FLOOD HAZARD MITIGATION PLAN
FOR COLORADO

Prepared Pursuant to
Section 406, PL 93-288
and the
Federal/State Agreement (FEMA 665-DR-CO)

Prepared by the
Colorado Water Conservation Board
Department of Natural Resources
in Cooperation with
The Division of Disaster Emergency Services

January 1983

STATE OF COLORADO

EXECUTIVE CHAMBERS
136 State Capitol
Denver, Colorado 80203
Phone (303) 866-2471

Richard D. Lamm
Governor

January 14, 1983

Mr. Alton D. Cook
Regional Director, Region VIII
Federal Emergency Management Agency
Denver Federal Center, Building 710
Denver, Colorado 80225

Dear Mr. Cook:

It is my pleasure to transmit to you this Flood Hazard Mitigation Plan prepared by the State of Colorado. On July 27, 1982, after the Lawn Lake dam failure, a federal/state agreement was negotiated pursuant to the President's Major Disaster Declaration Number FEMA-665-DR for Larimer County dated July 22, 1982. A major responsibility accepted by the state under Paragraph 7 of the agreement was the preparation and submission of a hazard mitigation plan to the FEMA Regional Director not later than 180 days following the President's declaration.

Considering the cause and nature of the damage, the Department of Natural Resources was identified as the appropriate state agency to meet this obligation. Responsibility for setting up a task force to prepare the report was assigned to the Water Conservation Board. This is the division of state government which is most familiar with floodplain management concepts and which functions as the state coordinator to the National Flood Insurance Program.

The report was written by a steering committee consisting of the State Hazard Mitigation Coordinator from the Department of Natural Resources and the State Coordinating Officer from the Division of Disaster Emergency Services and their respective staffs. The steering committee members prepared the body of the report and arrived at a series of conclusions and recommendations that represent their best judgment of the most attractive flood hazard mitigation measures.

The writers of the report were assisted by an interagency task force organized by the State Hazard Mitigation Coordinator to assure sufficient input from the several state and local government agencies which initially appeared to have potential opportunities for flood hazard mitigation.

The report will be a most useful tool in formulating Colorado's budgetary and policy positions regarding flood hazard mitigation. Within 90 days following your review and concurrence, we will hold the first of a series of meetings to establish and carry out the implementation process. These periodic meetings will then form the basis of a state management system for mitigation of flooding and other major hazards that face Coloradans now and in the future.

Sincerely,

Richard D. Lamm
Governor

Enclosure

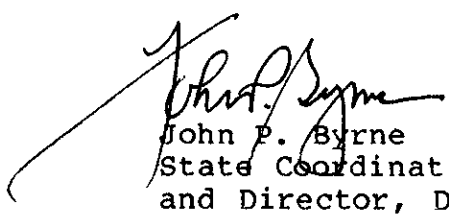
Preface

About 90% of the most catastrophic disasters which occur in the United States involve flooding. Colorado's experience closely parallels this national statistic. Admittedly incomplete records reveal that since the turn of the century several hundred Coloradans have been killed by floods, and property valued in excess of $1.6 billion has been destroyed or damaged.

Flood prone areas have been identified in every county in the State. More than 5% of the population and tens of thousands of residential, commercial and industrial structures valued in excess of $6 billion are in these areas. Several counties per year will experience flooding because of acts of nature or failure of man-made structures. Since 1965 eight flood events have been sufficiently catastrophic in scale to result in Presidential major disaster declarations. The Lawn Lake Dam failure flood is the second man-caused event to result in a Presidential declaration during the same period.

Clearly the threat of flood-related disasters justifies major preparedness, response and recovery planning efforts on the part of the State and local jurisdictions. Public safety responsibilities demand this. However, the most cost-effective approach to emergency management is mitigation--in this case efforts to reduce the occurrence of floods or the exposure of people and property should they occur. To that end this Flood Hazard Mitigation Plan for Colorado has been prepared.

