber and a barren landscape devoid of vegetation and ground cover. The burned soils exhibited hydrophobic (water repelling) properties, and the burned area's natural erosion control and runoff inhibiting characteristics were altered by the fire. Those conditions, in conjunction with a heavy rainstorm on July 12, were the recipe for disaster in Buffalo Creek.

Peak discharges for the July 12 event for the North Fork, Buffalo Creek, Sand Draw, and other tributaries

were estimated by the Colorado Water Conservation Board and the U.S. Geological Suvey (USGS). The CWCB obtained detailed surveyed cross-sections on the North Fork of the South Platte River, Sand Draw, and Buffalo Creek. The estimated flow rates on July 12 range from 4 to 25 times the published FEMA 100-year flow values. Obviously, the Buffalo Creek flash flood produced enormous flow magnitudes and was extremely dangerous.

2.4 Risk Information

To reduce the community's vulnerability to hazards, some knowledge of the risk/threat must exist. Thus, hazards assessment has two important components

1. ***Hazard Identification*** - What are the hazards that pose a threat to the community or a particular segment of the population? What is their expected magnitude? How frequently could they be expected to occur? Where are they likely to occur?

2. ***Vulnerability Analysis*** - What is the risk from the threat? What are the likely impacts? What are the economic, social, and political ramifications of these impacts?

In most communities, substantial work has already been completed on a hazard assessment, and maps portraying these risks are readily available. This is an integral step in the emergency planning process. Hazard assessment is the foundation upon which the local Emergency Operations Plan (EOP) is built. It is also the foundation for hazard mitigation planning, as well.

A hazard assessment provides the information that identifies the need to mitigate, as well as the ability to accurately focus mitigation efforts on a particular problem area. However, simply identifying vulnerability from an identified risk does not guarantee that any action will be undertaken to mitigate that situation. Thus, a critical component necessary to mitigate the impacts of hazards is a determination of acceptable ***risk.*** When vulnerability to a hazard risk is determined to be at an acceptable level, mitigation activities are not pursued. However, when communities determine that the vulnerability to a given risk is too great to chance (a determination of unacceptable risk), mitigation is pursued. (See ***Figure 2 - 10***).

This concept of acceptable risk is central to the community's determination as to whether mitigation is undertaken or not. This determination is typically answered based on community values being combined with technical information. Hazard assessments allow communities to focus on hazard mitigation planning needs. However, implementation of mitigation measures will only occur following the public's acceptance of both the problem and the solution. This requires a determination that there is unacceptable risk.

To sum up, the hazard mitigation planning process begins with the five preliminary steps relating to hazard assessment. First, the hazards affecting the jurisdiction must be identified. Second, the community's vulnerability to those hazards must be determined. Third, a determination of whether that vulnerability constitutes an ***unacceptable risk*** must be made. Fourth, if an unacceptable risk exists, it must be communicated to those who are in the position to effect its change. Fifth, the people receiving this risk information must agree that the risk is unacceptable, that there are viable solutions to the problem, and that

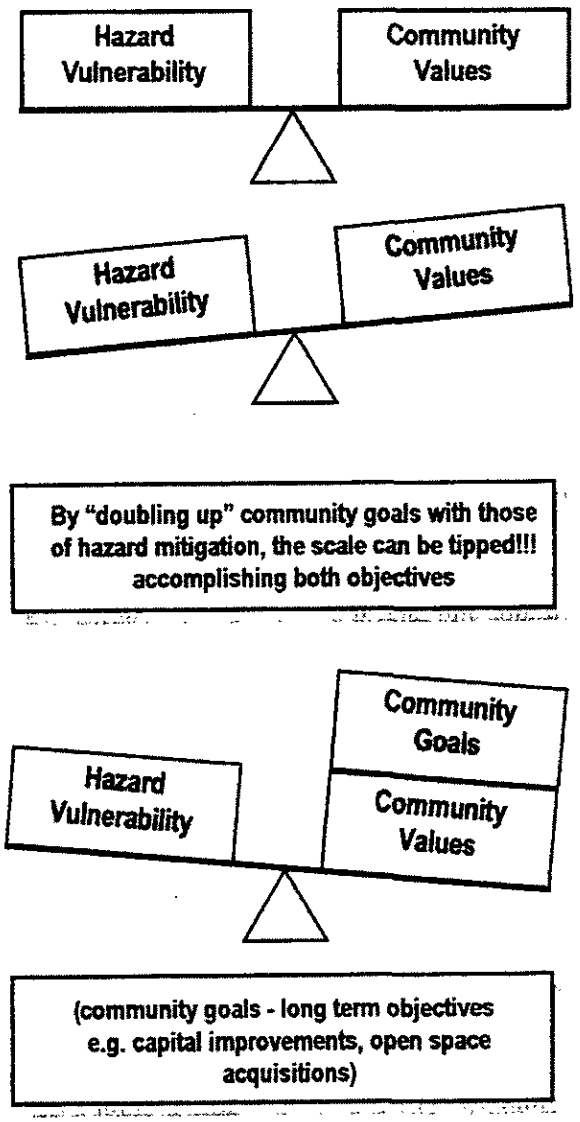


Figure 2-10

mitigation ought to be undertaken as a means of bringing about these solutions.

2.4.1 Loss Potential

Loss potential in Colorado exists in 268 cities and towns. All 63 Colorado counties have floodplains. Over 250,000 people now live in Colorado's floodplain. Flood loss potential is estimated that 65,000 homes and 15,000 commercial, industrial and business structures are in identified floodplains.

Total value of property, structure and contents at risk from the 100-year flood is now $11 billion (in 1997 dollars). Cumulative flood losses from the turn of the century to 1993 from the state's most damaging floods are $3.3 billion (1997 dollars).

In October of 1997, there were 14,058 flood insurance policies statewide with an insured value of $1,457,415,600 or $103,561 (avg) per policy. In 1994, there were 9,893 flood insurance policies. In 1997, there were 14,058 policies in force. This is a 42% increase (1994-97).

2.4.2 Potential Impact of No Action

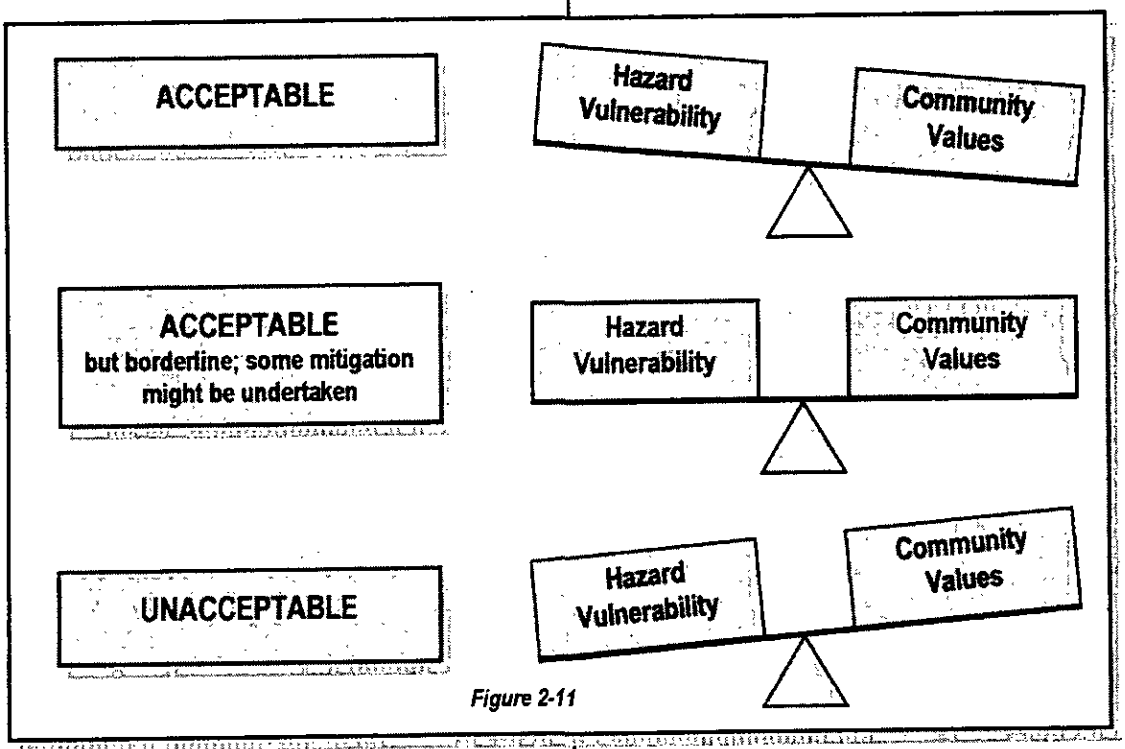


Figure 2-11

Chapter 3 - Capability Assessment

3.1 Legal Framework

Critical aspects of flood hazard mitigation relevant to this plan are floodplain management, geologic hazard management, dam safety, and emergency preparedness.

State enabling legislation, executive orders and memorandums adopted and currently in force for each of these critical aspects are listed in the following paragraphs, and selected authorities are reproduced in the ***Appendix C***.

3.1.1 Floodplain Management

The Colorado Revised Statutes dealing with floodplain management date back to 1937 with the creation of the Colorado Water Conservation Board. The Colorado Water Conservation Board (CWCB) in the Department of Natural Resources is the principal state agency responsible for water resource planning and development. A role in floodplain management has evolved over many years starting with flood control as an economically justifiable benefit of reservoir construction. Major flood legislation was further enacted in 1966 by House Bill 1007–State approval and designation of storm runoff channels and basins; in 1973 by S.B. 35-Subdivision regulations including delineation of 100-year floodplains; in 1974 by H.B. 1041–Land Use Act; and in 1977 by S.B. 126–State to establish criteria and requirements for performing floodplain studies by local, state and federal governments.

In 1977, the governor reinforced a concern for sound floodplain management by issuing two executive orders concerning the evaluation of flood hazards in locating state facilities and state participation in the National Flood Insurance Program.

The flood control and floodplain management section of the board has developed several programs directed toward the identification of floodplains and providing technical services to Colorado communities. State statutes and executive orders regarding floodplain management are listed in ***Appendix C***.

3.1.2 Geologic Hazard Management

The Colorado Geological Survey has both general and specific statutory authority in the area of geologic hazards. These include:

- **Title 34, Article 1, Colorado Revised Statutes, Colorado Geological Survey, and Objectives of the Survey-Duties of State Geologist.**
- **Title 24, Article 65.1, Colorado Revised Statutes, Government-State, Areas and Activities of State Interest.**

Under these statutes, the CGS has in the past provided advice and technical assistance to state and local agencies, completed geologic hazard mapping, and prepared numerous technical publications. Current budget constraints preclude such work unless cash funding can be arranged in advance.

House Bill 1041 of 1974, CRS 24-65-101 et seq., included comprehensive treatment of geologic hazards and charged local governments with legal responsibility for designation and administration of geologic hazard areas. The Colorado Geological Survey was designated as lead agency for geologic hazards mapping (identification) and for providing technical assistance to local governments in designation and administration of geologic hazard areas. The Colorado Geological Survey was also charged with preparing and publishing a set of guidelines and model geologic hazard regulations, and to assist local governments in the full process of geologic hazard management. In 1988, following the landslides and flooding on the western slope, the CGS prepared the Colorado Landslide Hazard Mitigation Plan (see ***Appendix C***).

For More Information

Appendix A - Lists the agencies and their addresses, telephone numbers, and summaries of their programs.

Appendix B - Includes information on financial assistance programs.

Appendix C - Includes information on references used in the preparation of this plan.

Appendix D - Includes definitions and acronyms.

Appendix E - Includes tips to minimize loss of life & property in the event of a flood.

Appendix F - Includes Mitigation Strategies & Measures.

Appendix G - Includes Mitigation Planning and Examples.

3.2 Government Organizations & Roles of Different Levels and Internal Organization

3.2.1 State Departments

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. Upon implementation of the State Emergency Operations Plan (SEOP) they are responsible for the implementation of assigned State Emergency Functions (SEFs). The operational roles, responsibilities and intra-organizational relationships of state departments are described in detail in the assigned State Emergency Function Annexes to the Plan.

3.2.1.1 Governor's Office

Governor's Office - "Colorado Disaster Emergency Act of 1992" (Part 21 of Article 32, Title 24, Colorado Revised Statute, 1988 as amended states the governor, as the executive head of state, has the inherent responsibility, constitutional and statutory authority, to commit state and local resources (personnel, equipment, and finances) for the purpose of ***.... meeting the dangers to the state and its people presented by disasters.*** This responsibility is exercised through the director, Office of Emergency Management (OEM), Department of Local Affairs (DOLA). The Governor's Disaster Emergency Council serves as an advisory council to the governor and the director, Office of Emergency Management on all matters pertaining to Declarations of State Disaster Emergencies, and on the response and recovery activities of state government. The Governor's Office is responsible for making state disaster declarations, usually at the recommendation of the Office of Emergency Management, and for the request to the president for a major disaster declaration, as necessary.

3.2.1.2 Department of Natural Resources (DNR)

The Department of Natural Resources has the mandate to conserve, protect, promote the development and regulate the use and enjoyment of the state's natural resources. The duties of the agencies in DNR are related to water, minerals, mineral fuels, soil conservation, reclamation of mined land, management of state lands, wildlife, parks, outdoor recreation, geological features and mine safety.

3.2.1.2.1 Colorado Water Conservation Board (CWCB)

The Colorado Water Conservation Board was created by the Colorado State Legislature in 1937 for the expressed general purpose ***" . . . to promote the conservation of the waters of the State of Colorado in order to secure the greatest utilization of such waters and the utmost prevention of floods . . . ."***

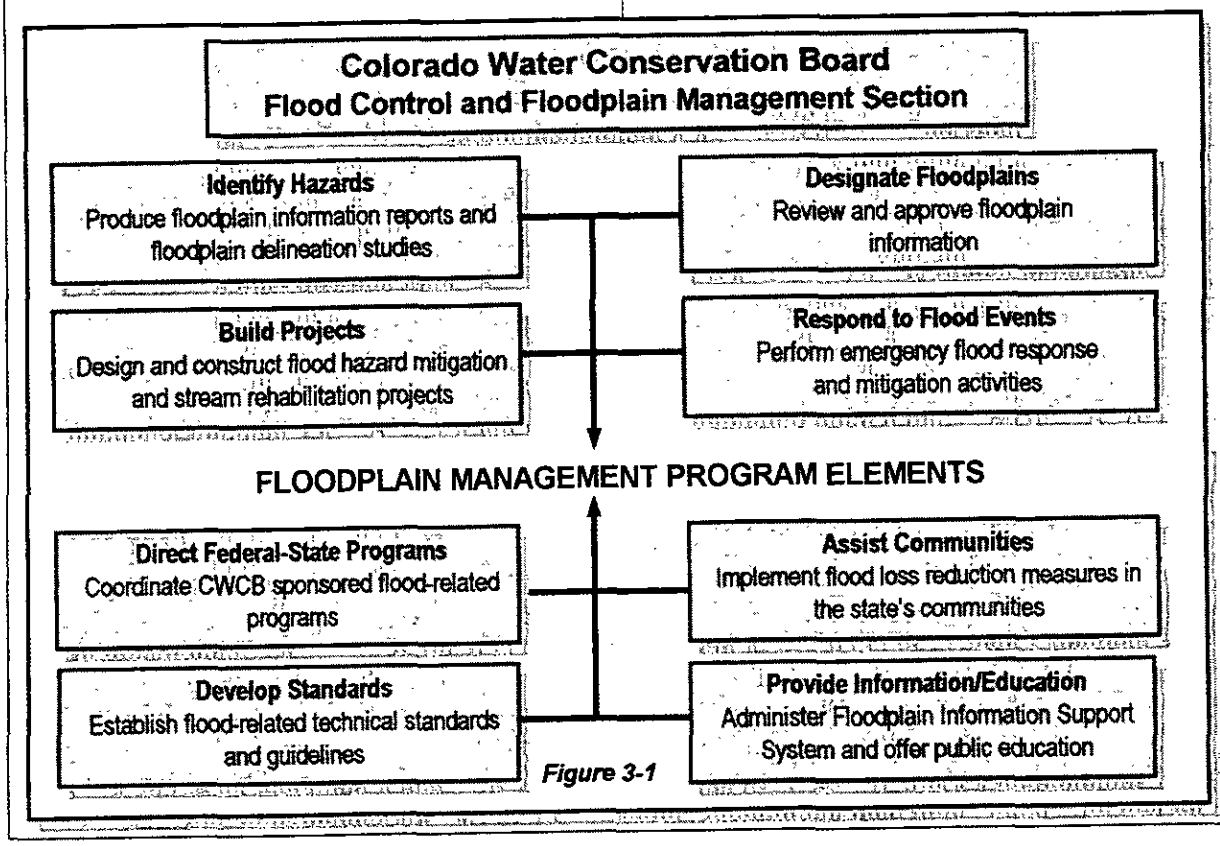


Figure 3-1

The Colorado Water Conservation Board provides engineering and technical assistance to local governments in the development of floodplain information studies. The board is the state coordinator of all floodplain management activities within the State of Colorado. The Colorado Water Conservation Board has developed a computerized database showing the availability of floodplain information in Colorado. The database should be available online at the Department of Natural Resources (DNR) homepage by mid-1998. The Board also maintains a library of completed floodplain information studies.

Through its designation and approval function, the Colorado Water Conservation Board certifies the technical accuracy and appropriateness of floodplain information to county and municipal governments. It is then up to these local governments to make wise land use decisions based on that information. Since 1967, a total of 462 studies prepared by various government agencies for a total of approximately 5,000 stream miles have been designated by the board.

The board's flood control and floodplain management programs are listed below:

a. Prescribe standards for flood hazard, flood control, drainage, flood mitigation and flood insurance studies;

b. Assist, review and perform studies for approval and designation as required by 24-65.1-403(3)(b) and 37-60-106(l)(c), CRS, as amended and to ensure compliance with the board's rules and regulations for delineating 100-year floodplains;

c. Prepare technical manuals of procedures and engineering methodologies in support of a and b above;

d. Collect data and documentation of flood events;

e. Provide coordination on federal studies and flood control projects when seeking Congressional authorization and funding including study and project reviews, as well as directing study efforts to ensure compliance with state standards and requirements;

f. Provide general information and coordination to communities concerning participation in the National Flood Insurance Program (NFIP) and the wise use of floodplains, in general. Also, provide assistance to communities to enter the NFIP's Community Rating System and participate in the FEMA-funded and CWCB-administered Flood Mitigation Assistance (FMA) program which provides annual funding to develop local flood hazard mitigation plans and implement flood mitigation measures;

g. Respond to state or federal flood disaster declarations, including preparation of required post-disaster flood hazard mitigation plans, advanced measures, flood fight activities and post-flood recovery operations. Activities which implement program objectives include: 1) chairing the Colorado Flood Task Force; 2) conducting an annual spring snowmelt review and issuing pre-flood forecasts, as applicable; 3) preparing news releases; and 4) issuing an annual flood report;

h. Provide general guidance, including preparation of ***"Scopes of Services,"*** to communities performing floodplain studies or preparing grant applications for studies;

i. Oversee and manage floodplain and major drainage studies, including assistance in negotiation of professional service contracts, study management, engineering work, etc.;

j. Assist local governments to prepare floodplain regulations or ordinances or amendments to flood insurance rate maps;

k. Perform hydrologic and hydraulic investigations; and

l. Assist (technically and financially) in constructing flood mitigation projects, which will reduce the exposure of Colorado citizens and their property to flood damages.

Due to the limits on the staff, the CWCB no longer provides site specific engineering and technical assistance required by individuals, local communities, and private entities (e.g., bankers, realtors, insurance agents, appraisers, etc.) on matters for which they are responsible in the flood, stormwater, and drainage areas.

In FY 81-82 at the request of the Colorado Water Conservation Board, the state engineer identified 34 high priority (unsafe) dams in need of rehabilitation. They were included in the governor's proposal for a five-year Capital Investment Plan. The owner of each facility listed was notified that dam rehabilitation funds may be available.

The Colorado Water Conservation Board, and later the Legislature, set a goal of using about one-third of the CWCB Construction Fund for dam rehabilitation. Funds for the rehabilitation of unsafe dams could be advanced to dam owners from the CWCB Construction Fund upon the Board's recommendation to the Legislature. The general rules for obtaining funds from this source are:

1. The state will only advance 50 percent of the estimated project cost to the owners. The remain-

ing 50% have to be obtained by the owner from another source.

2. The current interest charge for state funds is a minimum of 5 percent.

3. The maximum payback period for these funds is 40 years.

In 1995, the Colorado Water Conservation Board directed staff to utilize and make available to eligible applicants. 5 percent of the annual revenue to the construction fund for flood control projects and associated activities. The 5 percent loan funding is subject to the standard requirements of the construction fund. In 1995 and 1996 the total funding available was $600,000 each year. Both years, the City of Fort Collins borrowed a total of $900,000 ($400,000 and $500,000, respectively) for proposed flood control activities. This year (1998), the City of Sterling has a loan request pending for proposed flood control improvements.

The board also responds to state or federal flood disasters at the request of the Colorado Office of Emergency Management and local governments including preparation of required post-disaster drainage surveys and flood hazard mitigation plans. A minimal amount of funding is available each year for planning grants to develop local flood hazard mitigation plans. The funding is made available from the Federal Emergency Management Agency through the CWCB-administered Flood Mitigation Assistance (FMA) program. The board is also the primary planning agency for flood hazard mitigation activities. By Executive Order 8504 dated October 1, 1977, the board is the designated state agency for the coordination of the National Flood Insurance Program.

In recent years, the staff of the Colorado Water Conservation Board has met periodically with selected state agencies whose work included aspects of flood hazard mitigation. One purpose of those meetings is to determine how these state agencies are implementing the Governor's Executive Orders on floodplain management and on the National Flood Insurance Program.

As Colorado state government moves toward the 21st Century, the CWCB is taking a leadership role in flood hazard mitigation. Such leadership is embodied by current initiatives to: 1) develop a statewide stream corridor stewardship program; 2) develop hydrology guidelines for estimating 100-year flood flows for approximate floodplains; 3) integrate multi-objective management and watershed approaches to flood-related activities; and 4) formulate policy and direction for flood hazard mitigation through involvement in several state and national professional organizations such as the Association of State Floodplain Managers and the Colorado Association of Stormwater and Floodplain Managers.

3.2.1.2.2 Colorado Geological Survey

The Colorado Geological Survey (CGS) completed the Colorado Landslide Hazard Mitigation Plan in 1988. The CGS continues to respond within existing programs to floodplain and geologic hazard management goals. Salient points of continuing activities, as well as those that have been eliminated or curtailed, are described below.

Block grant requests are now screened by the CGS by title and location. Only those thought to have serious potential geologic hazard or floodplain problems are reviewed in detail.

The CGS continues to review some State Building Division activities and all Colorado Department of Health referrals for review of sewage treatment plant sites. Because sewage treatment plants are frequently located on or near floodplains, careful location and engineered protection are frequently needed. These reviews are a powerful tool for implementation of hazard management.

The CGS also reviews all subdivision applications from unincorporated areas. This is a requirement of SB 35 and it is now operated under a cash-funded fee system. These reviews provide an excellent opportunity for hazard review and recommendations for local governments. When geologic hazard problems are identified, CGS staff recommend plat changes and/or mitigation measures. If probable floodplain problems are identified CGS staff recommend delineations of the 100-year floodplain for review by the CWCB and any necessary changes in the plat or other initiation.

The CGS has assisted local governments and their staffs on education goals. There is a continuing need for such in-service training because of the relatively high turnover of local government officials and staff. The CGS recognizes the authority of local governments to regulate land use within their jurisdiction, but if serious problems are evident, CGS will inform the local government of the situation to be sure they are aware of it and the need to address it.

3.2.1.2.3 Division of Water Resources

The Division of Water Resources, primarily through its Dam Safety Branch, reviews, approves, and files plans and specifications for dams before construction as required by Section 37-87-105, CRS, as amended. Finished structures must be approved before storage of water is allowed. The concern is for the safety of downstream residents and property. The Dam Safety Branch's program is approximately 100 years old.

The Division of Water Resources, Office of the State Engineer, published the "Manual of Rules and Regulations for Filing Claims to Water and Plans and Specifications for the Construction of Dams."

All 1,824 dams in the state have been given high, moderate, or low hazard ratings based on the probability of loss of life or significant property damage below them. The hazard classification system considers failure of the structure under "normal operating conditions" or "failure in the dry" from structural deficiencies. If a dam is found to be unsafe, the Dam Safety Branch can restrict the storage behind it to ensure safety.

Reservoir owners with high hazard potential dams have been requested to prepare emergency preparedness plans (EPP). These include actions to combat dam incidents/failures and to identify emergency officials downstream of their dams. In addition, OEM is requesting local emergency coordinators to include the potential for the failure of these dams in their emergency evacuation plans. This project was successful and expanded to moderate hazard dams. A model EPP has been prepared for dam owner's use by staff members of the Dam Safety Branch.

Dam Ownership in Colorado

Federal	**140**
State	**63**
Local Governments/Districts	**275**
Privately Owned	**1,346**
Total	**1,824**

(monitored and inspected by state engineer)

Figure 3-2

A Dam Owner's Safety Manual is available from the state engineer. The manual instructs owners about the care, inspection and maintenance of dams, both to prolong the dam's useful life and to provide for its safe operation. Seminars have been presented throughout the state emphasizing the owner's responsibility for his or her dams. The Division of Water Resources performs other flood hazard mitigation functions in the areas listed below:

1. The division works with the U.S. Army Corps of Engineers on Snagging and Clearing Operations that fall under Section 208 of the Clean Water Act. The water commissioners throughout the state notify division engineers and the state engineer of local flooding problems. Following that notification, if appropriate, the corps is informed of the problem and the state engineer coordinates the work with local sponsors.

Office of the State Engineer
Rules & Regulations for Dam Safety
2 CCR 402-1 - Effective 9/30/88

Rule 16. Emergency Preparedness Plans (EPP)

16.A. Owners of Class I and Class II dams shall prepare, maintain, and exercise Emergency Preparedness Plans (EPP) for immediate defensive action to prevent failure of the dam. An EPP shall contain as a minimum the following:

16.A.(1) the identification of equipment, manpower, and material available for implementation of the plan;

16.A.(2) A notification procedure for informing the local emergency agencies (e.g., emergency coordinator or county sheriff), and the state engineer of the problem;

16.A.(3) A dam inundation map for Class I dams;

16.A.(4) A topographic map for Class II dams showing the streams which will be flooded; and,

16.A.(5) A procedure for warning nearby local residents if failure of the dam is imminent.

16.B. The owner shall use the state engineer's model EPP, which is available at no cost, or equivalent, for guidance in preparing the details of the components above.

16.C. The owner shall submit a copy of the proposed EPP to the Colorado Office of Emergency Management (OEM) and all local emergency coordinators involved in the plan for review. The owner shall incorporate reasonable recommendations from the above, if received within 60 days of the submittal.

16.D. The owner shall review and update the EPP as necessary annually.

Figure 3-3

2. The division reviews subdivision proposals. If the proposal involves an area under a dam, and if there is a clear indication of inadequate spillway capacity to protect the subdivision, the division will advise the local jurisdiction of the potential effect on the hazard rating for the dam and will recommend that the developer provide alternatives to assure the safety of the area below the dam. The division will, if necessary, require that the spillway be enlarged.

3. The division comments on dams that would potentially affect public facilities, such as utilities, below them. Some flooding problems are related to irrigation ditches and diversion dams. However, these facilities and their operation are not state regulated, so the division is not involved in addressing those kinds of floodplain management problems. Those facilities are federally regulated.

3.2.1.2.4 Colorado Soil Conservation Board

This division provides administrative and fiscal oversight, in addition to technical assistance, to Colorado's 78 Soil Conservation Districts (SCD). It also coordinates various programs with federal agencies on natural resource issues, oversees the state's living snow fence program, provides guidance on streambank erosion and riparian concerns, assists farmers and ranchers on various water and energy-efficiency programs, and helps sponsor **Camp Rocky**, an outdoor environmental adventure.

Each of the SCDs has the responsibility to inventory the natural resource concerns within their respective areas and to develop a plan to address these concerns. Information about these plans is available from the State Soil Conservation Board.

Eight of the nine members of the State Soil Conservation Board are elected by the SCDs organized by watersheds. The governor appoints the ninth board member.

SCD provide soil information needed for sound land use planning. Soil information is essential for building location, septic tank design, road design and construction, erosion control measures, property purchases and many other activities.

The El Paso County SCD reviews the subdivision plans that are submitted to the county planning agency for potential erosion, flooding and septic system problems.

Erosion and sediment control ordinances and ordinances regulating the plowout of grasslands have been developed and passed in various counties and municipalities with the assistance provided by the SCDs.

Information regarding the incorporation of xeriscape plantings in public and private residential areas has been provided by the Jefferson County SCD.

SCDs such as Shavano and Sedgwick County have completed watershed projects, which have reduced the risk from flooding, as well as providing erosion control benefits.

Mined land reclamation plans are reviewed by the SCDs and recommendations are given mining companies on site preparation and seeding mixtures.

New species of plants, trees and shrubs for reclamation purposes are provided by the Upper Colorado Plant Materials Center owned by the White River and Douglas Creek SCDs.

Assistance is given by the SCDs to counties and municipalities through the Resource Conservation and Development Program to speed up urban and rural economic development.

Colorado's SCDs represent private and public landowners; bring together state, federal and private sector dollars and resources to solve Colorado's natural resource problems; work to prevent soil erosion, conserve and develop water resources; improve water quality; control flooding; preserve wildlife habitat; and improved croplands; rangelands and forests provide thousands of hours of volunteer service to Colorado. The conservation efforts evolved out of the **"Dust Bowl"** to function as today's grass root leadership for conservation of environmental issues.

SCDs such as the Douglas County SCD, in cooperation with various agencies and groups, have planted over 300 living snow fences which will help keep many miles of county, state and interstate roads free of snow, as well as provide many acres of wildlife habitat.

SCDs have sponsored numerous riparian area workshops to promote the protection and restoration of riparian areas along Colorado's streams and rivers.

Streambank protection will be provided through the work of various SCDs with willow and cottonwood pole plantings.

Project Learning Tree is offered by the SCDs to teachers and other conservation-minded people to increase their knowledge of the forest and its special environment.

SCDs provide assistance to landowners to develop a forest management plan under the Forest Stewardship Program and arrange cost-share assistance through the Stewardship Incentives Program.

Colorado Soil Conservation Board

- Acts as a state board of appeals for the districts.
- Administers and disburses funds for the purpose of assisting soil conservation districts.
- Acts in an advisory capacity with the districts.
- Coordinates the programs of all districts.
- Undertakes studies of watershed planning.
- Develops, implements and administers watershed flood prevention and underground water storage projects.
- Accepts grants, services and materials for conservation purposes.

Figure 3-4

House Bill 1041 charges the State Soil Conservation Board and the Soil Conservation Districts with the responsibility of assisting local governments in determining natural hazard areas of state interest relative to floodplains, flood water problems, sediment and erosion, and soil suitability under the jurisdiction of the applicable local government.

The State Soil Conservation Board approves or disapproves watershed protection and flood prevention applications to the federal government under PL-566 (watershed protection). Although the most important purpose of these projects is the saving of lives and the reduction of property damage and crop loss through flood prevention, there are additional benefits through irrigation, recreation, and other purposes.

In cooperation with the USDA Soil Conservation Service, conservation of the land in Colorado through this program has resulted in over 352 erosion control dams, and 1,826,000 miles of terraces, which control runoff in 14 drainage basins.

3.2.1.2.5 Division of Wildlife

The Division of Wildlife (DOW) owns and controls a number of properties throughout the state. It has an ongoing inspection and maintenance program for all of its 74 lakes, 215 wildlife areas and 14 fish hatcheries. It has prepared an emergency action plan to be used in case of dam failure, which considers four potential flooding scenarios.

The primary involvement of the Division of Wildlife in floodplain management decisions is in the administration and protection of wildlife habitat areas that happen to be in floodplains. Because much of the wildlife in the state is dependent on riparian areas for water, food, or shelter, there are many such areas. Often there is a conflict between preserving the riparian habitat and removing the trees and shrubs, which can congest streams and increase flood hazard.

There are other cases where wildlife values and floodplain management values can coincide. In some urban or urbanizing areas, protection of undeveloped riparian lands for wildlife areas can also serve to preserve those lands in their undeveloped state and eliminate flood hazards by keeping out structures that would be subject to such hazards. Obviously there would still be a balance between preserving riparian vegetation and maintaining adequate channel capacity, but the opportunity exists to preserve the same area for two purposes. Fountain Creek in Pueblo is an example. One limitation on the Division of Wildlife's role is that they have to justify the acquisition of lands on the basis or current wildlife values, not potential values. Where those current values indicate its appropriateness, the division can act to work with communities on the condemnation or other means of acquisition of floodplains or on their management for wildlife values.

An important vehicle for the Division of Wildlife to provide input into floodplain decisions is the U.S. Army Corps' 404 Permit process. One other such vehicle is Senate Bill 40, concerning the protection of fishing streams. This bill is primarily intended to assure that the planning process for highways in river areas considers protection of the rivers for fishing. Other state activities are also included, with the exception of irrigation projects. The Colorado Water Conservation Board administers the instream flow program with the assistance and recommendations of this division. The Division of Wildlife also comments on all applications to the Colorado Water Quality Control Commission.

3.2.1.2.6 Division of Parks and Outdoor Recreation

The programs the Division of Parks and Outdoor Recreation (DPOR) administers in floodplain areas include recreation development, reservoirs, the state trails program, and Land and Water Funds. In administering these programs there are no established rules or regulations used to implement the Governor's Executive Orders regarding floodplain management and flood insurance.

The DPOR has floodplain maps for areas that it manages, but they are not used in the administration of these areas. The only flood protection plans developed by the DPOR are development plans for reservoir recreation facilities where reservoir high water lines are a factor in locating and designing those facilities.

3.2.1.2.7 Division of Minerals and Geology

This division is responsible for mineral and energy development, policy, regulation and planning. The division is comprised of three units-the Office of Mined Land Reclamation, the Office of Active and Inactive Mines and the Colorado Geological Survey.

The Office of Mined Land Reclamation issues reclamation permits from either the Minerals Program or the Coal Program. Together, these two programs regulate mining and reclamation activities at coal, metal, aggregate and other minerals mines. Their primary objective is to review mining and reclamation permit applications and to inspect mining operations to make sure that reclamation plans are being followed.

The Office of Active and Inactive mines reclaims and safeguards abandoned mine sites that are dangerous and create environmental hazards. The program also provides safety training for mine operators and em-

ployees. The division's activities are overseen by the seven-member Mined Land Reclamation Board and the four-member Coal Mine Board of Mine Examiners.

In 1992, legislation was passed that created the Mineral, Energy and Geology Policy Board. This board provides advice to the Department of Natural Resources, the governor and the General Assembly on improving efficiency, management data and records, policy development and the future of Colorado's energy and minerals industry.

The Division of Minerals and Geology (DMR) is concerned with flooding as it relates to successful operation and reclamation of mining operations. The interaction of the mining and reclamation operations with surface drainage is considered during the review of mine permit applications, inspections of ongoing operations, and evaluation of final reclamation. The major floodplain problems and potential hazards associated with mining are located primarily in urban areas where gravel is mined along major drainages. Adverse effects of mining on flooding occur less frequently in rural and mountainous areas, due to the sparse population. The DMR, however, is concerned with the re-establishment of stable geomorphic landforms and drainage regimes in all areas of mining.

During the review process or after inspection when a major flood issue arises, the division may refer the problem to the Colorado Water Conservation Board staff for review. Typical problems include the location of large gravel stockpiles or berms related to gravel mining operations within the floodplain and their effect on flooding.

The division derives its authorities for the minerals program from 34-32-101 et seq. and for the coal program, from 34-33-101 et seq. The authorities under the minerals program are quite general with regard to surface drainage control, but the coal program authorities are more specific. Under the coal program, operators are required to prepare runoff calculations for the volume of water in the 100-year, 24-hour storm and the peak flows for the 25-year, 24-hour storm.

3.2.1.2.8 State Board of Land Commissioners

The State Board of Land Commissioners manages 3 million acres of surface land and 4 million acres of mineral rights that were given to Colorado at statehood by the federal government. State trust lands are leased for a variety of activities, including grazing and crop production, mining and oil and gas production and recreation such as hunting. In 1996, board income totaled around $23 million--most of which went to support public education in Colorado.

During October 1997, at a meeting Greeley, the Colorado State Board of Land Commissioners approved the publication and distribution of a draft set of rules governing the implementation of the Stewardship Trust provision of Amendment 16.

Amendment 16 passed by Colorado voters in November 1996, directed the board to designate 295,000-300,000 acres of its 3-million-acre surface land asset into a Stewardship Trust. In order to enroll land in this trust, the board must determine that the land is valuable primarily to preserve long-term benefits and returns to the state. The board manages all its assets for the benefit of eight trusts 4th largest of which provides income for kindergarten 12th-grade education.

The amendment states that land within the trust will be managed to "maximize options for continued stewardship, public use or further disposition" by allowing only those uses that protect and enhance "the beauty, natural values, open space and wildlife habitat" on the lands.

Other provisions of Amendment 16 call for stewardship incentives for agricultural lessees and for additional benefits to public education. The amendment also changed the board structure from three full-time, salaried positions to a citizen board of five with experience in public education, natural resource conservation, production agriculture, local government and land-use planning.

The State Land Board administers about 4 million acres of land. Most of this land is leased for grazing, growing agricultural crops, and pumping oil. The main interest of the Land Board is to assure that, as a minimum, the income from any property will remain the same during development and that, as the property improves in value, the Land Board will receive a share of the appraised value. None of these uses have much significance in terms of floodplain management.

However, the Land Board also leases some land in urban or urbanizing areas. Clearly some of this land will include floodplain areas. The most likely places for such development will be the Front Range area and the Western Slope energy and recreation development areas. The leases on these properties are long term leases where homeowners would own their homes and lease the land on which they sit.

3.2.1.3 Department of Local Affairs

The Executive Director's Office of the Department of Local Affairs (DOLA) provides budgetary and policy direction and supervision to the various divisions and operational units within the department.

Decision-making authority for most department grant and loan programs is the responsibility of the execu-

tive director. In addition, the executive director and EDO staffs work closely with the various independent boards and commissions established by state statute and located in the department. These include the Board of Assessment Appeals and the Economic Development and Motion Picture and Television commissions.

3.2.1.3.1 Field Services

Field Services coordinates the work of the field representatives and administers five programs. The field representatives work with local clients to identify their needs; develop response capacity; coordinate delivery of department services, including financial assistance program services; provide follow-up with evaluation of services and project effectiveness; and serve as advocates for both local government clients and for department agencies. Primary clients include counties, municipalities and special districts.

The Energy/Mineral Impact Assistance program provides grants and loans for planning, construction and maintenance of public facilities and the provision of public services. Eligible recipients are municipalities, counties, school districts, special districts and other political subdivisions socially or economically impacted by the development, processing or energy conversion of minerals and mineral fuels.

The **"Small Cities"** Community Development Block Grant (CDBG) program provides grants and loans for housing, public facilities and business assistance projects that primarily benefit low/moderate income persons or eliminate slums or blight. Eligible recipients are all municipalities and counties except those larger jurisdictions that receive CDBG funding on an "entitlement" basis directly from the U.S. Department of Housing and Urban Development.

Applications for CDBG public facilities projects and Energy Impact Assistance funds are submitted to Field Services. The DOLA executive director makes final funding decisions.

The Division of Housing and the state Housing Board considers applications for CDBG housing projects monthly. Most CDBG applications for business financing are handled by the State Office of Business Development.

The Contiguous Counties Limited Gaming Impact program provides grants to finance planning, construction and maintenance of public facilities and for the provision of public services related to the impact of gaming. Grants may only be provided to counties that are geographically contiguous to the two gaming counties and the tribal lands.

The State Search and Rescue Fund reimburses county sheriffs for eligible costs associated with local search and rescue efforts. It also is a source of grant financing for search and rescue equipment and training. The State Search and Rescue Advisory Committee provide policy guidance for administration of the fund.

3.2.1.3.2 Division of Local Government

The Division of Local Government (DLG) builds independent local government capacity through general government, community development and information services.

DLG provides technical assistance, training, written materials and data to enhance service capabilities of local governments. Services include assistance with a variety of local government responsibilities including budgeting and financial management; planning for capital improvements; special district elections and administration; purchasing; land use and environmental matters; water and sewer financing and operations; and financial capacity research and analysis. Support for local and regional activities resulting from Governor Romer's Smart Growth and Development initiative are provided.

DLG evaluates the financial and managerial capacity of local government applicants to certain state and federal funding programs. Local government financial capacity is also evaluated to support emergency management funding decisions.

DLG distributes Conservation Trust Fund monies from Lottery proceeds to over 400 eligible local entities, and provides administrative support to the Colorado Emergency Planning Commission, Colorado Natural Hazards Mitigation Council, Colorado Incident Command System Board and to the executive - legislative - local Colorado State-Local Forum, an advisory commission on intergovernmental relations.

DLG provides demographic and economic information, assistance and coordination to public and private organizations. A subscription service that enables users to access and download much of these data directly is available. Cartography/GIS provides and exchanges cartographic information and a range of cartographic products and geographic information services to local governments, other state agencies and private firms. DLG annually publishes the Local Government Financial Compendium, which provides the single best source of statistical and financial information for the state's counties and municipalities, and maintains a number of databases containing information on local governments in the state.

Within DLG is the Office of Emergency Management (OEM). Services are made available through local emergency managers supported by OEM staff assigned to specific geographic areas of the state. In the

Colorado OEM
4 Aspects of Emergency Management:

Mitigation Preparedness
Response Recovery

event of an actual disaster, OEM provides for coordinated state response and recovery activities in support of local governments (*see **OEM below***).

3.2.1.3.2.1 Office of Emergency Management (OEM)

The governor has delegated the Office of Emergency Management, through its director, with the responsibility of managing and coordinating emergency operations which involve state and, when necessary, federal resources. OEM is charged with preparing and maintaining the Colorado State Emergency Operations Plan (The Plan) and for the expeditious and efficient manner in which The Plan is implemented. It is responsible for the organization and operations of the State Emergency Operations Center (SEOC) for both emergency and non-emergency operations. Further, the Office of Emergency Management is responsible for assisting local government emergency management in the development and maintenance of emergency operations plans, procedures and checklists. In the event of a major emergency or disaster, or the threat thereof, the director, Office of Emergency Management, makes recommendations to the governor and Disaster Emergency Council on matters pertaining to State Declarations of a Disaster Emergency, requests for federal assistance, and ongoing state disaster response and recovery activities.

OEM coordinates the work of other state agencies in these preparedness, response, recovery, and mitigation. These authorities have been strengthened in recent years through Executive Orders. OEM has prepared the Colorado State Emergency Operations Plan (mentioned above) which details response activities of state agencies during emergencies.

Once the threat of a specific flood is known, OEM begins work on that flood. First the local preparedness plan is evaluated. Next the means for providing help is reviewed. Following that is the coordination of work during and immediately after the flood, including establishing and operating a communications network. After the flood, OEM tries to determine what happened and why it happened and to take steps to assure that it does not happen again.

OEM acts as the conduit for emergency assistance to local governments from the Governor's Office. OEM will go through the following steps in the event of a request for assistance.

(1) Assess damages and local efforts made to repair the damages. They will review the analysis by the Department of Local Affairs, Division of Local Government, of the capacity of the local government to pay to repair the damages.

(2) Make a recommendation to the governor on funding.

(3) Process a state-local agreement so funding can be sent to the local government.

(4) Perform an on-site emergency survey of damages to see what has been and is being done to address the local problem.

The means by which OEM encourages or requires local governments to improve their floodplain management programs include:

(1) Federal pass-through funding;

(2) State funding to help local governments recover from a state-declared disaster; and

(3) State statutes that require local emergency preparedness plans.

OEM reviews current research in the area of disaster preparedness and recovery to assure that the state is informed on recent trends.

3.2.1.3.3 Colorado Economic Development Commission

The six-member Colorado Economic Development Commission was created by the state legislature in 1987 to promote economic development in Colorado. Appointments to the commission are made by the governor, who appoints four members, makes appointments to the commission, and by the president of the State Senate and the speaker of the State House of Representatives, who each appoint one member.

The EDC approves grants and loans from the economic development fund to public and private entities throughout the state to help existing businesses expand and new companies to locate in Colorado. It also implements marketing programs to support ongoing business activities. Although EDC is located in DOLA for administrative purposes, commission members make all policy and funding decisions. The EDC operates collaboratively with business development programs housed in the Office of the Governor.

3.2.1.3.4 Community Partnership Office

The Community Partnership Office was moved to Local Affairs in 1994. It operates several human development programs including Drug-Free Schools and Communities, Community Services Block Grants, Youth Crime Prevention and Intervention, and Denver Urban Resources Partnership.

The Community Services Block Grants (CSBG) program provides grants on a formula allocation basis to all counties for education, housing and other social services to benefit poverty-level persons.

3.2.1.3.5 Division of Housing

The Division of Housing (DOH) assists Colorado communities in providing safe, decent and affordable housing. Services include weatherization training, safety standards enforcement, rental assistance, and assistance to agencies for housing development and rehabilitation.

The Division of Housing administers a State Housing Grant Fund for the rehabilitation and repair of residential properties that are occasionally located within the 100-year floodplain. An agreement between the division and the CWCB consists of the following major flood hazard mitigation elements:

- First, State Housing Grant Funds will not be used in the rehabilitation of residential properties located within the 100-year floodplain unless the site can be safely removed from the floodplain or unless flood-proofing to the 100-year flood elevation plus one foot of freeboard can be achieved. However, in those cases in which the perceived threat to the health and safety of the occupants as a result of serious electrical, plumbing, heating and structural deficiencies is more immediate than the dangers posed by flood waters, some limited repairs may be justified, provided that such repairs can be adequately protected from the adverse effects of a 100-year flood. Given these circumstances, some electrical, heating and roof repairs are often justifiable. On the other hand, foundation repairs are generally not advisable.
- Second, the purchase of flood insurance by the owner of a property located in the 100-year floodplain does not justify the use of State Housing Grant Funds for the rehabilitation of the property.
- Third, CWCB staff assist Division of Housing staff and local program managers in determining whether a specific property is located within the floodplain and in determining what, if any, limited repairs may be justified in the event that the property is located within the floodplain.

DOH also acts as an information source by compiling statewide information and resources. The governor-appointed State Housing Board serves as an advisory unit to the division.

The division receives and disburses federal and state funds for many housing purposes and programs. Funds are distributed on a competitive application basis. To ensure the entire state is served effectively, DOH staff are assigned particular regions of the state. Technical assistance includes helping communities identify housing needs and securing private and public financing. In addition, DOH aids communities in forming housing development teams.