The Plan identifies opportunities and plans of action which can lead to avoidance of flood disaster costs. A management system to ensure continued high visibility of these proposals is included. Cooperative effort by the executive and legislative branches of the State government, local jurisdictions, and Federal agencies will be required to guide the development of this public policy initiative and to provide the resources to implement it. The payoff in terms of increased security for Coloradans and lowered economic costs of flood disasters will be high.



John P. Byrne
State Coordinating Officer, Lawn Lake Disaster
and Director, Division of Disaster Emergency Services

Acknowledgements

The following individuals, representing state agencies and local governments, participated on the task force that helped prepare this report. Considering the time constraints, task force members were especially cooperative, offering many helpful suggestions and critically reviewing the draft report.

Town of Estes Park

Bob Kistner ..... Disaster Recovery Manager
Richard Widmer ..... Director of Public Works

Larimer County

Rex Burns ..... Planning Department
Bill Gordon ..... Emergency Management

State of Colorado

Hal Simpson ..... Division of Water Resources
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Rick Storm ..... Division of Parks & Outdoor Recreation
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Jerry Whittacher ..... Division of Wildlife
Dave Shelton ..... Division of Mined Land Reclamation
William P. Stanton ..... Colorado Water Conservation Board
Brian Hyde ..... Colorado Water Conservation Board
John P. Byrne..... Division of Disaster Emergency Services
Jack Truby ..... Division of Disaster Emergency Services
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Dwight Bower ..... Department of Highways
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Albert Chotvacs ..... Department of Highways
Lee Thielan ..... Department of Health
Stu Asay ..... Water Quality Control Division
Ross Fraser ..... Division of Local Government
Dave Winfrey ..... Department of Institutions

The following individuals of the federal government provided general information useful in the preparation of this plan:

Robert Ives, Jr.	Federal Emergency Management Agency
Bill Callahan	Federal Emergency Management Agency
Jerry Olson	Federal Emergency Management Agency
Virginia Motoyama	Federal Emergency Management Agency
Wayne Graham	U.S. Bureau of Reclamation
Bob Jarrett	U.S. Geological Survey
Larry Tunnel	National Oceanic and Atmospheric Administration

This is the first time a flood hazard mitigation plan has been prepared for Colorado. For this reason, it was necessary to review and include a considerable amount of background material at a high level of detail. It is hoped that this foundation will form the basis of mutual understanding among concerned state agencies.

Floods will continue to happen in Colorado. Following the next major flood declared a disaster by the President, it can be expected that the federal government will appropriately require that this plan be revised as a condition of receiving federal assistance. The preparation or revision of any plan involving many state agencies with diverse objectives will require close coordination. The imagination and exchange of ideas among task force members works best in an atmosphere of creativity. It is hoped that in screening the ideas and editing contributions to this plan, I have not made too many omissions.

Floodplain management in Colorado has made tremendous progress in the last decade. But we are now at a turning point. Recent changes in federal policy have made it clear that financial assistance for disaster recovery will diminish and state governments will be required to bear a much larger share of the burden for such efforts. At the same time, many states, including Colorado, are experiencing a severe budget crisis. The success and future of flood hazard mitigation will depend on how well policy and budget decision-makers preceive that implementation of the recommendations in this plan will actually reduce flood damages.

William P. Stanton

William P. Stanton, P. E.
State Hazard Mitigation Coordinator
and Task Force Chairman

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Executive Summary

On July 15, 1982, the dam for a privately owned reservoir known as Lawn Lake located in Rocky Mountain National Park failed and released approximately 800 acre-feet of water down Roaring River, Fall River, and the Big Thompson River. Flood waters ripped through the National Park, Larimer County, and the Town of Estes Park at depths of 10 to 12 feet which were 2.5 times the estimated depth of a 500-year flood. Lake Estes, located on the Big Thompson River just below the town, rose 2.0 feet and prevented any further damages to canyon residents.