DOH helps to finance the construction of new housing and rehabilitation of existing housing. The housing must be owned or occupied by persons with very low to moderate incomes. The division uses federal and state funds for direct loans; loan guarantees; equity investments; and subordinated debt for construction or permanent financing. Types of housing can include multi-family apartments, single-family houses, homeless shelters and manufactured housing.

Every five years, DOH prepares a report for U.S. Housing and Urban Development (HUD) that analyzes housing conditions in communities throughout the state. This report, called the "Consolidated Plan," identifies housing needs and guides' DOH decisions and long-term plans. This document is used by many housing agencies throughout the state.

Together with Public Service Company of Colorado, DOH offers home improvements statewide through various community agencies. This federally funded program provides energy assistance services such as retrofitting homes with insulation and weather stripping and other material to decrease energy consumption. These services may reduce consumption up to 20 percent a year.

Where rental assistance is unavailable, DOH acts as a housing authority offering rental assistance. Rental assistance is offered to very-low income families by local community agencies in about 25 Colorado counties. Family Self Sufficiency (FSS) is a program offered to rental assistance recipients through their local community agencies. FSS helps families reduce their dependency on rental assistance through job training, family counseling and education. Its goal is to increase family income, self-esteem and to bring the family into the economic and social mainstream of the community.

DOH inspects factory-built (modular) housing, commercial structures, manufactured homes and recreational vehicles sold in Colorado to ensure the safety of state residents. Furthermore, there are 20 Colorado counties without building departments. Hotels, motels

and multi-family homes built in these counties are inspected by DOH.

In addition, the division offers a consumer information service for owners of manufactured and factory-built housing. The division serves as the consumer complaint contact for manufactured housing units built under the HUD Manufactured Housing Code. DOH answers questions or resolves complaints through its knowledge of factory-built housing and its rapport with manufacturers.

3.2.1.3.6 Division of Property Taxation

The Division of Property Taxation (DPT) coordinates and administers the implementation of property tax law throughout the 63 counties. It operates under the leadership of the property tax administrator, who is appointed by the State Board of Equalization (SBOE).

3.2.1.4 Department of Public Safety

3.2.1.4.1 Colorado State Patrol

The role of the State Patrol in flood hazard mitigation is in effect during flood emergencies. The jurisdiction of the State Patrol is mostly traffic. In flood emergencies the first aspect of traffic control would be to get people out of danger, whether by vehicle or on foot. The State Patrol relies on its local people in the field, including the dispatchers, to determine that there is an emergency and then to take action immediately. There are numerous dispatch centers throughout the state. In emergency situations the local commanding officers can make decisions on what to do. Sometimes local officials (police chiefs, fire chiefs, and mayors) will call OEM requesting State Patrol and other state assistance.

Before a flood happens or as it starts, the intent is to move people out of hazardous areas and keep other people from entering those areas. Once a flood is in progress, or has occurred, the State Patrol's main function is to set up a command post for the disaster area. Working in concert with the OEM, the State Patrol can establish and manage these posts where communications are handled.

An important function of the State Patrol is to assist in providing traffic control and security in flood damaged areas, limiting the movement of sightseers and non-essential personnel in the interests of preserving public health, safety and welfare.

The State Patrol assists in identifying victims and in keeping lists of missing persons in floods. This includes handling telephone calls from all over the country. In the case of the Big Thompson flood this function was carried out by the Denver Communications Center. The Patrol's auto theft unit aids in recovery and identification of flood damaged motor vehicles.

3.2.1.5 Colorado Department of Transportation

The Colorado Department of Transportation (CDOT) is involved in the design and construction of highways throughout the state, frequently in river valleys, so it is one state agency that is familiar with floodplain issues. Additionally, federal requirements tied to federal funding of highway projects have dictated that floodplain considerations enter into the highway design process.

Most Highways in Colorado are Classified into Two Categories:

1. **Federally funded highways, and**
2. **Federal aid designated highways.**

Criteria, policies, and methodologies used by the CDOT to design highways in floodplains are discussed below:

For interstate highways, U.S. highways, and Colorado highways in urban areas, the 100-year flood is the design standard. For interstate highways outside of urban areas, the 50-year flood is the design standard. For U.S. highways and Colorado highways in rural areas, design is based on the 25-year flood or less. What discharge is used depends on a benefit/cost analysis, which considers two major factors:

(a) Interruption of highway service, and

(b) safety to users during a flood event.

In addition, the consequences of the 100-year flood are analyzed. All of the above enter into the design of bridges, culverts, and the highways themselves. The methodologies, including computer models, used to calculate flows are all described in the Department's Design Standards. These include Natural Resources Conservation Services (NRCS) methodology, USGS Methodology for small basins, and others. CDOT uses flood histories as available. When floods occur, photographs are taken and report forms are filled out.

The Hydraulic Unit in Denver signs off on all projects throughout Colorado. They review any existing work by other agencies, such as the Colorado Water Conservation Board floodplain studies, and perform any additional work necessary to design structures in the floodplain, which minimize damages. The analysis is a two-step process. First, a location analysis is done. This includes public involvement and is intended as a

general analysis to assure basic compliance with state and federal requirements. The second step is a hydraulic analysis, where specific design criteria are followed. These specific studies may be sent to the Colorado Water Conservation Board to assure communication on common concerns.

Potential secondary impacts of highway construction, such as encouraging land use in the floodplain by building a highway in the floodplain, have to be addressed to satisfy federal requirements. But many CDOT officials believe transportation systems generally follow land use rather than creating it, and if problems occur, they are the result of land use decisions made by local governments rather than the result of CDOT policies and procedures.

In designing its own buildings, CDOT considers floodplain impacts. In Eagle County, for example, the floodplain was one factor in the design of a new area to house CDOT employees. Flood insurance for existing buildings in the floodplain has been purchased for some CDOT structures.

In the event of a flood disaster, CDOT does not place any conditions on the provision of emergency assistance (such as a written agreement to manage the floodplain to a certain standard). After emergency assistance had been provided, conditions on future assistance might be considered.

3.2.1.6 Department of Public Health and Environment (CDPHE)

3.2.1.6.1 Water Quality Control Division

The Water Quality Control Division is moving forward with a major reorganization, which moves away from a programmatic structure toward a more simplified, functional structure. The current sections will combine to form two new sections: a Watershed Section and a Water Quality Protection Section. An important component of the new organizational structure will be four watershed teams (South Platte, Arkansas/Rio Grande, Upper Colorado, and Lower Colorado) that draw from staff in each of the sections described above to provide an ongoing mechanism to coordinate overall program efforts within each watershed.

The role of the Colorado Department of Public Health and environment Division of Water Quality Control, in floodplain management relating to wastewater facilities includes three areas of involvement. First are site applications; an applicant requests approval to build a specific wastewater treatment facility in a specific location. Second are construction grant applications; an applicant requests federal financial assistance in building a wastewater treatment facility, either concurrent with or after a site application. Third is discharge permit applications; anyone who wishes to discharge pollutants (including treated waste) into a body of water in Colorado must hold a discharge permit. All three of these processes have the potential to include flood hazard mitigation opportunities.

Drinking Water Program

The Drinking Water Program is responsible for ensuring safe drinking water for the general public. Most of Colorado's residents receive their domestic water from community water systems. Since water is a potential carrier of disease, water supplies must be carefully treated to ensure their safety. This is accomplished through the maintenance and enforcement of the Primary Drinking Water Regulations. The Drinking Water Program also develops and updates design criteria for residential water systems, issue enforcement orders for violations and maintains an inventory of public water supplies. The Drinking Water Section of the Water Quality Control Division reviews applications for domestic water supply facilities. All portions of the water supply system as far as the plant outlet, with the exception of intake structures, must be located outside the 100-year floodplain. Typically, parties building water supply facilities locate the intakes in the floodplain, for obvious reasons, and then divert the water to a high place for treatment and storage. By locating the facilities above the floodplain, increased pressure is applied to the distribution system and locating the facilities above the floodplain reduces pumping costs. Therefore, floodplains are evaluated at the time plans and specifications are reviewed prior to construction of water treatment plants.

Permits and Enforcement

The Permits and Enforcement Section develops and administers discharge permits for approximately 1,070 domestic and industrial wastewater producers who discharge treated effluent to state waters. The section's staff also enforces the terms of the permits, using monitoring information provided by the field staff, and data furnished by the permittees in the form of discharge monitoring reports. Various actions may be taken to bring the facility back into compliance, including technical assistance, compliance orders and fines. Upon delegation by Environmental Protection Agency (EPA), the section will be responsible for the industrial pretreatment program, and for permitting federal facilities located within the state. Pretreatment is the processing of industrial wastes before they enter a domestic wastewater treatment plant. Pretreatment is necessary for certain types of wastes in order to protect the treatment facility, ensure that the facility will be able to meet the terms of its discharge permit, and ensure the quality of biosoids produced at the facility.

The section regulates the recycling of domestic sewage sludge (biosolids) as a fertilizer or soil amendment. Authorization is required before biosolids may

be marketed to the public or applied to agricultural land and reclamation sites. Stormwater from industrial activities, construction, and urbanized areas can contain high levels of pollutants, such as sediment, metals, oils, and nutrients. The section issues permits for the discharge of stormwater from these types of activities. The permits require the development of Stormwater Management Plans to identify and clean up potential stormwater pollutants.

Field Support

Field Support serves as a liaison between the Water Quality Control Division and the regulated community. The section conducts water and wastewater facility inspections, reviews plans and specifications and other technical documents for these facilities, investigates citizen complaints, collects surface water and wastewater effluent samples, and provides emergency response to spills and other situations that threaten water quality.

The section administers the State Construction Grant Program, and also implements the State Water Pollution Control Revolving Fund, which began providing loans in 1990, at or below market rates, for construction of publicly-owned treatment plants.

Operator Certification

The staff provides support for the Colorado Plant Operators Certification Board that certifies water and wastewater treatment plant operators and classifies treatment plants.

Ground Water and Standards

This section provides much of the support needed by the Water Quality Control Commission in setting water quality standards and developing control regulations to protect both surface and ground water quality. The section is responsible for collecting and analyzing much of the water quality data in the state and for writing reports on the quality of the state's waters. Of particular importance is the Agricultural Chemicals monitoring program carried out by the ground water unit. Other important functions of the ground water program are assistance to communities in protecting their ground water supplies via a Wellhead Protection Program, drafting of permits for point sources discharging to ground water, and maintenance of an extensive ground water database. The section also has responsibility for the management of the Nonpoint Source Control Program. The program conducts numerous demonstration and education projects showing how voluntary efforts at reducing nonpoint pollution can be successful. The program also provides oversight of water quality management planning (Section 208 of the Clean Water Act). Other duties of the section include final approval of sites for new or expanded wastewater treatment plants, issuance of 401 certification of Corps of Engineers 404 permits, consultation on individual sewage disposal systems (ISDS), and special field studies on streams and lakes.

Treatment Plants

All proposed treatment plants are analyzed to see how they meet the governor's executive orders on floodplain management and flood insurance. Because sewage flows downhill (unless pumped at great cost), many treatment plants are built in floodplains so that they are as low as possible in relation to the development they serve. For that reason a lot of sewage treatment plants require dikes or floodproofing.

The Water Quality Control Division staff relies on the Colorado Geologic Survey to review proposals for flood hazard problems. The division's review is primarily a conceptual review focusing on the sanitary issues. The primary concerns of the division's review process are whether the proposal meets local government standards and how it fits in with plans and recommendations by the Colorado Geological Survey, the local Council of Governments, and adjacent cities and towns. However, the site application does include questions regarding floodplain issues. The current review process allows the Geological Survey to forward to the Colorado Water Conservation Board any proposals it feels need additional review.

3.2.1.6.2 Laboratory and Radiation Services Division

The Laboratory and Radiation Control Division enforce standards for wastes. They have recently passed regulations for siting hazardous wastes. They enforce the requirement that such wastes not be disposed of in the 100-year floodplain. They are also forcing the removal of pre-existing deposits of wastes where public health, safety, and welfare are endangered. With regard to radioactive wastes, they also enforce standards requiring that wastes not be disposed of in the 500-year floodplain.

The Emergency Management Program

The Emergency Management Program (EMP) provides planning, training, coordination, exercise development and environmental emergency response functions on behalf of the Colorado Department of Public Health and Environment (CDPHE). The EMP staffs a 24-hour emergency reporting, response and assistance line for CDPHE. This emergency line links CDPHE with industry, emergency responders and resources to protect citizens of the state from the effects of environmental and public health hazards.

The EMP directs and supports state and local activities that enhance offsite response to possible radiological accidents at Rocky Flats Environmental Technol-

ogy Site. The EMP coordinates and presents the overall issues, objectives, approaches, and procedures for the transportation of transuranic (TRU) waste through Colorado to the Waste Isolation Pilot Plant (WIPP Site) near Carlsbad, New Mexico. TRU Waste is waste products (such as paper, metal, plastic or glass) radiologically contaminated with materials heavier than uranium on the periodical chart.

3.2.1.7 Department of Personnel
(General Support Services)

The primary involvement of the Department of Administration in floodplain management is in the review of proposed construction of new state buildings, the leasing of office space for state agencies, and the provision of insurance for state buildings and property.

The State Buildings Division, Capital Construction and Control Maintenance Section must approve plans for any new state building. All of those plans are referred to the State Geological Survey to determine whether certain geologic hazards are a concern. Flooding issues are referred to the Colorado Water Conservation Board. As an example, the location of a Highway Department building near Alamosa was changed to avoid flooding problems.

Renting or leasing of office space for state agencies must have approval by the department. For example, a proposed location for a vending operation for the blind, operated by the (then) Department of Social Services, was rejected because it was in the South Platte River floodplain. State agencies must now indicate whether the proposed facility will be in a floodplain or not. Floodplain considerations may be cause to reject a proposed location. In the past, the Colorado Water Conservation Board and the Colorado Geological Survey have reviewed a list of locations of proposed state leases to identify potential flood problems.

Flood insurance has been purchased for some state buildings, but a complete list of state buildings for which flood insurance has been purchased is not available. Several years ago, the Colorado Water Conservation Board provided the department with information on which state buildings were located in floodplains, and some state agencies were advised to obtain flood insurance where necessary. Several agencies chose not to insure some buildings because of budgetary constraints.

The Division of Accounts and Controls can provide emergency assistance to state agencies in the event of flood damage to their buildings. The three general options for state agencies that suffer flood damage are:

(1) Obtain emergency funding from Accounts and Controls. For uninsured losses, and losses not covered due to a deductible amount of $100,000 for state policies, the division can allocate up to $100,000 for repairs, per incident.

(2) Ask the governor to declare a disaster and allocate some of his disaster funds; or

(3) Wait for a supplemental appropriation from the legislature.

For any of these options, the State Buildings Division would be involved in the review of the proposed repairs. Also, other agencies such as the Geological Survey would be involved as appropriate. Funding would depend, in part, on approval by the State Buildings Division.

An example of a flood damaged facility that was repaired with funds from the division is a building used by Pueblo Vocational Community College in Pueblo.

3.2.1.8 Department of Institutions

The Department of Institutions manages various facilities including several youth camps, schools, detention centers, the Fort Logan Mental Health Center, the Colorado State Hospital, and three State Homes and Training Schools for the developmentally disabled. In addition, the department contracts with local agencies to provide services for their particular community.

A review by the CWCB showed that none of the department's facilities appear to be exposed to any significant flood hazard. The Colorado Department of Public Health and Environment is involved in the annual licensing of these facilities and they also consider floodplain information in licensing the facilities.

The Department of Institutions, through the locally operated mental health centers, provides counseling services to survivors in disaster struck areas. As an example, the Adams County Mental health Center provided such services to victims of the Thornton tornado in June 1981. The department coordinates the work of the local agencies in this area and provides counselors to serve victims of flooding suffering emotional and other mental health problems.

3.2.1.9 Department of Education

The Department of Education provides input to 181 local school boards on the location of their facilities, including advice on protecting them from flood hazards.

School districts finance construction and improvement of facilities entirely with locally raised money. The districts have a lot of power to make decisions on their own. In addition, they are exempt from county land use requirements other than building codes. The result is that there is little control over school districts

that build facilities on land in unincorporated areas of Colorado.

The state provides aid to school districts through the School Finance Act of 1973. However, that money goes to the districts' general funds and is not earmarked. There are no conditions placed on the state aid, such as satisfactorily addressing on-site hazards. If school districts request advice, such as how to finance projects or how to get architectural services on construction of facilities, the Department of Education staff will inform them of state requirements that affect the construction of school facilities in floodplains. The department's role is consultative, providing information to school districts primarily on educational matters.

During the Big Thompson Flood of 1976, both the Loveland and Estes Park school districts let their buildings, buses and other facilities be used for relief purposes (school was out at the time). In Holly, the school buildings were higher than many businesses when flooding occurred, so they were used as relief centers. In Kersey, a dam failure in 1973 caused flood damage to school buildings, and the school district received a grant to repair the damage.

Some school districts have prepared emergency plans, but many have not. There is no mandatory requirement for such plans, just as there is no mandatory requirement for other floodplain management activities.

3.2.1.10 Department of Higher Education

3.2.1.10.1 Colorado Commission on Higher Education

The Commission on Higher Education is the policy coordinating body for the seven boards that administer the State of Colorado's 22 college campuses. The planning process used by the commission for constructing new state buildings is as follows:

(1) The commission approves the campuses' General Master Plans, which generally fall on a 5-year cycle. These plans analyze who the customers are and what they need in terms of campus services.

(2) The Campus Physical Master Plans are prepared with a 5- to 10-year horizon on a 10-year cycle.

(3) The Facility Program Plans are prepared with a 5-year horizon. They are necessary for any changes to physical facilities to be justified.

(4) The Capital Budgets list the budgetary information associated with the Facility Program Plans.

(5) The appropriation for construction allows the actual construction (or purchase of property). After the appropriation, the management of the project is handled between the college and the State Buildings Division of the Department of Administration.

The Facility Program Plan is referred to other state agencies for review and staff makes a recommendation to the commission. They then take action, which can include approval with conditions. A checklist is used to ensure that either the college or the commission looks at the appropriate floodplain issues. The commission tries to assure that Campus Physical Facility Plans are consistent with local plans and with long-range state policies. They are exempt, by law, from local requirements, but they do try to conform.

3.2.1.11 Department of Corrections

3.2.2 Local Governments

The chief executive officer of each political subdivision (county and municipality) is responsible for reducing the vulnerability of people and property to the effects of emergency and disasters. Local governments disaster emergency responsibilities include the following: (a) Ensure that local government agencies are capable of efficient and responsive mobilization of resources to protect lives, minimize property loss, and expedite recovery efforts; (b) Ensure that an Emergency Management Office serves the jurisdiction; (c) Ensure that a Local Emergency Operations Plan is prepared and based on valid hazards and risk analysis; and (d) Ensure that the local plan is exercised and kept current. (Reference: Title 24, Article 32, Part 2107, Colorado Revised Statute, as amended) Local government retains command of an incident unless it is relinquished to another authority.

3.2.3 Regional Government

3.2.3.1 Urban Drainage and Flood Control District

The Urban Drainage and Flood Control District was established by the Colorado Legislature in 1969, for the purpose of assisting local governments in the Denver metropolitan area with multi-jurisdictional drainage and flood control problems. The district covers an area of 1608 square miles and includes Denver, parts of the five surrounding counties, and all or parts of 33 incorporated cities and towns. There are about 1,600 miles of "major drainageways" which are defined as draining at least 1,000 acres. The present population of the District is approximately two million people.

District Board of Directors

A 15-Member Board of Directors governs the district. The mayor or deputy mayor of Denver is always a

member of the board. Three Denver City councilmen are appointed to the board by the council president. The boards of county commissioners of the five counties surrounding Denver each appoint one commissioner to serve on the Board of Directors. The governor of the State of Colorado appoints four mayors, one each from Adams, Arapahoe, Boulder and Jefferson counties, to the board. These 13 locally elected officials select two registered professional engineers to complete the board membership.

District Staff

The present District Staff consists of an executive director, four program chiefs, four project engineers, an inspector/technician and four support personnel. The staff is responsible for management of all project funds, supervision of all work done by consulting engineers and coordination of all planning, design and construction efforts with local governments. The staff also assists local governments in the areas of floodplain regulation, flood insurance, developer reviews and flood warning plans.

District Funds

Funds are obtained through a district-wide property tax. The district is currently authorized to levy 0.1 mill for operation and planning purposes. The district has statutory authorization for a maximum levy of 2.5 mills; however, current assessed authorization is 0.9 mills. The present levy can only be increased by action of the Colorado Legislature or by a vote of all citizens living in the district.

Other sources of funds include local government contributions to planning, design, and construction projects; and grants from the state or federal governments.

District Activities

Primary activities of the district are listed below:

- Prepare drainage and flood control master plans for major streams, gulches and other multi-jurisdictional drainage problems.
- Design and construct drainage and flood control facilities.
- Assist local governments with the maintenance of flood control facilities.
- Delineate 100-year floodplains on major drainageways.
- Act as coordinating agency for the collection and dissemination of drainage information.
- Assist local governments in the formulation of floodplain management programs including the adoption and enforcement of adequate floodplain regulations.
- Coordinate flood studies with the Colorado Water Conservation Board and the Federal Emergency Management Agency.
- Collect and evaluate rainfall and runoff quantity and quality data in cooperation with the United States Geological Survey.
- Conduct conferences and seminars to disseminate information to local officials and engineering consultants.
- Publish maps, reports, and brochures to inform citizens in the district of flood hazards.
- Assist local governments in the formulation and implementation of flood warning plans.
- Notify floodplain occupants of flood hazards and actions they can take to mitigate the hazard.

The Urban Drainage & Flood Control District (UD&FCD) is also active in the areas of floodplain regulation, flood insurance, developer reviews, conferences and seminars, and publications. Activities in these areas are briefly outlined below.

Floodplain Regulation in the UD&FCD

The district's enabling legislation gave the Board of Directors the authority to adopt and enforce floodplain regulations in the district area. In order to spur local governments to adopt their own floodplain regulations, the Board of Directors established a deadline for local governments, with the provision that the district's regulation would be enforced in those local jurisdictions that had not adopted regulations by the deadline. All local governments required to adopt floodplain regulations have done so and at this time the district is not enforcing its regulation in any community.

The district continues to monitor the effectiveness of floodplain regulations to ensure the effectiveness of this policy.

Flood Insurance in the UD&FCD

The ability of individual property owners to purchase flood insurance is an important part of any floodplain management program. The National Flood Insurance Program provides the individual with this opportunity.

The Urban Drainage & Flood Control District has been actively encouraging local governments to participate in the National Flood Insurance Program, and has assisted local governments in the preparation of applications and the appropriate land use controls.

District Developer Reviews

Many local governments do not have the staff capability to evaluate proposed developments on land adjacent to major drainageways. The district will assist these local governments by reviewing development proposals when requested to do so. A brochure has been published which assists developers in preparing

drainage reports for developments located along major drainageways.

The district also requires that the designs for new flood control facilities to be constructed by others be approved by the district in order for the facilities to be eligible for district maintenance assistance.

District Conference & Seminars

From time to time, the district sponsors conferences, seminars, and meetings to further the knowledge and expertise of the participants. Conferences and seminars are held as the need arises.

District Publications

In addition to master plan and flood hazard area delineation reports, the district publishes many other kinds of information. The district is responsible for the publication, revision, and distribution of the "Urban Storm Drainage Criteria Manual." This manual, which was originally completed by the Denver Regional Council of Governments, is probably the most widely used drainage criteria manual in the world.

Several types of publications are utilized to disseminate flood hazard information to the general public. Floodplain information maps are prepared which show the 100-year floodplain for each drainageway, which has been studied in detail by the Corps of Engineers or the district. These maps are distributed to all local governments with the request that they be displayed in a location where interested citizens can look at them.

Other publications include a study of the economic, legal and financial aspects of drainage and a flood-warning guide for Front Range communities.

The district maintains a library devoted to publications related to drainage and flood control. The library is open to the public during normal business hours.

Notification of Floodplain Occupants in the UD&FCD

The district has instituted a program to notify occupants of defined flood hazard areas that a hazard does exist. Mailing lists are developed for each defined floodplain, and a brochure is mailed to each address. The brochure tells the occupant about the flood hazard and suggests steps the individual can take to mitigate the hazard, such as planning escape routes and buying flood insurance.

Flood Warning Plans

The district assists local governments in the development and implementation of flood warning plans. A complete plan, including detection of the threat, warning and evacuation, has been implemented for Westerly Creek in Denver and Aurora. A similar plan, on a larger scale, is being implemented for Boulder Creek and South Boulder Creek in Boulder and Boulder County. Planning is also underway for Lena Gulch and Bear Creek. The district is prepared to assist other local governments with flood warning plans on request.

3.2.3.2 Regional Planning Agencies

Local government associations, councils of government, planning commissions, and other regional agencies in Colorado have occasionally provided coordination and/or funding for various flood hazard mitigation projects. The boundaries of regional planning agencies, being larger than counties, are often more closely aligned with drainage basin boundaries. This can lead to a much more comprehensive approach to identifying the most appropriate mitigation strategy. Selected examples of work done by various regional-planning agencies are briefly summarized in the following paragraphs.

3.2.3.2.1 Northeastern Colorado Association of Local Governments (NCALG)

The NCALG provided support to the Town of Wiggins to secure a structural flood control project on Kiowa Creek.

3.2.3.2.2 Larimer-Weld Regional Council of Governments (L-WRCOG)

Through the circuit rider/city manager program sponsored by the (L-WRCOG), the Town of Milliken was successful in managing a major flood control project financed through the State Department of Local Affairs.

3.2.3.2.3 Denver Regional Council of Governments (DRCOG)

Following the disastrous floods in 1965, the DRCOG initiated the planning for the ultimate formation of the Urban Drainage & Flood Control District in 1969. Project REUSE (Renewing the Environment through Urban Systems Engineering) was a 2-year cooperative program in 1971-1972 of the Denver Regional Council of Governments and the Urban Drainage & Flood Control District, financed in part by an Urban Systems Engineering Demonstration Program grant from the Department of Housing and Urban Development. The project included solid waste management and storm drainage and flood control, in an effort to identify and demonstrate concurrent approaches to improve the management and control of the two systems.

The DRCOG, in cooperation with the Urban Drainage & Flood Control District and the Denver Water Board, has also completed an urban storm water quality-monitoring project. The Council is now cooperating

with the District in the Denver Urban Runoff Program, an effort to quantify the nature and sources and potential opportunities for control of urban runoff quality.

3.2.3.2.4 Pikes Peak Area Council of Governments (PPACOG)

The PPACOG has been active for many years providing coordination with the Corps of Engineers for structural flood control projects in the Colorado Springs metro area. The PPACOG is currently playing an active role in the coordination of the Upper Fountain Creek Basin Reconnaissance Study being prepared by the Albuquerque District Corps of Engineers.

3.2.3.2.5 Lower Arkansas Valley Council of Governments (LAVCOG)

The LAVCOG has coordinated with the Corps of Engineers and was responsible in part for a flood control project constructed at Las Animas and a flood hazard identification study in Lamar.

3.2.3.2.6 Pueblo Area Council of Governments (PACOG)

The PACOG during the mid 1970s was responsible for initial work which has led to formulation of a major structural flood control project on Lower Fountain Creek in the City of Pueblo. Following the groundwork done by the PACOG, the Fountain Creek Commission was formed to administer the project during the design phase. The Pueblo City Council, as the local sponsoring entity, is now in charge of the project. The PACOG is also providing funds for a flood warning system for the City of Pueblo.

3.2.3.2.7 District 10 Regional Planning Commission (RPC)

The RPC for District 10 is providing coordination and funding to complete a flood hazard identification study at Lake City initiated by the Colorado Water Conservation Board, but not completed due to limitations imposed by the Legislature.

3.2.3.2.8 Northwest Colorado Council of Governments

The NWCOG has been active in facilitating the disaster relief fund recovery process for communities damaged during the 1984 snowmelt runoff season.

3.2.4 Federal Government

3.2.4.1 Federal Emergency Management Agency (FEMA)

FEMA Region 8 in Denver is responsible for administering the Hazard Mitigation Program within the Mitigation Division, these responsibilities are usually handled by the Federal Hazard Mitigation Officer/Deputy Federal Coordinating Officer for Mitigation (FHMO/DFCOM). Hazard mitigation programs and activities include:

- The Hazard Mitigation Grant Program;
- Leadership of Hazard Mitigation Survey Teams and Interagency Hazard Mitigation Teams; and
- Planning activities conducted under Section 409.

In anticipation of a disaster declaration, the FHMO/DFCOM is also involved in pre-disaster activities Such involvement includes participating on the Preliminary Damage Assessment (PDA) to address mitigation issues, developing mitigation strategy for the disaster, evaluating state mitigation programs and activities for the Regional Analysis and Recommendation, and assisting in forming the hazard mitigation language contained in the FEMA-State Agreement.

After a disaster, the designated FHMO/DFCOM is responsible for leading the Hazard Mitigation Survey Team or, in the case of a flooding disaster, the Interagency Hazard Mitigation Team. FEMA is responsible for seeing That the Hazard Mitigation Survey Team or Interagency Hazard Mitigation Team report is completed.

Once the Interagency Hazard Mitigation Team or Hazard Mitigation Survey Team Report has been completed, the FHMO/DFCOM is responsible for assisting Colorado with the development and implementation of the state hazard mitigation plan. This may include providing guidance and technical assistance during the plan development process providing technical assistance from FEMA or other Federal agencies if requested, and reviewing drafts of the plan. FEMA's programs are covered in detail in ***Appendix A.***

In keeping with the National Mitigation Strategy, FEMA identifies mitigation measures and successful mitigation activities, and it reinforces the traditional long-term goal to reduce loss of life and property damage, by eliminating or reducing the impacts of natural or manmade hazards. During the response phase of the 1997 Colorado Flood Disaster, DR-1186-CO, many of the objectives of hazard mitigation were implemented. These mitigation activities provide a framework for revisions to the ***Colorado Flood Hazard Mitigation Plan***, as required by Section 409 of the Stafford Act.

The objectives are summarized under the following

categories, which were developed and implemented during the response phase of the 1997 disaster:

- *Mitigation Outreach*
- *National Flood Insurance Program (NFIP)*
- *Mitigation under the Public Assistance Program*
- *Mitigation under the Human Services Program*

3.2.4.1.1 Mitigation Outreach

Objective: Develop and distribute public education materials on mitigation to affected areas.

Dissemination of information is beneficial to the success of mitigation measures. Opportunities can be lost if information is not distributed to affected home/property owners and renters, particularly if repairs are already underway or completed. A public information campaign to publicize the benefits and techniques for mitigation is advantageous. Mitigation outreach included:

- Mitigation counselors staffed the Disaster Recovery Centers (DRCs) distributing mitigation information and offering technical advice.
- A mitigation tour was conducted for members of the media showing examples of existing mitigation and mitigation success stories used in other cities and states.
- Mitigation staff made several media appearances including a mitigation spot on the FEMA radio network, newspaper interviews and radio broadcasts.

3.2.4.1.2 National Flood Insurance Program (NFIP)

Objective: Increase the number of flood insurance policies by educating and promoting the benefits of flood insurance. Provide technical assistance to local floodplain officials on appropriate floodplain management practices through NFIP regulations.

The National Flood Insurance Program was created through enactment of the Flood Disaster Protection Act of 1968 and amended in 1973. The Act made flood insurance available to communities that adopted flood loss reduction measures in their jurisdictions. To participate, a community adopts a Resolution of Intent and a Flood Damage Prevention Ordinance that establishes sound floodplain management practices in areas subject to flooding. State and federal NFIP staff conducted various outreach and technical assistance services including the following:

- NFIP staff provided information at the Disaster Recovery Centers, including handouts and technical advice.
- NFIP staff gave numerous radio and newspaper interviews relating information about the benefits of flood insurance, and worked with the public information officer (PIO) in developing a flood insurance press release.
- NFIP staff attended local government and public community meetings, clarifying and explaining about the NFIP.
- Two NFIP insurance agent workshops were performed, discussing the NFIP regulations.

3.2.4.1.3 Mitigation Under the Public Assistance Program

Objective: Take advantage of mitigation opportunities allowable under FEMA's Public Assistance (PA) Program (Stafford Act Section 406). This type of mitigation is vital during the repair phase of a damaged site as identified by inspectors in Damage Survey Reports (DSRs).

A component of hazard mitigation will be accomplished through PA administered by FEMA's Infrastructure Support Division. For the 1997 Colorado flooding disaster, most mitigation measures will consist of additional work, above and beyond normal eligible PA work, designed to reduce or eliminate future damages and associated casts.

During the survey inspector briefings, the inspectors were instructed to investigate possible mitigation opportunities at each damaged site. A benefit/cost analysis will be performed on all Damage Survey Reports (DSRs) with Hazard Mitigation Proposals during the normal review process.

3.2.4.2 U.S. Department of Agriculture

3.2.4.2.1 U.S. Forest Service

During emergencies the Forest Service may install emergency measures on National Forest land for runoff retardation and soil erosion prevention to safeguard life and property on the downstream from watershed lands suddenly damaged by fire, flood, and other natural disasters. Where natural disasters cover National Forest as well as state and/or private lands the Forest Service works closely with the NRCS, state, and local government entities in coordination of mitigation activities. In 1984, the Forest Service worked with the Soil Conservation Board and local government on the Vail mudslide and the Blue River slide. In 1983, it worked with various entities on the Coal Creek landslide near Redstone.

3.2.4.2.2 U.S. Natural Resources Conservation Service (NRCS)

The Natural Resources Conservation Service (NRCS) can provide technical assistance in the conservation development and productive use of soil and water

resources. Its activities in Colorado include watershed protection and flood protection projects, Floodplain Management Studies, Resource Conservation and Development, Emergency Watershed Protection, Conservation Technical Assistance, soil surveys, snow surveys and water supply forecasting.

Watershed Protection and Flood Prevention

The Watershed Protection and Flood Protection Act (Public Law 83-566) authorizes NRCS to provide technical and financial assistance to local organizations to plan and install works of improvement for watershed protection, flood prevention, agricultural water management and other approved purposes. The flood control projects completed in Colorado listed below are described in more detail in the "Colorado River Basin and Watershed Summary" which is available from the NRCS:

- Big Sandy Watershed Project
- Box Elder Creek Watershed Project
- Canon Watershed Project
- Coalbank Creek Watershed Project
- Crooked Arroyo Watershed Project
- Fishers Peak-Carbon Arroyos Watershed Project
- Franktown-Parker Tributaries of Cherry Creek Watershed Project
- Indian Wash Watershed Project
- Kiowa Creek Pilot Watershed Project
- Limon Watershed Project
- Pine River Watershed Project
- Roatcap Wash Watershed Project
- Sedgwick-Sand Draws Watershed Project
- West Cherry Creek Watershed Project
- Wray Watershed Project

Floodplain Management Studies

The Soil Conservation Service provides assistance for cooperative floodplain management studies to local communities or units of government. The objective of these studies is to provide information and large-scale mapping needed in alleviating potential flood dangers. The studies are conducted on a priority basis through the Colorado Water Conservation Board. The cooperative studies require financial assistance from participating communities and the state to be at least 20 percent of the direct study costs. The final product includes a comprehensive report with detailed mapping and information to be used in implementing effective floodplain management programs. Authority for floodplain analyses is provided by Section 6 of Public Law 83-566.

The following Flood Hazard Analyses have been completed by the NRCS Colorado:

- Boxelder Creek near Wellington, Larimer County
- Big Sandy Creek at Limon, Lincoln County
- South Fork of the Rio Grande and the Rio Grande near South Fork Colorado, Alamosa County
- Chalk Creek, Chaffee County
- Cottonwood Creek near Buena Vista, Chaffee County
- San Juan River and McCabe Creek near Pagosa Springs
- Coal Creek and Rock Creek, Boulder and Weld Counties
- Jimmy Camp Creek and Tributaries, El Paso County
- Sand Creek near Colorado Springs, El Paso County

The following Flood Insurance Studies were completed by the NRCS under contract to the Federal Insurance Administration:

- City of Louisville, Boulder County
- Boulder County Unincorporated Areas
- City of Englewood, Arapahoe County

Resource Conservation and Development

NRCS administers the Resource Conservation and Development Program (RC&D) authorized under PL 88-703 section 102 of the Food and Agriculture Act of 1962. Under this program, technical and financial assistance is available to groups within the five authorized RC&D areas in Colorado for installation of flood prevention measures. Assistance can be provided for control of erosion on critical eroding areas, flood damage reduction, recreation developments, fish and wildlife developments, water supply developments, and water quality improvement. Funding for this program is, however, quite limited.

Emergency Watershed Protection

Funding is authorized under Sections 403-405 of the Agricultural Credit Act of 1978, for NRCS to provide emergency watershed protection assistance. This assistance is provided to reduce hazards to life and property in watersheds damaged by severe natural events.

Conservation Technical Assistance

In addition to the specific program activities, NRCS can provide technical assistance under PL 74-46 to land users in the planning and application of conservation treatments to control erosion and reduce upstream flooding along with other purposes (sediment reduction).

Water Supply Forecasting

The NRCS administers the cooperative snow survey program in cooperation with other federal, state, and local agencies as well as private organizations and individuals. The NRCS publishes a monthly accounting of snowpack values and basin water contents. These monthly reports are available December 31 through May 30 each runoff season. This information is gathered from snowtel reporting stations. This information and data is beneficial to flood forecasters and flood emergency operations.

3.2.4.3 U.S. Department of Defense

3.2.4.3.1 U.S. Army Corps of Engineers

The Corps of Engineers is involved in developing and implementing plans for flood control, navigation, hydropower, recreation and water supply. The corps also has authority for emergency operations, bank protection, permit administration, and technical assistance. Corps programs in Colorado can be lumped into five different authorities: 1) Feasibility Studies and Projects; 2) Continuing Authority Projects; 3) Emergency operations; 4) Floodplain Management Services; and 5) Permit Issuance.

Feasibility Studies and Projects

Congress can authorize the corps to perform feasibility studies that may result in projects for flood control, navigation, hydropower, water supply, and recreation.

The Albuquerque District has completed seven projects in the Arkansas River Basin. They are: John Martin Reservoir, Trinidad Lake, Pueblo Floodway Levee Extension, Templeton Gap Floodway, Holly Levee System, Wolf Creek Project, and Las Animas Flood Control Project. There is one project in the Rio Grande River Basin, the Willow Creek Channel Improvement. In addition, the corps under the Small Flood Control Project Authority constructed the Pinon Canyon Dam.

The Albuquerque District has a feasibility study of Fountain Creek-North of Pueblo in the reconnaissance stage and a study of Fountain Creek at Pueblo in an advanced engineering stage. The district also has studies in the advanced stages under the authorities of Arkansas River and Tributaries and Rio Grande and Tributaries.

The Omaha District has three existing reservoir projects in the South Platte River Basin: Cherry Creek Lake, Chatfield Lake, and Bear Creek Lake. The Omaha District has also constructed a detention dam and reservoir in Aurora under the Small Flood Control Project Authority. A channel improvement project on the South Platte River below Chatfield Dam is currently in the construction phase.

The Sacramento District is currently engaged in a study under the authority of the Colorado River and Tributaries above Lees Ferry.

Continuing Authorities

The Corps of Engineers has discretionary authority to implement certain types of water resource projects without congressional authority. These projects are typically limited in scope and cost. Applicable continuing authorities projects and federal cost limitations are section 14: Emergency Streambank Protection of Public Facilities - $250,000; Section 205: Small Flood Control Project - $4 million; and Section 208: Snagging and Clearing for Flood Control - $250,000.

The Albuquerque District completed four Section 14 Emergency Streambank Protection Projects in 1984. They are located at: 1) Fouritain Creek at Security; 2) Fountain Creek at Stratmore; 3) Interstate 25 in Colorado Springs; and 4) Four Mile Creek in Canon City. The Albuquerque District has four additional Section 14 investigations underway during 1984 in the Arkansas River Basin. The Omaha District had twelve Section 14 investigations underway during 1984 in the South Platte River Basin to determine if any streambank protection projects are feasible.

Emergency Operations

Under the provisions of Public Law 84-99, the corps has the authority to respond to flood emergencies. The authority includes flood fighting, constructing advance measures (temporary) in anticipation of imminent flooding, and repair of damaged flood control works after the flood event.

In 1964, the Sacramento District Corps was involved in floodlight activities in the communities of Silt, Grand Junction, Gunnison, Olathe, and Delta, Colorado. These activities consisted of providing sandbags, providing rock for erosion protection, and constructing emergency levees at an estimated cost of $155,000. The corps operated an Emergency Operations Office in Grand Junction with a 12-person staff in May. The corps provided inspectors for for Damage Survey Teams. It also provided floodlight assistance, engineering expertise, flood drainage assessment, and advice on applicable corps programs. In summary, the corps emergency activities in Colorado during 1984 involved about 25 personnel over several months of on-site visits totaling about 350 man-days.

Floodplain Management Services

The corps can provide assistance in evaluating flood hazards to a site, floodplain delineation, and technical assistance and guidance in wise floodplain management. To date, the corps has completed a total of 48

Floodplain Information Reports and 11 Special Flood Hazard Information Reports in Colorado.

The Sacramento District initiated a study in 1984 to delineate the 100-year floodplain on the Colorado River from Glenwood Springs to DeBeque Canyon. The Omaha District is conducting two flood hazard studies in the South Platte River Basin in response to local requests during 1984.

Permit Authority

The corps, by law has the authority to issue Section l0 permits to cover construction, excavation and other related work in or over navigable waterways and Section 404 permits covering the discharge of dredged or fill material in all waters of the U.S. and adjacent wetlands.

3.2.4.4 U.S. Department of Commerce

3.2.4.4.1 National Weather Service

The National Weather Service is responsible for 36-48 hour weather forecasting, issuing severe weather warnings and watches, flash flood warnings and watches, and flood warnings.

3.2.4.5 U.S. Department of Transportation

3.2.4.5.1 Federal Highway Administration

The Federal Highway Administration provides highway construction grants to the states and directs federal highway construction appropriations. It ensures that the construction and maintenance of highways built with federal aid complies with existing regulations and directives. These regulations provide for the flooding of roadway embankments and bridge structures located in floodplains. This agency is also concerned with stream channel changes in rural areas and detention facilities in urban areas, which affect highway routes. The design of its bridge projects occasionally involves reshaping channels for short distances upstream and downstream. The agency is involved with debris removal and erosion control during the construction stage, as well as channel cleaning as part of the maintenance of its projects. The Federal Highway Administration also provides funds to aid in the cost of maintaining traffic and rebuilding flood damaged highway facilities on the federal aid system when such work is beyond the financial capability of the owner of the highway. It will also assist in surveying roadway damage in flood stricken areas.

3.2.4.6 U.S. Department of the Interior

3.2.4.6.1 U.S. Bureau of Reclamation

The U.S. Bureau of Reclamation administers the federal program in western states for water resource development and use, which provides multiple purpose projects furnishing fish and wildlife protection and recreation opportunities, water for farm irrigation, municipal, and industrial use, hydroelectric power, flood control, and other natural resource conservation benefits. The program was established by the Reclamation Act of Congress in 1902.

3.2.4.6.2 U.S. Geological Survey

Congress established the U.S. Geological Survey on March 3, 1879, to classify public lands and examine the geological structure, mineral resources, and products of the country. Over the years, other congressional acts have enlarged its duties and functions to include making geological and topographic maps, gauging streams, and determining water supplies of the United States. The survey can assist communities and state agencies in collecting, developing, and computing basic data and information for floodplain engineering studies and investigations.

Information available from the U.S. Geological Survey includes records of water gauge heights, discharge runoff, times of travel, sediment discharge, historic flood peaks, and inundated areas. Reports of magnitude, frequency, and duration of flood flows are also kept. Flood prone areas subject to inundation by floods of approximately the 100-year frequency have been delineated on topographic maps for selected areas within Colorado and can be obtained through this agency.

3.2.4.6.3 U.S. Bureau of Land Management

The Bureau of Land Management has district offices located in the 11 western states and Alaska which are involved in land use planning for public lands. Each district office maintains a file of floodplain maps that are available for public inspection.

3.2.4.7 National Park Service

The National Park Service is responsible for flood hazard mitigation in the following areas in Colorado:

- **Rocky Mountain National Park**
- **Mesa Verde National Park**
- **Dinosaur National Monument**
- **Colorado National Monument**
- **Black Canyon of the Gunnison National Monument**

- **Great Sand Dunes National Monument**
- **Florissant Fossil Beds National Monument**
- **Hovenweep National Monument**
- **Bent's Old Fort Historic Site**
- **Curecanti National Recreation Area**

On August 6, 1979, the National Park Service revised its management policies on construction, shoreline processes, and limitation of visitor use. With respect to floodplains and wetlands, the revisions provide that facilities and structures will not be located, except where no practicable alternative exists, in 100-year floodplains, and that schools, hospitals, and museums will not be located within 500-year floodplains. Furthermore, the impact from construction activities will be avoided in floodplains and wetlands, except where no "reasonable alternative" exists. Whenever new facilities and structures must be located in floodplains and wetlands, "their design and siting shall be based on scientific, engineering and architectural studies; consideration to protection of human life, natural processes and cultural resources; and consideration to their planned life span." The same scrutiny will be applied to existing structures and facilities needing rehabilitation or replacement. Such scrutiny will be one actor in the case of historic structures.

In natural zones, shoreline processes, such as erosion, deposition, dune formation, and inlet formation, will be allowed to take place naturally, except where control measures are necessary to protect life and property in neighboring areas. In historic zones, the threat to the cultural resources and the imminence of the threat also are taken into account. In development zones, a management policy of phasing out, systematically relocating or providing alternative development to existing development will be followed; no new development will be placed unless it is essential to meet the park's purpose and no practical alternative locations are available.

Following the Lawn Lake Dam break and resultant flooding on Roaring River and Fall River in the Rocky Mountain National Park on July 15, 1982, the National Park Service has implemented several measures to identify and regulate flood prone areas, minimize flood recurrence and improve hazard warning and evacuation procedures.

3.3 Existing Mitigation Plans, Programs, and Structures

3.3.1 Federal Government

3.3.2 State Government

3.3.2.1 Flood Mitigation Capability in Colorado

Flood Hazard mitigation has been occurring in Colorado for several decades. In the past, it was often implemented at the local level of government generally following flood disasters. In recent times, involvement from both the state and federal government has become more common as each entity has provided funding and technical assistance for flood hazard mitigation. In the future the implementation of flood hazard mitigation strategies will still take place locally but it will be supplemented with new enthusiasm from the state and federal government, as pre-disaster mitigation becomes the cornerstone of FEMA and state programs.

In the 1980s and the 1990s, Colorado state government's first formal experience with flood hazard mitigation followed the 1982 and 1984 Presidential Disaster Declarations, particularly in 1984. The 1982 declaration addressed the Lawn Lake Dam failure near Estes Park and was fairly localized in scope. On the other hand, 17 counties on Colorado's Western Slope were included under the 1984 declaration. Mitigation measures related to infrastructure and watershed management were implemented in Delta and Montrose Counties. These measures consisted primarily of replacing structures, such as bridges and culverts, that had washed out or been damaged with ones of larger capacity. An acquisition/buyout also occurred in a subdivision in Paonia, Colorado. Bank stabilization efforts at several locations were undertaken.

In 1984, 100-year flooding occurred in the Delta County area upstream of the confluence of the Uncompahgre and Gunnison Rivers. These flood impacts set into a motion a series of actions by local governments, which today has culminated in the development of a park at the rivers' confluence.

In 1993, the state's mountain snowpack was at an all-time high in several drainages. Pre-disaster mitigation activities such as sandbagging critical locations and placement of diversion structures occurred in Western Slope counties such as Gunnison County. Rock deflection jetties were placed to protect the county fairground facilities in Hotchkiss (Delta County). Bank stabilization was again commonplace. In addition, education efforts through the Colorado Water Conservation Board's ***Spring Flood Awareness Campaign*** prompted action from local governments.

The state's first Flood Task Force was formed in 1993 to disseminate real time data regarding streamflow, snowpack and potential for flooding and to provide coordination among federal, state, local and private entities involved in flood preparedness and response. Involvement by the Colorado Natural Hazards Mitigation Council (CNHMC) came to the forefront, as experts from across Colorado offered technical and engineering assistance to mitigate the impacts of flooding. Several mountain counties throughout the state were impacted to one degree or another. Pre-disaster mitigation activities served to lessen impact in those communities that had taken action.

In 1995, snowpack development came very late in the season (April through early June). However, in many locations it was equal to or exceeded the recorded snowpack of 1993. The State's Flood Task Force was convened again and provided valuable data for flood preparedness and mitigation. Many of the permanent mitigation measures, which were enacted during the 1993 flood event, prevented damages. Many other mitigation measures put into place just prior to the flood event worked admirably, as well.

In 1996, the Flood Task Force was called into action again because of a high snowpack. In the end, much of the snow melted without causing substantial problems, but the task force was able to provide assistance to local officials concerned about flooding in their jurisdictions.

Prior to the 1997 flooding, mitigation activities were undertaken by the City of Fort Collins, which reduced flood damages on Spring Creek. Some buildings in the 100-year floodplain had been previously acquired and the land converted to parks or open space. Several bridges and culverts had been enlarged to increase flow capacity. The result was that substantially fewer buildings remained in the 100-year floodplain of Spring Creek.

During these two decades, state agencies have worked actively with local governments that have requested assistance with their specific problems. Mapping of floodplain areas has identified the mitigation needs of some communities. Planning and engineering assistance have been provided for developing or designing structural and non-structural projects to address flood problems. State funding has assisted many communities to implement projects. Two slide shows the Colorado Water Conservation Board has developed documenting mitigation efforts statewide and encouraging more mitigation and have been shown to various audiences. In response to the 1997 floods, the Water Conservation Board, in cooperation with local agencies, is preparing Flood Documentation Reports for all the 13 counties included in the Presidential Declaration. Also, the Water Conservation Board is preparing Flood Mitigation Feasibility Reports for selected communities to include with their Hazard Mitigation Grant applications, to provide technical support for those grant applications. The state is continuing to work cooperatively with as many entities as possible to reduce Colorado's flood hazard vulnerability.

Governor Roy Romer's Smart Growth and Development Initiative

Several of the recommendations deal directly with land use planning, and hazard mitigation planning is emphasized. Technical assistance is available directly to local governments, via planning commission workshops, land use planning workshops, publications and other means of information dissemination. Several projects that specifically involve hazard mitigation planning have been awarded the Governor's Smart Growth and Development Award.

3.3.2.2 Governor's Smart Growth & Development Initiative

Governor Roy Romer's Smart Growth and Development Initiative began in the fall of 1994 as a response to unprecedented population growth and the challenge of preserving Colorado's unique natural beauty and quality of life. Much of the new development occurring in the state is located in the urban/wildland interface. This poses a serious threat since many new residents are unaware of potential hazards such as flooding, wildfire and geologic hazards. The Smart Growth process provides local governments with vital assistance to help address this growing concern effectively and thoughtfully.

This initiative provides a forum in which public discourse has progressed beyond the simplistic notions of "pro-growth" and "no-growth" by developing partnerships among state and local governments, key stakeholder groups and citizens. Smart Growth is a bottom-up approach to local and regional visioning and strategy building process that relies on broad-based participation from all sectors of the community.

Two statewide summits, several regional summits, specific topic-based task forces and an Interregional Council developed an action agenda of 74 recommendations that deal directly with growth related problems, and an agency was designated responsible for implementation of each recommendation. Many of these recommendations have already been completed

or are well underway.

Several of the recommendations deal directly with land use planning, and hazard mitigation planning is emphasized. Technical assistance is available directly to local governments, via planning commission workshops, land use planning workshops, publications and other means of information dissemination. Several projects that specifically involve hazard mitigation planning have been awarded the Governor's Smart Growth and Development Award.

3.3.2.5 Colorado Natural Hazards Mitigation Council

For the past two decades, Colorado has experienced rapid population and business growth. Pressures have increased to build structures in floodplains, on steep slopes, in wildfire areas, and other locations previously considered unsafe or too costly to develop. Recognizing these issues, Governor Roy Romer signed an executive order establishing the Colorado Natural Hazards Mitigation Council (CNHMC) in March of 1989. The council was created as an interdisciplinary forum for exchanging information and promoting ways to reduce and manage impacts from natural hazards.

The council is composed of almost two hundred volunteer committee members in the state of Colorado. The council is organized into technical and hazard specific committees. The technical committees are Public Affairs and the Steering Committee. Hazard specific committees include Severe Weather, Dam Safety, Fire Management and Mitigation, Drought, Geologic Hazards, and Flood. A recently formed Policy Advisory Group will guide overall strategy. The primary duties of the council are to:

State of Colorado
Wildfire Hazard Mitigation Plan

Annex I
to
Colorado Multi-Hazards Mitigation Plan

August 1995
Colorado State Forest Service

- Prioritize natural hazards in the state and review existing mitigation plans.
- Develop a mitigation management strategy involving various levels of government.
- Provide information and technical assistance to local governments and individuals.

Through its volunteer committees, the council has supported over one hundred mitigation projects since its inception. These include:

- Pre and post-disaster mitigation workshops for homeowners and businesses in Canon City, Pueblo, Colorado Springs, Fort Collins, Rifle and Lyons.
- Major flood mitigation activities in Lyons and the San Luis Valley.
- Publication of "The Mitigation Siren" newsletter.
- GIS familiarization workshops.
- A hazard awareness contest for children.
- Dam Safety and Emergency Planning brochures.
- Publication of a Citizens Emergency Preparedness Guide.

3.3.2.4 State Hazard Mitigation Plan

The first Flood Hazard Mitigation Plan was prepared by the State of Colorado under authority of paragraph 7 of a Federal/State Agreement negotiated between the State of Colorado and the Federal Emergency Management Agency. Governor Lamm signed that agreement on July 27, 1982, following President Reagan's declaration of Larimer County as a major disaster area on July 22, 1982 (FEMA-665-DR-CO).

Status report No. 1, dated December 1983, was prepared pursuant to a commitment towards implementation of the plan expressed in Governor Lamm's January 14, 1983, letter transmitting the original plan to the FEMA regional director.

The second annual mitigation program review was prepared in January 1985 under authority of paragraph 10 of a FEMA/State Agreement signed by Governor Lamm on August 1, 1984. This agreement was negotiated following President Reagan's declaration of ten Western Slope counties as a major disaster area eligible for public assistance on July 27, 1984 (FEMA-719-DR-CO).

The 1998 Flood Hazard Mitigation Plan (409) updates the previous plans and incorporates additional information.

In 1988, The Colorado Geological Survey (CGS) prepared the Colorado Landslide Hazard Mitigation Plan in response to flooding and mudslides on the western-slope.

In 1995, The Colorado State Forest Service (CSFS) prepared the Colorado Wildfire Hazard Mitigation Plan is response to wildfires in the state.

3.3.3.5 Colorado Water Conservation Board (CWCB) - FMA Eligible Project(s) Grants

Pre-disaster flood mitigation planning and implementation funds are now available under the FEMA-funded Flood Mitigation Assistance (FMA) program. The Colorado Water Conservation Board (CWCB) administers the program. In Federal FY 98 (October 1, 1997 - September 30, 1998), the program will provide: (1) $106,290 in project funds to implement measures to reduce flood losses; and (2) $11,900 in planning funds for developing or updating local flood hazard mitigation plans. Fund amounts represent the 75 percent federal share. Interested entities must provide a 25 percent match. One -half of the 25 percent (12 1/2 percent) must be cash. The other half may be in-kind. Any city, town or county that participates, ***in good standing,*** in the National Flood Insurance Program (NFIP) is eligible to compete for these funds.

Examples of eligible projects include: 1) elevation of insured structures; 2) acquisition of insured structures and real property; 3) relocation or demolition of insured structures; 4) dry floodproofing of insured structures; 5) minor, localized structural projects that are not fundable by state or other federal programs; and 6) other activities that bring an insured structure into compliance with floodplain management requirements in 44 CFR 60.3 *(NFIP Regulations)*.

CWCB - Planning/Project Grants for FY 97

- **Georgetown Planning Grant - $11,900**
- **Silver Plume Project Grant - $23,454**
- **La Junta/Otero County Planning Grant $100,000**

Figure 3-6

Minimum Project Eligibility Criteria

1. Be cost effective, not costing more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future floods were to occur. Both costs and benefits are computed on a net present value basis.
2. Be in conformance with 44 CFR Part 9 Floodplain Management and Protection of Wetlands; Executive Order 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction; 44 CFR Part 10, Environmental Considerations, and Any Applicable Environmental Laws and Regulations.
3. Be technically feasible. Be in conformance with the minimum standards of the NFIP regulations at 44 CFR Part 60.
4. Be in conformance with the community's flood mitigation plan; the type of project being proposed must be identified in the plan.
5. Be located physically in a participating NFIP community that is not on probation or must benefit such community directly by reducing future flood damages.

Please note that No. 5, above, implies that a community must have an adopted flood hazard mitigation plan to be eligible for project funds. The CWCB has a model plan that meets FMA minimum standards. The CWCB staff assists local governments in the adoption process, as needed.

Planning Grants

Funding to develop or update local flood hazard mitigation plans is also available through FMA. Communities that plan on competing for FMA project funding must have adopted such a plan. The implementation of a long-term comprehensive program of floodplain management is necessary for the long-term success of a community's flood mitigation strategy. Floodplain management is a continuous process of decision-making about how floodplain lands and waters will be

used. It encompasses:

- The choices made by owners of floodplain homes and businesses,
- Decisions made by officials at all levels of government,
- Development plans made by owners of commercial flood prone land, and
- Judgments of farmers and ranchers with pastures bordering riverbanks.

The success of floodplain management on any scale depends on the collection and utilization of engineering and administrative information. Sound floodplain management improves the decision-making process for usage of floodplain land(s). Effective management requires prompt but careful decisions that are compatible with the risks and resources inherent to floodplains. If such decisions are not made, unwise development or other uses could occur that would prove costly in the long run.

City of Boulder Projects

The City of Boulder is going "above and beyond the call of duty" in educating its citizens about flood hazards. A 100th anniversary recognizing the 1894 flood event, which was greater than a 100-year flood on Boulder Creek, was planned by the city, the Red Cross and a city/county emergency management organization. The team developed the following information about flooding which was used to increase local awareness during May 30 - June 2, 1994.

- Table-top simulated flood exercise to kick-off the flood season in Boulder,
- A traveling flood exhibit with narrative and photos for schools, shopping centers, etc.,
- A video entitled "Flood Watch" for use on the local cable municipal channel and at presentations to local groups,
- A "Volksmarch - credited" walking tour of the areas flooded in 1894 and viewing of sites and buildings still remaining following that event,
- A booth at the annual Boulder Creek Festival which displays information about emergency management with videos about flooding and other natural hazards,
- Two symposiums (community meetings) in May about flood hazards, floodplain management, emergency management and the NFIP, and
- Working with local media to produce articles about flooding in Boulder and the 1894 flood.

Contact: Ned Willliams, City of Boulder, 441-3200

Source: Flood Stage CWCB Spring 1994

Figure 3-7

FEMA Honors City of Englewood With National Award

On June 10, 1996, FEMA Regional Director Mike Armstrong, announced that the City of Englewood has been named a recipient of FEMA's Community Service Award. Mayor Tom Burns accepted the award on behalf of the city during a ceremony at FEMA's Washington, D.C., offices on June 11, 1996.

FEMA's Community Service Award is given to private citizens and organizations in recognition for significant acts or service in the public interest during emergency events. The City of Englewood received the reward for its response to the September 1995 unexpected snowstorm that left yards and streets clogged with debris and thousands without power.

Source: Flood Stage CWCB Summer 1996

Figure 3-8

Planning/Project Grants for FY 97

The Colorado Water Conservation Board (CWCB) reports that 3 communities received project and planning grants in FY 97 (ended Sept 30, 1997) Planning grant Georgetown $11,900 to develop a local flood hazard mitigation plan; Project grants: Silver Plume - $23,454 to implement channel stabilization measures; La Junta/Otero County - $100,000 for an acquisition/relocation/demolition project involving nine structures in the Arkansas River floodplain. These projects have to be completed by 9-30-98. Both communities will have to draft and adopt local flood hazard mitigation plans as part of the grant requirement. Georgetown will have to have its plan adopted by 9-30-98. CWCB are now presently receiving the Notices of Interest from Colorado communities for the FY 98 funding. Project grant funding will total $118,000 for FY 98 and planning grants will be $11,900 for the same period.

3.3.3 Local Government

Local governments play an essential role in implementing effective mitigation, both before and after disaster events. In a post-disaster environment, locally affected areas are also expected to participate in mitigation evaluation. Local government participation

with federal and state agencies in the Colorado Hazard Mitigation Team process is crucial. Recommendations on alleviating or eliminating a repetitive problem often focus in local assessment as to the cause of damage and depend on a local applicant for implementation.

3.3.3.1 Local Government Hazard Mitigation Plans

Since 1983, local governments requesting state assistance for relief of flood damages have been asked by OEM and CWCB to prepare a flood hazard mitigation plan for their jurisdictions. This is a logical extension of the mitigation planning process initiated on a national scale by the federal government. A carefully made plan can be an extremely valuable resource to formulate annual work programs, budgets and policy positions.

As a result of the snowmelt flooding on the Western Slope in 1984, the CWCB began a program designed to bring the mitigation process to the local level where it will have the greatest benefit. Each applicant for disaster relief assistance was asked to develop a flood hazard mitigation plan tailored specially to the community. A suggested plan outline and a detailed questionnaire were developed by the CWCB to assist in this process.

The purpose of such a plan is to articulate those specific local issues which, if resolved, would help reduce future flood damages which will have an impact on the community. Those local issues, in turn, could also provide the basis for input to the statewide annual mitigation program review.

Several Colorado local governments have prepared hazard mitigation plans before and after flood events (**see Appendix C for more information**):

- **City of Manitou Springs**
- **Montrose County**
- **City of Boulder**
- **City of Arvada**
- **San Luis Valley**
- **Town of Lyons**
- **Town of Jamestown**
- **City of Canon City**
- **City of Rifle**
- **City of Fort Collins**
- **City and County of Pueblo**
- **Town of Silverplume**
- **Town of Georgetown**
- **Town of DeBeque**
- **Town of Wattenburg**

3.3.3.2 City of Fort Collins Hazard Mitigation Planning

Land-Use Planning

The City of Fort Collins Stormwater Utility conducts studies on channel stability and delineation of erosion buffer zones along certain channels. The purpose of these studies is to: 1) characterize the stability of the stream on the basis of evaluation of hydrologic, hydraulic, geomorphic, and sediment transport characteristics of the stream basin and develop practical improvements for mitigating adverse impacts on the streams; 2) develop design criteria and construction standards for improvements in drainageways, with regard to reach stability, within the City of Fort Collins; and 3) establish erosion buffer zones to restrict development along the floodplain. This will help to mitigate the effects of flooding along unstable reaches of the stream.

The Stormwater Utility has a ***"Watershed Approach"*** to address environmental impacts associated with urban runoff. This integrates water quality mitigation with water quality control in the City's watersheds. Mitigation objectives include: preventing the introduction of environmental pollutants onto lands within the watershed; treating runoff contaminated by urban land uses in the tributary system; and protecting receiving waters riparian, wetland, and aquatic habitats from deterioration.

Advanced Planning Activities

The Stormwater Utility has a City Plan that establishes core community values, an overall vision, and broad planning goals to the year 2015. This plan addresses city structure, principles and policies, land-use code, as well as implementation procedures.

The Stormwater Utility has developed and maintained Master Drainageway Plans for all streams within the Urban Growth Area. The plans specifies the regulatory flood elevation data as well as mitigation plans to address flooding problems (more information is displayed in ***Appendix G, Figure G-4, page G-12)***.

Chapter 4 - Mitigation Activities Underway and Proposed

4.1 Mitigation Opportunities

While similarities exist between the concepts of hazard mitigation and floodplain management, strong differences also exist among many of the strategies available to carry out these concepts. 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 and insurance. Effective land use, for example, can provide very high net benefits and can 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 generated over a relatively few years. In Colorado, flood warning systems and effective land use decisions are controlled mainly by action at the local level. Therefore, this plan emphasizes mitigation activities that will essentially support local efforts.

For More Information

Appendix A - Lists the agencies and their addresses, telephone numbers, and summaries of their programs.

Appendix B - Includes information on financial assistance programs.

Appendix C - Includes information on references used in the preparation of this plan.

Appendix D - Includes definitions and acronyms.

Appendix E - Includes tips to minimize loss of life & property in the event of a flood.

Appendix F - Includes Mitigation Strategies & Measures.

Appendix G - Includes Mitigation Planning & Examples.

4.2 Mitigation Strategies & Actions

4.2.1 Interagency Hazard Mitigation Team (IHMT)

To reduce damages associated with future floods or other natural hazards, the federal government has adopted a comprehensive coordinated strategy to address these concerns. An Office of Management and Budget (OMB) directive, dated July 10, 1980, established the basis for Regional Interagency and Intergovernmental Hazard Mitigation Teams. These teams are comprised of federal, state and local representatives in an effort to incorporate the background and expertise necessary to promote a comprehensive approach to hazard mitigation.

The Interagency Hazard Mitigation Team (IHMT) prepares mitigation recommendations for implementation during the post-disaster recovery phase, and presents the recommendations to the governor in a report format. The authority for the IHMT derives from an interagency agreement entered into by 12 Federal agencies, coordinated by the Federal Emergency Management Agency (FEMA). The agreement established a common policy statement and implemented guidelines with respect to flood disaster planning and post disaster recovery practices. The IHMT meeting was held in Fort Collins on August 26, 1997, with participants from federal, state, local, and private organizations.

4.2.2 Actions Organized by Priority

The following actions listed in this chapter are the State of Colorado's priorities for flood hazard mitigation. These priorities came from a local/state/federal team process .

4.2.2 Actions Organized by Category

The following issues and recommendations represent the collaborative efforts of Interagency Hazard Mitigation Team members that are intended to help achieve the goal of reducing future flood hazards. Many of the recommendations can be implemented immediately; others must be viewed as long term measures. Recommendations are summarized below:

Housing

H-1 Identify long term affordable housing

Watershed Management

WM-1 Improve and develop accurate floodplain maps.

WM-2 Promote local support for effective land use

planning and floodplain management.

WM-3 Encourage a comprehensive watershed management approach in flood prone communities.

WM-4 Promote an increased awareness of wetland and habitat resources and their benefits to floodplain management.

WM-5 Support the combination of structural and non-structural elements to reduce flood hazards in flood plains that have already been urbanized.

Infrastructure

I-1 Promote upgrading ditches and irrigation canals to safely convey flood flows.

I-2 Upgrade and maintain critical infrastructure.

I-3 Improve emergency warning systems.

Education/Coordination

EC-1 Provide disaster education to the general public.

EC-2 Improve access for local government officials to information regarding floodplain management, flood hazard mitigation and flood insurance.

EC-3 Develop a disaster education program for public officials.

EC-4 Provide technical assistance to communities concerning floodplain management.

EC-5 Promote regional intergovernmental cooperation concerning floodplain management.

EC-6 Develop a natural hazard awareness and education program in K-12 schools.

Health and Environment

HE-1 Encourage small communities to develop centralized sewer and water systems in areas that will not be impacted by flooding.

HE-2 Promote the development of contingency plans for household hazardous chemicals during flood events.

Codes and Standards

CS-1 Develop master drainage plans for state colleges, institutions, cultural facilities and other large public facilities.

CS-2 Strengthen design criteria for vulnerable infrastructure at the local level.

CS-3 Improve stream gage network.

CS-4 Increase rainfall-runoff modeling research.

Housing

H-1 Long term affordable housing following a disaster utilizing acquisition/relocation.

BACKGROUND:

Substantial damage to affordable housing stock following this disaster is a major concern. Permanent affordable housing that is safe from flooding needs to be made available to displaced individuals to ensure a strong, growing community and economy.

RECOMMENDATIONS:

Local governments must take the lead to provide adequate permanent affordable housing to meet the needs of those affected by the disaster. Acquisition/ relocation of housing affected by the disaster, and other housing in areas of high future flood probabilities, should be prioritized high on the list for mitigation opportunities in the recovery phase of this disaster. A combination of all disaster funding sources and a reprogramming of funds from housing related programs needs to be utilized to ensure a solid base of affordable housing in affected communities. Funding sources, which need to be combined, include:

- SBA
- HUD (HOME and CDBG)
- FEMA
- U.S. Department of Agriculture (Rural Development Administration)
- Cities, counties and Regional Planning Councils
- State DOLA
- Colorado Housing and Finance Authority (CHFA)

An interagency approach to this problem must be used, with local clearing houses of housing resources formed to counsel those in need of safe, affordable and permanent housing.

LEAD AGENCIES:

Local jurisdictions with support from Colorado DOLA, Division of Housing

FUNDING:

State, HUD, FEMA, SBA, U.S.D.A, CHFA, Colorado DOLA, Local jurisdictions

SCHEDULE: - One year

STATUS:

Watershed Management

WM-1 Lack of current and accurate floodplain mapping in Colorado communities, especially rural unincorporated areas and in areas experiencing development.

BACKGROUND:

Much of the flood damage suffered in this disaster period occurred in areas not shown on FEMA maps as 100-year floodplain areas. Areas subject to "storm drainage" problems (as opposed to riverine flooding problems, if such a distinction can be drawn), areas downstream of irrigation ditches, areas subject to ponding without satisfactory outlet paths, areas beyond the limits of the 100-year (and even 500-year) flooding, and areas where debris accumulation and/or human emergency intervention altered flow patterns were all witnessed in 1997. Floodplain managers, emergency responders and citizens can all ask, "Can we rely on these floodplain maps during an actual flood emergency?"

RECOMMENDATIONS:

- Seek funding (local, state, federal & private) to sponsor an all-day workshop on floodplain mapping issues.
- In view of the 1997 experience, compare current FEMA and other floodplain maps to the outlines of the areas of inundation during flooding in 1997; identify specific technical issues of concern to hydraulic engineers who prepare floodplain maps.
- Develop specific recommendations for each of the pertinent technical issues.
- Implement recommendations on a pilot basis by conducting floodplain studies in Colorado communities where a particular floodplain mapping problem was experienced.
- Examine pilot studies with independent outside reviewers and make adjustments, as necessary.
- Access information from EPA's Index of Watershed Integrity that uses 15 data layers to characterize individual watersheds.

LEAD AGENCIES:

CWCB, Urban Drainage and Flood Control District, CU, CSU, Colo. School of Mines, irrigation companies, private consulting engineers, FEMA, COE (including HEC in Davis, CA), NRCS

FUNDING:

Agency and program funding

SCHEDULE: - One to five years

STATUS:

Watershed Management

WM-2 Local support for land use planning and floodplain management is lacking in many of Colorado's rural communities.

BACKGROUND:

The concept of externally controlled land use planning is not universally accepted among Colorado's communities. Land use regulation connotes restriction of property rights. Property owners do not want to be restricted from utilizing their land to its maximum potential even if it is located in hazardous areas.

RECOMMENDATIONS:

Work with local governments to:

- Continue progress being made through the SMART Growth Process.
- Develop a strategic planning process for local governments that develops and implements goals and objectives.
- Use local area examples to build support.
- Conduct public meetings and surveys to achieve implementation.
- Provide incentives to encourage planning.

LEAD AGENCIES:

Colorado DOLA, Colorado Natural Hazards Mitigation Council, CWCB

FUNDING:

DOLA, CWCB

SCHEDULE: Immediate and ongoing

STATUS:

Watershed Management

WM-3 Local planning efforts in Colorado are not usually watershed-based. There is a lack of adequate data, funding and coordination to develop multi-jurisdictional comprehensive planning initiatives in many of Colorado's flood prone communities.

BACKGROUND:

Historically, master/comprehensive planning initiatives in Colorado are locally initiated. However, floods cross jurisdictional boundaries. Typically, jurisdictions do not cooperate to solve drainage problems. Funding priorities in communities are often a reason for this problem. Plans to address local interests often do not have a basinwide perspective.

RECOMMENDATIONS:

- Promote long-range planning for future development in floodplain areas that will result in integrated flood control projects, which incorporate acquisition, open space, recreation, and structural improvements to address floodplains that have existing development
- Create a watershed-based Geographic Information System (GIS) in flood affected areas of Colorado. The system should include: 1) geomorphic floodplain data (pre-development); 2)1997 flood affected areas including limits of flooding, diversion points, problem areas, etc.; 3) current land use, 4) currently designated flood-plains including 100-year/500-year irrigation ditches, engineered structures, etc.; 5) future mitigation opportunities, 6) location and amount of damages; 7) infrastructure including highway facilities, railroads, irrigation ditches, etc.; and 8) storm data from the summer 1997 flooding.
- Develop a cooperative work team to seek additional matching funds for the initiatives listed above including development of a GIS Decision Support System. Access resources from EPA's Community Based Environmental Protection (CBEP) programs that can provide technical assistance and funding when available for scientific analysis, monitoring systems and environmental information.

LEAD AGENCIES:

CWCB, CNHMC, DOLA, municipal and county planning departments

FUNDING:

USDA/NRCS, USACE, EPA, FEMA, WAPA, CWCB, CGS, CDPH&E

SCHEDULE: Immediate and ongoing

STATUS:

Watershed Management

WM-4 Floodplain, wetland and habitat resources have been degraded and destroyed in Colorado incrementally over decades.

BACKGROUND:

Colorado has experienced tremendous growth in the past 10 years. It is estimated that 50 percent of the state's wetlands have been lost over the past 100 years. Population growth, increased urbanization and intensified agricultural use have put additional pressure on wetlands. Benefits that may be achieved by wetlands include flood control, groundwater recharge, improved water quality, wildlife habitat and open space. Beyond wetland initiatives, opportunities exist to develop watershed management planning and implementation strategies. The need for watershed planning has been typified by some of the problems experienced due to recent flooding. The problems include damaged irrigation facilities, loss of riparian areas, wetland lass and degradation, sedimentation of rivers, streams, ditches, and other watercourses.

RECOMMENDATIONS:

- Promote watershed planning throughout Colorado.
- Encourage increased federal, state and local government participation in the Colorado Wetlands Initiative.
- Provide buffer areas adjacent to creeks and rivers to protect flow conveyance areas.
- Clean debris from ditches and fields.
- Make repairs to damaged irrigation facilities.
- Improve vegetative growth in areas subject to frequent flood flows.
- Coordinate watershed planning recommendations with proposed mitigation measures.

LEAD AGENCIES:

Local jurisdictions, CWCB, CDOW, USDA/FSA, USDA/NRCS, USF&WS, EPA

FUNDING:

FEMA, USDA/NRCS, USDA/FSA, CDOW

SCHEDULE: Immediate and on-going

STATUS:

Watershed Management

WM-5 Need for combining structural and non-structural elements to reduce flood hazards in floodplains that have already been urbanized.

BACKGROUND:

Much of the most severe flood damage experienced in this 1997 disaster occurred in watersheds where houses and other buildings cover much of the 100-year floodplain, including all or a significant part of the channel/flow path. If acquisition for demolition or relocation is feasible (economically, socially or politically) for only a small number of buildings and if floodproofing is similarly constrained, that does not mean other sound floodplain management alternatives don't exist. In such cases a combination of acquisition/relocation and floodproofing with structural drainage/flood control improvements can reduce flood hazards and provide open space and recreation, improve wildlife habitat and increase livability of neighborhoods.

RECOMMENDATIONS:

- Identify communities flooded in 1997 and other communities where urbanization appears to preclude fully non-structural approaches to flood hazard reduction;
- Identify non-structural measures that would contribute to flood hazard reduction in those communities and the constraints faced by the non-structural measures.
- Identify structural measures that would substantially enhance the effectiveness of non-structural measures in those communities.
- Seek multi-objective and multidiscipline design support for such combined structural non-structural projects.
- Seek funding (federal, state, local and private for final design and construction of such projects).

LEAD AGENCIES:

CWCB, DOLA, local jurisdictions, private planning consultants, private landscape architects, private consulting engineers, FEMA, COE, NRCS

FUNDING:

FEMA, COE, NRCS, CWCB, DOLA, local jurisdictions, special districts

SCHEDULE: One to 10 years

STATUS:

Infrastructure

I-1 Lack of outlet facilities in ditches and canals

BACKGROUND:

Irrigation ditches and canals tend to intercept storm runoff and convey flows to adjacent basins. A breach in the ditch bank can result in flooding areas that normally would not be affected.

RECOMMENDATIONS:

- Equip ditches and canals with outlets to allow releases into drainage channels capable of safely conveying flows.
- Establish overflow areas to accommodate the flood flows. Consider upgrading structural improvements where creeks and drainages intersect irrigation ditches.

LEAD AGENCIES:

Local jurisdiction, public works departments, ditch companies.

FUNDING:

FEMA, local jurisdiction, storm water programs, ditch companies.

SCHEDULE: Six to 12 months

I-2 Need to upgrade and maintain storm drainage infrastructure

BACKGROUND:

During high water flows, some storm drainage facilities failed. Plugged culverts, roadway elevations and railway embankments resulted in water being impounded and caused significant damage.

RECOMMENDATIONS:

- Improve drainage structures and roadway elevations.
- Increase maintenance on culverts and other infrastructure areas.
- Investigate legislative changes to address railroad exemptions in current statutes. Develop model standards and guidelines where county roads cross drainage areas.

LEAD AGENCIES:

CDOW DLG, CDOT, Colorado General Assembly, local jurisdictions

FUNDING:

FEMA, State of Colorado General Funds, local jurisdictions, state agencies, railroads

SCHEDULE: Immediate and ongoing

STATUS:

Infrastructure

I-3 Improve emergency warning systems

BACKGROUND:

Accurate and real time data is lacking in order to warn citizens of hazards, to direct emergency response and to determine emergency measures, such as road closures. There was a substantial period of time between the initial development of the storms that led to flooding in Fort Collins and Sterling in July 1997 and the actual flooding events. Nevertheless, lives were lost in Fort Collins and property and infrastructure were damaged in these communities and others. The question arises, ***"Was there a way to warn some people earlier in the sequence of events of the impending possibility of flooding?"*** If may have allowed emergency responders and citizens to remove more people, property and infrastructure from harm's way.

RECOMMENDATIONS:

- Review existing warning systems and procedures and implement changes that address adequate detection equipment, an understanding of authority, a mechanism to warn the public and monitoring procedures that result in improvements; public involvement is a key component to determine the appropriate system.
- Seek funding (local, state, federal and private) to sponsor an all-day workshop on a single system (or multiple systems if more appropriate) for flood warning in Colorado; research existing systems in the Urban Drainage and Flood Control District and in the Pikes Peak area, as well as programs of the National Weather Service and of private vendors in Colorado and other parts of the country; support funding and development of a comprehensive warning system with a local match (and other funding); implement initial phase of the system.

LEAD AGENCIES:

Local jurisdictions, CSU, CU, Colorado School of Mines, private meteorologists and other warning vendors, NWS, CWCB

FUNDING:

FEMA, NWS, USGS, local jurisdictions, agency and program funding

SCHEDULE: One year

STATUS:

Education/Coordination

EC-1 Lack of disaster education of the general public

BACKGROUND:

Education can mitigate loss of lives, property, jobs and other economic impacts by informing the public how to prepare for a disaster and steps to take in an emergency situation.

RECOMMENDATIONS:

Develop flood hazard awareness materials for the general public to include the following topics: 1) local emergency warning systems and procedures; 2) flood insurance (need and availability); and 3) instructions and safety information for individuals and families on disaster preparedness. Possible approaches include:

- Print/broadcast public service announcements.
- Information included in local phonebooks.
- Brochures and information pamphlets for stores, libraries and other public places.
- Information printed on grocery bags.
- Construction of memorial/education parks with historical flood information and safety tips.
- World Wide Web home pages for disaster awareness (www.fema.gov.).

LEAD AGENCIES:

Colorado OEM, CWCB, Colorado Natural Hazard Mitigation Council, American Red Cross

FUNDING:

FEMA, Colorado OEM, CWCB, Colorado Natural Hazards Mitigation Foundation, American Red Cross, private foundations

SCHEDULE: Immediate and ongoing

STATUS:

Education/Coordination

EC-2 Lack of access for local government officials to information regarding floodplain management, flood hazard mitigation and flood insurance

BACKGROUND:

The issues surrounding flood hazard reduction are not always a priority in Colorado communities. This results from several factors. First, flooding does not occur frequently enough in most communities to be in the forethought of most local officials. Second, personnel turnover is a fundamental reason that local floodplain administrations are not always educated about the specifics of floodplain manage management. Therefore, there is a significant need to provide the means and institutional tools for improved access to floodplain management, flood hazard mitigation and flood insurance information.

RECOMMENDATIONS:

- Promote the increased use of the Internet and Geographic Information Systems (GIS) through workshops with assistance from existing programs and new funding opportunities.
- Place an increased focus on the importance of hiring GIS technicians at the local level of government, as well as adequate software for successful completion of this objective.
- Focus on encouraging improved coordination within local government departments to encourage periodic information sharing.
- Request that local governments appoint a lead department to accomplish the periodic updates and coordination initiatives.
- Tabulate all floodplain management, flood hazard reduction, drainage and climate history information into a resource directory for local governments including: 1) programs; 2) funding; 3) technical assistance; and 4) contacts in local, state and federal government that can be utilized by local governments in accomplishing hazard mitigation.

LEAD AGENCIES:

CWCB, Colorado DOLA, Colorado Natural Hazards Mitigation Council

FUNDING:

FEMA, existing programs within CWCB and DOLA

SCHEDULE: Three to six months

STATUS:

EC-3 Lack of disaster education for public offi-

Education/Coordination

cials

BACKGROUND:

Education can prevent/lessen the loss of lives and prevent damage to property. The existing, limited, uncoordinated education of public officials concerning disaster management has resulted in a lack of knowledge on how communities can prevent, prepare and cope in time of disaster and following recovery operations.

RECOMMENDATIONS:

- Develop and implement a disaster education program to be presented to local public officials. The presentations will include information on the following topics: standard terms/definitions, NFIP, disaster prevention, community homeowner floodproofing, warning systems and federal/state recovery and mitigation programs. Possible approaches include: 1) print/broadcast announcements; 2) presentations to local agencies; and 3) distribution of already developed materials.
- Provide educational presentations and materials to Colorado Municipal League and Colorado Counties Inc.

LEAD AGENCIES:

DOLA, Colorado OEM

FUNDING:

FEMA, Colorado OEM

SCHEDULE: Immediate and ongoing

STATUS:

Education/Coordination

EC-4 Lack of technical capability in local government causes a shortfall in delivery of services related to floodplain management, flood hazard mitigation and flood insurance.

BACKGROUND:

The Colorado Water Conservation Board (CWCB) and the Colorado Department of Local Affairs (DOLA) provide training activities to improve local government capability in the areas of floodplain management and land use planning, respectively. Improved training and education is warranted.

RECOMMENDATIONS:

- Develop improved delivery of training and technical assistance with current state-of-the-art slide shows, workshops, manuals, etc., and assure that the correct audiences are targeted.
- Utilize the Colorado Association of Stormwater and Floodplain Managers (CASFM) and promote certification of local floodplain managers.
- Encourage increased community participation in the NFIP's Community Rating System (CRS).
- Promote the concept of shared services among smaller local governments.
- Promote the concept of basinwide planning among communities.

LEAD AGENCIES:

CWCB, Colorado DOLA, Colorado OEM, Colorado Natural Hazards Mitigation Council, American Planning Association

FUNDING:

FEMA, CWCB, DOLA, Colorado OEM

SCHEDULE: Six to 12 months

STATUS:

Education/Coordination

EC-5 Difficulty in achieving intergovernmental cooperation when flooding crosses jurisdictional boundaries

BACKGROUND:

Floods cross jurisdictional boundaries. Typically, these jurisdictions do not cooperate to solve drainage problems. Funding priorities in communities are often a reason for this problem. Different communities in a similar geographic area often develop different master/comprehensive plans. These planning efforts often address local interests and do not have a basinwide perspective.

RECOMMENDATIONS:

- Expand and continue training for local government officials regarding comprehensive planning and take that opportunity to promote regional intergovernmental cooperation.
- Educate the public and local officials about the advantages of intergovernmental cooperation.
- Assemble peers from different jurisdictions to share experiences and provide assistance related to land use planning, floodplain management, flood hazard mitigation and intergovernmental cooperation.

LEAD AGENCIES:

DOLA, Colorado Natural Hazards Mitigation Council, American Planning Association

FUNDING:

Agency and program funding

SCHEDULE: Immediate and ongoing

STATUS:

Education/Coordination

EC-6 Lack of natural hazard awareness and education in K-12 Schools

BACKGROUND:

Education can mitigate loss of lives and property. The existing in-school programs do not adequately address natural hazard awareness/preparedness which has resulted in a lack of knowledge on how to prepare for disaster events.

RECOMMENDATIONS:

- Develop and implement a disaster education program, which expands on current fire safety programs in schools K-12. Program will include: Presentations by fire authority, meteorologists and media that inform school age children on the danger of natural hazards. Distribution of brochures with hazard information, family disaster plans, and emergency phone numbers needed in the time of disasters.

LEAD AGENCIES:

Colorado Association of School Boards, local school districts

FUNDING:

FEMA, American Red Cross, Colorado OEM

SCHEDULE: 1998-99 school year

STATUS:

Health & Environment

HE-1 Flooding of sewers, septic systems, and private wells in northeastern and southeastern Colorado

BACKGROUND:

In northeastern and southeastern Colorado, during storm and runoff periods, many sewers, septic systems and private wells are flooded. Farms that rely completely on private wells may require outside water sources.

RECOMMENDATIONS:

- Encourage small communities, which depend on individual sewers, septic systems and private water wells, to develop centralized systems in areas that will not be impacted by flooding.

LEAD AGENCIES:

Local jurisdictions, DOLA, DLG, CDPHE, CWQCD, EPA

FUNDING:

EPA, Drinking Water and Sewer State Revolving Funds, WAPA and local jurisdictions

SCHEDULE: Immediate

STATUS:

Health & Environment

HE-2 Collection and disposal of hazardous household chemicals impacted by flooding; chemicals impacting landfills, flooded areas and public water supplies

BACKGROUND:

Municipalities and counties often budget for periodic collection and disposal of household hazardous chemicals, but lack funding and procedures during an emergency. Flooding compounds problems for landfills that are experiencing difficulties with water issues, and creates the possibility of impacting downstream water quality. Hazardous materials from various sites were released in the flooded areas and may have also moved downstream into public water supplies.

RECOMMENDATIONS:

- Develop a contingency plan that includes procedures for handling household chemicals during flooding periods and other emergencies.
- Identify a funding source for emergencies.
- Encourage increased mitigation measures such as elevation, diking or diversion around existing hazardous materials sites that might experience flooding.
- Establish partnerships through the Local Emergency Planning Commissions to address issues of the local level.

LEAD AGENCIES:

Local jurisdictions, fire departments and districts, emergency management offices, Local Emergency Planning Commissions.

FUNDING:

EPA, FEMA, USDA, local jurisdictions, partnerships with the private sector

SCHEDULE: Immediate and ongoing

STATUS:

Codes & Standards

CS-1 Lack of master drainage plans for state colleges and universities, institutions, cultural facilities, and other large local public facilities including hospitals, nursing homes, public safety facilities, etc.

BACKGROUND:

Universities, colleges, institutions, cultural facilities, and other large local public facilities including hospitals, nursing homes, public safety facilities, etc., in Colorado periodically experience (or face the threat of) flooding drainage problems. These entities may or may not know the level of threat at their location and the range of strategies that can be implemented to deal with it. Public officials and managers, as stewards of these facilities, must increase protective and risk management activities.

RECOMMENDATIONS:

- Encourage preparation and implementation of a drainage floodplain master plan for every essential public facility. Master plans should include mitigation alternatives and recommendations for implementation. Encourage that all buildings within the 100- 500-year floodplain is identified. Any building with a basement and/or a lowest floor lower than the 500-year flood elevation needs an inventory of everything (books, artwork, furniture, computers, etc.) that is kept below that flood level.

LEAD AGENCY:

All Colorado Executive Departments with the CWCW

FUNDING:

All Colorado Executive Departments with the CWCW

SCHEDULE: One year

STATUS:

Codes & Standards

CS-2 Inadequate infrastructure for storm water and surface drainage

BACKGROUND:

The existing storm sewer and surface drainage retention infrastructure are not adequate to contain severe storms and /or channel storm water into existing drainage in many rural communities and urban areas. Design criteria that are used for storm water control projects generally follow the two- or five-year event criteria. This design standard may need to be more flexible to consider critical links and vulnerable sites.

RECOMMENDATIONS:

Local governments need to review and evaluate their existing storm water management plans and infrastructure to determine where improvements are necessary. The review criteria for critical and vulnerable areas may need a higher design criterion than the 2- or 5-year design to ensure total integrity of the entire plan.

LEAD AGENCIES:

Local jurisdictions

FUNDING:

FEMA, DOLA, USACE, FHWA

SCHEDULE:

Studies - Six months. Implementation of new design criteria- one to five years

STATUS:

Codes & Standards

CS-3 Review and improve stream gage network

BACKGROUND:

Flood hydrology is essential to preparing floodplain maps that appropriately guide local floodplain management efforts and properly warn people of the flood risk they may face. Two methods for performing flood hydrology are: 1) Statistical analyses of stream gage records on the stream(s) being studied, which assumes that we have good gages and that they have been in place for a good number of years (25 plus); and 2) Rainfall-runoff modeling, which measures the theoretical or actual rainfall data and translates that rainfall mathematically into flow on the stream system receiving the rainfall. The theoretical or actual rainfall data is dependent on one or more accurate rain gages, which are limited in many portions of Colorado. This includes the zone between the Front Range foothills and the plains, where a large portion of Colorado's residents live and work. As a result, our hydrologic estimates for our floodplain studies are less accurate and reliable.

RECOMMENDATIONS:

- Perform an inventory of existing network of stream and precipitation gages in northeastern and southeastern Colorado and determine the "holes" in that network; seek local, state and federal funding to install, operate and maintain gages to fill as many of those "holes" as possible; commit, to the extent possible, to a 25-year plan for each gage to assure an adequate period of record.

LEAD AGENCIES:

CWCB, Urban Drainage and Flood Control District, Colorado Division of Water Resources, USGS, NWS

FUNDING:

USGS, CWCB

SCHEDULE: One year

STATUS:

Codes & Standards

CS-4 Rainfall-runoff modeling research

BACKGROUND:

Many flood hydrology analyses in Colorado have been performed using rainfall-runoff modeling. That means the hydrologist uses theoretical or actually measured rainfall data and translates that rainfall mathematically into flow on the stream system receiving the rainfall. Generally, stream-gaging information is not available to verify that the flows computed through the mathematical model correspond to physical reality on that stream system.

RECOMMENDATIONS:

- Seek funding (local, state, federal and private) to support rainfall-runoff modeling research at one or more universities and/or colleges in northeastern Colorado; inventory the rainfall-runoff methodologies currently in use by hydrologists performing floodplain studies in northeastern Colorado; conduct studies over a period of years to verify and/or modify the relationship between a given rainfall in a particular watershed and a specific flow at various locations on the stream system draining that watershed; develop one or more new rainfall-runoff models and calibrate the new model(s) to actual field data for the region of interest.

LEAD AGENCIES:

CWCB, C.U., C.S.U, Colorado School of Mines, COE, NRCS, USGS

FUNDING:

COE, NRCS, C.U., C.S.U, CWCB

SCHEDULE: One year

STATUS:

Chapter 5 - Plan Implementation & Monitoring

5.1 Implementation and Monitoring

Successful implementation of Colorado's Flood Hazard Mitigation Plan is the next step in the plan process. Both state and local involvement continue to be the foundation during the implementation and monitoring phases. At the state level, the Colorado Office of Emergency Management (OEM) will lead and provide support to other state agencies and local offices for implementation and monitoring activities. The local Emergency Management Offices, the State Hazard Mitigation Team (SHMT) and other state level agencies will also play key roles in effective implementation and monitoring.

5.1.1 Role of Office of Emergency Management (OEM)

The Colorado Office of Emergency Management (OEM) and the Colorado Water Conservation Board (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 other OEM and CWCB staff, the SHMT (Colorado Natural Hazards Mitigation Council), other state agencies, county emergency management coordinators (EMCs) and other state and local level organizations. OEM and CWCB will work closely with the Colorado Natural Hazards Mitigation Council to get feedback and assistance in monitoring the progress during this phase.

In addition to the coordinator role, OEM and CWCB will develop and conduct education and outreach activities to introduce the plan to Coloradans. 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 emerging importance of mitigation as a prerequisite for future funding.

In order to implement this plan OEM has appointed a staff person to serve as the state hazard mitigation officer (SHMO). While bringing a full time SHMO into the office will greatly enhance OEM's effectiveness in implementing this plan, the role of other OEM staff cannot be diminished. It remains important that communication, programs and planning encompass the entire spectrum of disaster planning, preparedness, response, recovery and mitigation.

The SHMO will be the state's first contact point for mitigation issues and serve as the pivot point for implementing this plan. In this role, the SHMO's activities will include:

- Activating the State Hazard Mitigation Team (SHMT) and serving as its chair; (Colorado Natural Hazards Mitigation Council also serves as the SHMT)
- Working with state agencies to implement mitigation recommendations as determined in this plan;
- Serving as the information liaison with state policymakers regarding mitigation issues and priorities;
- Monitoring and reporting the progress of state agencies and local level implementation of the mitigation recommendations;
- Developing and conducting education and training about mitigation for county EMCs;
- Providing technical assistance to county EMCs; and
- Developing and supporting regional hazard mitigation teams of county EMCs responsible for monitoring implementation.

For More Information

Appendix A - Lists the agencies and their addresses, telephone numbers, and summaries of their programs.

Appendix B - Includes information on financial assistance programs.

Appendix C - Has information on references used in the preparation of this plan.

Appendix D - Includes definitions and acronyms

Appendix E - Includes tips to minimize loss of life & property in the event of a flood.

Appendix F - Includes Mitigation Strategies & Measures.

Appendix G - Includes Mitigation Planning & Examples.

5.1.2 Role of Colorado Water Conservation Board (CWCB)

- Developing and supporting a statewide organization or association of county EMCs focusing on mitigation issues and activities;
- Visiting each of the 63 counties on a three-year cycle;
- Working with other agencies in approving mitigation grants proposals;
- Assisting in exploring and developing a state funding pool exclusively for hazard mitigation efforts;
- Serving as communication liaison with regional and national government agencies;
- Assisting in the implementation of cost-effective and environmentally-acceptable flood mitigation measures with local government; and
- Monitoring local project progress, as well as monitoring annual maintenance activities for flood mitigation projects.

5.1.3 Role of Colorado Natural Hazards Mitigation Council (CNHMC)

The Colorado Natural Hazards Mitigation Council (CNHMC) serves as the State Hazard Mitigation Team (SHMT). For the past two decades, Colorado has experienced rapid population and business growth. Pressures have increased to build structures in floodplains, on steep slopes, in wildfire areas, and other locations previously considered unsafe or too costly to develop. Recognizing these issues, Governor Roy Romer signed an executive order establishing the Colorado Natural Hazards Mitigation Council (CNHMC) in March of 1989. The council was created as an interdisciplinary forum for exchanging information and promoting ways to reduce and manage impacts from natural hazards.

The council is composed of almost two hundred volunteer committee members in the state of Colorado. The council is organized into technical and hazard specific committees. The technical committees are Public Affairs and the Steering Committee. Hazard specific committees include Severe Weather, Dam Safety, Fire Management and Mitigation, Drought, Geologic Hazards, and Flood. A recently formed Policy Advisory Group guides overall strategy.

As an organization unique in this country, the Colorado Natural Hazards Mitigation Council is afforded a great opportunity as the State Hazard Mitigation Team (SHMT) to identify and mitigate hazards prior to major disasters. State, federal and local governments, as well as the private and academic sectors, are working together as a dynamic coalition to address these significant issues in a systematic and timely fashion.

5.1.4 Role of Local Government Emergency Management and Floodplain Coordinators

Local government emergency management coordinators are frequently forced by multiple roles and job demands to deal with mitigation issues and projects only as extra time permits. This is both a cause and a result of mitigation's traditional low priority status. The development of this Flood Hazard Mitigation Plan marks a shift in priorities, which will result in more attention and funding to mitigation. This priority shift is consistent with federal policy and will prepare Colorado communities for future mitigation funding requirements.

Throughout the mitigation planning process, the county EMCs have played an important role. They are the local level contact and the coordinator of mitigation implementation, 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 will play the dominant role in implementing this plan at the local level. Among their responsibilities are:

- Working closely and communicating with the SHMO to implement mitigation recommendations;
- Conducting public awareness and education activities on mitigation, its importance and methods;
- Conducting education activities for community organizations;
- Developing and implementing the prioritized 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;
- Monitoring progress in recommendation implementation through participation on a regional team; and

- Participating in development of a statewide county EMC association focusing on mitigation activities.

As the link between the SHMO and other community agencies and organizations, the county emergency management coordinator is the recognized focal point for implementation and monitoring of mitigation activities.

5.2 Lead Agencies and Their Roles

5.2.1 State Hazard Mitigation Team and Colorado Natural Hazards Mitigation Council

The CNHMC will be activated to take a leadership role in the implementation and monitoring phases of the plan process. Membership on the CNHMC will be expanded to include additional state agency and local representation. In addition, the CNHMC will develop its role to extend into the capability, evaluation and update phases functioning to coordinate all mitigation activities of state agencies.

5.2.2 Other State Agencies

Designated state agencies will serve on the SHMT. Other agencies have a role to play in hazard mitigation, as well, and will be called upon to participate in appropriate mitigation activities.

This plan designates a reasonable lead agency for each recommendation. The lead agency first will develop a work plan for implementing and monitoring the recommendation. It is expected that this work plan will involve other appropriate state agencies and organizations at the state and local levels. In essence, the lead agency will coordinate the state/local team designed to most effectively implement the recommendation. In that capacity, the lead agency is responsible for communication and reporting progress toward implementation to the SHMO, OEM, CWCB, and SHMT. Monitoring will also be the responsibility of the lead agency.

Where possible the lead agency will review relevant emergency management activities and build upon existing efforts or linkages to minimize bureaucracy and duplication and to strengthen functional networks and service systems.

5.2.3 Monitoring & Reporting Activities

Ongoing monitoring and reporting activities will not only provide information by which to measure progress toward the outcomes but will also serve as impetus for implementation of the recommendations. As a part of the plan process, these activities will be developed and conducted by OEM and CWCB, lead agencies and by local level officials according to the work plans for each specific recommendation.

In addition, OEM and CWCB will monitor the implementation process as a whole at all levels to ensure that progress is being made. Some of the same measures will be utilized to determine and document the overall effectiveness of implementation and monitoring activities. In its role as coordinator of implementation, the SHMO, OEM, and CWCB must have current information regarding status of the entire plan process and that of individual recommendations.

5.2.3.1 Surveys

A number of effective monitoring activities will be utilized, including surveys, site visits and written reports. OEM and CWCB or designated entities will develop and conduct surveys to obtain information from several audiences.

The public, including local officials, will be surveyed to monitor increases in awareness, understanding and acceptance of hazard mitigation as a valid issue.

Policymakers will be surveyed to monitor changes in their awareness, understanding and priority ranking of mitigation as it relates to policy development.

State agencies will be surveyed to monitor their departmental mitigation activities and their participation on the State Hazard Mitigation Team.

Finally, county EMCs will be surveyed to monitor community progress in implementing specific local level recommendations.

Future surveys can be built upon this process to continue to measure effectiveness based on data collected regularly.

5.2.4 Regional CNHMC Teams

Regional monitoring teams will be formed to provide local level feedback about implementation and mitigation success in the communities. Local involvement is again crucial to the overall success of the State Hazard Mitigation Plan. County EMCs and other appropriate officials, such as the county engineer or mayor, will join a multi-county effort to monitor mitigation implementation in those counties. The teams will be developed and coordinated statewide by OEM and will report their findings to the SHMO.

In developing the regional teams, OEM and SHMO will consider existing region-based activities and networks in an effort to build upon current working groups.

5.2.5 Site Visits

The Emergency Management Office and Colorado Water Conservation Board will participate in on-site visits with a goal of reaching each of the 63 counties over a three-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 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.

Site visits will allow the state to monitor and document mitigation recommendation implementation. Equally important results will be the enhanced communication between OEM and the local levels and heightened awareness locally of mitigation and its importance in obtaining future funds.

5.2.6 Written Reporting

Each lead agency will be responsible for providing periodic written progress reports to the SHMO. The format for these reports will be developed by the SHMO to capture the information necessary to monitor progress in implementing mitigation recommendations. The reports will include the project work plan and modifications, progress toward outcomes in measurable form and outreach undertaken to educate and train appropriate audiences.

The lead agency or the SHMO may request similar reports from county EMCs to document progress on implementation. County EMCs may in some cases complete reports to monitor specific local mitigation projects.

5.2.7 Monitoring Roles of OEM and SHMT

The Colorado Office of Emergency Management is the coordinating agency for implementing and monitoring the progress of the mitigation plan. Within the office, the state hazard mitigation officer is responsible for the communication, development and coordination of the implementation and monitoring process. The State Hazard Mitigation Team (Colorado Natural Hazards Mitigation Council) will support the SHMO and lead agencies through its activities within and between state agencies.

5.3 Evaluation

This plan is designed to be a changing document. Regular scrutiny and evaluation is the critical portion of the plan process that keeps the plan current and usable as a tool for mitigation activities. The State Hazard Mitigation Plan will be evaluated annually or more frequently if deemed necessary to ensure its ongoing relevance to the state's mitigation needs.

Evaluation of the plan will be coordinated and conducted by the state hazard mitigation officer (SHMO) with support and involvement of the State Hazard Mitigation Team (SHMT). Each year the goals and objectives will be reviewed to determine their continued appropriateness. The state's progress in hazard mitigation, developments in hazard identification and analysis, mitigation opportunities and mitigation policy developments are some of the issues to be considered in evaluating the plan's goals and objectives. The SHMO will develop the specific activities to accomplish the evaluation.

Local viewpoints and information will be sought to facilitate this evaluation process. Community meetings, focus groups or other outreach activities will be held to access local ideas. County and city officials and organizations have indicated their interest in ongoing participation in the evaluation of the plan in this manner. Lead agencies and state agencies will be asked for their views on the goals as they relate to the recommendations with which they are involved.

Mitigation recommendations will also be evaluated as they relate to the goals. Each recommendation will be measured against the expected outcomes stated in the plan. Surveys of lead agencies, state agencies and local government emergency management coordinators, together with information gathered during the monitoring process, will provide much of the basis for evaluation. Those outcomes will be reviewed to see if the expected outcomes were attained, the reasonableness of the progress, the effectiveness of the process of implementation and the need for modification of the expected outcomes.

Selected success stories or problem areas will be studied in depth to highlight and illustrate issues needing further focus. These case studies will be utilized in suggesting models for mitigation for other Colorado communities and for analysis of process effectiveness.

This information documenting progress toward outcomes will be presented to the SHMT by the SHMO for evaluation. The SHMT will assist in analyzing the information and suggesting steps to modify the plan.

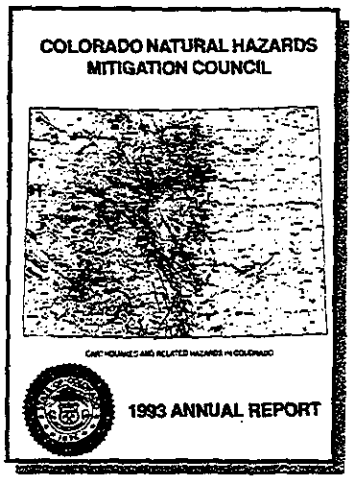
Overall the SHMO, the Office of Emergency Management Office, the Colorado Water Conservation Board, and the Colorado Natural Hazards Mitigation Council will complete scrutiny of the plan process. Special problem areas such as implementation, coordination, support and policy focus will be explored. The process evaluation will report which implementation processes worked well, what barriers were discovered, how the communication and coordination efforts performed and which processes need to be revisited or strengthened. These findings will be incorporated into the updated plan.

5.4 Update and Modification

Following the annual review and evaluation of the plan, updates and modifications will be developed by the state hazard mitigation officer (SHMO) and the Colorado Natural Hazards Mitigation Council (State Hazard Mitigation Team). This part of the plan process

involves bringing all of the information together from all of the previous phases, measuring that information against the plan and initiating appropriate changes to the plan.

Updating the plan is much like developing the initial plan in that without local and state agency support, the plan will be difficult to implement. Consequently, results of the outreach activities conducted in the monitoring and evaluation stages must be the foundation for the suggested plan *modifications*.



The Colorado Natural Hazards Mitigation Council (CNHMC) will be best suited to introduce the modified plan to the state agencies and secure their support in implementing the changes. The CNHMC will also work with the SHMO in educating and taking the modifications to the county EMCs and other local officials and organizations. Many of the same community outreach activities will be held as were conducted when the plan was first developed and introduced. In this manner the cycle of implementation, monitoring, evaluation and modification will be again set in motion.

Since Colorado's Flood Hazard Mitigation Plan focuses heavily upon policy issues, options for ongoing funding and developing a high priority for mitigation, it is expected that as progress is made in these areas, some of the goals will shift to keep pace with the state's progress and current needs. This plan is intended to be the launching point for the state commitment to mitigation. To remain a useful tool for the long term, it is critical that we stretch our system and remain flexible to reach current goals while forming new goals that will prepare us for the future.

5.4.1 Future Enhancements

Other updates and modifications will be undertaken as new hazards are defined or in the event of a federally declared disaster in the state. In these events, the process will continue to solicit and include the contributions of those at the local and state levels to best define mitigation needs for the current situation and for the comprehensive long-term plan.

Appendix A - Hazard Mitigation Information Resources and Agencies

A variety of local, state, federal, and private agencies can provide assistance to a community in planning and implementing a mitigation program. Some agencies provide advice and guidance, some can help find the program, and some provide both technical and financial assistance.

Chapter 3 identified which agencies can help on specific mitigation measures. This appendix provides a brief summary of the agencies' programs and notes where to contact the agency.

A.1 Local and Private Agencies

A.1.1 International Conference of BuildingOfficials (ICBO) Colorado Chapter

Types of Assistance: Provide assessments for disaster locations, and advice, development and improvement for building codes

Eligibility: Benefactors of building code information

Colorado Chapter ICBO
950 South Birch Street
Glendale, CO 80246
303-639-3601 Fax 303-759-0561

A.1.2 Colorado Association of Stormwater and Floodplain Managers

Types of Assistance: Provide assessments for disaster locations, and advice, development and improvement for floodplain and stormwater management

Eligibility: All

Colorado Association of Stormwater
and Floodplain Managers
P.O. Box 22673
Denver, CO 80222-0673
c/o Susan Hayes (City of Fort Collins)
970-221-6589 Fax 970-221-6239

Other Local Governments

Other local governments are offer agreeable to cooperative efforts where a flood mitigation project can further their objectives. In addition to their primary concerns, river conservancy districts and drainage districts can construct drainage or flood control improvements. School districts initiate cooperative education and public information programs. Counties, cities, towns and fire districts often enter into mutual aid agreements to support each other during emergencies. These agreements can include loaning building officials and other staff to help with heavy workloads during recovery.

A.1.3 Urban Drainage and Flood Control District (UFDCD)

Types of Assistance: The Urban Drainage and Flood Control District was established by the Colorado legislature in 1969, for the purpose of assisting local governments in the Denver metropolitan area with multi-jurisdictional drainage and flood control problems. The District covers an area of 1608 square miles and includes Denver, parts of the 5 surrounding counties, and all or parts of 33 incorporated cities and towns. There are about 1600 miles of "major drainageways" which are defined as draining at least 1000 acres. The present population of the District is approximately two million people.

The District can help by documenting flood levels and the effectiveness of in-place structures. It can review or help prepare flood protection plans, master drainage plans, and flood control project designs. The UDFCD has emergency contingency funds that may be available for certain activities. For example, a recent project with the City of Arvada included the acquisition of approximately 100 mobile homes located in the Ralston Creek floodplain. The mobile homes have all been relocated and the floodplain and creek will be restored.

Eligibility: Participating communities in the UFDCD

Urban Drainage and Flood Control District
2480 West 26th Avenue, Suite 156 B
Denver, CO 80211
303-455-6277 Fax 303-455-7880
http://www.udfcd.org

A.1.4 City of Fort Collins Stormwater Utility

Types of Assistance: The Utility can help by documenting flood levels and the effectiveness of in-place structures. It can review or help prepare flood protection plans, master drainage plans, and flood control project designs. The Utility has emergency contingency funds that may be available for certain activities.

Eligibility: City of Fort Collins

City of Fort Collins Stormwater Utility
235 Mathews
P.O. Box 580
Fort Collins, CO 80522-0580
303-573-0444 Fax 970-221-6239

A.1.5 Association of State Floodplain Managers Floodplain Management Resource Center

Type of Assistance: The Association of State Floodplain Managers has established a Floodplain Management Resource Center located at the Natural Hazards Research and Applications Information Center. Documents are summarized and entered into a computerized bibliographic database. Topics include floodproofing, arid west issues, stormwater management, and guidance for local officials. Most inquiries are handled by phone or by the Internet.

Floodplain Management Resource Center
Natural Hazards Research & Applications Center
Information Institute of Behavioral Science #6,
Campus Box 482, University of Colorado
Boulder, CO 80309-0482
(303) 492-6818 Fax: 303-492-2151
http://www.Colorado.EDU/hazards

A.1.6 The Association of State Floodplain Managers

Type of Assistance: The Association of State Floodplain Managers also publishes flood hazard reduction planning and implementation documents. In addition to proceedings from their annual conference. Members receive News and Views, their bi-monthly newsletter. For a list of publications, contact:

ASFTM Publications
P.O. Box 2051
Madison, WI 53701-2051
608-249-0649

A.2 State Agencies

A.2.1 Department of Natural Resources, Colorado Water Conservation Board

Types of assistance: Prepare flood documentation reports, mitigation recommendations. River rehabilitation and floodplain management. Advice and assistance on floodplain regulations, state floodplain permit requirements, and local responsibilities under the National Flood Insurance Program. Operate construction fund with 5% of total revenue available as low interest loans for floodplain management activities.

Eligibility: Local jurisdictions, agencies, boards, organizations and private sector.

Department of Natural Resources
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, CO 80203
303-866-3441 Fax 303-866-4474
http://www.dnr.state.co.us/water/flood

A.2.2 Department of Natural Resources Division of Water Resources

Types of Assistance: Technical assistance for dams, flood control structures, water rights, and funding for emergency construction.

Eligibility: Local and regional jurisdictions, State agencies

Department of Natural Resources
Division of Water Resources
1313 Sherman Street, Room 818
Denver, CO 80203
303-866-3581 Fax 303-866-3589
http://www.dnr.state.co.us

A.2.3 Department of Natural Resources Colorado Geological Survey

Types of Assistance: Cooperative program for natural hazard mitigation planning including GIS resources.

Eligibility: Local and regional jurisdictions, State agencies

Department of Natural Resources
Colorado Geologic Survey
1313 Sherman Street, Room 715
Denver, CO 80203
303- 866-2611 Fax 303- 866-2461
http://www.dnr.state.co.us

A.2.4 Department of Natural Resources Division of Wildlife

Types of Assistance: Grants and technical assistance for impacts on wildlife and wetlands.

Eligibility: Local and regional jurisdictions, State agencies, individuals, and private sector

Department of Natural Resources
Division of Wildlife
6060 North Broadway
Denver, CO 80216
303-297-1192 Fax 303-294-0874
http://www.dnr.state.co.us

A.2.5 Department of Local Affairs Office of Emergency Management

Types of Assistance: Offers financial and technical assistance as well as emergency training, planning and exercises services. Provides a coordinated state response and recovery program.

Eligibility: Local and regional jurisdictions, State agencies, organizations, boards and the private sector

Department of Local Affairs
Office of Emergency Management
15075 South Golden Road
Golden, CO 80401
303-273-1622 Fax 303-273-1795
www.state.co.us/gov_dir/Loc_Affairs

A.2.6 Department of Local Affairs Division of Local Government

Types of Assistance: Provides technical assistance for planning, land use, GIS service, resource coordination with universities and colleges, and packaging of grants for rural development

Eligibility: Local governments

Department of Local Affairs
Division of Local Government
1313 Sherman Street, Room 521
Denver, CO 80203
303-866-2156 Fax 303-866-4819
www.state.co.us/gov_dir/Loc_Affairs

A.2.7 Department of Local Affairs Field Services

Types of Assistance: Manages Community Development Block (non-entitlement) Grants, Energy/Mineral Impact Assistance Program, and Contiguous County Limited Gaming Impact funds

Eligibility: Local governments

Department of Local Affairs - Field Services
1313 Sherman Street, Room 323
Denver, CO 80203
303-866-2771 Fax 303-866-2751
www.state.co.us/gov_dir/Loc_Affairs

A.2.8 Department of Local Affairs Division of Housing

Types of Assistance: Coordinates low to moderate housing grants

Eligibility: Local governments and non-profits

Department of Local Affairs - Division of Housing
1313 Sherman Street, Room 521
Denver, CO 80203
303-866-2033 Fax 303-866-4077
www.state.co.us/gov_dir/Loc_Affairs

A.2.9 Department of Transportation

Types of Assistance: Response and repairs to emergencies plus damage reimbursement to federal-aid road systems

Eligibility: Jurisdictions with federal-aid road systems

Department of Transportation
1325 South Colorado Blvd., Suite 770B
Denver, CO 80222
303-757-9536 Fax 303-757-9719

A.2.10 Colorado Department of Public Health and Environment

Types of Assistance: Manages State Revolving Fund for loans and grants to restore waste and wastewater facilities and drinking water projects. Provides damage and costs estimates for storm sewers, advise on household waste issues, testing of water quality in landfills, mosquito spraying (if warranted), and activates the Crisis Management Center

Eligibility: Local and jurisdictions

Colorado Department of Public Health
and Environment
4300 Cherry Creek Drive South
Denver, CO 80246
303-692-3024 Fax 303-782-4969

A.2.11 Colorado Historical Society State Historical Preservation Office

Types of Assistance: Provides consultation on historical structures and archeological sites, technical advice on preservation methods and resources, and administers the State Historical Fund Grants, including Emergency Grants.

Eligibility: Local jurisdictions and non-profits, federal and state agencies

Colorado Historical Society
State Historical Preservation Office
1300 Broadway
Denver, CO 80203
303-866-3398 Fax 303-866-4464

A.2.12 Colorado Natural Hazards Mitigation Council (CNHMC)

Types of Assistance: Technical assistance for evaluation of projects and information on reducing and managing impacts from natural hazards

Eligibility: Local and regional jurisdictions, State agencies, organizations, boards and the private sector

Colorado Natural Hazards Mitigation Council
C/o Office of Emergency Management
15075 South Golden Road
Golden, CO 80401
303-273-1622 Fax 303-273-1795

A.2.13 The Natural Hazards Center, located at the University of Colorado, Boulder

Types of Assistance: The Natural Hazards Center, located at the University of Colorado, Boulder, Colorado, USA, is a national and international USA, is a national and international clearinghouse for information on natural hazards and human adjustments to hazards and disasters. This center can help by conducting literature searches, research projects, and quick response post-disaster studies or documentation. The Natural Hazards Center carries out its mission in four principal areas: information dissemination, an annual workshop, research, and library services. The Natural Hazards Center has a variety of resources available from the Internet, including:

- Introduction to the Hazards Center, its Services, and its Staff
- The Natural Hazards Center On-line Library Database

- Latest issues of the Natural Hazards Observer - their printed newsletter and Information on how to subscribe

Eligibility: Individuals, agencies, and organizations that are actively working to reduce disaster damage and suffering.

The Natural Hazards Center
University of Colorado at Boulder
Campus Box 482
Boulder, CO 80309-0482
303-492-6818 Fax: 303-492-2151
http://www.Colorado.EDU/hazards

A.2.13 Colorado Soil Conservation Board

Types of Assistance: Acts as a state board of appeals for the districts. Administers and disburses funds for the purpose of assisting soil conservation districts. Acts in an advisory capacity with the districts. Coordinates the programs of all districts. Undertakes studies of watershed planning. Develops, implements and administers watershed flood prevention and underground water storage projects. Accepts grants, services and materials for conservation purposes.

Eligibility: Farmers and ranchers. Colorado's 78-soil conservation districts.

Colorado State Soil Conservation Board
1313 Sherman Street, Room 219
Denver, CO 80203
303-866-3351 Fax 303-832-8106
Http://www.dnr.state.co.us/edo/soil.html

A.3 Federal Agencies

A.3.1 Consolidated Farm Services Agency (CFSA) under USDA U.S. Department of Agriculture

Types of Assistance: Emergency Conservation Program for rehab of farmland, debris removal, water conservation (CFSA will provide up to 64% cost share of project, balance to be funded by farmers or ranchers)

Eligibility: Eligible agricultural producers

Releasing commodities for shelter residents' meals, initiating disaster food stamps and providing school lunches for displaced students

Eligibility: Shelter residents and disaster victims

U.S. Department of Agriculture
655 Parfet, Suite 301
Lakewood, CO 80215
303-236-2866 Fax 303-236-2879
Http://www.usda.gov

A.3.2 Department of Interior (DOI) including Bureau of Indian Affairs (BIA) and U.S. Geological Survey (USGS)

Types of Assistance: Repair and restore wildlife refuges. BIA welfare assistance to meet food and fuel needs of affected Tribes, and also snow removal, school repairs, and other assistance. Replacement and repair of USGS stream gauges and other damaged equipment (assistance varies with types of services)

Eligibility: Local and State governments and Indian tribes

U.S. Department of Interior (DOI)
1849 "C" Street, N.W.
Washington, D.C. 20240
202-208-6416
Http://www.doi.gov

Bureau of Indian Affairs (BIA)
500 Gold S.W., 6th Floor
Albuquerque, NM 87103
505-248-7243 Fax 505-248-7210
Http://www.bia.gov

U.S. Geological Survey (USGS)
Building 53, Denver Federal Center
P.O. Box 25046
Denver, CO 80225
303-236-4882 Fax 303-236-4912
Http://www.usgs.gov

A.3.3 Department of Labor (DOL)

Types of Assistance: Fund temporary jobs and provide cleanup assistance (assistance varies with type of services)

Eligibility: Dislocated workers, homeowners under Federal Weatherization Program and public entities

U.S. Department of Labor (DOL)
1999 Broadway, Suite 1660
Denver, CO 80202-5716
303-844-1700 Fax 303-844-1615
Http://www.dol.gov

A.3.4 Economic Development Districts (EDDs) under Department of Commerce (DOC)

Types of Assistance: Grants for preparing disaster mitigation plans, identifying potential projects, coordinating long term needs and projects (assistance 75% federal/ 25% sponsor cost share)

Eligibility: Local and State Governments

Economic Development Administration (EDA)
1244 Speer Blvd.
Denver, CO 80204
303-844-4403 Fax 303-844-3968

A.3.5 Environmental Protection Agency (EPA)

Types of Assistance: EPA State Revolving Fund/ CWA low interest loans for restoring wastewater facilities and for drinking water projects. CBEP scientific analysis, monitoring systems, environmental information. EPA also offers technical assistance on wetlands,

household waste and removal of tanks and drums. (CBEP - Technical assistance limited funding)

Eligibility: Cities and Towns

US EPA, Region 8 (EPR-PS)
999 18th Street, Suite 500
Denver, CO 80202-2466
1-800-227-8917
http://www.epa.gov

A.3.6 Federal Highway Administration (FHWA

Types of Assistance: Reimbursement for repair of damaged federal-aid roads (assistance state match generally varies from 10% to 20%)

Eligibility: Local and State governments

U.S. Federal Highway Administration (FHWA)
Region 8 (HRA-08)
555 Zang Street, Room 400
Lakewood, CO 80228
303-969-6722
http://www.fhwa.dot.gov

A.3.7 Federal Emergency Management Agency (FEMA)

Types of Assistance: (HMGP or 404) grants for Hazard Mitigation Assistance designed for long term mitigation projects (assistance up to 75% federal/25% sponsor cost share)

Eligibility: Local and State governments, nonprofit organizations and Indian Tribes

Public Assistance PA - Public Assistance grants designed to restore public infrastructure. Also funds cost-effective mitigation measures (assistance up to 75% federal/25% sponsor cost share)

Eligibility: Local and State governments, nonprofit organizations and Indian Tribes

(FMAP) Grants - Flood Map Assistance Program (assistance limited to planning and technical assistance)

Eligibility: NFIP jurisdictions in good standing

Federal Emergency Management Agency (FEMA)
Region 8, Denver Federal Center
P.O. Box 25267, Building 710
Denver, CO 80225-0267
303-235-4900 Fax 303-235-4894
http://www.fema.gov

Federal Emergency Management Agency (FEMA)
500 C Street, SW
Washington, DC 20472
http://www.fema.gov

A.3.8 Health and Human Services (HHS)

Types of Assistance: Serve and enroll children affected by floods

Eligibility: Head Start children

U.S. Health and Human Services (HHS)
1961 Stout Street
Denver, CO 80294-3538
303-844-3372 Fax 303-844-4545
http://www.hhs.gov

A.3.9 Housing & Urban Development (HUD)

Types of Assistance: Community Development Block Grant (CDBG) (assistance provides grants for a variety of projects)

Eligibility: Cities and counties

U.S. Housing and Urban Development (HUD)
633 17th Street
Denver, CO 80202
303-672-5285 303-672-5028
http://www.hud.gov

A.3.10 Natural Resources Conservation Service (NRCS) - (formerly SCS) under U.S. Department of Agriculture (USDA)

Types of Assistance: Emergency Watershed Protection - emergency repair of levees and structures, channel clearance and protection of eroding stream banks (assistance up to 75% federal/25% sponsor cost share)

Eligibility: Public and private landowners represented by a project sponsor (public agency)

PL 566 - Small Watershed Protection Program - construct flood protection projects and land treatment (assistance - 100% grants for structural projects, 75% for non-structural projects)

Eligibility: Local, regional, and State and governments

Cooperative River Basin Program - appraises water sheds and land resources for conservation planning (assistance limited to technical assistance)

Eligibility: Local, regional, and state and federal governments

U.S. Natural Resources Conservation Services (NRCS)
U.S. Department of Agriculture (USDA)
655 Parfet Street
Lakewood, CO
303-236-2903 Fax 303-236-2896

A.3.11 Rural Economic & Community Development Services (formely FmHA)

Types of Assistance: Soil and water loans to develop wells, terraces, waterways, control erosion and build dikes (assistance - 1% loans)

Eligibility: Owners and operators of farms and ranches

HR 2667 - Emergency Farm Loans to assist where physical damage affects farming, ranching or aquaculture (assistance - 4.5% loans)

Eligibility: Farmers, ranchers, and aquaculture operators

Rural Economic & Community Development Services
655 Parfet, Suite 301
Lakewood, CO 80215
303-236-2866 Fax 303-236-2879
Http://www.usda.gov

A.3.12 U.S. Army Corps of Engineers

Types of Assistance: Section 206 - Floodplain management services for floodplain mapping, flood warning & preparedness planning and technical assistance (Cost share varies with types of services)

Section 22 - Planning assistance to support any water resource issue analysis related to state water plan (50% federal/50% sponsor cost share)

PL 84-99 - Rehabilitation of flood control structures damaged by flooding (Repair to pre-flood conditions; cost share may apply)

Section 205 - Small flood control projects for flood prevention (projects up to $5 million per project, 65% federal/35% sponsor cost share)

Section 14 - Emergency stream bank and shoreline protection to prevent erosion from damage to public and nonprofit facilities (projects up to $500,000; 65% federal/ 35% sponsor cost share)

Elgibility: Local and State governments, Indian Tribes, and water districts (in some cases)

U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435
505-342-3283 Fax 505-342-3498
http://www.swa-wc.usace.army

U.S. Army Corps of Engineers
Albuquerque District
Southern Colorado Project Office
720 North Main Street, Suite 205
Pueblo, CO 81003-3046
719-543-9459 Fax 719-543-9475
http://www.swa-wc.usace.army

U.S. Army Corps of Engineers
Omaha District
215 North 17th Street
Omaha, NE 68102
404-221-4897 402-221-4656
http://www.swa-wc.usace.army

U.S. Army Corps of Engineers
Omaha District - Tri Lakes Project Office
9307 State Highway 121
Littleton, CO 80123-6901
303-979-4120 Fax 303-979-0602
http://www.swa-wc.usace.army

A.3.13 U.S. Fish and Wildlife (USF&W)

Types of Assistance: Partners for Wildlife - provides funds for improvement, protection of fish and wildlife habitat on private lands (approximately 50% federal/50% sponsor cost share with USF&W providing supplies and landowner will to actual restoration) The Service administers Federal Aid grants to States for fish and wildlife restoration. The money for these programs does not come from general taxes, but from Federal excise taxes paid by hunters, anglers, and boaters on hunting and fishing equipment and motorboat fuels. In 1995, Colorado received $4.9 million for sport fish restoration and $5.2 million for wildlife restoration and hunter education from the Fish and Wildlife Service's Federal Aid program

Elgibility: Private citizens and corporations

U.S. Fish and Wildlife
Region 8 Office
134 Union Blvd.
Lakewood, CO 80225
303-236-7904
Http://www.fws.gov

A.3.14 U.S. Small Business Administration (SBA)

Types of Assistance: SBA disaster loans to help rebuild and recover after a disaster - assists in damaged real and personal property (low-interest, long-term loans at various terms Up to 20% additional loan for mitigation measures)

Elgibility: Homeowners, renters, businesses of all sizes and private nonprofit organizations

U.S. Small Business Administration (SBA)
4400 Amos Carter Blvd. #102
Fort Worth, TX 76155
970-207-4588 970-207-4584
http://www.sba.gov

Additional Hazard Mitigation Information Resources and Agencies

AMERICAN ACADEMY OF VETERINARY DISASTER MEDICINE

3910 Morehouse Road, West Lafayette, IN 47906. E-mail: seh@vet.purdue.edu.

AMERICAN ENGINEERS FOR DISASTER RELIEF, INC.

P.O. Box 684, Princeton Junction, NJ 08550-0684. James Cohen, Trustee; (609) 730-0510; fax: (609) 730-0511 or 737-3714; e-mail: jccpc@msm.com.

AMERICAN INSTITUTE OF ARCHITECTS

1735 New York Avenue, N.W., Washington, DC 20006. Kerry Lord; (202) 626-7383; fax: (202) 626-7365; e-mail: 47334@t-mail.telescan.com.

AMERICAN METEOROLOGICAL SOCIETY

45 Beacon Street, Boston, MA 02108. Richard Hallgren, Executive Director; (617) 227-2425; fax: (617) 742-8718; e-mail: hallgren@ametsoc.org; WWW: http://www.ametsoc.org/AMS.

AMERICAN PLANNING ASSOCIATION

122 South Michigan Avenue, Suite 1600, Chicago, IL 60603. William Klein, Director of Research; (312) 431-9100; fax: (312) 431-9985; e-mail: research@planning.org; WWW: http: ww.planning.org.

AMERICAN PSYCHOLOGICAL ASSOCIATION, DISASTER RESPONSE NETWORK

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AMERICAN PUBLIC WORKS ASSOCIATION, EMERGENCY MANAGEMENT COMMITTEE

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AMERICAN RED CROSS

National Headquarters, Disaster Services Department, 8111 Gatehouse Road, Second Floor, Falls Church, VA 22042. John Clizbe, Vice President; (703) 206-8672; fax: (703) 206-8836; 24-Hour Disaster Operations Center: (703) 206-8822; e-mail: infor@usa.redcross.org; WWW: http://www.redcross.org. [Note: Disaster information is provided by local Red Cross chapters. Requests sent to the national headquarters are referred to local chapters.]

AMERICAN SOCIETY FOR PUBLIC ADMINISTRATION, SECTION ON EMERGENCY AND CRISIS MANAGEMENT

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AMERICAN WATER RESOURCES ASSOCIATION

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APPLIED TECHNOLOGY COUNCIL

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ASSOCIATION OF CONTINGENCY PLANNERS

National Headquarters, 421 North Rodeo Drive, Suite 15-565, Beverly Hills, CA 92010; (800) 445-4223. Charlie Fox, National Chairperson and CEO; (801) 246-2802. Mary Carrido, National President, Regional Business Recovery and Mitigation; fax: (801) 246-2810; e-mail: mlc2resq@ix.netcom.com.

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ASSOCIATION OF STATE DAM SAFETY OFFICIALS

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ASSOCIATION OF STATE FLOODPLAIN MANAGERS

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ASSOCIATION OF STATE WETLAND MANAGERS

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BUILDING SEISMIC SAFETY COUNCIL

1090 Vermont Avenue, N.W. Suite 700, Washington, DC 20005-4905. James R. Smith; (202) 289-7800; fax: (202) 289-1092; e-mail: bssc@nibs.org; WWW: http://

www.nibs.org/bssc1.htm.

BUSINESS AND INDUSTRY COUNCIL FOR EMERGENCY PLANNING AND PREPAREDNESS

P.O. Box 1020, Northridge, CA 91328. (213) 386-4524; fax: (818) 775-4879.

_BUSINESS EMERGENCY PREPAREDNESS COUNCIL

c/o Emergency Management Agency, 125 North Main, Room 2B49, Memphis, TN 38103. James L. Johnson; (901) 528-2780; fax: (901) 576-6547 or 528-3711.

CALIFORNIA SPECIALIZED TRAINING INSTITUTE

P.O. Box 8123, San Luis Obispo, CA 93403-8123. John Mirolla, Director; (805) 549-3535; fax: (805) 544-7103; e-mail:plfa@csti.org; WWW: http://www.csti.org.

CENTER FOR THE STUDY OF EMERGENCY MANAGEMENT

1241 Johnson Avenue, Department 160, San Luis Obispo, CA 93401; (805) 782-6787; fax: (805) 782-6730; e-mail: wbalda@simeon.org; WWW: http://www.simeon.org/msm.html.

DISASTER EMERGENCY RESPONSE ASSOCIATION INTERNATIONAL

P.O. Box 37324, Milwaukee, WI 53237-0324. (970) 532-3362; fax: (970) 532-2979; e-mail: disasters@delphi.com; WWW: http://www.disasters.org/dera.html.

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE

499 14th Street, Suite 320, Oakland, CA 94612-1934. Susan Tubbesing, Executive Director; (510) 451-0905; fax: (510) 451-5411; e-mail: eeri@eeri.org; WWW: http://www.eeri.org.

INSTITUTE FOR BUSINESS AND HOME SAFETY (Formerly Insurance Institute for Property Loss Reduction)

73 Tremont Street, Suite 510, Boston, MA 02108-3910. Karen Gahagan; (617) 722-0200; fax: (617) 722-0202; e-mail: info@ibhs.org; WWW: http://www.ibhs.org.

INSURANCE INFORMATION INSTITUTE

110 William Street, New York, NY 10038. Jeanne Salvatore, Manager of Public Relations and Consumers; (212) 669-9200; fax: (212) 791-1807; e-mail: IIIConsumer@aol.com; WWW: http://www.iii.org.

INSURANCE RESEARCH COUNCIL

211 South Wheaton Avenue, Suite 410, Wheaton, IL 60187. Terrie E. Troxel, Executive Director; (630) 871-0255; fax: (630) 871-0260; e-mail: insrescoun@aol.com.

INTERNATIONAL ASSOCIATION OF FIRE CHIEFS

4025 Fair Ridge Drive, Fairfax, VA 22033-2868. Michael O. Forgy; (703) 273-0911; fax: (703) 273-9363; e-mail:iems@connectinc.com; WWW: http://www.ichiefs.org.

INTERNATIONAL CITY/COUNTY MANAGEMENT ASSOCIATION

777 North Capitol Street, N.E., Suite 500, Washington, DC 20002-4201. (202) 962-3610; fax: (202) 962-3500; WWW:http://www.icma.org.

NATIONAL ASSOCIATION OF FLOOD AND STORMWATER MANAGEMENT AGENCIES

1225 Eye Street, N.W., Suite 300, Washington, DC 20005. Susan Gilson, Executive Director; (202) 682-3761, ext. 239; fax: (202) 842-0621.

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, ENVIRONMENTAL AND SOCIETAL IMPACTS GROUP

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_NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS

505 Huntmar Park Drive, Suite 210, Herndon, VA 20170. Jill Moreschi, Communications Specialist; (703) 437-0100; fax: (703) 481-3596.

NATIONAL COORDINATING COUNCIL ON EMERGENCY MANAGEMENT

111 Park Place, Falls Church, VA 22046-4513. Elizabeth Armstrong, Executive Director; (703) 538-1795; fax: (703) 241-5603; e-mail: nccem@aol.com; WWW: http://www.nccem.org.

NATIONAL EMERGENCY MANAGEMENT ASSOCIATION

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NATIONAL FIRE PROTECTION ASSOCIATION

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NATIONAL GOVERNORS ASSOCIATION, NATURAL RESOURCES GROUP

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NATIONAL INSTITUTE OF BUILDING SCIENCES

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NATIONAL INSTITUTE FOR URBAN SEARCH AND RESCUE

P.O. Box 91648, Santa Barbara, CA 93190-1648. Lois Clark McCoy; (800) 767-0093; fax: (805) 569-3270; e-mail: 3090usar@ucsduxa.ucsb.edu; WWW: http://emergencyservices.com/niusr.

NATIONAL LIGHTNING SAFETY INSTITUTE

891 North Hoover Avenue, Louisville, CO 80027. Richard Kithil, Executive Director; (303) 666-8817; fax: (303) 666-8786; e-mail: rich@lightningsafety.com; WWW: http://www.lightningsafety.com.

NEW ENGLAND STATES EMERGENCY CONSORTIUM

607 North Avenue, Suite 16, Wakefield, MA 01880. (617) 224-9876; fax: (617) 224-4350; e-mail: nesec@serve.com; WWW: http://www.serve.com/NESEC.

OAK RIDGE NATIONAL LABORATORY, DISASTER MANAGEMENT AND MITIGATION GROUP

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PUBLIC ENTITY RISK INSTITUTE

11350 Random Hills Road, #800, Fairfax, VA 22030. Gerard Hoetmer, Executive Director; (703) 934-6046; fax: (703) 352-7085; e-mail: ghoetmer@msn.com.

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STATE AND LOCAL EMERGENCY MANAGEMENT DATA USERS GROUP

c/o SDS, Inc., 684 Country Club Drive, Lake Ozark, MO 65049. Mike McNeill, President; (573) 365-7373; fax: (573) 365-2163 or 365-2581; e-mail: mmc-neill@mail.advertisnet.com; WWW: http://www.salemdug.dis.anl.gov.

URBAN AND REGIONAL INFORMATION SYSTEMS ASSOCIATION

900 Second Street, N.E., Suite 304, Washington, DC 20002. Tom Palmerlee, Executive Director; (202) 289-1685; fax: (202) 842-1850; e-mail: members@urisa.org; WWW: http://www.urisa.org.

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COLORADO STATE UNIVERSITY

Fluid Mechanics and Wind Engineering Program, Fluid Dynamics and Diffusion Laboratory, Department of Civil Engineering, Fort Collins, CO 80523. Robert N. Meroney, Director; (970) 491-8574; fax: (970) 491-8671; e-mail: meroney@engr.colostate.edu; WWW: http://www.lance.colostate. edu/depts/ce/netscape/depts/fluid_mechanics. Hazards Assessment Laboratory, Fort Collins, CO 80523. Hal Cochrane, Director; (970) 491-6493; fax: (970)

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GEORGE WASHINGTON UNIVERSITY, INSTITUTE FOR CRISIS AND DISASTER MANAGEMENT, RESEARCH, AND EDUCATION

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College of Architecture, College Station, TX 77843-3137. Michael K. Lindell, Director; (409) 845-7813; fax: (409) 845-5121; e-mail: hrrc@archone.tamu.edu; WWW: http://archone.tamu.edu/centers/hrrc.html.

TEXAS TECH UNIVERSITY, DEPARTMENT OF CIVIL ENGINEERING

Box 41023, Lubbock, TX 79409-1023. (806) 742-3476; fax: (806) 742-3446. Institute For Disaster Research, James R. McDonald, Director; e-mail: frnjrm@ttuacsl.ttu.edu. Wind Engineering Research Center, Kishor C. Mehta, Director. April MacDowell, Research Coordinator; e-mail: amacdowell@coe2.coe.ttu.edu. Glass Research And Testing Laboratory, H. Scott Norville, Director.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES AND ARID LANDS INFORMATION CENTER

1955 East 6th Street, Tucson, AZ 85719-5224. Barbara Hutchinson, Director and Librarian; (520) 621-8578; fax: (520) 621-3816; e-mail: barbarah@ag.arizona.edu; WWW: http://ag.arizona.edu/OALS/oals/oals.html.

UNIVERSITY OF CALIFORNIA - BERKELEY

Continuing Education in Business and Management - Courses and Certification for Emergency Preparedness Managers, 1995 University Avenue, Suite 300, Berkeley, CA 94704-4704. Diane Wolcott; (510) 642-7537; fax: (510) 643-8290; e-mail: dlw@unx.berkeley.edu; John Laye, Program Director: e-mail: johnlaye@violet.berkeley.edu.

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Natural Hazards Research and Applications Information Center, Campus Box 482, Boulder, CO 80309-0482.(303) 492-6818; fax: (303) 492-2151; e-mail: hazctr@colorado.edu; WWW: http://www.colorado.edu/hazards. Floodplain Management Resource Center, Natural Hazards Center, Campus Box 482, Boulder, CO 80309-0482. Dave Morton, Librarian; (303) 492-5787; fax: (303) 492-2151; e-mail:

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UNIVERSITY OF NORTH CAROLINA - CHAPEL HILL, CENTER FOR URBAN AND REGIONAL STUDIES

Campus Box 3410, Chapel Hill, NC 27599. William M. Rohe, Director; Mary Beth Powell, Associate Director; (919) 962-3076; fax: (919) 962-2518; e-mail: powell.curs@mhs.unc.edu; WWW: http://www.unc.edu/depts/curs.

UNIVERSITY OF NORTH TEXAS, EMERGENCY ADMINISTRATION AND PLANNING INSTITUTE

School of Community Service, P.O. Box 13438, NT Station, Denton, TX 76203. David M. Neal; (817) 565-3292; fax: (817) 369-8771; e-mail: neal@scs.unt.edu.; WWW: http://www.ias.unt.edu:9510.

UNIVERSITY OF PENNSYLVANIA, WHARTON RISK MANAGEMENT AND DECISION PROCESSES CENTER

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UNIVERSITY OF WISCONSIN, DISASTER MANAGEMENT CENTER

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_NATIONAL ACADEMY OF SCIENCES/NATIONAL RESEARCH COUNCIL

Board on Natural Disasters/U.S. National Committee for the Decade for Natural Disaster Reduction/Committee on Hazards Mitigation Engineering, HA 370, 2101 Constitution Avenue, N.W., Washington, DC 20418. (202) 334-1964; fax: (202) 334-3362 or (202) 334-1377; WWW: http://www2.nas.edu/bond/.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, BUILDING AND FIRE RESEARCH LABORATORY

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (see also NATIONAL WEATHER SERVICE)

Central Library, 1315 East West Highway, Second Floor, Silver Spring, MD 20910. Carol Watts, Chief; (301) 713-2600; fax: (301) 713-4598; e-mail: reference@nodc.noaa.gov; WWW: http://www.nodc.noaa.gov/NODC-contact/li brary.html.

National Climatic Data Center, 151 Patton Avenue, Asheville, NC 28801. Primary public contact point and climatic data ordering service; (704) 271-4682; fax: (704) 271-4876; e-mail: ncdc@noaa.gov; WWW: http://www.ncdc.noaa.gov.

National Geophysical Data Center, Code E/GC, 325 Broadway, Boulder, CO 80303. Michael S. Loughridge, Director; (303) 497-6215; fax: (303) 497-6513; e-mail: info@mail.ngdc.noaa.gov; WWW: http://www.ngdc.noaa.gov.

National Severe Storms Laboratory, 1313 Halley Circle, Norman, OK 73069. Douglas Forsyte, Acting Director; (405) 366-0427; fax: (405) 366-0472; e-mail: forsyte@nssl.uoknor.edu; WWW: http://www.nssl.uoknor.edu.

NATIONAL PARK SERVICE, RIVERS AND TRAILS CONSERVATION ASSISTANCE PROGRAM

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Natural and Technological Hazards Mitigation Program, Eleonora Sabadell, Program Director; (703) 306-1362; e-mail: esabadel@nsf.gov.

NATIONAL WEATHER SERVICE

Industrial Meteorology Staff (W/IM), Silver Spring Metro Center 2, Station 18462, 1325 East West Highway, Silver Spring, MD 20910. (301) 713-0258; fax: (301) 713-0610; WWW: http://www.nws.noaa.gov/im/index.html.

National Centers for Environmental Prediction, Climate Prediction Center, W/NMC53, Room 805, World Weather Building, Washington, DC 20223. Richard Tinker, Editor, Weekly Climate Bulletin; (301) 763-4670; fax: (301) 763-8125; e-mail: tinker@climon.wwb.noaa.gov; WWW: http://nic.sb4.noaa.gov.

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Midwestern Climate Center, Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL 61820-7495. Kenneth Kunkel, Director; (217) 244-8226; fax: (217) 244-0220; e-mail: k-kunkel@uiuc.edu; WWW: http://mcc.sws.uiuc.edu.

Northeast Regional Climate Center, 11th floor, 1123 Bradfield Hall, Cornell University, Ithaca, NY 14853. Warren Knapp, Director; (607) 255-1751; fax: (607) 255-2106; e-mail: nrcc@cornell.edu. WWW: http://met-www.cit.cornell.edu/.

Southeastern Regional Climate Center, South Carolina Department of Natural Resources, 1201 Main Street, Suite 1100, Columbia, SC 29201. Michael R. Helfert, Director; (803) 737-0849; fax: (803) 765-9060; e-mail: helfert@water.dnr.state.sc.us; WWW: http://water.dnr.state.sc.us/climate.sercc.

Southern Regional Climate Center, 260 Howe-Russell Complex, Louisiana State University, Baton Rouge, LA 70803. Kevin Robbins, Associate Director; (504) 388-5021; fax: (504) 388-2912; e-mail: krobbins@maestro.srcc.lsu.edu; WWW: http://www.srcc.lsu.edu.

Western Regional Climate Center, Desert Research Institute, P.O. Box 60220, Reno, NV 89506-0220. Richard L. Rinehart, Director; (702) 677-3106; fax: (702) 677-3243; e-mail: rrwrcc@sage.dri.edu; WWW: http://wrcc.sage.dri.edu.

Aviation Weather Center, Federal Building, Room 1728, 601 East 12th Street, Kansas City, MO 64106. David R. Rodenhuis, Director; (816) 426-5922; fax (816) 426-3453; e-mail: avid.rodenhuis@noaa.gov.

Office of Hydrology, Hydrologic Operations Division, Hydrologic Services Branch, Station 8144, W/OH22, 1325 East West Highway, Silver Spring, MD 20910. Edward R. Johnson or Glenn Austin; (301) 713-0006; fax: (301) 713-0963; e-mail: edward.johnson@noaa.gov.

Office of Meteorology, Warnings and Forecast Branch, W/OM11, Room 14414, 1325 East West Highway, Silver Spring, MD 20910. Donald R. Wernly; (301) 713-0090; fax: (301) 713-1598; e-mail: don.wernly@noaa.gov.

SMALL BUSINESS ADMINISTRATION, DISASTER ASSISTANCE DIVISION

Office of Disaster Assistance, 409 Third Street, S.W., Washington, DC 20416, Bernard Kulick, Associate Administrator for Disaster Assistance; (202) 205-6734; fax: (202) 205-7728; e-mail: bernard.kulick@sba.gov; WWW: http://www.sbaonline.sba.gov/disaster/.

Area 3 - Arkansas, Colorado, Iowa, Kansas, Louisiana, Missouri, Montana, North Dakota, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Utah, Wyoming; 4400 Amon Carter Boulevard, Suite 102, Fort Worth, TX 76155. Raymond P. Chatham, Director; (817) 885-7600; fax: (817) 885-7616; e-mail: raymond.chatham@sba.gov.

TENNESSEE VALLEY AUTHORITY, WATER MANAGEMENT, RIVER SYSTEM OPERATIONS

400 West Summit Hill Drive, WT 10B, Knoxville, TN 37902. Gregory W. Lowe; (423) 632-6857; fax: (423) 632-4670; e-mail: gwlowe@tva.gov; WWW: http://www.tva.gov.

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT/OFFICE OF FOREIGN DISASTER ASSISTANCE

State Department, Room 1262-A, Washington, DC 20523-0008. Michael Sullivan, Information Unit Manager; (202) 647-5707; fax: (202) 647-5269; e-mail: msullivan@usaid.gov; WWW: http://www.info.usaid.gov.

U.S. ARMY CORPS OF ENGINEERS

Directorate of Civil Works, Readiness Branch, CECW-OE, 20 Massachusetts Avenue, N.W., Washington, DC 20314. Edward Hecker, Chief; (202) 761-0409; e-mail: edward.hecker@inet.hq.usace.army.mil; WWW: http://www.hq.usace.army.mil.

Flood Plain Management Services and Coastal Resources Branch, 20 Massachusetts Avenue, N.W., Washington, DC 20314. (202) 272-0169; fax: (202) 272-1972; WWW: http://www.hq.usace.army.mil/cecw/planni ng/main.htm.

Hydrologic Engineering Center, 609 Second Street, Davis, CA 95616. Vern Bonner, Publications and Training; (916) 756-1104; fax: (916) 756-8250; e-mail: bonner@hec61.wrc-ec.usace.army.mil; WWW: http://wrc-hec.usace.army.mil.

Water Resources Support Center, 701 Telegraph Road, Casey Building, Alexandria, VA 22315-3868. John Singley, Sociologist; (703) 355-2219; fax: (703) 355-8435; e-mail: singley@inet.hq.usace.army.mil; WWW: http://www.wrc-ndc.usace.army.mil/.

Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199. Office of Public Affairs: (601) 634-2502; WWW: http://www.wes.army.mil/Welcome2.html.

U.S. COAST GUARD, NATIONAL RESPONSE CENTER

2100 Second Street, S.W., Room 2611, Washington, DC 20593. Jeffrey Ogden; (202) 267-2185; Hotline: (800) 424-8802; fax: (202) 267-2165; e-mail: jogden@comdt.uscg.mil; WWW: http://www.dot.gov/dotinfo/uscg/hq/nrc.

U.S. DEPARTMENT OF AGRICULTURE

Farm Service Agency, Room 5438, South Building, 14th and Independence Avenue, S.W., Washington, DC 20250-0700. James Radintz, Director, Farmer Programs Loan Making Division; (202) 720-1632; fax: (202) 690-1117.

Forest Service, Intermountain Research Station, Federal Building, 324 25th Street, Ogden, UT 84401. Carol A. Ayer, Technical Information Officer; (801) 625-5348; WWW: http://www.xmission.com/~int.

Forest Service, International Forestry Staff, Disaster Assistance Support, 1099 14th Street, N.W., Suite 5500 West, Washington, DC 20005-3402. Greg Garbinsky, Branch Chief; (202) 273-4724; fax: (202) 273-4749.

Forest Service, Fire, and Aviation Management, P.O. Box 96090, Washington, DC 20090-6090. Denny Truesdale, Emergency Disaster Coordinator; (202) 205-1485; fax: (202) 205-1272.

Natural Resources Conservation Service (formerly Soil Conservation Service), P.O. Box 2890, Washington, DC 20013.

Community Assistance and Resource Development Division; (202) 720-2847; fax: (202) 690-0639.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Chemical Emergency Preparedness and Prevention Program, Office of Solid Waste and Emergency Response (5104), Washington, DC 20460. E-mail: home-page.ceppo@epamail.epa.gov; http://www.epa.gov/docs/swercepp/index.html.

U.S. GEOLOGICAL SURVEY

Earthquake Hazards Program, MS-905, National Center, Reston, VA 20192. Robert A. Page; (703) 648-6714; fax (303) 648-6717; e-mail: page@usgs.gov.

Earth Science Information Center, 507 National Center, Reston, VA 20192; (703) 648-6045; fax: (703) 648-5948; e-mail: esicmail@usgs.gov; WWW: http://mapping.usgs.gov/esic/esic.html.

Earth Resources Observation Systems Data Center, 1608 Mountain View Road, Rapid City, SD 57702. (605) 594-6151; fax: (605) 594-6589; e-mail: custserv@edcserver1.cr.usgs.gov; WWW: http://edcwww.cr.usgs.gov/.

Library, USGS National Center, MS-950, Reston, VA 20192. Information Desk: (703) 648-4302 or 648-4303; e-mail: library@usgs.gov; WWW: http://www.usgs.gov/education/library.html.

Library, Special Video Collections, MS-955, 345 Middlefield Road, Menlo Park, CA 94025. Michael Moore; (415) 329-5009.

National Landslide Information Center, MS-966, P.O. Box 25046, Federal Center, Denver, CO 80225-0046. Lynn M. Highland, Director; (800) 654-4966; fax: (303) 273-8600; e-mail: nlic@usgs.gov; WWW: http://gldage.cr.usgs.gov/html_files/nlicsun.html .

National Water Information Center, 427 National Center, Reston, VA 20192. (800) 426-9000; e-mail: h2oinfo@usgs.gov; WWW: http://h2o.usgs.gov.

Photographic Library, MS-914, P.O. Box 25046, Federal Center, Denver, CO 80225-0046. Joe McGregor, Librarian; (303) 236-1010.

Public Affairs Office, MS-119, National Center, Reston, VA 20192. Don Kelly, (703) 648-4460.

Public Affairs Office, Western Region, 345 Middlefield Road, MS-144, Menlo Park, CA 94025. Pat Jorgenson; (415) 329-4011; fax: (415) 329-4013; e-mail: pjorgenson@isdmal.wr.usgs.gov.

Research Applications (Earthquake), MS-955, Reston, VA 20192. Robert Hamilton or Walter W. Hays; (703) 648-6550 or (703) 648-6711; fax: (703) 648-6032; e-mail: rhamilto@usgs.gov.

Rocky Mountain Mapping Center, P.O. Box 25046, MS-516, Federal Center, Denver, CO 80225. Michael Crane, Director; (303) 202-4312; e-mail: rmpcrane@usgs.gov.

USGS Information Services (Maps, Professional Papers, and Circulars), Box 25286, MS-306, Federal Center, Denver, CO 80225. (303) 202-4700 or (800) 435-7627; fax: (303) 202-4693.

USGS Information Services (Open-File Reports Section), P.O. Box 25286 , MS 517, Federal Center, Denver, CO 80225; (303) 202-4210; fax: (303) 202-4695.

U.S. Public Health Service, Office of Emergency Preparedness, National Disaster Medical System, Room 4-81, 5600 Fishers Lane, Rockville, MD 20857. Robert Knouss; (301) 443-1167 or (800) 872-6367; fax: (800) 872-5945.

Appendix B - Financial Assistance Programs

There are a variety of public and private programs that can help after a disaster. Most of these are limited to helping recovery activities that return a property to its pre-flood condition. Disaster assistance programs are not meant to improve properties or to make people better off than they were before. However, several programs have been modified recently and some new ones have been initiated to help with mitigation efforts.

These programs change over time. For example, the Robert T. Stafford Act significantly amended the major FEMA programs in 1988 and again after the Midwest floods of 1993. The details of their funding arrangements, what is an eligible project, the amount of state cost-sharing, etc., are likely to be different after Colorado's next flood.

Therefore, this chapter provides a brief summary of each program and the appropriate contact during or after the next flood, the Colorado Office of Emergency Management and the Colorado Water Conservation Board will obtain the latest information on these programs an disseminate it to the public and appropriate state, city, and county offices.

B.1 State and Regional Programs

There are no separate established State or regional financial assistance programs available after a disaster. The State does pay a share of the Individual and Family Grant program and may help on the nonfederal share of Public infrastructure Assistance and the Hazard Mitigation Grant Program. During or after a flood, the applicants must contact the Office of Emergency Management through County emergency management channels to obtain the latest information on State assistance. There are State and regional programs that provide technical assistance. These include:

Office of Emergency Management (OEM): OEM coordinates State and FEMA disaster assistance and can provide technical assistance on response, recovery, and mitigation. OEM staff has participated in several recovery assistance projects, including open houses and technical assistance tables.

Colorado Water Conservation Board (CWCB): The Board is responsible for floodplain management programs and is the State Coordinator for the NFIP. Staff can help with ordinance interpretation and enforcement, documenting flood flows, and improving maps and data.

Colorado Natural Hazards Mitigation Council (CNHMC): The Council can identify sources of technical assistance from among its member agencies. It has good connections to research institutions and experienced practitioners.

Urban Drainage and Flood Control District (UDFCD): The District is concerned with flood control, master drainage planning, floodplain management, flood warnings, and response activities. It can support public information activities and help in planning community-level mitigation projects.

B.2 Private Programs

Red Cross Assistance

Administered by:	American Red Cross, Mile High Chapter, 444 Sherman, Denver (722-7474).
Purpose:	Help disaster victims meet immediate needs
Type of assistance:	Shelter, clothing, groceries, etc. Can include funds for reconstruction if there is no other source of assistance. Medical and occupational supplies and disaster mental health services are also available.
Amount available:	Depends on person's immediate needs
Who qualifies:	Anyone
Application:	At Disaster Application Center or the Red Cross chapter

Private Sector Basement Flooding Insurance

Administered by:	Insurance companies
Purpose:	Provide insurance coverage for buildings subject to sump pump failure or sewer back up
Type of assistance:	Insurance claim payment
Amount available:	Varies
Who qualifies:	People who buy appropriate insurance
Application:	Contact insurance agent who arranges for an adjuster

Flood Relief Fund

Administered by:	Local churches or ad hoc committee
Purpose:	To help disaster victims
Type of assistance:	Gifts, donations of food, money
Amount available:	Varies
Who qualifies:	Up to administering organization
Application:	Up to administering

organization

Colorado Volunteers Active in Disaster (COVOAD)

Administered by: Volunteer organizations, such as Habitat for Humanity and the Mennonite Disaster Service, private businesses, and service organizations, such as the Lions, Elks, and VFW

Purpose: To help disaster victims

Type of assistance: Donations of food, labor, or money. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings

Amount available: Varies

Who qualifies: Up to organization

Application: Up to organization. These groups may be coordinated by COVOAD, 237-7768

B.3 Federal Programs

National Flood Insurance Program

Administered by: Insurance companies (overseen by FEMA)

Purpose: Provide insurance coverage for properties subject to surface water flooding

Type of assistance: Insurance claim payment

Amount available: Single-family house: up to $250,000 on the structure, up to $100,000 on the contents

Who qualifies: People who buy flood insurance

Application: Contact insurance agent who arranges for an adjuster

Community Development Block Grant (CDBG)

Administered by: Certain local governments with funds from the U.S. Department of Housing and Urban Development

Purpose: To improve housing conditions for low- and moderate-income families.

Type of assistance: 100% grants. These funds can be used as a local match for other funding programs.

Amount available: Some larger communities receive a set amount from HUD each year. After a very large flood, Congress may authorize a supplemental appropriation.

Who qualifies: Low/moderate income families

Application: Procedures are established by a city/county-planning department

SBA Disaster Loans

Administered by: Small Business Administration (SBA), Disaster Assistance Division
4400 Amon Carter Blvd., Ste 102
Ft. Worth, Texas 76155
817-885-7600 Fax 885-7616

Purpose: To help people rebuild and recover after a disaster

Type of assistance: Loan of 4% or 8%, depending on financial condition. Eligible expenses include repairs and reconstruction, refinancing an existing mortgage, bringing a building up to current codes, and installing mitigation measures (Limited to 20% over the amount of the loan).

Amount available: Varies

Who qualifies: Homeowners and businesses (including landlords) with the ability to repay the loan

Application: Requires Presidential or SBA disaster declaration, apply at the DAC or via FEMA's disaster assistance hotline

Temporary Housing and Limited Home Repairs (LHR)

Administered by: Federal Emergency Management Agency. It is likely that this program will be administered by FEMA Region VIII in Denver, 235-4900. Operations will be conducted from a Disaster Field Office, which may be located elsewhere.

Purpose: Provide housing for those made homeless by the disaster

Type of assistance: Housing payments for up to 18 months. Pays contractors and related expenses to make minor repairs needed to make a home livable. Temporary Housing can be used to house people waiting for funding to bring a substantially damaged building up to code or waiting for an agency to acquire their property. Funds may be available for minor flood-proofing projects incorporated during limited home repairs.

Amount available: As needed to pay local housing expenses

Who qualifies: Homeowners and renters of a

declared county made homeless by the disaster; no income requirements

Application: Requires Presidential disaster declaration, apply at the DAC or via the assistance hotline

Individual & Family Grant (IFG)

Administered by: Colorado Department of Social Services in cooperation with the Colorado Office of Emergency Management (OEM)

Purpose: Help people with unmet needs from the disaster. The "minimization program" will fund minor flood-proofing projects, such as relocating furnaces.

Type of assistance: 100% grant

Amount available: Up to $11,000

Who qualifies: People who cannot qualify for a SBA loan or cannot cover disaster expenses, including minor flood-proofing

Application: Requires Presidential disaster declaration. Apply at the DAC or via FEMA's disaster assistance hotline within 60 days of the disaster declaration.

Public/Infrastructure Assistance

Administered by: Federal Emergency Management Agency. It is likely that this program will be administered by FEMA Region VIII in Denver, *235-4900*. Operations will be conducted from a Disaster Field Office, which may be located elsewhere.

Purpose: To help agencies pay for emergency measures during the flood fight and for repair and reconstruction of public facilities. There is also a provision to fund appropriate mitigation measures as part of reconstruction of damaged facilities.

Type of assistance: 75% federal grant

Amount available: Varies

Who qualifies: Agencies and non-profit organizations receiving disaster assistance for restoring public facilities

Application: Projects should be identified during damage assessment and identified on a Damage Survey Report ~SR). After the flood, FEMA will hold a meeting to explain the procedures and hand out application forms.

Hazard Mitigation Grant Program (HMGP or 404)

Administered by: Colorado Office of Emergency Management (OEM), 273-1622

Purpose: To support post-disaster mitigation programs

Type of assistance: 75% federal funding available for mitigation measures. Total federal funding available is limited to 15% of Federal funding provided under Public Assistance and Individual Assistance Grants.

Amount available: Federal share: 15% of FEMA disaster assistance grants

Who qualifies: All communities in Colorado may apply.

Application: The community applies to the state and establishes its own procedures for disbursing the funds

Flood Mitigation Assistance ((FMA) Program

Funded by: Federal Emergency Management Agency

Administered by: Colorado Water Conservation Board

Type of Assistance: 75% federal 25%(state or local) grant funding

Purpose: Develop local pre-disaster flood mitigation plans and implement mitigation measures identified in the plans. Provide technical assistance to local governments to adopt plans and implement mitigation measures.

Amount available: $100,000 (minimum) annually for projects; $11,900 for plans; $10,800 for technical assistance.

Who qualifies: Local and state government

Application: Annually. Contact the Colorado Water Conservation Board

Appendix C - References

Colorado Disaster Emergency Act of 1992 (Part 21 of Article 32, Title 24, Colorado Revised Statutes, 1988 as amended).

Colorado State Emergency Operations Plan, Department of Local Affairs, Colorado Office of Emergency Management, written and promulgated in 1988, updated in 1995.

Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments, Federal Emergency Management Agency, DAP-12, September 1990.

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Colorado Natural Hazards Mitigation Council Annual Report –1991-1992, Colorado Department of Local Affairs, Division of Local Government, Office of Emergency Management, Golden, CO.

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Flood of 97, Hazard Mitigation Team Report in Response to DR-1186-CO Flood Disaster in Colorado, Declared August 1, 1997.

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City of Canon City Flood Hazard Mitigation Plan, "The August 12, 1991 Flood," City of Canon City, Colorado Department of Local Affairs, Division of Local Government, Office of Emergency Management, August 1993.

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Repairing Your Flooded Home, American Red Cross – Federal Emergency Management Agency, ARC 4477, FEMA 234, August 1992.

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Colorado Chapter, Inc. of the International Conference of Building Officials, 1992, ICBO Disaster Team Operations Manual for Building Damage Assessments, Colorado Office of Emergency Management, Golden, Colorado, 56 p.

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Town of Lyons Colorado Flood Hazard Mitigation Plan, Colorado Office of Emergency Management, Defnet, Cynthia, 1995, Golden, Colorado, 33 p.

Hazard Mitigation and Relocation Assistance Act of 1993 (P.L. 103-181).

City and County of Pueblo Flood Hazard Mitigation Plan: The June 3, 1994 Flash Flood, Pueblo County Public Safety and Operations and Colorado Office of Emergency Management, Golden, Colorado, Hill, Andy and Kistner, Robert, 1994, 29 p.

Natural Hazards Observer, Natural Hazards Research and Applications Information Center, University of Colorado, Boulder, Colorado, four issues:

- January 1995, Volume XIX, Number 3
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- July 1994, Volume XVIII, Number 6
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Severe Weather Committee, Colorado Natural Hazards Mitigation Council, 1993, Family Emergency Preparedness Guide, Colorado Office of Emergency Management, Golden, Colorado, 30 p.

Flood Protection Handbook, City of Arvada, Engineering Division, Department of Public Works, Arvada, Colorado and Urban Drainage and Flood Control District, Denver, Colorado. July 1994. 40 p.

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1) Special Publication No. 6, 1974, entitled: Guidelines and Criteria for Identification and Land-Use Controls of Geological Hazard and Mineral Resource Areas.

2) Special Publication No. 12, 1979; entitled: Natures Building Codes–Geology and Construction in Colorado.

3) Environmental Geology No. 10, 1976, entitled: Geologic Hazards Geomorphic Features and Land-Use Implications in the area of the 1976 Big Thompson Flood, Larimer County, Colorado.

4) Information series No. 8, 1977, entitled: Debris-Flow Hazard Analysis and mitigation–an example from Glenwood Springs, Colorado.

Floodplain Management Regulations and Statutes:

Title 24, Article 65.1, Section 302, Colorado Revised Statutes, Government-State, Colorado Land Use Act, Areas and Activity of State Interest, Functions of other State Agencies.

Title 24, Article 65.1, Section 403, Colorado Revised Statutes, Government-State, Colorado Land Use Act, Areas and Activity of State Interest, Technical and Financial Assistance.

Title 30, Article 28, Section 111, Colorado Revised Statutes, Government-County, County Planning and Building Codes, Zoning Plan.

Title 30, Article 28, Section 133, Colorado Revised Statutes, Government-County, County Planning and Building Codes, Subdivision Regulations.

Title 30, Article 30, Colorado Revised Statutes, Government-County, County Planning and Building Codes, Flood Control.

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Section 37-60-106 (1) (c), CRS, as amended, specifies that the Colorado Water Conservation Board is to devise and formulate methods, means, and plans for preventing flood damages. In addition, 24-65.1-403(3)(a), CRS, as amended, requires the CWCB to prescribe the standards for and coordinate all floodplain analyses conducted in the state. Finally, 37-60-106(l)(c), CRS, as amended, provides that floodplain designations must first be reviewed and approved by the Board before local units of government can use them. Such approval designations are required before local governments can exercise their zoning: powers, which zoning in turn is required in order to qualify a community for federally subsidized flood insurance.

Section 37-60-106(l)(d), CRS, as amended, and Section 24.65.1-302(2)(a), CRS, as amended, direct the CWCB to provide local jurisdictions with the technical assistance and floodplain information needed to make wise land-use decisions and to protect the public health, safety, and welfare.

Appendix D - Definitions

44 CFR PART 9: Floodplain Management and Protection of Wetlands; regulations to implement and enforce Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.

44 CFR PART 10: Environmental Considerations; regulations for compliance with the National Environmental Policy Act.

44 CFR PART 13: Uniform Administrative Requirements for Grants and Cooperative Agreements to States and local Governments; establishes administrative requirements for Federal grants and subgrants.

44 CFR PART 14: Administration of Grants: Audits of State and Local Governments; requirements for non-Federal audits of recipients of financial assistance from FEMA.

44 CFR PART 206: Federal Disaster Assistance for Disasters Declared On or After November 23, 1988; regulations for implementing the Stafford Act.

100-Year Discharge: is the volume rate of streamflow (usually expressed in cubic feet per second) having a 100-year frequency of recurrence. This discharge magnitude is based on statistical analysis of stream flow records and analysis of rainfall and runoff characteristics in a particular watershed.

100-Year Flood: (also called the Base Flood) is the flood having a one- percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years.

100-Year Floodplain: The area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood. (see 100-year Floodplain Schematic)

100-Year Frequency: means a recurrence interval averaging 100 years. It can also be stated as having a one- percent probability of occurring in any given year.

Applicant: A state agency, local government, eligible private nonprofit organization, or Indian tribe, as identified in Subpart N of 44 CFR Part 206, submitting an application to the Governor's Authorized Representative for assistance under the State's grant.

Appurtenant Structure: shall mean a structure on the same parcel of property as the principal structure, the use of which is incidental to the use of the principal structure.

Assistance: Any form of Federal grant under section 404 to implement cost effective mitigation measures that will reduce the risk of future damage, hardship, loss, or suffering as a result of major disasters.

Base Flood: shall mean the flood having a one-percent chance of being equaled or exceeded in magnitude in any given year. (Also knows as the 100-Year Flood). This is the flooding event that is used to calculate flood risk for the National Flood Insurance Program (NFIP) and the Federal Emergency Management Agency (FEMA).

Base Flood Elevation: means the height (above sea-level) that flood waters will reach at a given location in the event of the Base (100-year) flooding event.

Basement: shall mean any area of the building having its floor subgrade (below ground level) on all sides.

Bench Mark: means a permanent marker or monument of known elevation and horizontal location used for surveying.

Building: means a walled and roofed structure, other than a gas or liquid storage tank, that is principally above ground and affixed to a permanent site, including a manufactured (i.e., mobile) home on a permanent foundation. (See STRUCTURE).

Colorado Emergency Management Plan: The plan which is developed and continuously maintained by the Director of the Colorado Office of Emergency Management for the purpose of coordinating the emergency management activities of mitigation, preparedness, response and recovery within the state.

Colorado Hazard Mitigation Plan: The plan developed and maintained by the Colorado Water Conservation Board, Department of Natural Resources, which describes and coordinates the hazard mitigation activities of state agencies designed to lessen or eliminate the effects of disasters and emergency situations on Colorado citizens and communities.

Colorado Office of Emergency Management: - The office within the Department of Local Affairs which coordinates the comprehensive emergency management activities (mitigation, preparedness, response and recovery) of state and local government and maintains the Colorado Emergency Management Plan. The Office of Emergency Management is the primary state-coordinating agency for the Hazard Mitigation Grant Program.

Colorado Water Conservation Board: The primary state agency which provides engineering and techni-

cal assistance to local governments in 1) identifying flood hazards and developing floodplain information studies, 2) developing local flood hazard mitigation plans, 3) implementing flood mitigation measures/ activities, 4) designing and constructing flood hazard mitigation and stream rehabilitation projects, 5) establishing flood-related technical standards and guidelines, 6) coordinating CWCB-sponsored flood related programs and projects that have Federal involvement, and 7) administering the floodplain information support system and providing education to the public-at-large about flood hazards and flood mitigation.

Community: Any state or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or authorized native organization which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction.

Conveyance: is a measure of the water carrying capacity of a stream reach.

Cross Section (XSEC): means surveyed ground points along a line that shows the geometry of the floodplain and channel.

Damage Assessment: The systematic process of determining and appraising the nature and extent of the loss, suffering, or harm to a community resulting from an emergency/disaster.

Damage Survey Report (DSR): A report of damages caused by a major disaster or emergency including location, description, and estimate of required work.

Dam Safety - A program to inventory, classify and inspect dams to identify hazardous conditions and insure proper maintenance through corrective orders for the purpose of protecting human life and property. A dam (including the waters impounded by such dam) constitutes a threat to human life or property if it might be endangered by overtopping, seepage, settlement, erosion, sediment, cracking, earth movement, earthquakes, failure of bulkheads, flashboards, gates on conduits, or other conditions.

Development: Means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Disaster Field Office: (DFO): The location established within the disaster area which functions as the joint Federal-state center for all response and recovery activities.

Disaster Preparedness Improvement Grant Program: A program authorized under Section 201 of the Stafford Act which provides matching awards not to exceed *$50,000* to states to improve or update their disaster assistance plans and capabilities.

Drainageway: shall mean a depression two feet or more below the land which serves to give direction to a current of water less than nine months of the year, and which has a bed and well-defined banks ***(see Watercourse).***

Dry Flood-proofing: Any combination of adjustments and/or additions to structures that are intended to eliminate or reduce the potential for flood damage by preventing water from entering the structure. Examples: (waterproof walls and floors; permanently or semi-permanently seal doors, windows, or other openings; build a berm higher than the floor level.)

Emergency: - Any occasion or instance which, in the determination of the President, Federal assistance is needed to supplement state and local efforts and capabilities to save lives and protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States.

Emergency Management - A program to "reduce vulnerability of people and communities of this state to damage, injury, and loss of life and property resulting from natural or man made catastrophes".

Emergency Program (NFIP): is typically the first phase under which a community participates in the NFIP. It is intended to provide a first layer amount of insurance at subsidized rates to all insurable structures in that community before the effective date of the initial Flood Insurance Rate Map (FIRM).

Encroachment: is any man-made obstruction in the floodplain, which displaces the natural passage of floodwaters.

Environmental Assessment: A document that is prepared when a project does not qualify as a categorical exclusion and serves to determine whether an Environmental Impact Statement is needed.

Environmental Impact Statement: A document that is prepared for all actions significantly affecting the environment.

Existing Construction: means (for the purposes of determining flood insurance rates) structures for which the "start of construction" commenced before the effective date of the FIRM or before January 1, 1975, for FIRM's effective before that date. ***"Existing construction"*** may also be referred to as ***"existing structures."***

Existing Manufactured Home Park or Sub-Division: means a manufactured home park or subdivision for which the construction of facilities for

servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is complete before the effective date of the floodplain management regulations adopted by a community.

Expansion of Existing Manufactured Home Park or Sub-Division: means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Executive Orders 11988 and 11990: The requirements to avoid direct or indirect support of floodplain development and to minimize harm to floodplains and wetlands. Federal decision-makers are obligated to comply with these orders, accomplished through an eight-step decision-making process.

Facility: Any publicly or privately owned building, works, system, or equipment, built or manufactured, or an improved and maintained natural feature. Land used for agricultural purposes is not a facility.

Federal Agency: Any department, independent establishment, government corporation, or other agency of the executive branch of the Federal government including the U.S. Postal Service. Does not include the American Red Cross.

Federal Coordinating Officer (FCO): The person appointed by the President to manage all Federal response to a major disaster or emergency.

Federal Emergency Management Agency (FEMA): is an independent federal agency established to respond to emergencies beyond the scope of local and state resources. FEMA administers the US Fire Administration, Office of Strategic Communication and the Federal Insurance Administration which includes the National Flood Insurance Program and the Federal Crime Insurance Program. FEMA operates through ten regional offices that work in partnership with various state and local agencies. FEMA's "Mission" is to provide leadership and support to reduce the loss of life and property and protect the nations institutions from all types of hazards through a comprehensive, risk-based, all-hazards emergency management program of mitigation, preparedness, response and recovery. FEMA has been delegated primary responsibility for administering the President's Disaster Relief Program, which includes the Hazard Mitigation Grant Program.

Flood: means a general and temporary condition of partial or complete inundation of normally dry land areas from: (1) The overflow of inland or tidal waters. (2) The unusual and rapid accumulation of runoff of surface water from any source.

Flood Boundary and Floodway Map: is a floodplain management map issued by FEMA that shows, based on detailed and approximate analyses, the boundaries of the 100-year and 500-year floodplains and the 100-year floodway.

Federal-State Agreement: The document that states the understandings, commitments, and conditions for assistance under which FEMA disaster assistance shall be provided. This agreement imposes binding obligations on FEMA, the State, and local governments in the form of conditions for assistance, which are legally enforceable.

Finding of no Significant Impact: A determination that an action will have no significant impact on the environment.

Flood Fringe: means that portion of the 100-year floodplain outside the floodway in which total encroachment is permissible.

Flood Hazard Boundary Map (FHBM): is the initial insurance map issued by FEMA that identifies approximate areas of 100-year flood hazard in a community.

Flood Insurance Rate Map (FIRM): is the insurance and floodplain management map issued by FEMA that identifies areas of 100-year flood hazard in a community. In some areas, the map also shows base flood elevations and 500-year floodplain boundaries and occasionally, regulatory floodway boundaries.

Flood Insurance Study (FIS): is an engineering study performed by FEMA to identify flood hazard areas, flood insurance risk zones, and other flood data in a community.

Flood Mitigation Assistance Program: A program created under the National Flood Insurance Reform Act of 1994 to provide mitigation planning and project grants to states and communities. The program is funded through flood insurance policy fees. A maximum of $20 million in grant money is available annually.

Floodplain: The lowland and relatively flat areas adjoining inland or coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

Floodplain Management: - A comprehensive approach "to reduce the damaging effects of floods, preserve and enhance natural values and provide for optimal use of land and water resources within the floodplain. Its goal is to strike a balance between the values obtainable from the use of floodplains and the potential losses to individuals and society arising from such use". The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to, emergency preparedness plans, flood control work, and

floodplain management regulations.

Flood-proofing: Permanent or contingent measures applied to a structure and/or its contents that automatically prevent or provide resistance to damage from flooding by intentionally allowing water to enter the structure. Examples: Move all electrical outlets above expected flood levels; install floodwalls and protection closets around equipment, and secure furnace and water heater that cannot be relocated.

Floodway: means the channel of a river or watercourse and the adjacent land areas that must be reserved in order to discharge the 100-year flood without cumulatively increasing the water surface elevation more than one foot. Federal Hazard Mitigation Officer (FHMO): The FEMA employee responsible for representing the agency for each declaration in carrying out the overall responsibilities for hazard mitigation and for Subpart M, including coordinating post-disaster hazard mitigation actions with other agencies of government at all levels.

Force Account: An applicant's own labor forces and equipment.

Gauging Station: is a particular site on a stream, river, canal, lake or reservoir where systematic observations of gage height or discharge are collected.

Geologic Hazard Management: - A program to recognize hazardous geologic processes and conditions and their potential adverse effects on existing or proposed works of man. Upon identification of such geologic hazard constraints, a second phase of management requires effective statutory and administrative procedures and actions to minimize loss of life and property through prudent controls and mitigation.

Governor's Authorized Representative (GAR): The individual, designated by the Governor, who serves as the grant administrator for all funds provided under the Hazard Mitigation Grant Program.

Grant: An award of financial assistance. Under the Hazard Mitigation Grant Program, the total grant award shall not exceed ten percent of the estimated Federal assistance provided under Section 406 of the Stafford Act for permanent restorative work and associated administrative costs.

Grantee: The government to which a grant is awarded and which is accountable for the use of the funds provided. Under the Hazard Mitigation Grant Program, the State is the grantee.

Hazard Mitigation - A plan "to alleviate by softening and making less severe the effects of a major disaster or emergency and of future disasters in the affected areas, including reduction or avoidance". "Hazard mitigation can reduce the severity of the effects of flood emergency on people and property by reducing the cause or occurrence of the hazard; reducing exposure to the hazard; or reducing the effects through preparedness, response and recovery measures. Hazard mitigation is a management strategy in which current actions and expenditures to reduce the occurrence or severity of potential flood disasters are balanced with potential losses from future floods".

Hazard Mitigation Assistance Program: A FEMA program that provides a limited amount of funding to states to cover or to assist in covering the cost of preparing a pre-disaster hazard mitigation plan, one or more components of such a plan, or a related activity which will contribute to reducing vulnerability to hazards either throughout the state or for a selected area within the state.

Hazard Mitigation Grant Program: A program authorized under Section 404 of the Stafford Act that provides funding for hazard mitigation projects that are cost effective and complement existing post-disaster mitigation programs and activities by providing funding for beneficial mitigation measures that are not funded through other programs.

Hazard Mitigation Plan: The plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards in a given area, that includes the actions needed to minimize future vulnerability to hazards. Section 409 of the Stafford Act requires that a hazard mitigation plan be developed (or an existing plan be updated) as a condition of receiving Federal disaster assistance.

Hazard Mitigation State Administrative Plan: The plan developed by the State to describe the procedures for administration of the Hazard Mitigation Grant Program.

Hazard Mitigation Survey Team (HMST): The FEMA/state/local team that is activated following disasters to identify immediate mitigation opportunities and issues to be addressed in the Section 409 hazard mitigation plan. The Hazard Mitigation Survey Team may include representatives of other Federal agencies, as appropriate.

Hazard Mitigation Survey Team Report: The report developed by the Hazard Mitigation Survey Team, similar in format to the Interagency Hazard Mitigation Team Report, that identifies mitigation measures for implementation and recommends issues to be addressed in the State Hazard Mitigation Plan, including those measures recommended for funding under the Hazard Mitigation Grant Program.

Historic Structure: means any structure that is: (a) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for indi-

vidual listing on the National Register; (b) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district; (c) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or (d) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either: (1) By an approved state program as determined by the Secretary of the Interior or (2) Directly by the Secretary of the Interior in states without approved programs.

Hydraulics: is a branch of engineering dealing primarily with the flow of water and the application of fluid mechanics principles.

Hydrology: is a science dealing with the properties, distribution and circulation of water on the surface, below the ground and in the atmosphere.

Immediate Threat: The threat of additional damage or destruction from an event, which can reasonably be expected to occur within one year.

Interagency Hazard Mitigation Team (IHMT): The mitigation team that is activated following flood-related disasters pursuant to the Office of Management and Budget directive on Nonstructural Flood Protection Measure and Flood Disaster Recovery, and the subsequent December 15, 1980 Interagency Agreement for Nonstructural Damage Reduction.

Interagency Hazard Mitigation Team Report: The report developed, within 15 days following any Presidential-declared flood disaster, by an interagency, intergovernmental, and interdisciplinary team representing each of the signatory agencies of the Interagency Agreement for Post-Flood Hazard Mitigation. The report identifies post-flood mitigation opportunities and common post-flood recovery policies.

Local Emergency Management Coordinator: The person appointed to coordinate emergency management activities for a county or municipal emergency management program.

Local Hazard Mitigation Officer: The representative of local government who serves on the Hazard Mitigation Survey Team or the Interagency Hazard Mitigation Team, and who is the primary point of contact with FEMA, other Federal agencies, and the State in the planning and implementation of post-disaster hazard mitigation activities. In many instances, the local Emergency Management Coordinator may fill this role.

Letter of Map Amendment (LOMA): is the result of an administrative procedure in which the Federal Insurance Administrator reviews scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated special flood hazard area (SFHA). A LOMA amends the currently effective FEMA map and establishes that a property is not located in a SFHA.

Letter of Map Revision (LOMR): is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations, and planimetric features. All requests for LOMRs must be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map.

Letter of Map Revision Based on Fill (LOMR-F): is an official revision to a currently effective FEMA map to remove a parcel of land from the floodplain by the placement of compacted fill to elevate the surface of the ground to or above the base flood elevation at that location. (See ***Letter of Map Revision***)

Lowest Floor: shall mean the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area, is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of the State of Colorado Minimum Standards for Floodplain Management.

Major Disaster: Any natural catastrophe (including any hurricane, tornado, storm, high-water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any flood, fire, or explosion, in any part of the United States which in the determination of the President cause damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

Mandatory Purchase: means under the provisions of the Flood Disaster Protection Act of 1973, individuals, businesses, and others buying, building, or improving property located in identified areas of special flood hazards within participating communities are required to purchase flood insurance as a prerequisite for receiving any type of direct or indirect federal financial assistance (e.g., any loan, grant, guaranty, insurance, payment, subsidy, or disaster assistance) when the building or personal property is the subject of or security for such assistance.

Manufactured Home: shall mean a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or

without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include a "RECREATIONAL VEHICLE."

Manufactured Home Park or Subdivision: shall mean a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Measure: Any mitigation measure, project, or action proposed to reduce risk of future damage, hardship, loss, or suffering from disasters.

National Environmental Policy Act (NEPA): P. L. 91-190, as amended, which requires that actions affecting the environment comply with specific policies and procedures. NEPA requires that environmental information be available to public officials and citizens before decisions are made and actions are taken.

National Flood Insurance Program (NFIP): The program established in 1968 under the National Flood Insurance Act to provide property owners in floodplains with Federally subsidized flood insurance in those communities that implement ordinances to reduce future flood losses. The National Flood Insurance Reform Act of 1994 revised and strengthened many aspects of the program.

National Geodetic Vertical Datum (NGVD): is the National standard reference datum for elevations, formerly referred to as Mean Sea Level (MSL) of 1929. NGVD is used as the reference datum on most FIRMs.

Natural Grade: means the grade unaffected by construction techniques such as fill, landscaping, or berming.

New Construction: shall mean obstructions for which the "start of construction" commenced on or after the effective date of the floodplain management regulation adopted by a community and includes any subsequent improvements to such obstructions.

Non-Residential: includes, but is not limited to: small business concerns, churches, schools, nursing homes, farm buildings (including grain bins and silos), pool houses, clubhouses, recreational buildings, government buildings, mercantile structures, agricultural and industrial structures, warehouses, and hotels or motels with normal room rentals for less than 6 months' duration.

Obstruction: shall mean any wall, wharf, embankment, levee, dike, pile, abutment, projection, excavation (including the alteration or relocation of a watercourse or Drainageway), channel rectification, bridge, conduit, culvert, building, stored equipment or material, wire, fence, rock, gravel, refuse, fill, or other analogous structure or matter which may impede, retard, or change the direction of flow of water, either in itself or by catching or collecting debris carried by such water, or that is placed where the natural flow of the water would carry such structure or matter downstream to the damage or detriment of either life or property. Dams designed to store or divert water are not obstructions if permission for the construction thereof is obtained from the Colorado Department of Water Resources.

Other Residential: means hotels or motels where the normal occupancy of a guest is 6 months or more; a tourist home or rooming house which has more than 4 roomers. A residential building (excluding hotels and motels with normal room rentals for less than 6 months' duration and containing more than 4 dwelling units) is permitted incidental office, professional private school, or studio occupancy, provided that the total area of such occupancy is limited to less than 25 percent of the total floor area within the building.

Overbank, Left and Right: is the floodplain that lies to the left and right, respectively, of the watercourse, as one looks downstream.

Physical Map Revision: is an official republication of a map to effect changes to flood insurance zones, floodplain delineations, flood elevations, floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas, or corrections of base flood elevations or flood insurance risk zones.

Post-Firm Construction: is construction or substantial improvement, which started on or whichever, is later.

Pre-Firm Construction: is construction or substantial improvement which started on or before December 31, 1974, or before the effective date of the initial Flood Insurance Rate Map (FIRM) of the community, whichever is later.

Principally Above Ground: shall mean that at least 51 percent of the actual cash value of the structure is above ground.

Private Nonprofit Facility: Any private nonprofit educational, utility, emergency, medical, or custodial Care facility for the aged or disabled, and other facility providing essential governmental type services to the general public, and such facilities on Indian reservations. Further definition is as follows:

a. ***Educational Facility:*** Classrooms plus related supplies, equipment, machinery, and utilities of an educational institution necessary or appropriate for instructional, administrative, and support purposes, but does not include buildings, structures and related items used primarily for religious purposes or instruction

b. ***Utility:*** Buildings, structures, or systems of energy, communication, water supply, sewage collection and treatment, or other similar public service facilities.

c. ***Emergency Facility:*** Those buildings, structures, equipment, or systems used to provide emergency services, such as fire protection, ambulance, or rescue, to the general public, including the admin-

istration and support facilities essential to the operation of such emergency facilities even if not contiguous.

d. ***Medical Facility:*** Any hospital, outpatient facility, a rehabilitation facility, or facility for long term care as such terms are defined in section 645 of the Public Health Service Act (42 U.S.C. 2910) and any similar facility offering diagnosis of or treatment of mental or physical injury or disease, including the administrative and support facilities essential to the operation of such medical facilities even if not contiguous.

e. ***Custodial Care Facility:*** Those buildings, structures, or systems including those for essential administration and support, which are used to provide institutional care for persons who require close Supervision and some physical constraints on their daily activities for their self-protection, but do not require day-to-day medical care.

f. ***Other Essential Governmental Services Facilities:*** Facilities such as museums, zoos, community centers, libraries, homeless shelters, senior citizen centers, rehabilitation facilities, shelter workshops, and facilities which provide health and safety services of a governmental nature. All such facilities must be open to the general public.

Private Nonprofit Organization: Any non-governmental agency or entity that currently has:

a. An effective ruling letter from the U.S. Internal Revenue Service, granting tax exemption under section *501(c),* (d), or (e) of the Internal Revenue Code of 1954, or

b. Satisfactory evidence from the State that the non-revenue producing organization or entity is a non-profit one organized or doing business under State law.

Probation: is the means of formally notifying participating communities of violations and deficiencies in the administration and enforcement of the local floodplain management regulations. A community is placed on probation for one year (may be extended) during which time a surcharge is applied to all NFIP policies issued on or after the Probation Surcharge effective date. Probation is terminated if deficiencies are corrected. If a community does not take remedial or corrective measures while on probation, it can be suspended.

Project: All work performed at a single site or multiple sites as described on a project summary.

Public Assistance: Federal financial assistance provided through the Public Assistance Grant Program (PAGP) to state and local governments or to eligible private nonprofit organizations for disaster-related requirements.

Public Assistance Permanent Work: The restorative work that must be done, through repairs or replacement, to restore an eligible facility on the basis of its pre-disaster design and in conformity with current applicable codes, specifications, and standards.

Public Entity: An organization formed for a public purpose whose direction and funding are provided by one or more political subdivisions of the state.

Reach: a continuous segment of a watercourse.

Recreational Vehicle: shall mean a vehicle which is (i) built on a single chassis; (ii) 400 square feet or less when measured at the largest horizontal projections; (iii) designed to be self-propelled or permanently towed by a light duty truck; and (iv) designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Regular Program (NFIP): is the phase of a community's participation in the NFIP where more comprehensive floodplain management requirements are imposed and higher amounts of insurance are available based upon risk zones and elevations determined in a flood insurance study. The Flood Insurance Rate Map is the map used in this phase of the NFIP.

Regulatory Flood Elevation: in Colorado means the Base Flood Elevation plus one foot of freeboard which is required to meet the Minimum Standards for Floodplain Management in the State of Colorado.

Replacement Cost: means the cost to replace property with the same kind of material and construction without deduction for depreciation.

Roughness Coefficient (Manning's): is a measure of ground surface roughness used in flow equations.

Section 404: The section of the Stafford Act, which authorizes the Hazard Mitigation Grant Program (HMGP). The HMGP provides funding for cost-effective hazard mitigation measures.

Section 406: The section of the Stafford Act which authorities the Public Assistance Grant Program (PAGP). This program provides grants to repair, restore, or replace damaged facilities belonging to public and private non-profit entities, and other associated expenses, including emergency protective measures and debris removal.

Section 409: The section of the Stafford Act, which requires the identification and evaluation of mitigation opportunities as a condition of receiving Federal disaster assistance.

Section 409 Hazard Mitigation Plan: The hazard mitigation plan required under Section 409 as a condition of receiving Federal disaster assistance.

SF 424: Standard Form 424: Application for Federal Assistance, which is part of the State Hazard Mitigation Application.

Sheet Flood Hazard: is a type of flood hazard with flooding depths of 1 to 3 feet that occurs in areas of

sloping land. The sheet flow hazard is represented by the zone designation AO on the Flood Insurance Rate Map (FIRM).

Special Flood Hazard Area: is the darkly shaded area on the Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM) which identifies an area that has a one percent chance of being flooded in any given year (100-year floodplain). The FIRM identifies these shaded areas as FIRM Zones A, AO, AH, A1-A30, AE, A99, V, V1-30, and VE.

Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, P. L. 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, P. L. 93-288.

Stage: is the elevation of surface water above a reference datum, that datum usually being near the streambed.

Standards: Codes, specifications or standards for the construction of facilities to include legal requirements for additional features.

Start of Construction: shall mean the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days of the permit date. "Start of construction" includes substantial improvements. The actual start means the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings. The installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds nor occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not the alteration affects the external dimensions of the building.

Structure: shall mean a walled and roofed building that is principally above ground, as well as a manufactured home, and a gas or liquid storage tank that is principally above ground (see ***Building***).

State Coordinating Officer (SCO): The person appointed by the Governor to manage all aspects of a disaster, in cooperation with the Federal Coordinating Officer (FCO).

State Hazard Mitigation Officer (SHMO): The representative of state government who serves on the Hazard Mitigation Survey Team and/or Interagency Hazard Mitigation Team, and who is the primary point of contact with FEMA, other Federal agencies, and local units of government in the planning and implementation of post-disaster mitigation activities.

State Hazard Mitigation Team: The team composed of key state agency representatives and, as appropriate, local units of government and other public or private sector agencies, which is responsible for evaluating hazards, identifying strategies, coordinating resources, and implementing measures that will reduce the vulnerability of people and property to damage from hazards. In Colorado, the Colorado Natural Hazards Mitigation Council is designated as the State Hazard Mitigation Team.

State Public Assistance Officer (SPAO): The person appointed by the Governor's Authorized Representative to assist in the management of assessment and recovery operations in response to a disaster.

Statutory Administrative Costs: Under the Stafford Act, administrative costs for the preparation of applications, progress reports, audits, etc., are reimbursable based on a percentage of financial assistance received.

Subgrant: An award of financial assistance under a grant by a grantee to an eligible subgrantee.

Subgrantee: The government or other legal entity to which a subgrant is awarded and which is accountable to the grantee for the use of the fluids provided.

Subgrant M. Hazard Mitigation Planning: 44 CFR Part 206 Subpart M prescribes the actions and Procedures for implementing Section 409 of the Stafford Act.

Subpart N. Hazard Mitigation Grant Program: 44 CFR Part 206, Subpart N, provides guidance on the administration of hazard mitigation grants made under provisions of Section 404 of the Stafford Act.

Substantial Damage: shall mean a damage of any origin sustained by an obstruction whereby the cost of restoring the obstruction to its before-damage condition would equal or exceed 50 percent of the market value of the obstruction before the damage occurred.

Substantial Improvement: shall mean any reconstruction, rehabilitation, addition, or other improvement of an obstruction, the cost of which equal or exceed 50 percent of the market value of the obstruction before "start of construction" of the improvement. This includes obstructions, which have incurred. "substantial damage," regardless of the actual repair work performed. The term does not, however, include either (1) any project for improvement of a structure or other obstruction to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or (2) any alteration of a "historic structure," provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Supplement: An amendment to the hazard mitigation

application to add or modify one or more mitigation measures.

Surcharge: means an increase in flood elevation due to destruction of the floodplain that reduces its conveyance capacity.

Suspension: means the removal of a participating community from the National Flood Insurance Program (NFIP) because the community has not enacted and/or enforced the proper floodplain management regulations required for participation in the National Flood Insurance Program (NFIP).

Variance: is a grant of relief to a person from the requirements of Floodplain Management Standards, which permits construction in a manner otherwise, prohibited by ordinance where specific enforcement would result in unnecessary hardship. The granting of a variance does not remove the requirements for flood insurance, which lending institutions will require if the structure is the collateral of a loan. Flood insurance rates will be much higher for structures built below the Base Flood Elevation.

Violation: means a failure of a structure or other development to be fully compliant with the community's floodplain management regulations.

Watercourse: shall mean any depression two feet or more below the surrounding land which serves to give direction to a current of water at least nine months of the year and which has a bed and well-defined banks. (See Drainageway)

Watershed: (also called a Drainage Basin). It is that area of land, which may contribute flow from runoff to a particular watercourse.

Water Surface Profile: (also referred to as Flood Elevation Profile) means a graph showing the relationship of water surface elevation to location, the latter generally expressed as a distance upstream from some reference point.

Wetlands: Those areas which are inundated or saturated by surface or ground water with a frequency sufficient to support, or that under normal hydrologic conditions does or would support, a prevalence of vegetation or aquatic life typically adapted for life in saturated or seasonally saturated soil conditions.

Write Your Own (WYO) Program: is a cooperative undertaking of the insurance industry and the Federal Insurance Administration begun in October 1983. The WYO Program operates within the context of the NFIP and involves private insurance carriers who issue and service National Flood Insurance Program policies.

Zone A (Unnumbered): are Special Flood Hazard Areas subject to inundation from the 100-Year flood. Because detailed hydraulic analyses have not been performed, no base flood elevation or depths are shown. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-30: are Special Flood Hazard Areas subject to inundation by the 100-Year flood determined in a Flood Insurance Study by detailed methods. Base flood elevations are shown within these zones. Mandatory flood insurance purchase requirements apply. (Zone AE is used on new and revised maps in place of Zones A1-30.)

Zone AH: are Special Flood Hazard Areas subject to inundation by 100-Year shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base flood elevations derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements apply.

Zone AO: are Special Flood Hazard Areas subject to inundation by 100-Year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone B, C, and X: are areas that have been identified in the community flood insurance study as areas of moderate or minimal hazard from principal source flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Flood Insurance is available in participating communities but is not required by regulation in these zones. (Zone X is used on new and revised maps in place of Zones B and C.)

Zone D: are unstudied areas where flood hazards are undetermined by flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

Acronyms

APA	American Planning Association
BFE	Base Flood Elevation
CASFM	Colorado Association of Stormwater and Floodplain Managers
CDBG	Community Development Block Grant
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CGS	Colorado Geologic Survey
CHFA	Colorado Housing and Finance Authority
CNHMC	Colorado Natural Hazards Mitigation Council
COE	Corps of Engineers (Same as USACE)
CRS	Community Rating System
CWCB	Colorado Water Conservation Board
DLG	Colorado Division of Local Government
DOLA	Colorado Deportment of Local Affairs
DFO	Disaster Field Office
DSR	Disaster Survey Report
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FBFM	Flood Boundary and Floodway Map
FCO	Federal Coordinating Officer
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FHWA	Federal Highway Administration
FIA	Federal Insurance Administration
FIRM	Flood Insurance Rate Map
FSA	Farm Service Agency
GAR	Governor's Authorized Representative
GIS	Geographic Information System
GPS	Global Positioning Systems
HEC	Hydrologic Engineering Center
HMGP	Hazard Mitigation Grant Program
HUD	Housing & Urban Development
IHMT	Interagency Hazard Mitigation Team
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
NFIP	National Flood Insurance Program
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OEM	Colorado Office of Emergency Management
SBA	Small Business Administration
SFHA	Special Flood Hazard Area
USACE	U. S. Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	U. S. Geological Society
USF&WS	United States Fish & Wildlife Service
WAPA	Western Area Power Authority
WYO	Write Your Own

Appendix E - Tips to Minimize Loss of Life & Property in the Event of a Flood

The following tips are from the Federal Emergency Management Agency's National Flood Insurance Program and the Colorado Water Conservation Board (CWCB) and should be used as suggested guidelines for action before, during, and after a flood.

http://www.dnr.state.co.us/water/flood_watch/tips.html

STEPS TO TAKE TODAY

- **Make an itemized list of personal property**, including furnishings, clothing, and valuables. Photographs of your home - inside and out are helpful. These will assist an adjuster in settling claims and will help prove uninsured losses, which are tax deductible.
- **Learn the safest route from your home or place of business** to high, safe ground if you should have to evacuate in a hurry.
- **Keep a portable radio, emergency cooking equipment, and flashlights in working order.**
- **Persons who live in frequently flooded areas should keep on hand materials** such as sandbags, plywood, plastic sheeting, and lumber, which can be used to protect private property. (Remember that sandbags should not be stacked directly against the outer walls of a building, since, when wet, the bags may create added pressure on the foundation.)
- **Buy flood insurance**. You should contact your property/casualty agent or broker about eligibility for flood insurance, which is offered through the National Flood Insurance Program. Generally, there is a 30-day waiting period for this policy to become effective, so don't wait until the last minute to apply.
- **Keep your insurance policies and a list of personal property** in a safe place, such as a safe-deposit box.
- **Know the name and location** of the agent(s) who issued the policies.

WHEN THE FLOOD COMES

The safety of your family is the most important consideration. Since floodwaters can rise very rapidly, you should be prepared to evacuate before the water level reaches your property.

- **Keep a battery-powered radio** tuned to a local station, and follow all emergency instructions.
- **If you're caught in the house by sudden rising water**, move to the second floor and, if necessary, to the roof. Take warm clothing, a flashlight, and a portable radio with you. Then wait for help; don't try to swim to safety. Rescue teams will be looking for you.
- **When outside the house, remember - floods are deceptive.** Try to avoid flooded areas, and don't attempt to walk through floodwaters that are more than knee deep.
- **If, and only if, time permits . . .** there are several precautionary steps that can be taken.
  - > Turn off all utilities at the main power switch and close the main gas value if evacuation appears necessary.
  - > Do not touch any electrical equipment unless it is in a dry area and you are standing on a piece of dry wood while wearing rubber gloves and rubber soled boots or shoes.
  - > Move valuable papers, furs, jewelry, clothing, and other contents to upper floors or higher elevations.
  - > Fill bathtubs, sinks and jugs with clean water in case regular supplies are contaminated. You can sanitize these items by first rinsing with bleach.
  - > Board up windows or protect them with storm shutters or tape to prevent flying glass.
  - > Bring outdoor possessions inside the house or tie them down securely. This includes lawn furniture, garbage cans, tools, signs, and other movable objects that might be swept away or hurled about.
- **If it is safe to evacuate by car,** you should consider doing the following:
  - > Stock the car with non perishable foods (like canned goods), a plastic container of water, blankets, first aid kit, flashlights, dry clothing, and any special medication needed by your family.
  - > Do not drive where water is over the road. Parts

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of the road may already be washed out.

> If your car stalls out in a flooded area, abandon it as soon as possible. Floodwaters can rise rapidly and sweep a car (and its occupants) away. Many deaths have resulted from attempts to move stalled vehicles.

AFTER THE FLOOD

- **If your home, apartment or business has suffered flood damage**, immediately call the agent or broker who handles your flood insurance policy. The agent will then submit a loss form to the National Flood Insurance Program. An adjuster will be assigned to inspect your property as soon as possible.
- **Prior to entering a building**, check for structural damage. Make sure it is not in danger of collapsing. Turn off any outside gas lines at the meter or tank, and let the house air for several minutes to remove foul odors or escaping gas.
- **Upon entering the building,** do not use open flame as a source of light since gas may still be trapped inside; a battery-operated flashlight is ideal.
- **Watch for electrical shorts or live wires** before making certain that the main power switch is turned off. Do not turn on any lights or appliances until an electrician has checked the system for short circuits.
- **Cover broken windows and holes** in the roof or walls to prevent further weather damage.
- **Proceed with immediate cleanup measures to prevent any health hazards**. Perishable items, which pose a health problem, should be listed and photographed before discarding. Throw out fresh food and previously opened medicines that have come in contact with flood waters.
- **Water for drinking and food preparation** should be boiled vigorously for ten minutes (until the public water system has been declared safe.) Another method of disinfecting is to mix 1/2 teaspoon of liquid commercial bleach with 2-1/2 gallons of water . . . let stand for five minutes before using. The flat taste can be removed by pouring the water from one container to another or adding a pinch of salt. In an emergency, water may be obtained by draining a hot water tank or melting ice cubes.
- **Refrigerators, sofas, and other hard goods** should be hosed off and kept for the adjuster's inspection. A good deodorizer when cleaning major kitchen appliances is to add one teaspoon of baking soda to a quart of water. Any partially damaged items should be dried and aired; the adjuster will make recommendations as to their repair or disposal. Take pictures of the damage done to your building and contents.
- **Take all wooden furniture outdoors**, but keep it out of direct sunlight to prevent warping. A garage or carport is a good place for drying. Remove drawers and other moving parts as soon as possible, but do not pry open swollen drawers from the front. Instead, remove the backing and push the drawers out.
- **Shovel out mud while it is still moist** to give walls and floors a chance to dry. Once plastered walls have dried, brush off loose dirt. Wash with a mild soap solution and rinse with clean water; always start at the bottom and work up. Ceilings are done last. Special attention at this early stage should also be paid to cleaning out heating and plumbing systems.
- **Mildew can be removed** from dry wood with a solution of 4 to 6 tablespoons of tri-sodium phosphate (TSP), 1-cup liquid chlorine bleach, and 1-gallon water.
- **Clean metal at once** then wipe with a kerosene-soaked cloth. A light coat of oil will prevent iron from rusting. Scour all utensils, and, if necessary, use fine steel wool on unpolished surfaces. Scrubbing with a solution of vinegar, cream of tartar, and hot water may brighten aluminum.
- **Flooded basements should be drained and cleaned as soon as possible**. However, structural damage can occur by pumping out the water too quickly. After the flood waters around your property have subsided, begin draining the basement in stages, about 1/3 of the water volume each day.

Appendix E - The National Flood Insurance Program Questions and Answers

I Introduction to the NFIP

1. What is the National Flood Insurance Program (NFIP?

The NFIP is a federal program enabling property owners in participating Communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. Until recently, such coverage was generally unavailable from private-sector insurance companies.

Participation in the NFIP is based on an agreement between local communities and the federal government that if a community will implement and enforce measures to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHA), the federal government will make flood insurance available to protect against flood losses that do occur.

2. Why was the NFIP established by Congress?

For decades, the national response to flood disasters was generally limited to constructing flood control works such as dams, levees, and sea walls and providing disaster relief to flood victims. This approach did not reduce losses or discourage unwise development and, in some instances, may have actually encouraged additional development. To compound the problem, the public could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, Congress created the NFIP. The intent was to mitigate future damage and provide protection for property owners against potential losses through an insurance mechanism that relies on a premium base to provide protection to those most at risk.

3. How was the NFIP established and who administers it?

Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. The NFIP is administered by the Federal Insurance Administration (FIA), a component of the Federal Emergency Management Agency (FEMA).

4. What is a flood?

"Flood" is defined in the Standard Flood Insurance Policy (SFIP), in part, as: A general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters or from the unusual and rapid accumulation or runoff of surface waters from any source.

5. How does the NFIP benefit property owners? Taxpayers? Communities?

Through the NFIP, property owners in participating communities are able to insure against flood losses. By employing wise floodplain management, a participating community can protect its citizens against much of the devastating financial loss resulting from future flood disasters. Careful local management of development in the floodplains results in construction practices that can reduce flood loss and the high costs associated with flood disasters to all levels of government.

6. Why is participation in the NFIP on a community basis rather than on an individual basis?

The National Flood Insurance Act allows FIA to make flood insurance available only in those areas where the appropriate public body has adopted adequate floodplain management regulators for its flood-prone areas. Individual citizens cannot regulate building or establish construction priorities for communities. Without community oversight of building activities in the floodplain, the best efforts to reduce future flood losses could be undermined or nullified by the careless building of others. Unless the community as a whole is practicing adequate flood hazard mitigation, the potential for loss cannot be reduced sufficiently to affect disaster relief costs. Insurance rates also would reflect the probable higher losses that would result without local floodplain management enforcement activities.

7. Is community participation mandatory?

No. Community participation in the NFIP is voluntary. Some states require NFIP participation as part of their state floodplain management program. Each identified flood-prone community must assess its flood hazard and determine whether flood insurance and floodplain management would benefit the community's residents and economy. However, a community that chooses not to participate within one year after the flood hazard area is identified and the flood risk map

becomes effective is subject to the ramifications explained in Answer #8.

Because a community's participation status can significantly affect current and future owners of property located in Special Flood Hazard Areas (SFHA) and the availability of federal financial assistance in the flood-prone areas of the community, the decision should be made with a full awareness of the consequence of each action.

8. **What happens if a community does not participate in the NFIP?**

Flood insurance under the NFIP or Write Your Own (WYO) program is not available within that community. If a Presidentially declared disaster due to flooding occurs in a non-participating community, no federal financial assistance can be provided for the permanent repair or reconstruction of insurable buildings in Special Flood Hazard Areas (SRHAs). Eligible applicants may receive those forms of disaster assistance not related to permanent repair and reconstruction of buildings.

II. Flood Insurance Information for Prospective Buyers

1. **Who may purchase a flood insurance policy?**

NFIP coverage is available to all owners and occupants of insurable property (a building and/or its contents) in a community participating in the NFIP. Owners and renters may insure their personal property against flood loss.

Condominium associations may purchase a condominium master policy that covers both the common elements of the building and the individual units owned by the members of the association. Residential condominium unit owners may purchase building and contents (personal property) flood insurance to supplement any insurance purchased by the condominium owners' association. Owners of nonresidential condominium units may purchase only contents coverage in their own name. The nonresidential condominium building must be insured in the name of the association. Builders of structures in the course of construction, in participating communities all may purchase flood insurance.

2. **How can I find out if I am eligible to purchase flood insurance?**

NFIP coverage is available only in participating communities. Almost all of the nation's communities with serious flooding potential have joined the NFIP. To learn if a community is participating in the NFIP, contact local community officials.

3. **How can I find out if my home or business is in a Special Flood Hazard Area (SFHA)?**

The Federal Emergency Management Agency has produced Flood Insurance Rate Maps (FIRM) that show areas of flood risk, called Special Flood Hazard Areas (SFHA). To review the FIRM for your area, contact your local building permit or engineering office.

4. **How is flood insurance purchased?**

After a community joins the NFIP, a policy may be purchased from any licensed property insurance agent or broker who is in good standing in the state in which the agent is licensed. For more information or to locate an agent in your area who sells flood insurance, you may call I-8004274661.

5. **Why should I buy flood insurance when Federal disaster assistance is available after a disaster?**

Many forms of federal disaster assistance are available after a Presidentially declared disaster. However, many forms of federal assistance are loans that must be paid back. Grants made available after a Presidentially declared disaster are frequently not enough to pay for all of your losses.

Because ninety percent of all flood events are not Presidentially declared, obtaining and maintaining flood insurance is a wise investment. The average payment for a $50,000 Small Business Administration disaster home loan is $320 a month. The average premium for a flood insurance policy is $300 a year.

6. **My home has already been flooded. Can I still buy flood insurance?**

Yes. It doesn't matter how many times your home, apartment, or business has flooded. You are still able to purchase flood insurance, provided your community is participating in the NFIP.

7. **Is there a waiting period for flood insurance to become effective?**

There is a 30-day waiting period after you have applied and paid the premium before the policy is effective. Losses in progress are not covered.

8. **Am I required to buy flood insurance?**

You may be required by your lender to purchase flood insurance if you are getting a federally backed mortgage loan or other federal assistance, and your building is in a Special Flood Hazard Area (SFHA). Your lender, at their discretion, may also require that you purchase flood insurance even if your home is not in a SFHA.

9. **Can I buy flood insurance even if I live in a high-risk area?**

You can buy flood insurance no matter where you live, if your community belongs to the National Flood Insurance program.

10. Can I buy flood insurance even if I live in a low risk area?

Yes. If you live in an area that is not flood-prone, a preferred-risk policy is available for as little as *$85* per year ($20,000 building$5,000 contents) for a one to four family residential building.

11. Can I buy a flood insurance policy for the contents of my home or business?

Yes. To cover the contents of homes, businesses, and even for rental property, you can purchase separate contents coverage.

12. How many buildings or locations (and their contents) may be insured on each policy?

Normally, only one building and its contents can be insured on each policy. The Dwelling Form of the Standard Flood Insurance Policy does provide coverage for up to 10 percent of the policy amount for accessory structures such as garages and carports, but not for tool and storage sheds and similar buildings.

13. What types of property may be insured against flood loss?

Almost every type of walled and roofed building that is principally above ground and not entirely located over water may be insured if it is in a participating community. In most cases, this includes manufactured (i.e., mobile) homes anchored to permanent foundations, but it does not include travel trailers or converted buses or vans. Contents within insurable walled and roofed buildings also may be insured under separate coverage.

14. What kinds of property are not insurable under the NFIP?

Buildings over water or principally below ground, gas and liquid storage tanks, animals, birds, fish, aircraft, wharves, piers, bulkheads, growing crops, shrubbery, land, livestock, roads, machinery or equipment in the open, and motor vehicles are not insurable. Most contents and finishing materials located in a basement or in enclosures below the lowest elevated floor of an elevated post-FIRM building are not covered. Information on the insurability of any special property may be obtained by contacting a property insurance agent or a Write Your Own Company agent.

III. Coverage

1. How much flood insurance coverage is available?

(See chart this Page)

IV. The Community's Role in Floodplain Management

1. What is the role of the community in NFIP participation?

When the community chooses to join the NFIP, they must then adopt and enforce minimum floodplain management standards for participation. FEMA works closely with states and local communities to identify flood hazard areas and flooding risks. The floodplain management requirements within the Special Flood Hazard Area (SFHA) are designed to prevent the new development from increasing the flood threat and to protect new and existing buildings from anticipated flood events.

When a community chooses to join the NFIP, it then must require floodplain development permits for all development in the SFHA and ensure construction materials and methods used will minimize future flood damage. Floodplain development permit files must contain documentation to substantiate how buildings were actually constructed. In return, the federal government makes flood insurance available for almost every building and its contents within the community.

Communities must ensure their adopted floodplain management regulations and enforcement procedures meet NFIP requirements. Local regulations must be updated when additional data are provided by FEMA or when federal or state stan-

How Much Flood Insurance Coverage is Available

Building Coverage	Emergency Program	Regular Program
Single Family Dwelling	$35,000*	$250,000
2-4 Family Dwelling	$35,000*	$250,000
Dwelling Other	$100,000**	$250,000
Residential Nonresidential	$100,000**	$500,000
Contents Coverage	$10,000	$100,000
Residential	$10,000	$100,000
Nonresidential	$100,000	$500,000

* In Alaska, Guam, Hawaii, and U.S. Virgin Islands, the amount available is $50,000.

** In Alaska, Guam, Hawaii, and U.S. Virgin Islands, the amount available is $150,000.

dards are revised.

2. **What is meant when FEMA uses the phrase, "floodplain management measures"?**

   The phrase, "floodplain management measures," refers to an overall community program of corrective and preventive measures for reducing future flood damage. The measure takes a variety of forms and generally includes zoning, subdivision, or building requirements and special-purpose floodplain ordinances.

3. **Do the floodplain management measures required by the NFIP affect existing buildings?**

   They affect existing buildings only when an existing building is substantially damaged and/or improved.

4. **What constitutes "substantial-improvement" or "substantial-damage?"**

   "Substantial-improvement" means any rehabilitation, addition, or other improvement of a building when the cost of the improvement equals or exceeds *50* percent of the market value of the building before start of construction of the improvement. The term "substantial-improvement" includes buildings that have incurred "substantial-damage," or damage of any origin sustained by a building when the cost of restoring the building to its pre-damaged condition would equal or exceed *50* percent of the market value of the building before the damage occurred. Substantial-damage is determined regardless of the actual repair work performed.

   Substantial-improvement or damage does not however, include any project for improvement of a building to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and are the minimum necessary to assure safe living conditions. Also excluded from the substantial- -improvements requirements are alterations to historic structures as defined by the NFIP.

5. **Do FEMA requirements apply to construction taking place outside the Specific Flood Hazard Areas (SFHA) within the community?**

   No. The local floodplain management regulations required by the NFIP apply only in SFHAs.

6. **Can modifications be made to the basic floodplain management requirements?**

   In developing their local floodplain management ordinances, participating communities must meet at least the minimum regulatory standards issued by FEMA. NFIP standards and policies are reviewed periodically and revised whenever appropriate.

V. Mapping

1. **What is the role of the local community in its flood hazard study and mapping process?**

   Before the flood hazard study is initiated, FEMA considers all available existing information for use in the study. Public meetings may be conducted allowing interested parties to present relevant facts to help ensure accurate results. FEMA also works closely with each community's officials before and during the study to describe the technical procedures and to obtain community input before publication of the Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM). Before the FIS is started, community officials, FEMA representatives, and the study contractor meet to discuss the areas in the community that need to be studied. This is called the time and cost estimate meeting.

2. **How are the flood hazard areas and flood levels determined?**

   Flood hazard areas are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analysis. The detailed FIS covers those areas subject to flooding from rivers and streams, along coastal areas and lakeshores, or in shallow flooding areas, but do not include areas of less than one square mile.

3. **What are flood hazard zones and what do they mean?**

   The Flood Insurance Rate Map (FIRM) shows areas within the 100-year flood boundary, which are also known as "Special Flood Hazards Areas (SFHA)." A "100-year flood" does not refer to a flood that occurs once every 100 years, but refers to a flood level with a 1 percent or greater chance of being equaled or exceeded in any given year. The SFHAs may be further subdivided into insurance risk rates zones. Areas between the 100-year and the 500-year flood boundaries are termed "moderate flood hazard areas." The remaining areas are above the 500-year flood level and are termed "minimal flood hazard areas."

   Historically, about one-third of the claims paid by the NFIP are flood damage in areas identified as having only "moderate" or 'minimal" risk of flood. Flooding in these areas often is the result of inadequate local drainage systems, and such flooding sources with small drainage areas are generally not identified on FIRMS. The SFHAS are subdivided into flood hazard zones (insurance risk rate zones) according to the following criteria:

   Zone A: SFHA subject to inundation by the 100-

year flood. Because detailed hydraulic analyses have not been performed, no base flood elevation or depths are shown. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-30: SFHAs subject to inundation by the 100-year flood determined in a Flood Insurance Study by detailed methods. Base flood elevations are shown within these zones. Mandatory flood insurance purchase requirements apply. (Zone AE is used on new and revised maps in place of Zone A1-30).

Zone AH: SFHAs to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone AO: SFHAs subject to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone V: SFHAs along coasts subject to inundation by the 100-year flood with additional hazards associated with storm waves. Because detailed hydraulic analyses have not been performed, no base flood elevations or depths are shown. Mandatory flood insurance purchase requirements apply.

Zone VE and VI-30: SFHAs along coasts subject to inundation by the 100-year flood with additional hazards due to velocity (wave action). Base flood elevations derived from hydraulic analyses are shown within these zones. Mandatory flood insurance purchase requirements apply. (Zone VE is used on new and revised maps in place of zones VI-30).

Zones B, C, and X: These areas have been identified in the community flood insurance study as areas of moderate or minimal hazard from the principal source of flooding in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage Systems are not normally considered in the community's FIS. The failure of a local drainage system creates areas of high flood risk within these rate zones. Flood insurance is available in participating communities but is not required in these zones. (Zone X is used on new and revised maps in place of Zones-B and C).

Zone D: Unstudied areas where flood hazards are not undetermined but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available to participating communities.

4. **What is a floodway and who designates it?**

   The floodway includes the channel of a river and the adjacent floodplain that must be reserved in an unobstructed condition so that the base flood discharge can be carried while allowing development in the flood fringe area. Some state standards specify smaller allowable increases. FEMA requires the community to designate a floodway to avoid the possibility of significantly increasing upstream flood elevations. A community must prohibit development within the designated floodway that would cause any additional rise in base flood elevations.

5. **If a FIRM is believed to be incorrect, what can be done to change it?**

   Three procedures have been established for changing or correcting a flood map. They are:

   Letter of Map Amendment (LOMA), Letter of Map Revision (LOMR), and a physical map revision.

6. **What is a Letter of Map Amendment (LOMA)?**

   A LOMA is the result of an administrative procedure in which the Federal Insurance Administrator reviews scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a property is not located in a SFHA.

   Although FEMA may issue a LOMA, it is the lending institution's prerogative to require flood insurance as a condition of its own beyond the provisions of the Flood Disaster Protection Act of 1973 before granting a loan or mortgage. Those seeking a LOMA should first confer with the affected lending institution to determine whether the institution will waive the requirements for flood insurance if a LOMA is issued. If the lender accepts the LOMA, the policyholder may cancel the flood insurance coverage and obtain a premium refund.

7. **What is a Letter of Map Revision (LOMR)?**

   A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations, and planimetric features. All requests for LOMRs must be made to FEMA through the *chief* executive officer of the community, since it is the community that must adopt any changes and revisions to the map. The minimum charge for reviewing and processing a LOMR is $400.

8. **What is a physical map revision?**

   A physical map revision is an official republication of a map to effect changes to flood insurance zones, floodplain delineations, flood elevations, floodways, and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas, or corrections of base flood elevations or flood insurance risk zones.

   The community's chief executive officer can submit scientific and technical data to FEMA to support the request for a map revision. The data will be analyzed, and the map will be revised, if warranted. When the base flood elevations are changed, a 90-day appeal period is provided, followed by a period for formal approval. Generally, there is a fee associated with the review and processing of a physical map revision.

9. **Who should be contacted in FEMA to initiate a LOMA, LOMR, or physical map revision?**

   Requests for blank forms and technical assistance should be addressed to:

   Federal Emergency Management Agency
   Region VIII
   P.O. Box 25267, DFC
   Denver, CO 80225
   (303) 235-4830

   All completed requests should be addressed to:

   Federal Emergency Management Agency
   Mitigation Directorate
   Hazard Identification and Risk
   Assessment Division
   500 C Street SW
   Washington, D.C. 20472

10. **How long does it take to obtain a LOMA, LOMR, or physical map revision?**

    For single-building or single-lot determinations that do not involve changes to base flood elevations or floodways, a LOMA or LOMR generally can be issued within 60 days. LOMAs and LOMRs involving multiple lots or multiple buildings require up to 60 days to process. Times are specified from the date of receipt of all technical, scientific, or legal documentation. LOMRs involving decreases in Base Flood Elevations (BFEs) or floodway take approximately 90 days for processing. If changes in flooding conditions are extensive or if BFEs increase, a physical map revision will be required, which may take 12 months or longer.

11. **If a LOMA or LOMR is granted and the lender waives the requirement for flood insurance, how can a flood insurance policy be cancelled?**

    To effect a cancellation of a flood insurance policy, the policyholder must supply a copy of the LOMA or LOMR and a waiver for the flood insurance purchase requirement from the lending institution to the insurance agent or broker who services the policy. A completed cancellation form along with the LOMA or LOMR and the waiver must be submitted by the agent to the NHP or the appropriate Write Your Own Company.

12. **Why is the burden of proof on the person requesting a map change?**

    Government agencies and private engineering firms are contracted at considerable cost to perform analyses of flood risks and prepare flood maps for the community. The analysis and Flood Insurance Study findings are then reviewed by FEMA and community officials. FEMA has no justification for changing a study determination without sufficient evidence that a change is appropriate.

Appendix F - Mitigation Strategies & Measures

F.1 Mitigation Strategies

Four basic strategies may be applied to mitigate flood hazards. Each strategy has different measures that are appropriate for different conditions. In many communities, a different person may be responsible for each strategy. The four strategies are described briefly below (see ***figure F-2)***.

Planning:

Through prevention, flood problems are kept from getting worse. The use and development of floodprone areas is limited through planning, land acquisition, or regulation. Building, zoning, planning, and/or code enforcement offices usually administer preventive measures.

Property protection:

Property owners on a building-by-building or parcel basis usually undertake property protection. Government agencies can provide information and technical or financial assistance to owners who want to elevate, floodproof, insure, or otherwise protect their property.

Emergency services:

Emergency measures are taken during a flood to minimize its impact These measures are the responsibility of city or county emergency management staff and the owners or operators of critical facilities.

Flood control:

Keeping floodwaters away from an area with a levee, reservoir or other structural project is the goal of flood control. Flood control activities are usually designed by engineers and managed or maintained by public works staff.

Prevention

Prevention measures are designed to keep the problem from occurring or getting worse. They ensure that future development does not increase flood damage or they maintain the drainage system's capacity to carry away floodwaters.

F.1.1 Planning

Comprehensive plans and land use plans identify how a community should be developed. Generally, a plan has limited authority. It reflects what the community would like to see happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and subdivision ordinances. The ordinances are covered in later sections.

A community's capital improvement program identifies where major public expenditures will be made over the next 5 to 20 years. Capital expenditures may include acquisition of land for public uses, such as parkland, and extension or improvement of roads and utilities.

If the community's long range plan calls for preserving the floodplain as open space, then the capital improvement program should support the plan by acquiring floodprone areas for parks and by not improving or extending roads into the floodplain.

Where appropriate: All communities that expect growth and are willing to guide it are prime candidates for developing land use plans.

Limitations: Plans are only as strong as the local authorities want them to be. To be effective, they must be implemented, which may require additional legal measures, such as a zoning ordinance.

For more information: Technical advice can be found at the county planning agencies and the Colorado Department of Local Affairs, Division of Local Govern-

For more information

Each strategy and measure is summarized in this appendix. The discussion on each Measure ends with a **"For more information"** section which identifies agencies and/or references that can help.

Appendix A	Lists the agencies and their addresses, telephone numbers, and summaries of their programs.
Appendix B	Includes information on financial assistance programs.
Appendix C	Includes information on references used in the preparation of this plan.
Appendix D	Includes definitions and acronyms.
Appendix E	Includes tips to minimize loss of life & property in the event of a flood.
Appendix F	Includes mitigation strategies & Measures
Appendix G	Includes mitigation planning and examples

ment. *(see Sections A.2.5 and A.2.6 in Appendix A).*

F.1.2 Zoning

A zoning ordinance regulates development by dividing the community into zones or districts and setting development criteria for each district. There are two approaches that can prevent inappropriate floodprone development: separate districts and overlay zoning.

Separate districts: The floodplain can be designated as one or more separate zoning districts that only allow development that is not susceptible to damage by flooding. Appropriate districts include public use, conservation, agriculture, and cluster or planned unit developments that keep buildings out of the floodplain, wetlands, and other areas that are not appropriate for intensive development.

Flood Hazard Mitigation Measures

Prevention
- Planning
- Zoning
- Open space preservation
- Floodplain regulations
- Wetland regulations
- Stormwater management
- Watershed measures
- Soil erosion and sediment control
- Channel nmaintenance
- Drainage protection
- Real estate disclosure

Property Protection
- Building relocation
- Acquisition
- Building elevation
- Barriers
- Dry floodproofing
- Wet floodproofing
- Sewer backup protection
- Sewer backup protection
- Insurance
- Community programs

Emergency Services
- Flood threat recognition
- Flood warning
- Flood response
- Critical facilities
- Health and safety maintenance

Flood Control
- Reservoirs
- Levees and floodwalls
- Diversions
- Conveyance improvements
- Drainage/sewer improvements

Figure F-2

Overlay zoning adds special requirements in areas subject to flooding. The areas can be developed in accordance with the underlying zone, provided the flood protection requirements are met. As illustrated on the next page, there may also be setbacks or buffers to protect stream banks and shorelines or to preserve the natural functions of the channels and adjacent areas.

Where appropriate: Communities that expect development or redevelopment should adopt zoning ordinances.

Limitations: Some zoning regulations have been nullified because they placed too many restrictions on the use of private property and those restrictions could not be justified as needed for public health, safety or welfare. Some zoning requirements have been nullified when the community did not develop the technical data to support them.

For more information: Technical advice can be found at the county planning agencies and the Colorado Department of Local Affairs, Division of Local Government. *(see Sections A.2.5 and A.2.6 in Appendix A).*

F.1.3 Open Space Preservation

Keeping the floodplain open - free from development - is the best approach to preventing flood damage. Preserving open space is beneficial to the public in several ways. By preserving floodplains and natural sites for water storage, such as wetlands and low-lying areas, important recreational areas are secured while habitats for local flora and fauna are similarly protected.

Floodplains are excellent sites for scenic recreation areas and greenways. Local governments have prevented millions of dollars in flood damage through their open space preservation programs of floodprone areas. Open space preservation should not be limited to floodplains, as some sites in the watershed may be key to controlling runoff that adds to the flood problem.

Land use and capital improvement plans should identify areas to be preserved by acquisition and other means. Purchasing property with an easement, enables the land owner freedom to develop and use private property in the floodplain. If the owner agrees to not build on the floodprone parcel taxes are reduced. In some cases, the owner is allowed to develop the area for low hazard uses or to transfer the right to develop other flood-free parcels (known as "TDR" or transfer of development rights).

Easements do not always have to be purchased. Flood flow, drainage, or maintenance easements can be required of developers as a condition for approving the development. These are usually linear parcels along property lines or channels.

Streamside property owners in return for a community channel maintenance program also can provide maintenance easements.

Where appropriate: Open space preservation is encouraged in undeveloped areas in floodplains, wetlands, other watershed storage areas, natural areas, and along streams and drainageways.

Limitations: Reaching agreement on an easement can be complicated. Enforcing it requires vigilance by the community.

For more information: Technical advice can be found at the county planning agencies and the Colorado Department of Local Affairs, Division of Local Government. *(see Sections A.2.5* and *A.2.6* in *Appendix A).* There are funding programs to help acquire open space for recreational use or to preserve natural areas

F.1.4 Floodplain Regulations

In addition to zoning ordinances, regulations on construction in 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: Subdivision regulations govern how land will be subdivided into individual lots, often requiring that every lot have a buildable area

Minimum Floodplain Regulation Requirements - *Figure F-3*

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, Colorado communities agree to regulate new construction in the 100-year floodplain. To reduce confusion, the 100-year floodplain is called the "base floodplain" and the elevation of the 100-year flood is known as the base flood elevation.

The base floodplain is shown as the 'Special Flood Hazard Area" on the Flood Insurance Rate Map (FIRM) provided by FEMA. The base floodplain is designated as an "A" Zone. The 500-year floodplain is shown as a "B" Zone and areas above the 500-year flood level are shown as "C" Zones. On newer maps, the B and C zones are called 'X' zones. The designation as B, C, or X Zone does not mean that the area is not subject to local drainage problems or overbank flooding from streams or ditches smaller than the FEMA mapping criteria.

Additional floodplain regulatory requirements are set by state law and administered by the Colorado Water Conservation Board. These are the minimum floodplain requirements. Cities and counties often have additional or more restrictive regulations.

1. All development must have a permit from the community. Development is defined as any man-made change to the land, including new buildings, improvements to buildings, filling, grading, mining, dredging, etc.

2. Only "appropriate uses" are allowed in the floodway. The floodway is the channel and central portion of the floodplain that is needed to convey the base flood. Appropriate uses include flood control structures, recreational facilities, detached garages and accessory structures, floodproofing activities, and other minor alterations. They do not include buildings, building additions, fences, or storage of materials. The result of this requirement is that vacant floodways will essentially remain as open space, free of insurable buildings or other obstructions.

3. New buildings are allowed outside the floodway, but they must be protected from damage by the base flood. Residences must be elevated above the base flood elevation. Nonresidential buildings must be elevated or floodproofed.

4. When an addition, improvement or repair to an existing building is valued at more than 50% of the value of the original building, then it is considered a substantial improvement. A substantial improvement is treated as a new building.

5. Any filling, building or other obstruction placed in the floodplain reduces the amount of floodwater that can be stored. Developers must remove an equal or greater volume of fill to compensate for the loss of storage.

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. *(Storm sewer and drainage standards are discussed* in the *section on Stormwater management)*

Building codes: 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.

Most Colorado communities have adopted the Building Officials and Code Administrators' (BOCA) National Building Code. Chapter 18 of the 1993 edition sets standards for protecting foundations against flood damage, including requirements for soil testing and prepared fill.

Wetlands

- **Store large amounts of floodwaters**
- **Reduce flood velocities and erosion**
- **Filter water, making it cleaner for those downstream**
- **Provide habitat for species that cannot live or breed anywhere else**

Figure F-4

Minimum regulatory requirements: Most communities with a flood problem in Colorado participate in the National Flood Insurance Program (NHP). The NFIP sets minimum requirements for participating communities' subdivision regulations and building codes. The Colorado Water Conservation Board (CWCB) has information concerning requirements for communities in Colorado. The NFIP and CWCB minimum requirements are summarized in ***Figure F-3.***

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.

Where appropriate: Any area with surface flooding is appropriate for floodplain regulations.

Limitations: 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 and the Colorado Water Conservation Board.

For more Information: Technical assistance can be found at the county planning agencies and the Colorado Water Conservation Board (CWCB) *(see Sections A.2.1* in *Appendix A).*

F.1.5 Wetland Protection Regulations

Wetlands are usually found in floodplains or depressional areas. They provide numerous natural and beneficial functions that warrant protection. Many wetlands in Colorado are subject to the Corps of Engineers' Section 404 regulations. Corps permits are required for projects that will place fill or dredged materials in a wetland. Before a permit is issued, the plans are reviewed by several agencies, including the US Fish and Wildlife Service and the US Environmental Protection Agency. Some communities also have their own wetland protection programs. Local programs are important for addressing gaps in the federal regulations, particularly for smaller wetlands and unregulated activities.

Where appropriate: Any community that seeks to preserve the natural and beneficial functions of wetlands should consider instituting wetland regulations.

Limitations: In many areas, smaller wetlands are not mapped, so projects may be built by owners who don't know the area should be protected. The Corps authority is generally limited to filling wetlands. They can be impounded or otherwise damaged without a 404 permit being required. Therefore, communities should consider their own more comprehensive regulations.

For more Information: Technical advice can be found at the county stormwater planning agencies, the Colorado Water Conservation Board, the US Army Corps of Engineers, the US Fish and Wildlife Service, and the US Environmental Protection Agency (see A.2.1, A.3.12, A.3.13 in Appendix A).

F.1.6 Stormwater Management

Development outside a floodplain can contribute significantly to flooding problems. Runoff is increased when natural ground cover is replaced by urban development.

Unconstrained watershed development often will aggravate downstream flooding and overload the community's drainage system. Effective stormwater management policies require developers to build detention basins and utilize other "best management practices" ("BMPs") to minimize increases in runoff rates and volumes in comparison to pre-development conditions.

Many developments utilize wet basins as landscaping amenities and for water quality BMPs. In some cases, watershed planners identify the most effective location for a basin. Communities then require developers to contribute funds for a regional basin in lieu of constructing on-site detention. Since detention only controls runoff rates, and not runoff volumes, there is a need for other BMPs to enhance the infiltration of stormwater. Swales, infiltration trenches, vegetative filter strips, and permeable paving blocks are recommended additions to the standard detention requirements. Stormwater management requirements are generally found in subdivision ordinances.

Where appropriate: Stormwater management requirements are encouraged for all new developments.

Limitations: The community must bear the cost of maintaining detention features after the developer leaves. Even with the best BMPs, development will increase runoff volumes.

For more information: Technical advice can be found at the county planning agencies and the Colorado Water Conservation Board, Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Flood and Stormwater Managers *(see Sections A.2.1, A.1.3, and A.1.4 in Appendix A).*

F.1.7 Watershed Measures

Agricultural practices also can cause stormwater problems. Subsurface drainage and row cropping can speed the runoff onto downstream properties. Because farmland is usually bare, stormwater runoff can carry large amounts of sediment that can fill in downstream drainage facilities.

Ultimately, flood prevention must be viewed from a watershed perspective. Watershed measures should emphasize approaches that reduce runoff volumes and storing surface runoff naturally.

The runoff can be slowed down by watershed measures, such as vegetation, terraces, contour plowing and no-till farm practices. Slowing runoff on the way to a drainage channel increases infiltration into the soil and controls the loss of topsoil from erosion and the resulting sedimentation.

Protecting areas that naturally hold water is another effective type of watershed measure. Most watersheds have wetlands, depressions and other natural storage areas, which, if preserved from development, help reduce the impact of urbanization.

Where appropriate: Modifications to farming practices and urban development are most effective on steeper slopes where the most runoff and erosion occurs. Preserving storage areas is most effective in flat areas with natural depressions.

Limitations: These measures are usually implemented in areas beyond a municipality's jurisdiction. It can be hard to convince owners of property who are not near the flood problem to modify their drainage practices at their own expense.

For more information: Soil and Water Conservation Districts and their Natural Resources Conservation Service staff have both the expertise in watershed measures and the contacts with watershed landowners *(see Sections A.3.1 and A.3.10 in Appendix A).*

F.1.8 Soil Erosion and Sediment Control

As rain hits the ground - especially where there is bare dirt, as on farm fields and at construction sites - soil is picked up and washed downstream. This erosion of soil produces sedimentation in waterways that may be far from the eroded area. Sediment tends to settle where the river slows down and will gradually fill in the channel. Erosion and sediment control has two principal components: minimize erosion with vegetation and capture sediment before it leaves the site. Specific measures can be taken on farms and construction sites.

Farm practices such as contour plowing, terracing and no-till help reduce agricultural erosion and keep topsoil where it is needed. Soil loss can be cut at construction sites with techniques such as mulching, seeding, and erosion blankets. Silt fences and sediment traps slow runoff so sediment is dropped on-site before it gets to a watercourse. The key is to get these measures used, particularly on construction sites or at the downstream end of plowed fields.

The CWCB is currently undertaking watershed approaches to flood mitigation in its three (3) Multi-Objective Floodplain Management Studies on the Arkansas, South Platte and Roaring Fork Rivers.

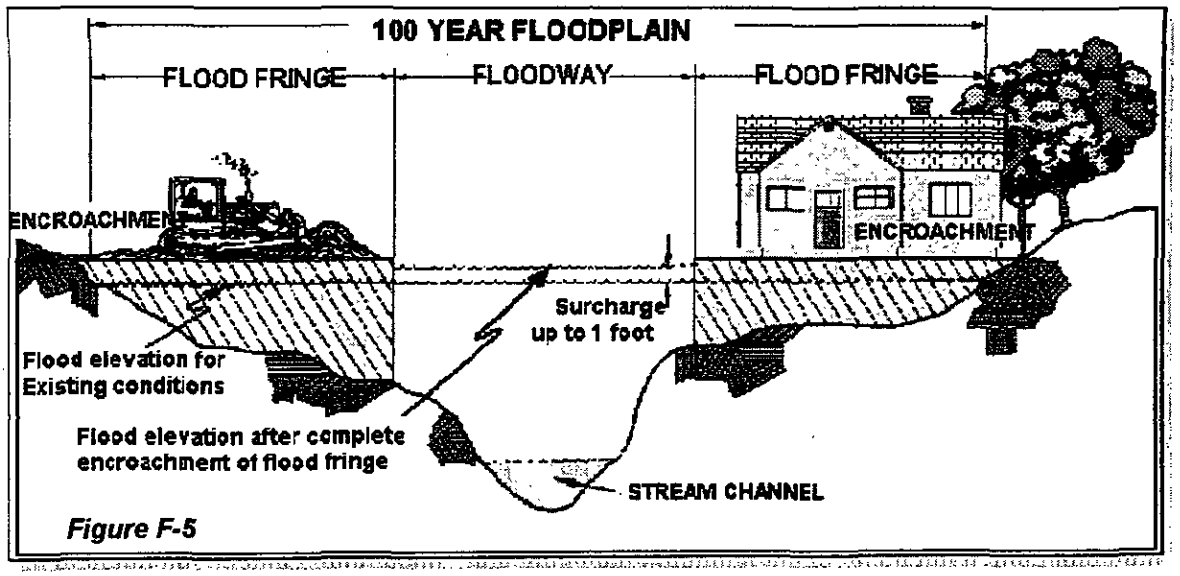


Figure F-5

Where appropriate: All watersheds are candidates for erosion and sediment control measures.

Limitations: As with any regulatory program. the community must have trained staff to educate developers and property owners, to monitor compliance, and to enforce the requirements.

For more information: Soil and Water Conservation Districts and their Natural Resources Conservation Service staff have both the expertise in watershed measures and the contacts with watershed landowners *(see Sections A.3.1 and A.3.10* in *Appendix A).*

F.1.9 Channel Maintenance

Channel maintenance is an ongoing program to clean out blockages caused by overgrowth or debris. Public works or drainage districts crew usually does this work. Channel maintenance addresses vegetative growth and debris that can block flows. Channel maintenance activities normally do not affect the shape of the channel, but they do affect how well the channel can do its job.

Where appropriate: Smaller streams in all watersheds should be the targets of channel maintenance programs. Annual cleanup campaigns should be conducted in late fall through winter, before spring flows and when there are no leaves restricting visibility.

Limitations: If done improperly, channel clearing can allow bank erosion and destroy natural habitats. Channel inspection and maintenance must be conducted year-round. Property owners must consent to the maintenance program, in many cases, which may require legal negotiations to obtain maintenance easements.

For more information: Soil and Water Conservation Districts and their Natural Resources Conservation Service staff have both the expertise in watershed measures and the contacts with watershed landowners *(see A.3.1 and A.3.10* in *Appendix A).*

F.1.10 Drainage Protection

Small amounts of debris can accumulate or be accidentally or intentionally dumped into channels and detention basins. They obstruct low flows or accumulate to become major blockages. Stream dumping regulations are one approach to preventing intentional placement of trash or debris in watercourses.

Many communities have nuisance regulations that prohibit dumping garbage or other "objectionable waste" on public or private property. Some prohibit the discharge of polluted waters into natural outlets or storm sewers. Waterway dumping regulations need to also apply to "non-objectionable" materials, such as grass clippings or tree branches, which can kill ground cover or cause obstructions.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. Similarly, they may not understand how regrading their yard, or discarding leaves or branches in a watercourse can cause a problem.

Therefore, a drainage protection program should include public information materials that explain the reasons for the rules as well as the penalties. Regular inspections to catch violations also should be scheduled.

Where appropriate: All waterways, including street ditches, should be placed under stream dumping regulations. Obstructions have their greatest impact in smaller streams and ditches, so an anti-dumping program has its greatest effect there.

Limitations: Finding dumped materials is easy; locating the source of the refuse is hard. Usually the owner of property adjacent to a stream is responsible for keeping the stream clean. This may not be fair for sites near bridges and other public access points

For more Information: Example dumping ordinance language can be found in the NFIP Community Rating System - ***CRS Credit for Drainage System Maintenance***. Public information examples are in ***CRS Credit for Outreach Projects.***

F.1.11 Real Estate Disclosure

Many times after a flood, people say they would have taken steps to protect them-selves if only they had known they had purchased a floodprone property. Federal law requires that a potential purchaser of a parcel be told of any flood hazard.

Federal Law: Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building that the property is in a floodplain as shown on the Flood Insurance Rate Map. Because this requirement has to be met only five days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

This requirement does not affect renters or instances where properties are purchased without mortgages from federally regulated lenders. Enforcement of this law is up to the federal agencies that regulate lending institutions, such as the FDIC.

Where appropriate: Real estate disclosure can help everywhere.

Limitations: Enforcement of these regulations can be difficult. Compliance with the federal lending requirements has been spotty, but has been improving in recent years. The best approach for a community is to work with the local real estate agencies to encourage them to use the latest maps and provide assistance to them as needed.

For more Information: Information on the federal lending requirements can be obtained from the FEMA Region 8 Mitigation Division *(see Section A.3.7 in Appendix A)*. The basic reference is ***Mandatory Purchase of Flood Insurance Guidelines.***

F.2 Property Protection

Property protection measures are used to modify buildings subject to flood damage rather than to keep floodwaters away. A community may find these to be inexpensive measures because often they are implemented by or cost shared with property owners. Many of the measures do not affect the buildings' appearance or use, making them particularly appropriates for historical sites and landmarks.

F.2.1 Building Relocation

Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier structures, such as those made of brick, and for large or irregularly shaped buildings. There are many experienced house movers in Colorado who knows how to handle any job.

Where appropriate: Communities with areas subject to flash flooding, deep waters or other high hazard where the only safe approach is to remove the building should consider a relocation program.

Smaller, wood frame buildings on crawlspaces or basements are easier to move because they are lighter and it is easier to place jacking and moving equipment underneath the floor.

Relocation is also preferred for large lots with portions outside the floodplain or where the owner has a new flood-free lot available.

Limitations: Relocation can be expensive. The cost can average $25,000 and exceed *$50,000* depending on the type, weight and size of the house, whether it has to be cut and moved in parts, and the cost of a new lot However, there are some government loans or grants available Buildings that have suffered frequent flooding may be contaminated or structurally weakened and should be demolished.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) ***Elevating or Relocating a House to Reduce Flood Damage, Design Manual for Retrofitting Flood-prone Residential Structures,*** and ***Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.2 Acquisition

Flood Assistance Program
City of Arvada Colorado

The Urban Drainage and Flood Control District (UDFCD)in Denver has emergency contingency funds that may be available for certain activities of it's participating communities and counties. For example, a recent project with the City of Arvada included the acquisition of approximately 100 mobile homes located in the Ralston Creek floodplain. The mobile homes have all been relocated and the floodplain and creek will be restored.
Figure F-6

Like relocation, acquisition ensures that buildings in a floodprone area will cease to be subject to damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public use, such as a park.

Acquiring and clearing buildings from the floodplain is not only the best flood protection measure available, it is also a way to convert a problem area into a community asset and obtain environmental benefits.

Occasionally acquisition and relocation projects are undertaken jointly. The purchasing agency sells the building for salvage and the new owner relocates the structure rather than demolishes it.

Sometimes arrangements are made to allow the previous owner to buy back the building at the salvage value. This way, the owner gets to keep the house but have enough money from the sale to pay for a new lot and moving expenses.

Where appropriate: While acquisition works against any type of flood hazard, it is more cost-effective in areas subject to flash flooding, deep waters, or other severe flood hazards where other property protection measures are not feasible.

Communities that want to clear floodprone areas, or redevelop them for other uses, such as recreation or riparian habitat, will find acquisition to be necessary. Acquisition, followed by demolition, is most appropriate for buildings that are too expensive to move -- such as larger, slab foundation, or masonry structures -- and for dilapidated structures that are not worth protecting.

Limitations: Cost is the number one concern with acquisition. An acquisition budget should be based on the median price of similar properties in the community, plus $10,000 to $20,000 for appraisals, abstracts, title opinions, relocation benefits and demolition.

Cost may be lower following a flood. For example, the community may have to pay only the difference between the full price of a property and the amount of the flood insurance claim received by the owner.

Communities should avoid creating a ***"checkerboard"*** acquisition pattern in which nonadjacent properties are acquired. This can occur when some owners, especially those who have and prefer a waterfront location, prove reluctant to leave. Creation of a checkerboard in a community simply adds to maintenance costs that taxpayers must support.

Smaller towns may be concerned if a large area is

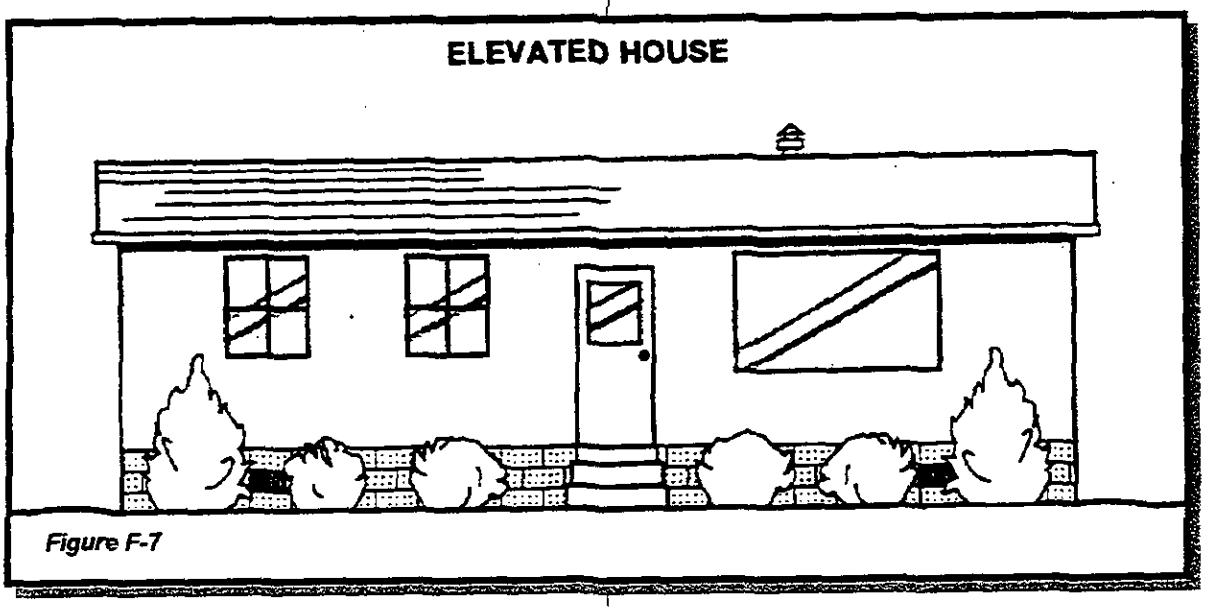


Figure F-7

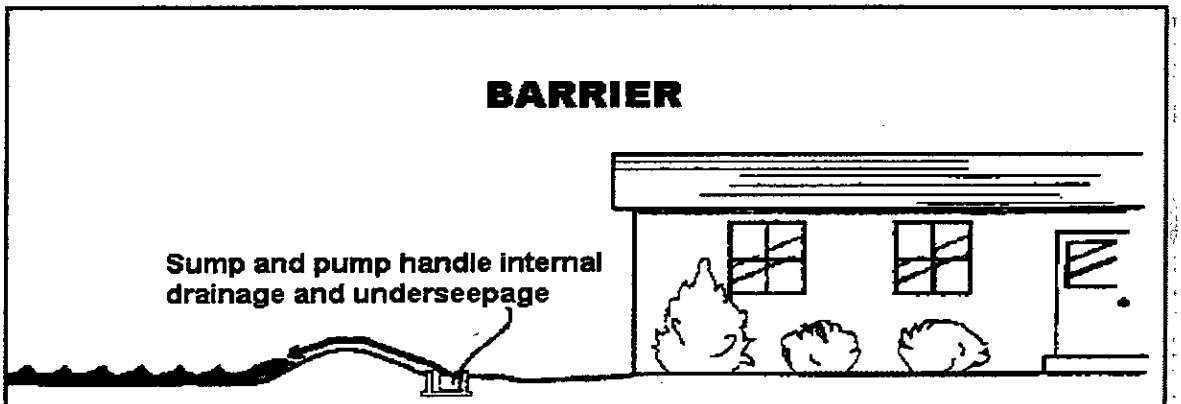


Figure F-8

affected, for they may risk losing residents, businesses and/or revenue from property taxes and utility fees.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) ***Elevating or Relocating a House to Reduce Flood Damage, Design Manual for Retrofitting Flood-prone Residential Structures,*** and ***Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.3 Building Elevation

Raising a house above the flood level is the best way to protect a structure that cannot be removed from the floodplain. Water flows under the building, causing no damage to the structure or its contents.

Raising a building above the flood level is cheaper than moving it, and can be less disruptive to a neighborhood. Commonly practiced in flood-prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a floodplain. House moving contractors know the techniques to elevate a building.

Elevating a structure will change its appearance. If the needed degree of flood protection is low, the result is similar to putting a house on a two or three foot crawlspace. If the house is raised two feet, the front door would be three steps higher than before. If the house is raised eight feet, the lower area can be wet floodproofed for use as a garage and for storage of items not subject to flood damage.

Floodplain Development Permit Required City of Fort Collins

Always check with the Building Department before you build on, alter, regrade, or fill on your property. A floodplain Use Permit is also required from the Stormwater Utility to ensure that projects do nor cause problems for other properties.

Figure F-9

City of Fort Collins Code

The Fort Collins Code requires that all new residential buildings be elevated 18 inches above the base or 100-year flood elevation. New non-residential buildings must be elevated or floodproofed 18 inches above the base flood.

Figure F-10

Where appropriate: Smaller, wood frame buildings on crawlspaces are the cheapest to elevate. Use of this technique is safest where flood depths do not exceed six feet and velocities are slow.

Limitations: Elevation can be expensive. The price to raise a wood frame building on a crawlspace has run as low as $5,000 when the owner does much of the work. Otherwise, the cost averages $15,000 to $25,000. Raising a structure with brick walls resting on a slab foundation can cost *$25,000* to *$50,000.*

During flooding, the building may be isolated and without utilities, and therefore unusable. Newly created lower stories may be occupied or used for storage, putting household goods at risk for flood damage.

Some owners object to the change in appearance and are concerned that their home will stand out and affect property values.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) ***Elevating or Relocating a House to Reduce Flood Damage, Design Manual for Retrofitting Flood-prone Residential Structures,*** and ***Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.4 Barriers

Barriers - levees, floodwalls and berms - keep floodwaters from reaching a building. Plans for using these structures must include ways to handle leaks, water seepage under the barrier and rainwater that accumulates inside the barrier. Therefore, they need a sump and/or drain tile to collect the internal ground and surface water, a pump to remove the water, and a pipe to send it over the barrier. ***(See section 3.4.2 for more information on levees and floodwalls)***

Berms are commonly used in areas subject to shallow flooding. Not considered engineered structures, berms are made by regrading or filling an area.

Low floodwalls may be built around stairwells to protect the basement and lower floor of a split-level home. By keeping water away from the building walls, the problems of seepage and hydrostatic pressure are reduced.

The cost can range from practically nothing, when the homeowner re-grades the yard or builds a berm with local fill, to $10,000 for a concrete floodwall with drain tiles and sump pump.

Where appropriate: Barriers are recommended where the depth of flooding is three feet or less. Barriers may be used to protect any type of building, although buildings with basements wall be more susceptible to under-seepage. Floodwalls are more appropriate on small lots where there is little room for a levee. Care must be taken in locating barriers. They must be placed so as not to create flooding and/or drainage problems on neighboring properties. All barriers must be kept out of regulatory floodways.

Limitations: Private levees, floodwalls and berms are more susceptible to deterioration than publicly-held structures, as maintaining them falls to the property owner, not a public agency.

Private barriers do not eliminate the need for flood insurance, as they normally address only smaller, more frequent floods. They often have to rely on human intervention to close openings or operate pumps. Insurance is needed for those times when there is no one present who knows what to do when the flood arrives.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) - ***Design Manual for Retrofitting Flood-prone Residential Structures,*** and ***Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

In North Dakota when flooding is imminent, firemen knock on the residents doors and say: "It is time to fill your basement" - The firemen lower the fire hose through the basement window and the homeowner turns on the nozzle and fills the basement with water to prevent hydrostatic pressure from collapsing the walls.

Figure F-11

F.2.5 Dry Floodproofing

Through dry floodproofing, a building is sealed against floodwaters. Buildings with crawlspaces generally are not dry floodproofed because water can seep under walls into the crawlspace. However, two kinds of structures can benefit from dry floodproofing.

Buildings on slab: All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, sewer lines and vents, are closed either permanently, with removable shields, or with sandbags. Many dry floodproofed buildings cannot be distinguished from those that have not been modified.

Where appropriate: Dry floodproofing should be used only where the flood depth is less than three feet, and floodwaters will have little velocity. Most building walls and floors are not strong enough to withstand the hydrostatic pressure from more than three feet of water.

Buildings with basements: Houses with basements or other floors below grade can be protected with a backfill approach. A waterproofing compound is applied to the walls and fill is placed against the side of the house. The goal is to protect the house against contact with surface water or saturated ground. Such contact will greatly increase the amount of pressure against the basement walls, which may result in structural failure. Therefore, installation of a subsurface drain tile and one or two sump pumps is a must. Properly sized drains and pumps can handle any water that will naturally seep through the fill to reach the house.

Where appropriate: Buildings with basements or floors below grade may be dry floodproofed only with the waterproofing berm approach shown above and only where the flood protection level is lower than the first floor. In such a situation, the basement area should not be used as a bedroom where the occupants could be caught by surprise if water comes in.

Limitations: Dry floodproofing may involve closing openings and turning on pumps. These actions are dependent on adequate warning and the presence of someone who knows what to do.

As with barriers, flood insurance is highly recommended for those occasions when the protection level is overtopped or when there is no one available to take the proper steps.

An owner may be tempted to try to keep out floodwaters deeper than the design flood protection level. This can result in collapsed walls, buckled floors and danger to the occupants. It should be noted that floodplain management regulations do not allow new buildings to be dry floodproofed.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) - ***Design Manual for Retrofitting Flood-prone Residential Structures, and Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board (CWCB) can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.6 Wet Floodproofing

"Wet floodproofing" includes protection measures that deal with floodwaters in the building. Wet floodproofing approaches range from moving a few valuable items to rebuilding the flood prone area (see ***Figure 5-10***).

Water standing on the ground outside a basement will quickly build up pressure against the basement walls, putting the equivalent pressure of six to seven feet of water on the walls and floor. Most walls and floors are not built to withstand hydrostatic pressure of more than three feet of water. As a result, sometimes basement walls and floors that have been waterproofed may be cracked, buckled or broken by the pressure of floodwater.

Low-Cost Steps to Wet Floodproof a Structure

- Sewer openings, such as floor drains, must be plugged.
- Everything subject to damage by water or sediment must be moved to a higher level or out of the building. For example, the electrical panel and the furnace could be relocated to an upper floor.
- Where flooding is not expected to be deep, items needing protection may be placed on platforms or blocks.
- Owners should be prepared to move lighter items, such as lawn furniture or bicycles, after a flood warning is issued.

Figure F-11

Wet floodproofing has one advantage over the other approaches: No matter how little is done, flood damage will be reduced. Simply moving furniture and electrical appliances out of the floodprone area can prevent thousands of dollars in damage.

Where appropriate: Wet floodproofing will work wherever there is an area above the flood protection level to which items can be relocated or temporarily stored.

Wet floodproofing works best in buildings with unfinished basements, garages, sheds, commercial and industrial facilities, and buildings with contents that are either water-resistant or easily moved. One-story houses are not appropriate for wet floodproofing because the likely flooded zone comprises living areas.

Many wet floodproofing techniques can be incorporated during repairs, reconstruction or remodeling. For example, damaged wallboard in a basement can be removed and the concrete walls can be covered with water-resistant paint. Wet floodproofing is sometimes the only way to protect a historic building that cannot be moved or elevated.

Limitations: Owners are often reluctant to "abandon" large areas of their buildings in anticipation of a flood. A plan to move contents relies on adequate warning and the presence of someone who knows what to do. Flood insurance is highly recommended for those occasions when the protection level is overtopped or when there is no one available to take the proper steps. There will still be a need for clean up, with its accompanying potential for health problems.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) - ***Design Manual for Retrofitting Flood-prone Residential Structures, and Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board (CWCB) can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.7 Sewer Backup Protection

In areas where sanitary and storm sewers are combined, basement flooding can be caused by stormwater overloading the system and backing up into the basement through the sanitary sewer line.

In areas where sanitary and storm waters are carried in separate pipes, the same thing can happen when there are cross connections between the storm and sanitary sewers or infiltration or inflow problems in the lines.

Houses which have downspouts, footing drain tile, and/or the sump pump connected to the sanitary sewer service may be inundated when heavy rains overload the system. If allowed by the local code, these should be disconnected. Rain and ground water should be directed out onto the ground, away from the building.

Four other approaches may be used to protect a structure against sewer backup: floor drain plug, floor drain standpipe, overhead sewer, and backup valve.

The first two devices keep water from flowing out of the lowest opening in the house, which is the floor drain. They cost less than $25. However, if the water gets deep enough in the sewer system, it can flow out of the next lowest opening in the basement, such as a toilet or laundry tub.

The latter two devices are more secure, but more expensive ($3,000 to $4,000). An overhead sewer, as illustrated on the next page, keeps water in the sewer line during a backup. A backup valve allows sewage to flow out while preventing backups from flowing into the house.

Where appropriate: All four approaches are appropriate for split levels, basements, and other locations where water in the sewer lines can back up into a building. Plugs and standpipes are only useful where the backup causes shallow flooding (lower than the next lower opening).

Limitations: Plugs and standpipes need to be carefully installed, as a little debris may prevent a good seal. In older houses, sewer lines under a basement floor may be clay tiles; a buildup of pressure may break them. Sewer lines in newer houses usually are cast iron, making breakage unlikely.

For more Information: The following information is available from The Hazards Center in Boulder (see A.2.13 in Appendix A) - ***Design Manual for Retrofitting Flood-prone Residential Structures, and Protect Your Home from Flood Damage.*** Also, the Urban Drainage and Flood Control District, City of Fort Collins Stormwater Utility, Colorado Association

Sample Flood Insurance Premiums

In floodplain	Structural coverage	Contents coverage	Annual Cost
Yes	$ 80,000	$ 40,000	$ 681
Yes	$ 10,000	$ 20,000	$ 261
No	$ 80,000	$ 40,000	$ 471
No	$ 10,000	$ 20,000	$ 214

Rates are for older buildings with basements. Lower premiums are available for newer buildings built in accordance with floodplain regulations, for buildings outside the floodplain that have not been flooded in the past, for coverage with higher deductibles, and in communities in the Community Rating System.

Flood Insurance Manual, March 1995, pp Rate 2, Rate 8, Rate 10. Rate 11

Figure F-12

of Stormwater Floodplain Managers Association, the Colorado Water Conservation Board (CWCB) can offer technical assistance (see A.1.2, A.1.3, A.1.4, and A.2.1 in Appendix A).

F.2.8 Insurance

Insurance does not prevent flooding or flood damage; it helps an owner pay for repairs and replacement items damaged in a flood. Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work.

While most homeowner's insurance policies do not cover a property for flood damage, there are two ways an owner can insure a building: National flood Insurance and basement backup insurance.

National Flood Insurance: Most Colorado communities with a significant flooding problem participate in the National Flood Insurance Program (NFIP).

Their participation allows any local insurance agent to sell a separate flood insurance policy under rules and rates set by the Federal Insurance Administration. Rates do not change after claims are paid; they are set on a national basis. *Sample rates as of 1995 are shown in* ***Figure F-12.***

Flood insurance is required as a condition of certain types of federal aid and most bank loans and mortgages for buildings in the floodplain shown on FEMA's Flood Insurance Rate Maps. However, many policyholders drop it after a few dry years and/or do not purchase it for the building's contents. In spite of the federal law, less than one floodplain property in four is covered.

30 - DAY WAITING PERIOD

The recently enacted National Flood Insurance Reform Act makes it even more appropriate to purchase and keep a flood insurance policy. There is now a 30-day waiting period before coverage goes into effect.

If a person who was required to purchase insurance as a condition of receiving disaster assistance dropped the policy, then disaster assistance would not be provided again. Public buildings will have the amount of insurance coverage they should have carried deducted from any disaster assistance they may be eligible for after a flood.

Basement backup insurance: National Flood Insurance covers seepage and sewer backup for an additional deductible provided there is a general condition of flooding in the area which was the proximate cause of the basement getting wet.

Several insurance companies offer coverage for damages incurred should a sump pump fail or sewer line

Figure F-13

Spring 1996

Fort Collins Flood Preparedness:
Your Property is Located in or near a Floodplain

Flooding in Fort Collins: Your Property Is Located In or Near The Floodplain

Floodplain Management

The Fort Collins Stormwater Utility is responsible for the management and administration of the City floodplains. In 1979 the City entered the federal National Flood Insurance Program (NFIP) and has participated in the Community Rating System (CRS) since 1990.

Both the NFIP and CRS are programs intended to provide flood protection through:

- increased awareness of the flood hazard
- minimum floodplain development design standards

The CRS provides an incentive, through flood insurance premium reductions, for the community to do more than meeting the minimum federal NFIP requirements to help citizens prevent or reduce flood losses. Fort Collins floodplain residents receive one of the lowest flood insurance rates in the country as a result of the City Floodplain Management Program.

CSU campus, Sept 6,1938.

Flood of 1904, Cache La Poudre River, at the roadway and railway bridges on Linden Street. Courtesy of Fort Collins Public Library.

The Local Flood Hazard

Fort Collins is vulnerable to flooding from several different sources. Principal flood sources include the rivers and streams in Fort Collins such as the

- Cache La Poudre River
- Spring Creek
- Dry Creek
- Foxtail Creek
- Boxelder Creek

There are a number of smaller tributaries and canals which may also flood. The main cause of floods in the Fort Collins area is intense rainfall, which normally occurs in the period of May through September. Cache La Poudre River flooding could also occur in May and June as a result of increased runoff from snowmelt.

Urban flash flooding of streets is also a hazard.

Notable floods occurred on the **Cache La Poudre River** in 1844, 1864, 1884, 1891, 1904, 1923, and 1930. The three largest floods occurred in 1864, 1891, and 1904, with flood peaks of approximately 21,000 cubic feet per second (cfs). For comparison, the discharge of the Poudre at "flood stage" is about 6000 cfs.

The 1904 flood probably did the greatest financial damage. During this flood, approximately 150 houses were swept away, and *all the bridges* were destroyed except one. The record of past flood damages on the Cache La Poudre River, however, does not accurately represent the current flood threat to Fort Collins. A severe flood has not occurred in nearly 90 years.

reconstruction, rehabilitation, addition, or other improvements to a building equals or exceeds 50% of the existing building's market value, then the building must meet the same construction requirements as a new building.

In the case of an addition, only the addition must be protected. In the case of an improvement to the original building, the entire building must be protected. Substantially damaged buildings must also be brought up to the same standards. Improvement requirements are addressed during the floodplain development permitting process.

Drainage System Maintenance

Do not dump or throw anything into the ditches or streams. Obstruction and pollution of our waterways and ditches is in violation of City Code. A plugged channel cannot carry water and when it rains, the water has to go somewhere. Every piece of trash counts, as flooding. Even grass clippings and branches can accumulate and plug channels.

If your property is next to a ditch or stream, please do your part and keep the banks clear of trash and debris. The Stormwater Utility has a drainage system maintenance program that inspects the channels regularly and can help you remove major blockages such as downed trees. Please report any debris or dumping in ditches or streams to the Stormwater Utility. The debris may increase flooding on your property.

Natural and Beneficial Functions

Under natural conditions, a flood causes little or no damage. Nature ensures that floodplain fauna and flora can survive the more frequent inundations. This is the case along the Cache La Poudre River where many natural reaches have been preserved such as the Gustav Swanson Natural Area and the Northern Colorado Nature Center.

Natural floodplain areas help to reduce our flood damage by allowing flood waters to spread over a large area. This reduces velocities and provides flood storage to reduce peak flows downstream. The City also owns a number of parcels along Spring Creek and the Cache La Poudre River which permanently reserves these areas as Open Space and reduces the flood hazard.

Open Space along the Cache La Poudre River provides natural flood and erosion control and fish and wildlife habitat. Many types of birds including the Kingfisher, *Great Blue Heron, and Redtail Hawk*, as well as a diversity of migrant songbirds use the Cache La Poudre River riparian corridor.

Spring Creek habitats are not as diverse as the Cache La Poudre River, however, the creek does have some fairly well-developed riparian areas. It is our job to help preserve natural areas in the floodplain.

For more information contact:
Mike Grimm, Floodplain

City of Fort Collins

backup. Most exclude damage from surface flooding that *would* be covered by the NFIP.

Each company has different amounts of coverage, exclusions, deductibles, and arrangements. The cost varies from nothing, to up to $70 for a rider on the homeowner's insurance premium.

Where appropriate: NFIP coverage is good regardless of flood velocities, duration, warning time or other flood hazards. The NFIP does not insure buildings for subsurface flooding, including seepage and sewer backup.

Private insurance, which covers sewer backup, is appropriate for buildings with basements.

Limitations: The NFIP requires a ***"general condition of flooding,"*** so a very local problem may not be covered.

National Flood Insurance will not cover finished portions of a basement. Also, it does not cover property outside a building such as landscaping, driveways, walls or fences.

Some private insurance companies offering basement coverage may cancel the coverage or increase the premium if the policyholder collects on a claim.

For more information: Local insurance agents have information on both the NFIP and private insurance.

F.2.9 Community Programs

Property owners usually implement their own property protection measures. Therefore, a community mitigation program should include measures to encourage and assist owners. A community's plan may provide three kinds of help: pertinent information, technical advice and financial assistance.

Information: A community has passive and active ways to inform residents about flood hazards and damage mitigation.

Passive ways to provide information, such as through references in the public library may not bring immediate reductions in flood damage. However, they can have a long-term effect when people make construction or land use decisions later.

In addition to the library, many elementary and high schools have geography or science classes that are appropriate for sessions on flooding, natural hazards, and preserving the natural functions of floodplains and wetlands. The ***"Internet"*** is another source of information.

Pros and Cons of Various Warning Media

Mass warning systems: sirens, whistles, church bells, etc.

Advantages:
Often already available in the fire department
Reaches large numbers of people rapidly in urban areas instills sense of urgency

Disadvantages:
Cannot convey an explanation of the problem or instructions on what to do
May suddenly fail if dependent on telephone or electrical power for operation
Expensive for use in rural areas

Radio, television, and cable Systems

Advantages:
Receivers widely available
Low or no initial investment
Reaches large numbers of people rapidly during daylight and evening hours
Suitable for both urban and rural areas
Can convey explanation of problems and instructions for action

Disadvantages:
Dependent on electrical power
Few people are likely to be listening during late night and early morning
Local stations may be off the air during late night and early morning hours

Mobile public address systems

Advantages:
Reaches large numbers of people rapidly conveys sense of urgency
Low or no initial investment
Can convey an explanation of problem and instructions for action
Suitable for both urban and rural areas
Person giving the warning can adapt procedures to the situation

Disadvantages:
Local travel or flying may be prevented by weather or flooding conditions
May tie up police or other vehicles when they are needed

Fan out systems: telephone trees, block captains, etc.

Advantages:
Low or no initial investment
Can convey explanation of problem and instructions for action
Suitable for both urban and rural areas

Disadvantages:
Messages may become garbled through many relays
Vulnerable to rumors and speculation
Slow
Vulnerable to telephone system disruption

Door-to door contact

Advantages:
Can convey explanation of problem and instructions for action
Can give residents written instructions
Conveys sense of urgency
Persuasive
Suitable for both urban and rural areas Low or no initial investment

Disadvantages:
Slow
May interfere with other essential duties

Figure F-14

Active approaches include outreach projects, such as notices to floodprone property owners, to introduce the idea of property protection and identify sources of assistance. Other approaches, such as cable television shows, notices in public buildings, or booths at shopping centers, help but are not as effective as notices specifically directed to the owners of properties that should be protected.

More intensive efforts include distribution of handbooks and videos on property protection, public meetings with neighborhood groups, and "open houses." The last is a variation on the public meeting that includes exhibits by local contractors, insurance agents, building officials, the Red Cross, and others expert in flood protection who display their wares and answer questions.

Technical Assistance: In one-on-one sessions with property owners, community officials can provide advice and information on matters such as identifying flood hazards at the site, correcting local drainage problems, floodproofing, dealing with contractors, and funding.

Technical assistance can be given in telephone conversations, as complimentary critiques of the owner's plans or ideas, and in visits to the building. A more intensive effort is a written "flood audit," which provides the owner with a written description of the flood hazard at the site and specific recommendations to protect the site or building.

Where appropriate: Providing information and technical assistance can help every property owner, and is one of the least expensive measures a community can undertake. Every step taken by a property owner can reduce flood damages.

Limitations: Some community staff members are hesitant to provide advice due to a lack of knowledge about property protection measures or concern about liability should a recommended measure fail. Both of these concerns can be overcome through training using manuals, technical assistance, and courses available from FEMA and the Corps of Engineers.

For more information: Guidance on establishing a community program to provide information and technical assistance to property owners can be found in *Flood Proofing Techniques, Programs* and *References, Local Flood Proofing Programs,* and *CRS Credit for Public Information Programs.* Information on financial assistance programs *is* available from the agencies in Appendix A.

F.3 Emergency Services

Emergency services measures protect people during and after a flood. All counties in Colorado and several cities have emergency management offices to coordinate warning, response, and recovery during a disaster. At the state level, the Colorado Office of Emergency Management coordinates their work.

F.3.1 Flood Threat Recognition

The first step in responding to a flood is knowing that one is coming. A flood threat recognition system provides early warning to emergency managers. A complete system measures rainfall, snow conditions, soil moisture, and stream flows upstream in order to calculate the time and height of the flood crest downstream.

On large rivers, the flood threat recognition work is done by the National Weather Service. The Weather Service is in the National Oceanic and Atmospheric Administration (NOAA). Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. Communities on smaller rivers must develop their own systems. They may install rain and river gauges in key

Where appropriate: Communities located near streams and watersheds large enough to provide adequate lead time are candidates for setting up their own flood alert systems. Generally, flooding comes too fast in watersheds smaller than 10 - 20 square miles.

Limitations: If the system overstates the flood threat, a lot of energy and resources can be wasted responding to a nonexistent threat. A false warning also can create the hazard of **"crying wolf"** - people won't heed the next warning.

On the other hand, a system that understates the threat can create worse problems: the flood will catch the community unprepared, resulting in damage that could have been prevented, especially to vehicles and other items that could have been moved out of harm's way.

For more information: The National Weather Service

Flood Response Plan Tasks:

- **Activating the emergency operations center** (emergency manager)
- **Sandbagging certain areas** (public works or county road department)
- **Closing streets or bridges** (police or sheriffs department)
- **Shutting off power to threatened areas** (utility company)
- **Releasing children from school** (school district)
- **Ordering an evacuation** (mayor)
- **Opening evacuation shelters** (churches, schools, or the Red Cross)
- **Monitoring water levels** (engineer)
- **Guarding sandbag walls and other protection measures** (police)

Figure F- 15

Two Categories of Critical Facilities

Category 1 - Buildings or locations vital to the flood response effort:

- Emergency Operations Centers
- Police and Fire Stations
- Hospitals
- City/County/State Highway Garages
- Selected Roads and Bridges
- Suppliers of Needed Materials
- Evacuation Routes

Category 2 - Buildings or locations that if flooded would create secondary disasters:

- Hazardous Materials Facilities
- Water and Wastewater Treatment Plants
- Schools
- Nursing Homes

Figure F-16

has information on the NOAA Weather Radio and can provide technical assistance on establishing a local flood threat recognition system *(see National Weather Service page A-10 in Appendix A)*

F.3.2 Flood Warning

Once the flood threat recognition system tells the emergency manager that a flood is coming, the next step is to notify staff in other agencies, the public and critical facilities that a flood is imminent. The earlier and the more accurate the warning, the greater the number of people who can implement protection measures.

A complete warning system should have a public information component so people can relate a warning to their situation and know what to do when a flood threatens. Summary safety information should be provided. If time allows, the warning can include information on evacuation and where temporary shelters will be established.

A flood warning may be disseminated in a variety of ways, as listed in ***Figure F-14***, which also describes the pros and cons of each system. These methods of disseminating a warning - be it for floods, tornadoes, or severe storms - are in widespread use throughout Colorado.

Multiple or redundant systems are most effective - if people do not bear one warning, they may still get the message from another part of the system. Most flood warning programs have two levels of notification:

A flood watch - conditions are right for flooding.

A flood warning - a flood has started or is expected to occur in the community.

The National Weather Service often issues a ***"flash flood watch"*** for urban areas, a notice that the amount of rain expected will cause ponding and other flooding on small streams where much of the watershed has been urbanized.

Where appropriate: Everywhere. While a warning system based on a flood threat recognition system will be more accurate and helpful; one that relies only on National Weather Service watches will still help people.

Limitations: Issuing a warning does not mean people will react promptly or properly. People need to be advised of what the warnings mean and what actions they should take.

For more information: More information and assistance is available from the county emergency management office, the Colorado Office of Emergency Management, Colorado Water Conservation Board, Urban Drainage and Flood Control District, Fort Collins Stormwater Utility and the National Weather Service *(see A.1.3, A.1.4, A.2.5, and National Weather Service page A-10 in Appendix A).*

F.3.3 Flood Response

Once a flood threat is recognized, the first priority is to alert others through the flood warning system. The second priority is to respond with actions that can prevent or reduce damage or injury.

A flood response plan is the best way to ensure that all bases are covered and that the response activities are appropriate for the expected flood threat. It is developed in coordination with the agencies or offices that are given various responsibilities.

A flood response plan should include a flood stage

forecast map. This map relates flood levels to topographic information to show where various floods will go. The plan should identify different activities for the different flood levels. Such advance planning is needed to ensure that response measures, such as sandbagging, are the most efficient activities for the areas that are predicted to flood.

Drills and exercises should be conducted between floods to ensure that key participants understand their duties. The result is a coordinated effort implemented by people who have experience working together so that available resources will be used most efficiently.

Where appropriate: All situations. Even where there is no flood threat recognition system, a written flood response plan can ensure that nothing is forgotten during the initial phase of reacting to storms and flooding.

Limitations: Careful planning and stockpiling are necessary to ensure the availability of people and supplies on short notice. If not properly planned or keyed to the flood threat, flood response can be a wasted effort when the flood exceeds predicted levels.

Property owners may resist evacuation in order to protect their belongings. Response operations, especially at night or in fast currents, can pose a danger to those responding.

For more information: More information and assistance is available from the city/county emergency management office and the Colorado Office of Emergency Management Agency *(see A.2.5 in Appendix A)*. References include *Flood Fighting* and *CRS Credit for Flood Warning Programs*.

F.3.4 Critical Facilities

Protecting critical facilities during a flood is a vital part of any emergency service effort. If a critical facility is flooded, workers and resources may be unnecessarily drawn away from protecting the rest of the community. If such a facility is prepared, it will be better able to support the community's flood response efforts. Critical facilities fall into two categories (see ***Figure F-16***).

Critical Facilities Deserve Special Attention in an Emergency Plan

Most critical facilities have full-time professional managers or staff who are responsible for the facility during a disaster. These people often have their own emergency response plans. State law requires hospitals, nursing homes, and other public health facilities to develop such plans.

Many facilities would benefit from early flood warning, flood response planning, and coordination with community flood response efforts.

Where appropriate: Each community and state agency must identify which facilities are considered critical. All such facilities should have their own flood response plan coordinated with the communities.

Limitations: Owners or operators of critical facilities may be reluctant to voluntarily spend time and resources to develop a plan that they may think they won't need.

For more information: More information and assistance is available from the county emergency management office and the Colorado Office of Emergency Management *(see A.2.5 in Appendix A)*.

F.3.5 Health and Safety Maintenance

Preventing dangers to health and safety is critical after a flood. The flood response plan should identify appropriate measures to take. These include:

- ***Patrolling evacuated areas to prevent looting***
- ***Providing safe drinking water***
- ***Vaccinating residents for tetanus***
- ***Clearing streets***
- ***Cleaning up debris and garbage***

The plan also should identify which agencies will be responsible for carrying out these measures. Normally, they are the police, sheriff, or public health authorities.

Where appropriate: All situations.

Limitations: Many people are more interested in returning to and repairing their flooded properties than in taking health and safety precautions. A public information program to counter this tendency is an essential part of any flood response plan.

For more information: More information and assistance is available from the county emergency management office, the Colorado Office of Emergency Management, and Colorado Department of Public Health *(see A.2.5 and A.2.10 in Appendix A)*. A good reference to advise residents about health and safety measures is **Repairing Your Flooded Home** *(available from the Hazard Center see A.2.13 in Appendix A)*.

F.4 Flood Control

Flood control measures are used to prevent floodwaters from reaching properties, thus preventing damage. These measures are "structural" because they

involve construction of man-made structures to control water flows. Because of their size and cost, structural projects typically are implemented with the help of state or federal flood control agencies such as the Colorado Water Conservation Board, the US Army Corps of Engineers, and the Natural Resources Conservation Service.

Most flood control projects have shortcomings besides their sheer cost: They disturb the land and disrupt natural water flows, often destroying habitant. They require regular maintenance, which if neglected, can have disastrous consequences. They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage. They can create a false sense of security, as people protected by a project often believe *that no flood can ever reach them.*

Because most flood control projects will have regional or watershed-wide implications, they are often planned at a regional level. Nonetheless, communities should participate in and coordinate with regional flood control studies.

F.4.1 Reservoirs

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can handle downstream. The lake created may provide recreational benefits. Wet or dry basins can serve multiple uses by doubling as parks or other open space uses.

Where appropriate: Reservoirs are suitable for protecting existing development. They may be the only flood control measure that can protect development close to a watercourse. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store Building a reservoir in flat areas and on large rivers may not be cost-effective because large areas of land have to be purchased.

Limitations: As with other structural flood control projects, reservoirs:

- ***Are expensive***
- ***Occupy a lot of land***
- ***Require periodic maintenance***
- ***May fail to prevent damage from floods that exceed their design levels***
- ***May eliminate the natural and beneficial functions of the floodplain***

For more information: Agencies with expertise in reservoir design and construction include the US Army Corps of Engineers, the Natural Resources Conservation Service, and the Colorado Water Conservation Board *(see A.3.10, A.3.12, A.2.1* in *Appendix A).*

F.4.2 Levees and Floodwalls

Probably the best known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and walls must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

They should be set back out of the floodway so they will not push floodwater onto other properties. Their design also should compensate for the flood storage that they will displace.

Where appropriate: Levees are effective in protecting existing development. Levees need considerable room to fit between the river and the area to be protected. If space is a constraint, more expensive floodwalls are used.

Limitations: Levees or floodwalls can be overtopped, flooding people who thought they were protected.

If one fails, the sudden rush of floodwater can endanger lives and may cause greater damage than having no flood barrier at all. Levees and floodwalls can be barriers to access, views, and local drainage. There are continued operation and maintenance costs to ensure the pumps work and that the levees do not slump or develop holes caused by animals or vegetation.

Larger levees or floodwalls usually cost so much that they cannot be built without state or federal aid. Flood control agencies require that the benefits of a major project exceed the cost Thus, protecting major concentrations of property in urban areas often can be justified. However, where development is scattered or aligned in narrow strips along a river, the cost often exceeds the benefits of protecting a smaller number of properties.

For more Information: The U.S. Army Corps of Engineers can provide information on levee construction criteria *(see A.3.12* in *Appendix A).*

F.4.3 Diversions

A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels.

During normal flows, the water stays in the old channel. During flood flows, the stream spills over to the diversion channel or tunnel, which carries the excess water to a lake or another river.

Where appropriate: Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed.

Limitations: Care must be taken to ensure that the diversion does not cause a new flood problem.

Even the appearance of transferring the flood to someone else greatly complicates - and often halts - a diversion project. Diversion channels may be blocked by residents who don't understand, or don't agree with, their purpose.

For more Information: Agencies that can help with technical advice include the U.S. Army Corps of Engineers and the Colorado Water Conservation Board. *(see Sections A.3.13 and A.2.1 in Appendix A).*

F.4.4 Conveyance Improvements

By improving channel conveyance, more water is carried away. Improvements include making a channel wider, deeper, smoother or straighter. Some smaller channels can be lined with concrete or even put in underground pipes.

Dredging is one form of conveyance improvement. It is often cost prohibitive because the dredged material must be disposed of somewhere and the stream will usually fill back in with sediment in a few years. Dredging is usually undertaken on larger rivers only to maintain a navigation channel.

Where channel modification is the only practical flood control solution, it should be performed in an environmentally sensitive manner. Mitigation of natural habitat and water quality functions should be incorporated. If there is enough room, properly sloped and planted channel banks can prove cheaper to maintain than concrete ditches.

Where appropriate: Conveyance improvements are recommended for smaller streams and ditches in developed areas, particularly if there is no room for a levee.

Limitations: The cost of modifying a channel and then maintaining it can be expensive.

Channel projects can damage or destroy wildlife habitats and create new erosion problems. Straightening a stream is a temporary measure because it tries to eliminate meanders and other features that nature will continually work to recreate. Improving a channel so that water travels through it faster may aggravate a flood problem downstream.

For more Information: Agencies that can help include the US Army Corps of Engineers, the Natural Resources Conservation Service, and the Colorado Water Conservation Board.

F.4.5 Drainage & Storm Sewer Improvements

Man-made ditches and storm sewers help drain areas where the surface drainage system is inadequate or where underground drainageways may be safer or more attractive. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements usually are designed to carry the runoff from smaller, more frequent storms.

Storm sewer improvements include installing new sewers, enlarging small pipes, and preventing back flow. Streets in many developments are used as a part of the drainage system, to carry or hold water from larger, less frequent storms. They collect runoff and convey it to a receiving inlet, inlet sewer, ditch or stream. Allowing water to stand in the streets and then draining them slowly can be a more effective and less expensive drainage measure than building bigger sewers and ditches.

Where appropriate: Drainage and storm sewer improvements should be considered wherever storm sewers are overloaded and local ponding from heavy storms damage property.

Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding.

Limitations: Local drainage improvements can adversely affect wetlands and increase flooding on downstream properties.

Storm sewers and concrete ditches have limited flow capacities and do not allow for filtering stormwater to improve water quality or for recharging aquifers.

Debris can sometimes get caught in flap gates and valves, preventing them from closing, thereby making them useless. This can be prevented with proper monitoring and maintenance and use of designs that are less prone to obstructions.

For more information: Public works departments and engineers are the best sources of information on local sewer improvements and maintenance.

Appendix G - Mitigation Planning & Examples

G.1 Post-Flood Recovery and Mitigation

After a flood, a window of opportunity opens for hazard mitigation. It can be an excellent time to tap into the public's high level of interest in recovery and call upon the technical and financial assistance programs that can become available to design and implement mitigation measures.

Once the immediate response efforts and damage assessments are completed, the community should prepare a post-flood plan that addresses clearing, redeveloping, and/or rebuilding the flooded area. 'There are five reasons why this period can be so productive:

1. ***Resources*** - A flood can bring experts from various federal, state, and regional agencies and fields together to focus their attention on the community and its flood problems.
2. ***Involvement*** - The residents and elected officials will be more willing to spend time on the community's flood problems - and to try some new solutions.
3. ***Protection*** - Incorporating some property protection measures is easier during repairs and reconstruction.
4. ***Acquisition*** - It may be relatively easy to acquire and clear heavily damaged structures and start anew.
5. ***Money*** - *If* a major disaster declaration is made, several sources will make money available *to* protect or buy properties.

G.2 The Post-Flood Setting

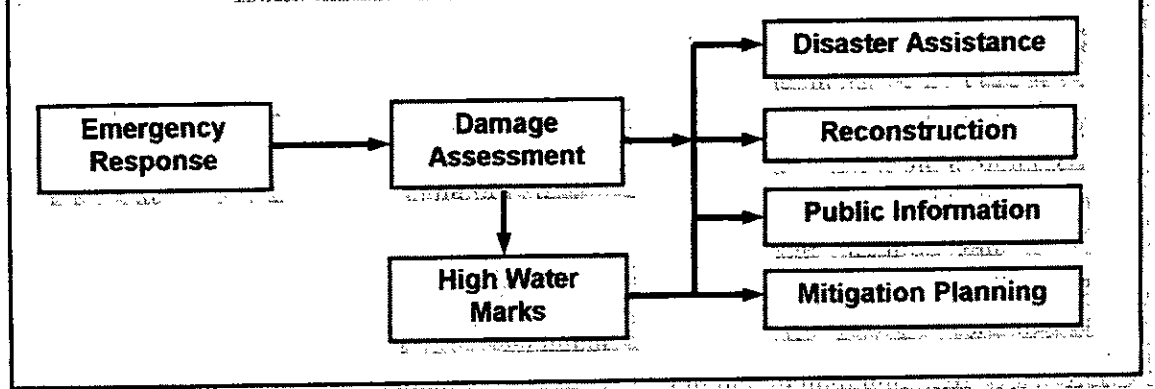
Returning to normal will be the community's highest priority aster a flood. A number of things will impede this effort:

- The community's expenses will be increasing while its income may fall off sharply.
- Implementing emergency plans under county, state and federal rules will require participation in many unfamiliar activities. This will leave little time to assess the situation and make decisions.
- The public, and elected officials, may seek to waive building permit procedures and regulations in order to help people return too normal as fast as possible.
- Community officials will be hard-pressed to take care of their own personal needs, do their regular jobs, and at the same time assume disaster recovery and mitigation responsibilities.

In short, stress will be high, patience, and the working environment unfamiliar - and there won't be enough time or money to meet everyone's expectations.

With these limitations in mind, this section covers the activities that a community should implement immediately after a flood or other disaster in the floodplain. This is only an overview of the post-flood setting. The emergency manager should know the details of emergency response, damage assessment and disaster assistance activities. The mitigation coordinator should become familiar with the reconstruction, public information, and mitigation aspects of the post-flood scene.

Figure G-1 Post-Flood Activities



G.2.1 Emergency Response Procedures

Being closest to the problem, local government is responsible for responding to floods and other emergencies. Most Colorado communities have emergency response plans designed to cope with a variety of disasters. Any community without such a plan should set out now to prepare a flood response plan to guide activities before, during and immediately after high water strikes.

At the local level, the American Red Cross can provide vital assistance in setting up emergency shelters and assessing damage. Mutual aid agreements with surrounding communities can supply additional police, fire or Colorado Chapter International Conference of Building Officials.

In most situations, immediate disaster response needs are met by the community, the county, and the state - in that order. Help in responding to a disaster escalates only aster each level of government declares that handling the emergency is beyond its capabilities. When coping with the disaster exceeds the community's abilities and resources, it may request county and then state assistance through emergency management channels.

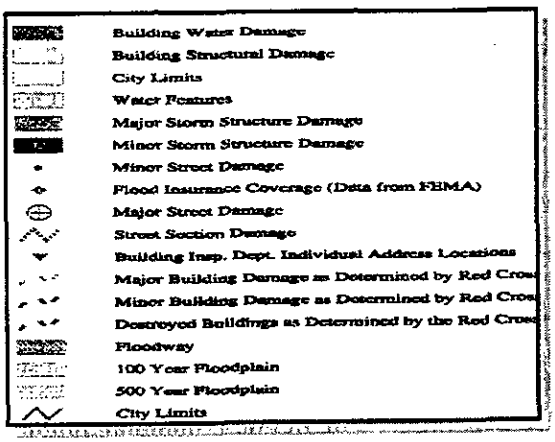
If appropriate, the Colorado Office of Emergency Management (OEM) will ask the governor to declare a state of emergency, enabling support by state resources such as the National Guard and the Department of Transportation.

Only in extreme cases will the federal government be called upon for help. For example, the US Army Corps of Engineers may be called in to coordinate a flood fight or debris removal operation in order to provide emergency access into the disaster area. Often, floodwaters have receded before many federal agencies can respond.

G.2.2 Damage Assessments

As soon as emergency response activities are underway, community, Red Cross and county personnel should conduct an initial damage assessment. This information is critical in obtaining additional levels of assistance. Small floods require a detailed damage assessment in order to help state and federal officials determine whether supplemental assistance is required.

In large and catastrophic floods, like the Fort Collins



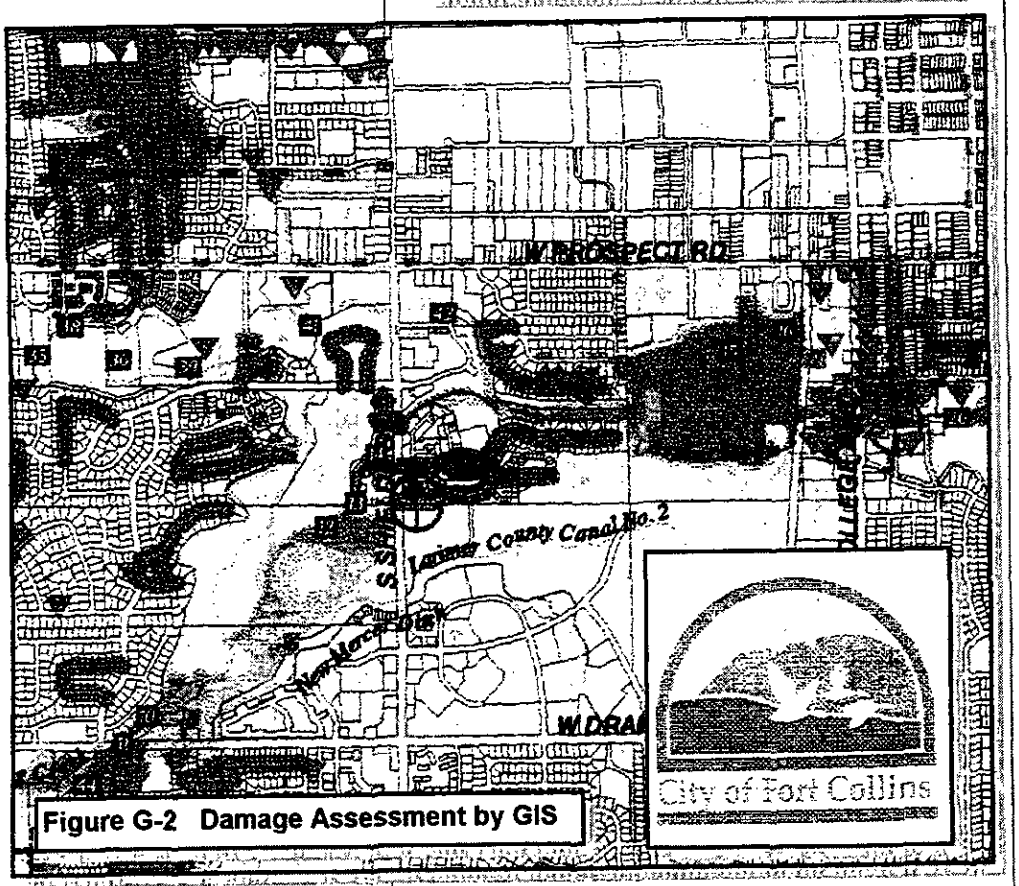


Figure G-2 Damage Assessment by GIS

flood, it is obvious that local and state capabilities will be exceeded. In such cases, many of the emergency response and damage assessment activities will be undertaken jointly by staff from the community, the county, OEM and FEMA.

G.2.2.1 Initial Assessments

The initial damage assessment is usually a windshield survey done by police, fire, and emergency management personnel to determine just how bad the situation is. The survey should answer these questions:

- Is there significant damage? If so, is it widespread?
- Where are the problem areas?
- Is there access?
- Are lives in danger?
- Should a state of emergency be declared?
- Do we need help? If so, what kind?

Once emergency response activities are completed, a more detailed damage assessment takes place to determine what types of resources will be needed to complete the recovery. These questions must be answered:

- How many people are out of their homes and businesses?
- Is damage to buildings sufficient to require a long-term recovery effort?
- Does the community have enough people and equipment to address the problems at hand (road closures, medical support, debris clearance, etc.)?
- Should we ask for a state or federal disaster declaration?

G.2.2.2 Preliminary Damage Assessment

If the initial assessment results in a request for state or federal help, **OEM** or **FEMA** will request a "Preliminary Damage Assessment" or "PDA. This is a more formal assessment to determine whether the federal government should augment the resources of the community, county and state governments to meet recovery needs. A joint FEMA-OEM-Local team usually conducts the PDA. A person familiar with community problems and mitigation possibilities should be the local participant on the PDA. This will help the community capture any mitigation opportunities available through Public infrastructure Assistance.

6.1.2.3 Building Condition Assessment

Concurrently with the PDA, a more detailed assessment of the damage to buildings should be made. Initial assessments are designed to help get recovery under way. For example, the Red Cross gathers information to decide whether it is necessary to establish shelters and provide meals for disaster victims. Its assessment is not intended to be accurate enough to determine the extent of structural damage or needed repairs. The building condition assessment is not required for emergency management or disaster assistance purposes. It should be conducted to help determine mitigation needs and opportunities *(see **Chapter 5**)*.

G.2.3 Disaster Assistance

If damage is severe enough, the governor will issue a disaster declaration and may request a similar declaration from the president. The request is sent through emergency management channels to FEMA. Several state and federal agencies provide disaster assistance, but the major ones are implemented by FEMA as authorized by the Stafford Act (see Appendix A for details). The state cooperates in the administration of the programs and shares the costs of some of them. In Colorado, the current Statute authorizing FEMA's disaster assistance programs is the Stafford Act Several of the programs are known by their section numbers in the Act:

404 Hazard mitigation grants

406 Public/infrastructure assistance

G.2.3.1 Hazard Mitigation Planning Requirements

FEMA widely publicizes the assistance programs that are made available after a disaster declaration. Three main types of assistance are available:

1. ***Public/infrastructure assistance*** provides technical and financial assistance to public agencies and certain private nonprofit organizations for the repair or replacement of damaged facilities. (This was formerly known as the Public Assistance Program.)
2. ***Human services programs*** provide resources to assist residents and business owners, such as temporary housing, unemployment aid, food stamps, grants and loans. (Many of these were formerly called the Individual Assistance Program.)
3. ***Hazard mitigation programs*** provide technical and financial resources to help reduce susceptibility to damage from a future disaster.

Each of these programs can fund mitigation measures, so the mitigation coordinator should be sure to obtain the latest information from OEM-CWCB, or FEMA staff on what is covered, who is eligible, and how funds are disbursed.

G.2.3.2 Disaster Service Center Mitigation Tables

After a disaster declaration, the federal government may establish a Disaster Service Center (DSC) where people can file initial requests for aid. In the DSC, state and federal officials may set up "mitigation tables" where properly owners can sit down with mitigation experts (such as floodplain managers or code officials) to review how the flood affected their property and what they can do about it. If a DSC mitigation table is set up, the building department should either staff the table or provide materials about the community's building code requirements and permit procedures. Disaster Service Centers will not be established after every disaster. Applications for assistance may be handled through telephone hotlines or other methods. The community should determine if the method selected could be used to communicate mitigation information to residents.

G.2.3.3 Interagency Hazard Mitigation Team

After the President issued the disaster declaration DR-1186-CO, FEMA will formed an Interagency Hazard Mitigation Team within a few days of the flood. Its mission was to prepare a mitigation report.

Team members are drawn from state and federal agencies that have mitigation programs or can provide guidance on recovery and reconstruction. Many of the flooded communities were represented in order to keep abreast of mitigation funding opportunities and to help ensure that the report reflects local needs.

G.2.3.4 409 Planning

After a Presidential disaster declaration was issued, Colorado is required to update this hazard mitigation plan as a condition for receiving federal disaster aid, immediately and in the future. This document often is referred to as the "409" plan, after the section in the Stafford Act that requires it.

This plan evaluates the hazard that caused the disaster, and identifies strategies for reducing the impact of similar future events. Post-disaster mitigation projects will not be eligible for funding unless they are in conformance with this plan. Also, future federal disaster assistance may be limited if the intent of the planning requirement is not met.

G.2.3.5 Public infrastructure Assistance Program

Under Section 406 of the Stafford Act, FEMA provides 75 percent of the cost of repairing or restoring facilities owned by public agencies and certain private nonprofit organizations. If an applicant prefers to relocate a facility out of the floodplain rather than replace it, FEMA will still provide funds, but at a reduced share.

FEMA takes the first step in obtaining Public infrastructure Assistance funding by completing a Damage Survey Report ([DSR) for each facility. The community should have a representative on each DSR team to provide local input into the repair or replacement design for damaged facilities.

The local DSR representative should be aware that

Example: a flood washes out a culvert that used back up every time there was a 1-inch rain. FEMA and the state will estimate the cost to repair or replace it as it was. If someone points out that a larger culvert can save more money than it costs by reducing flood damage to other properties and floodplain regulations prohibit obstructions in the floodway, then FEMA may share the expense of replacing the lost culvert with a larger one.

Similarly, damaged water and sewer lines can be protected or relocated, pumping stations can be floodproofed, and bridges can be replaced with clear spans

this program provides an opportunity to incorporate hazard mitigation features while replacing some damaged property. FEMA can provide funding above and beyond the cost of repairing or replacing a public facility, if a state or local regulation can demonstrate.

G.2.3.6 Individual and Family Grants

FEMA and the State of Colorado jointly administer this program. It is designed to help disaster victims pay for "unmet needs," i.e., needs other programs do not fund that. It is a grant to individuals; usually those who cannot qualify for a loan or cannot get a loan to cover all of their expenses.

Sometimes Individual and Family Grants (IFG) can be used to fund minor property protection projects, such as elevating a furnace, water heater, washer or electrical service box above the flood level. These grants can be especially useful in areas with lower income or fixed income families that are subject to shallow or basement flooding.

G.2.3.7 Post-Disaster Hazard Mitigation Grant Program

Section 404 of the Stafford Act makes money available to assist eligible applicants after a presidential disaster declaration. Section 404's Hazard Mitigation Grant Program will pay for 75 percent of the cost of such mitigation projects.

To be eligible, the projects should be consistent with the recommendations of the Interagency Hazard Mitigation Team's report and the Colorado 409 plan. Such projects must be shown to be cost-effective, and they may mitigate hazards other than the one that caused the disaster. If the community applies for funds to support projects on private properties, the property owner can help pay the local cost-share.

G.2.4 Local Responsibilities

Most emergency response plans do not include mitigation activities. Therefore, while the community's emergency manager will be responsible for the "normal" post-disaster operations, such as restoring services and debris removal, the mitigation coordinator should be aware of the following post-disaster responsibilities of the community.

G.2.4.1 High Water Marks

High water marks should be marked and recorded throughout the flooded area. Setting high water marks can be as simple as spray-painting lines on telephone poles or as involved as recording exact elevations. The community should check with the Colorado Water Conservation Board (CWCB) and the local stormwater agency before initiating this work, as they often send teams out to record high water marks *(see Appendix A for telephone numbers)*.

The water depth data can be used to improve floodplain mapping, to relate the flood to the base flood, and to correlate the flood with an expected return frequency. Determining the return frequency of the flood - in other words, was it a 10-year flood or a 25-year flood? - is needed to evaluate the performance of existing flood control facilities and to help justify future flood mitigation measures.

The return frequency can be linked to the dollar value of the damage. That information, when compared to the cost of a proposed mitigation measure, will help determine the benefit/cost relationship of a proposed mitigation project.

G.2.4.2 Reconstruction Regulations

Not only is enforcing reconstruction regulations important to the immediate safety of the building occupants, it is an effective method of reducing future flood damage. A community in the National Flood Insurance Program must enforce its floodplain regulations in order to maintain its eligibility in the NFIP. The floodplain development permit office must ensure that substantially damaged buildings are treated as new buildings and must be elevated or otherwise protected from damage by the base flood.

G.2.4.3 Support of Disaster Assistance Activities

The community may be asked to provide a site for a Disaster Service Center, and/or staff to help prepare Damage Survey Reports. Community staff should participate on the Interagency Hazard Mitigation Team and help with the 409 plan. If the community is not participating on the team, it should at least invite the team to visit its damaged areas and review ideas for mitigation projects.

G.2.4.4 Time and Expense Records

Community staff should make a concerted effort to document all activities and expenses related to disaster response and recovery, regardless of the degree of damage. Departments should maintain records that account for staff assignments by location and task description), staff time and overtime, equipment use, expenses, and any damaged or destroyed public property. This level of documentation is required for reimbursement should federal assistance become available.

G.2.4.5 Flood Insurance

Flood insurance is always preferable to disaster assistance as a way to be reimbursed for damage to a public building. Financial help is available for all floods, regardless whether a disaster declaration is made.

Under the Stafford Act, a local government's eligible disaster assistance is reduced by a dollar amount equal to the value of the building or the maximum amount of flood insurance available ($500,000 for a nonresidential building), whichever is larger. For example, if a fire station or public works garage was flooded and suffered $300,000 in damage, it may not be eligible for any disaster assistance because the community should have had up to $500,000 in flood insurance coverage. This approach is followed whether or not the community actually carried insurance. Accordingly, it behooves a community to review its own facilities in identified flood hazard areas and determine if flood insurance policies are warranted. An inventory of such facilities will also help catalog the community's vulnerability to flood damage.

G.3 Organizing for Post-Flood Mitigation

After a flood, three mitigation tasks must be undertaken simultaneously:

1. ***Monitor and regulate reconstruction*** to gather information on building conditions, ensure that the community's ordinances are being enforced and buildings are safe to reoccupy, and incorporate mitigation measures in reconstruction projects.
2. ***Inform the public*** about recovery matters and mitigation opportunities.
3. ***Prepare a mitigation plan*** to coordinate mitigation efforts and identify needs for post-disaster funding.

G.3.1 Staff Resources

As with pre-flood planning, the first step is to make one person responsible for coordinating all mitigation activities. Ideally, a mitigation coordinator is appointed before a disaster, allowing the person time to attend training sessions and otherwise prepare for the job. Outside assistance to the busy community staff can come from consulting engineers and planners. Other communities may be able to loan building officials to help with the heavy reconstruction permit workload.

G.3.2 Public Involvement

Involving the public in mitigation activities after a disaster is difficult, but very important. While residents of the affected area will be busy cleaning up, they will also be very interested in knowing what will happen next Accordingly, frequent public information releases are needed just to keep residents abreast of what is happening. Residents also need to be involved in mitigation planning. As with pre-flood planning, a committee is a key element of the planning process. Resident membership is especially important following a disaster that destroyed homes or caused substantial damage. Because in such cases it is likely the mitigation plan will recommend acquisition or elevation of properties, activities that are potentially disruptive to people and neighborhoods, it is vital that residents have input in planning and decision-making.

G.3.3 Technical Assistance

The same agencies that provide technical assistance for pre-flood planning can help on post-flood mitigation planning. Additional help on post-disaster aspects and disaster assistance programs should be available from FEMA's Mitigation Division and FEMA's Mitigation Coordinator *(see Appendix A)*. Sometimes federal financial assistance is made available to fund regional planning commission or other staff to help the community's mitigation planning effort

Other sources of counsel include mitigation coordinators from other communities that have been flooded in recent years, and private consultants who are experienced in post-disaster operations and mitigation programs.

G.3.4 Training

Training is available for a mitigation coordinator who is appointed before a flood. Contact the Colorado Office of Emergency Management Office or FEMA's Emergency Management Institute at ***www.FEMA.gov***. Tuition for the course is free and travel stipends are available.

G.4 Reconstruction

Reconstruction activities need to pursue twin goals:

1. Get people back into their homes quickly, thus reducing the need to operate shelters or provide temporary housing assistance, and
2. At the same time, make sure that buildings are safe, sanitary and secure from future flood damage.

Enforcing reconstruction regulations is important to the immediate safety of the building's occupants, a highly effective way to reduce future flood damage, and a requirement of the community's participation in the National Flood Insurance Program.

G.4.1 Reconstruction Requirements

Under its agreement with FEMA and the State, the community is required to enforce its floodplain regulations in order to maintain its eligibility in the National Flood Insurance Program.

FEMA can be expected to closely watch the community's enforcement of its regulations, especially its enforcement of the substantial damage requirement, to ensure that the community is upholding its agreement with the NFIP. Failure to enforce the rules can result in increases in flood insurance premiums for the community's residents, suspension from the NFIP, loss of flood insurance coverage, and/or loss of eligibility for disaster assistance and mitigation funds.

To maintain eligibility in the NFIP, the community's code enforcement office must require permits prior to the start of construction for any development in the floodplain, review applications for permits to ensure the development will meet code, and issue permits where appropriate.

G.4.1.1 What Needs a Permit?

All development in a NFIP community needs a permit. ***"Development"*** includes any man-made change to the land, including new buildings, improvements to buildings, filling, grading, mining, dredging, etc. (also see definition in ***Appendix E***).

After a flood, property owners must be reminded that permits are required for reconstruction, repairs, alterations, modifications or demolition of existing buildings. A permit is needed for each building that will be required with new or replacement drywall, flooring, foundation walls, furnace, water heater, cabinets, or any significant system or portion of the structure.

G.4.1.2 Waiving Requirements

After a disaster, there is often pressure to waive the permit and code requirements to help people "return to normal" as fast as possible. Such an action would violate the agreement between the community and FEMA; the regulations must be enforced. After the initial damage assessment, fees may be waived or reduced to lessen the burden on people who have suffered losses.

G.4.2 Building Condition Assessment

Soon after the initial damage assessments confirm that an area can be visited safely, the code enforcement office should survey the flooded buildings to assess their damage. There are two objectives to this assessment:

1. Determine if any building is in so dangerous a condition that it should not be reentered without a careful inspection.
2. Determine what buildings need a floodplain development permit before they can be repaired or reoccupied.

The building condition assessment is conducted from outside the building, usually from a vehicle. The damage assessor conducts a "triage" by designating each building as one of three types:

1. ***Apparently safe:*** No exterior signs of damage. People can be allowed back in but they will still need building permits for structural work.
2. ***Obviously destroyed or substantially damaged:*** The flood swept the building away, it has collapsed, or it is missing one or more walls. The building cannot be reoccupied. The owner can rebuild only by meeting all current code requirements.
3. ***Possibly substantially damaged:*** *The* building may be substantially damaged, but it is not obvious. Guidance for determining substantial damage is provided later in this chapter. If the building is confirmed to be substantially damaged, it should not be reoccupied. The owner can rebuild only by meeting all current code requirements. The code enforcer should record the address of any building where these conditions are visible.

G.4.2.1 Notice to Owners

Many people assume that they can repair (heir homes or businesses without a building permit. They often think that permits are needed only for new construction, not for repairing or replacing elements of an older building. Accordingly, after the building condition assessment identifies properties that will need permits, the code enforcement staff needs to advise owners of the requirement. This should be done both through the media and by direct notice.

G.4.3 Regulatory Procedures

After the building condition assessment is completed and property owners are advised of the need to obtain a permit, enforcement of the regulations should follow the community's normal procedures for administering its building permit requirements. Assistance may be available from other code enforcement officials who have been through disasters. Other communities may be able to loan code enforcement staff for a short period after the disaster when the workload is heaviest.

G.4.3.1 Check the Rules

The code enforcement office should contact FEMA or the Colorado Water Conservation Board to obtain the latest update on the substantial damage requirement new explanatory materials may be available.

G.4.3.2 Emergency Repairs

The community may allow temporary emergency repairs to be done without a permit These would include patching holes in roofs or wails and covering windows to prevent the weather from inflicting further damage.

However, owners of potentially substantially damaged buildings should be advised against making major emergency repairs, such as shoring up the foundation, unless the building presents a safety hazard. The buildings may be purchased and/or demolished.

G.4.3.3 Public Information

A property owner who may have just lost all of his or her possessions and suffered building damage may feel that the substantial damage requirement is the last straw, so a careful information program is needed.

The mitigation coordinator should work with the code enforcement and public information offices to develop public information materials on the requirements for

permits and the substantial damage rule.

G.4.3.4 Property Protection Opportunities

If a building was not substantially damaged, the building permit plan reviewer should examine the damage and reconstruction plans to identity property protection opportunities. If any property protection opportunities are found, the reviewer should explain them to the applicant and urge that they be implemented.

For example, if a basement was flooded and the owner intends to replace the furnace and water heater, the permit reviewer should advise the owner to consider relocating them to a floor above the flood level.

If there was a Presidential disaster declaration, the owner should be advised that there may be financial assistance for a mitigation project' such as through the minimization program of FEMA's Individual and Family Grants.

If a building was substantially damaged, the permit office must enforce the code requirement that the building either be elevated, flood-proofed, or relocated out of the floodplain. The owner should be told that this is a mitigation measure intended to prevent future flood damage.

The office should advise the owner about possible sources of financial assistance and whether the community is interested in acquisition of damaged properties.

G.4.3.5 Reconstruction Moratorium

In an area where there is a concentration of destroyed or substantially damaged buildings, the community should consider a moratorium on repair permits. A moratorium would give mitigation planners time to consider whether the area should be purchased and cleared - in which case, all reconstruction should be prohibited. The mitigation coordinator must alert the code enforcement office if a moratorium is possible.

G.4.4 Substantially Damaged Buildings

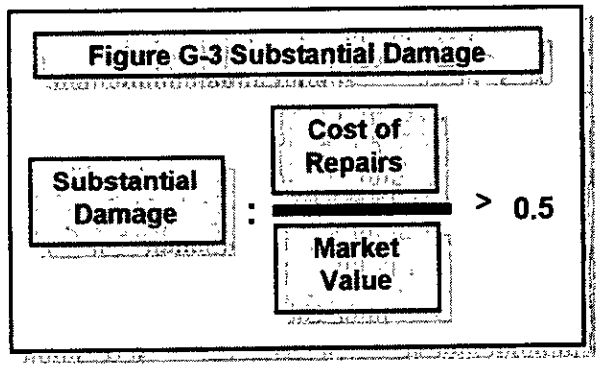
The code enforcement office must determine if flooded buildings were substantially damaged. This is an important part of the community's obligation to enforce the NFIP regulatory requirements. This also can have a significant impact on the property. Owners will view it either as a mitigation opportunity or a major obstacle to getting back to normal. It is therefore very important that the code enforcement office knows the requirements, enforce them, and work closely with the property owners to minimize the adverse impacts and maximize mitigation opportunities and financial assistance.

G.4.4.1 The Requirement

If a building has been damaged so that the actual cost of repairing it equals or exceeds 50% of the building's pre-flood market value, then it is substantially damaged. Substantial damage is a form of substantial improvement. ***"Substantial improvement"*** is defined in the definition section of this plan. The community's ordinance (and federal regulations) treats a substantially damaged building or a substantial improvement the same as construction of a new building.

G.4.4.2 Regulatory Impact

If a building is judged to be substantially damaged,



then:

- A substantially damaged residential building must be elevated above the flood protection elevation or relocated out of the floodplain.
- A substantially damaged nonresidential building must be elevated, relocated out of the floodplain, or dry flood-proofed.

These regulations affect community-owned buildings as well as private property, even if community construction projects do not normally apply for building permits.

Officially designated historic structures can be exempted from this requirement, although some mitigation measures may still be required.

Many communities (City of Fort Collins) have requirements that are more restrictive than these minimums. For example, some allow only demolition or relocation of substantially damaged buildings in the floodway.

G.4.4.3 Flood Insurance Impact

Most buildings in Colorado floodplains are "pre-FIRM," that is; they were constructed before the mid-1970's when most Flood Rate Maps (FIRM) were published. Therefore, most flood-prone buildings are benefiting from the federally backed pre-FIRM flood insurance

rates.

New, or **"Post-FIRM,"** buildings must be constructed in accordance with the NFIP flood protection requirements. They are subject to actuarial flood insurance rates that are based on the exposure to flood damage. Post-FIRM rates for buildings protected from flood damage are actually lower than pre-FIRM rates.

A substantially damaged building is treated as a new building for flood insurance rating purposes. Its flood insurance premium is therefore based on post-FIRM rates. If the building is elevated, the premium will be lower than for a pre-FIRM building.

If a substantially damaged building is not elevated, the actuarial post-FIRM premium can **be *several thousand dollars per year***. Therefore, it is to the owner's financial benefit to meet the substantial damage reconstruction requirements of the community's ordinance.

G.4.4.4 Identifying Possible Substantial Damage

The building condition assessment discussed in above identified whether a building is obviously or possible substantially damaged. The last category - ***"possibly substantially damaged"*** - is the hardest one to deal with, especially where slow-moving floodwaters can leave many buildings in this condition. Three guidelines can be followed to identify buildings that may be substantially damaged:

- Structural damage, such as a collapsed basement wall or signs that the structure has shifted on its foundation,
- Signs of concurrent damage, such as that from a fire, or
- A high water line more than 3 feet over the first floor.

G.4.4.5 Determining Substantial Damage

The windshield survey or building condition assessment provides only an indication of the potential for substantial damage. Declaring a building substantially damaged is the job of the code enforcement office. Only after the cost of repairs has been compared with the pre-flood market value of the building can such a declaration be made. A simple formula explains the relation:

The code enforcement office must divide the cost of repairs and by the building's pre-flood market value. If the result is greater than or equal to *0.5,* then the building has been substantially damaged. Obtaining accurate values for these two variables is very important. It is also the most difficult part of regulating reconstruction in the floodplain after a disaster.

G.4.4.6 Cost of Repairs

The cost of repairs must be the "true cost" of returning the building to its pre-damage condition, based on the prevailing construction wages for the area. Because the requirement is based on this true cost, the rules must be met irrespective of the eventual actual cost to the owner. A licensed contractor should provide a repair estimate, even if the owner or someone else will do much of the work. Care should be taken to ensure that the contractor is not providing an estimate below the true cost in order to get the job. The estimate should be checked against published or locally available construction costs. The cost of repairs does not need to include architectural fees or estimating; clean up or debris removal; repairs to carpeting (unless over an unfinished floor), plug-in appliances, and other items not part of the building's structure; and repairs to detached structures, fences, sidewalks, and swimming pools.

G.4.4.7 Market Value

The market value is the value of the building in its pre-flood condition. The value of the lot, landscaping, swimming pools, other site improvements, and detached buildings are not included. There are three common sources for the pre-flood market value of a damaged building:

1. The tax assessor's office will have a record of the building's market value.
2. The code enforcement office may estimate the market value, if the staff is qualified and agrees to make the determination.
3. A professional appraiser can make an independent appraisal.

The most common approach is to use tax records. The applicant may contest the tax appraiser's valuation, or figures supplied by the community, by submitting an appraisal prepared by a professional appraiser.

G.4.4.8 Records

The code enforcement office should develop permit application forms that record the full cost of repairs and the market value. These forms are permit records and should be kept in the permanent file for the permit They should not be confused with damage survey forms or building condition assessment notes which are not part of a permit's legal record.

G.4.4.9 Historic Buildings

NFIP regulations (and therefore most ordinances) allow communities to issue variances to exempt certain historic structures from the substantial improvement (substantial damage requirement. Most ordinances

quote the NFIP regulations, which limit the exemption to buildings on the National Register of Historic Places or the ***"Colorado Inventory of Historic Places."*** This exemption is limited to the substantial damage requirement. Each building must be evaluated individually. A variance may only be granted if it proves necessary. It must be limited to the minimum exception needed to maintain me historical integrity of the building. The exemption does not relieve the property from meeting other floodplain regulations, nor does it mean that owners of historic buildings should ignore the opportunity to implement property protection measures during repair and reconstruction after a flood. The community should still require mitigation measures that will not affect the historical integrity of the structure.

G.5 Post-Flood Mitigation Planning

The first task after a flood is to ensure that the flooded area, and the buildings in it, is safe to enter. Repairs and reconstruction can begin after the needed permits are obtained, property protection measures are explained and encouraged, and substantially damaged buildings are tentatively identified for acquisition. Once these immediate concerns are satisfied, the community can devote time to longer-range mitigation activities. At this point, the mitigation coordinator can begin to undertake the job's third responsibility: prepare a mitigation plan to coordinate future efforts and identity needs for post-disaster funding.

G.5.1 The Planning Process

The local mitigation planning effort should be coordinated with FEMA, OEM, and the Colorado Water Conservation Board. After the Presidential disaster declaration, the Interagency Hazard Mitigation Team visited the impacted communities to assess mitigation opportunities *(see **Chapter 4**)*. In the best situation, the community already will have prepared a pre-flood mitigation plan with a post-flood section. If the mitigation coordinator has proposals ready when state and federal people come to town, they should be able to advise the coordinator as to how feasible the ideas are, and whether funds or assistance are likely to be provided under their programs.

G.5.1.1 Area Flooded

Attention will likely focus on the flooded area, which may not include all of the community's floodplains and therefore may not encompass all of the potential sources of flooding. For this reason, the planners need to be careful that the recommended measures are not limited to protecting property only to the level of the last flood unless it was found to be greater than the base (100-year) flood.

G.5.1.2 Funding Support

Attentions will likely focus on mitigation measures eligible for funding support from FEMA or other outside sources. The big-ticket item attracting the most interest may be an acquisition program funded by a hazard mitigation grant however; a good plan should still address all feasible mitigation measures, particularly those that would help properties not in the acquisition area.

G.5.1.3 Time Constraints

A post-flood mitigation plan needs to be prepared quickly in order to take advantage of the window of opportunity that the flood has presented and to settle any uncertain-ties residents may have about their future (e.g., should they repair or sell and leave?).

Some preliminary ideas should be ready in time for presentation to the Interagency Hazard Mitigation Team and state mitigation planning staff. The plan itself should be drafted within two to three weeks. Do not delay the planning effort in order to obtain detailed data; an adequate plan can be based on generalized information. Enact a temporary moratorium on reconstruction in areas most likely to be acquired. Design the plan to address overall issues and make general recommendations. For example, it might recommend that additional studies be conducted before finalizing some projects.

G.5.2 Mitigation Opportunities

Hazard mitigation planners must view mitigation in the broadest sense; it is not limited to private buildings or city-owned facilities. There are three kinds of opportunities that may arise:

1. Acquiring and clearing destroyed or substantially damaged buildings,
2. Incorporating property protection measures during repairs and reconstruction, and
3. Implementing mitigation measures after reconstruction.

G.5.2.1 Acquisition Sites

The building condition assessment should provide an early indication of whether damage was severe enough to warrant clearing out an area. Places to consider for acquisition are:

- High damage areas, such as floodways,
- Pre-FIRM structures buildings not built to flood protection standards),
- Non-conforming uses that the community wants eliminated, and

- Sites contiguous to parks and open space that are appropriate for expansion of public property.

Where possible, the community should have such sites already identified in its pre-flood plan. Or, it may want to designate a potential acquisition area in its comprehensive plan. The community could purchase properties as they come up for sale, rather than wait for a flood to cause damage and suffering to the occupants.

Because acquisition and relocation has such a major impact on the targeted residents, they should be involved in the deliberations, or at least kept fully informed of them. One of the best ways to do this is through the mitigation planning committee. A decision needs to be reached quickly so people aren't kept in temporary housing for months while they wait to find out whether they can keep their homes.

G.5.2.2 Reconstruction Opportunities

Property protection measures should be implemented in buildings not slated to be acquired. For example, a substantially damaged house will stall have to be elevated. If the foundation was damaged, it may have to be lifted up anyway to make repairs. Wet flood-proofing is another measure to incorporate during reconstruction. Wet flood-proofing measures are outlines in Appendix F.

G.5.2.3 After Reconstruction

Many voluntary mitigation measures can be implemented at any time (see ***Appendix F***). For example, constructing barriers and installing some dry flood-proofing measures (other than those required by code) can be done after the building is rebuilt. Major public facilities, such as bridges, will take a long time to rebuild. Before their plans are finalized, the post-flood planning effort should identify appropriate mitigation measures. Such projects could be eligible for funding by disaster assistance.

G.5.2.4 Reconstruction Moratorium

If damage is widespread, and many buildings are likely to be declared substantially damaged, then the opportunities for mitigation projects (and the building officials' workloads) increase. Rather than deal with each building individually, the community may want to clear out one or more blocks of damaged buildings. Because this will involve preparation of a mitigation plan, a reconstruction moratorium may be needed. A moratorium would stop all repairs in a designated area whose borders would be delineated based on the findings of the building condition assessment.

The moratorium can be lifted when the mitigation plan concludes that reconstruction can proceed. To shorten it' the community could prepare an interim mitigation plan that focuses only on the issue of reconstruction in the affected area. When the community concludes what is best for the future of the area, the moratorium can be lifted or (if the plan concludes that the area should be acquired) extended.

Once the moratorium is lifted, property owners would still need to apply for building permits. Since the area was considered to be substantially damaged, each permit applicant would have to provide the information needed to determine if his or her building was substantially damaged.

G.5.2.5 Coordination

One of the benefits of the flood-opened window of opportunity is that many agencies will be in town wanting to help with technical and financial assistance. The Interagency Hazard Mitigation Team is a good starting point to identify these agencies and learn about how they can help.

G.5.2.6 Adoption and Implementation

The post-flood plan document should look the same as a pre-flood plan, unless the community wants to separate immediate concerns from long-range projects. Because a post-flood mitigation plan will be in effect as long as a pre-flood plan, the same care and procedures should be followed in getting it adopted and implemented In the pre-flood setting, several weeks could be dedicated to writing and reviewing the plan. But time is of the essence after the disaster; so much less time will be available for public review of the draft plan. The community will have to use its judgement and make a good faith effort to let people review and comment on the plan without taking too much time. The local officials may opt to send a copy of the draft to all affected residents within a reasonable time before it is due to be voted on.

Flood Mitigation in Fort Collins, Colorado

Spring Creek Improvements

Since 1989, over $5 million was spent on improvements to Spring Creek. These projects included acquisition and relocation of structures; channelization to remove pre-FIRM properties from the floodplain; storm drainage improvements, reinforcement of the Burlington-Northern Railroad embankment, and bridge improvements. Approximately 86 structures were removed from the 100-year floodplain, including approximately 41 that were acquired by the city.

List of Acquired Structures

- 30 mobile homes in the area that is now Creekside Park (adjacent to the devastated Johnson Mobile Home Park). These structures were in a very high hazard portion of the Spring Creek floodplain.
- 9 residential homes
- 1 retirement home that could have housed more than 15 people - This would be considered a "critical facility" according to the revised 1995 City Code.
- 1 business, a Kentucky Fried Chicken, located along College Avenue in the area that is now Creekside Park.

Possible Lives Saved Because of Acquisition

- **Mobile Homes** - assume 2 people to a mobile home 2 X 30 = 60
- **Residential Structures** - assume 2 people per home 2 X 9 = 18
- **Retirement Home** - 15 residents = 15
- **Business** - assume 3 workers and 2 customers = 5

TOTAL 98 lives saved

Higher Regulatory Standards

- Class 6 rating Community Rating System (CRS) October 1996, entered into CRS in 1990
- Administer floodplain regulations for all floodplains within the city, including those not studied in detail by the Federal Emergency Management Agency (FEMA), to standards exceeding those of the National Flood Insurance Program (NFIP) minimum requirements. For example, hydrology standards are based on fully developed conditions instead of existing conditions, the floodway standard is more restrictive with a 0.5 foot rise instead of a 1.0 foot rise, and on one stream the floodplain is administered as the floodway.
- Maintain higher regulatory standards for Freeboard, Cumulative Substantial Improvements, Lower Substantial Improvements Threshold, Protection of Critical Facilities
- Maintain Floodplain Use Permits, Floodproofing Certificates, and Elevation Certificates

Outreach Activities

- Residents in or near the floodplain receive floodplain brochures in the mail each year. These brochures discuss the local flood hazard, safety, property protection, flood insurance, etc. These were mailed in May of 1997.
- Flood Awareness Week - In the spring of each year, City Council proclaims one week as "Flood Awareness Week." Activities include newspaper articles and booths at City Hall and the public library with informational brochures. The 1997 Flood Awareness Week was held May 12-18.
- A mailing is sent to all city residents in their utility bills with a flood-related article at least annually. The topic of the May 1997 mailer was Flood Safety.
- FEMA's "Best Build" video and a local floodplain video are telecast on the local cable channel annually. These are shown in conjunction with Flood Awareness Week.
- A mailing to the members of the Board of Realtors publicizing the map information services provided by the city (e.g., map determinations, elevation data).
- In addition, the City offers training classes to local Realtors on how to read Flood Insurance Maps because the realtors are required to determine if the property is in a floodplain before it is listed.
- Flood safety section published in the Yellow Pages.
- "City Line" phone system with flood safety and hazard information recordings.
- Educational programs for schools.
- Informational brochures are available at the stormwater Utility Office.
- The city provides flood assistance site visits to advise property owners of mitigation and property protection measures.
- A flood resource collection was established at the public library.

Open Space

- Of the approximately 2,823 acres of floodplain in the City of Ft. Collins (including both FEMA regulatory floodplains and locally designated floodplains), approximately 958 acres are preserved as Open Space. More Open Space is continually being acquired.
- On Spring Creek, there are 313 acres of floodplain and 97 acres are open space. This includes several parks and a bike trail along the entire length of the stream.

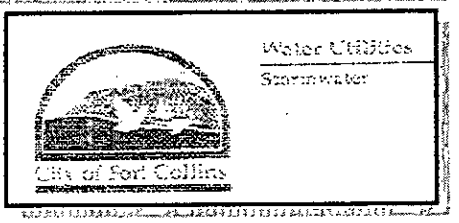


Figure G- 4

The National Flood Insurance Program's Community Rating System in Colorado Status (as of December 16, 1997)

Community	Initial Year	Class	Modification Year	Class	Cycle Year	Class
Adams County	1992	9			1997	Pending
Alamosa	1990	9			1995	9
Alamosa County	1995	9				
Arapahoe County	1990	9	1992	8	1995	8
Archuleta County	1991	9			1996	
Arvada	1990	9			1995	7
Aurora	1991	9			1996	8
Boulder	1991	9			1996	8
Boulder County	1990	9			1995	8
Brush	1993	9				
Canon City	1991	9			1996	9
Cherry Hills Vlg	1995	9			1996	9
Colorado Springs	1991	9			1996	9
Delta	1995	9			1996	8
Denver	1995	9				
Douglas County	1995	9				
Durango	1991	9			1996	9
El Paso County	1991	9			1996	9
Englewood	1994	9	1996	8		
Fort Collins	1991	9	1993	8	1996	6
Fountain	1991	9	1996	9		
Fremont County	1992	9			1997	Pending
Frisco	1992	9			1997	Pending
Golden	1995	9			1996	9
Gunnison	1994	9				
Gunnison County	1993	9				
Lakewood	1990	9			1995	7
Larimer County	1991	9			1996	10
Littleton	1991	9			1996	7
Longmont	1991	9			1996	8
Louisville	1990	9			1995	9
Manitou Springs	1991	9			1996	9
Morrison	1995	9				
Parker	1991	9			1996	7
Pitkin County	1991	9			1996	8
Rio Grande County	1991	9			1996	10
Sheridan	1992	9			1997	Pending
Silverthorne	1995	9				
Steamboat Springs	1991	9			1997	Pending
Telluride	1993	9				
Thornton	1993	9				
Vail	1990	9			1995	8
Westminster	1990	9			1995	8
Wheat Ridge	1990	9			1995	7

Figure G-5

The National Flood Insurance Program's Community Rating System

How the Community Rating System Works

Every year, flooding causes hundreds of millions of dollars worth of damage to homes and businesses around the country. Standard homeowners and commercial property policies do not cover flood losses. So, to meet the need for this vital coverage, the Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP).

The NFIP offers reasonably priced flood insurance in communities that comply with minimum standards for floodplain management. The NFIP's Community Rating System (CRS) recognizes community efforts beyond those minimum standards by reducing flood insurance premiums for the community's property owners. Discounts range from 5 percent up to 45 percent. The discounts provide an incentive for new flood protection activities that can help save lives and property in the event of a flood.

You're probably already doing many of the CRS activities. To get credit, community officials will need to prepare an application documenting the efforts. The CRS assigns credit points for each activity. Based on the total number of points your community earns, the CRS assigns you to one of 10 classes. Your discount on flood insurance is based on your class.

What You Can Do to Get Credit

The CRS grants credit for 18 different activities that fall into four series. Here's a brief description of the series:

Public information

This series includes six activities that advise people about the flood hazard, flood insurance, and ways to reduce flood damage. One popular activity is maintaining a collection of flood related materials at the local library.

Mapping and Regulations

This series, with five activities, consists of programs that ovide increased protection to new development. One activity is maintaining open space in the floodplain.

Flood Damage Reduction

This series has four activities that reduce flood risk to existing development. Maintaining the drainage systems in your community is one important activity.

Flood Preparedness

This series has three activities, including flood warning, levee safety, and dam safety projects. Many communities can get credit for programs that a state or regional agency implements on behalf of its communities. When you're deciding what flood protection activities to implement, CRS credit will be only part of the decision-making process. You should evaluate all your activities for their ability to increase public safety, reduce property damage, avoid economic disruption and loss, and protect the environment.

How to Apply

Participation in the CRS is voluntary. If your community is in full compliance with the rules and regulations of the NFIP, you may apply. There's no application fee, and all CRS publications are free. Your community's chief executive officer (that is, your mayor, city manager, or other top official) must appoint a CRS coordinator to handle the application work and serve as the liaison between the community and FEMA. The coordinator should know the operations of all departments that deal with floodplain management and public information. And the coordinator should be able to speak for your community's chief executive officer.

Figure G-6