Three persons were killed and one is still missing. Damages initially estimated at $21 million, were revised to about $31 million. This event is the fifth most severe flood in Colorado recorded history. On July 22, 1982, the President issued a Major Disaster Declaration for Larimer County.

In the past 20 years, there have been a total of eight presidential major disaster declarations due to flooding in Colorado. The Lawn Lake incident is only the second time a flood due to dam failure in Colorado has been declared a major disaster by the President. In 1973, the Lower Latham Reservoir dam in Weld County failed and caused major flood damages in the Town of Kersey.

There are 120 federal and 2,129 non-federal dams, or a total of 2,249 high, moderate, and low hazard dams in the State of Colorado. Since 1890, there have been at least 130 known dam failures in Colorado. The recent Lawn Lake flood was not the first time a dam failure flood had impacted the Estes Park area. On May 25, 1951, Lilly Lake Dam on Fish Creek, a tributary of Lake Estes, failed and caused considerable damage.

Between 20 and 30 major floods occur somewhere in Colorado every year. The largest number of people killed in a single flood event is 139 lives lost during the Big Thompson Canyon flood of July 31, 1976. At least 314 people have been killed from floods since Colorado became a state. The most damaging flood occured in June 1965 when almost $500 million in property was lost in the Denver metropolitan area. Cumulative flood losses since statehood are estimated to be over $1.6 billion dollars at present value.

Floodprone areas have been identified in 212 cities and towns and in all 63 Colorado counties. Approximately 150,000 people, or about 5 percent of the state's permanent population, are now believed to be living in the floodplain. The total value of property exposed to flood hazard is estimated to be over 6 billion dollars. Only about 9 percent of all structures in the floodplain are insured and the amount of coverage is estimated to be only about 7 percent of the value of the exposed property. As the population of the state grows, so grows the potential for higher flood damages.

Numerous state agencies have already developed programs under various authorities that take flood hazard mitigation into consideration. The Division of Water Resources is the principal agency responsible for managing the state's Dam Safety Program. The Colorado Water Conservation Board is responsible for floodplain management at the state level. The Division of Disaster Emergency Services is responsible for coordinating emergency preparedness activities among agencies at all levels of government. The integration of dam safety, floodplain management, and emergency preparedness is important to establishing an effective flood hazard mitigation plan among state and local government agencies. The resolution of critical issues in each of these three aspects will greatly enhance existing mitigation efforts.

The issues relating to dam safety identified and discussed in this plan include the problems of aging dams and their rehabilitation; the classification of dams into high, moderate, and low hazard ratings; the limited state resources to inspect dams on a timely basis; the hydrologic criteria used to design dam spillways; unsafe dams; and the need for improved dam safety legislation.

Critical issues relative to floodplain management include the need to identify the dam failure inundation zone, the effectiveness of the National Flood Insurance Program in Colorado, the demise in the State's floodplain mapping program, the lack of a state program to acquire floodplain lands and the failure of some Colorado communities to satisfactorily enforce floodplain regulations.

In the area of emergency preparedness, critical issues relate to the low public awareness of the general population to flood hazards; the importance of community planning to warn and evacuate people who reside in a a potential inundation zone; the need for new or improved flood warning activity; and the need to better coordinate mitigation activities of various federal, state, local, and private agencies.

A total of 29 recommendations are set forth in the plan to address the three aspects of dam safety, floodplain management, and emergency preparedness. Each recommendation includes a brief statement of the problem, a general statement of the solution, ideas for short and long term initiatives, the lead agency and cooperating agencies if appropriate, and an estimated cost to implement the idea.

The following state agencies have been identified as lead agencies to carry out the indicated number of recommendations: State Engineer (5), Colorado Water Conservation Board (8), Colorado Geological Survey (1), Divsion of Parks and Outdoor Recreation with the Division of Wildlife (5), Division of Disaster Emergency Services (8), Department of Highways (1), and the Department of Institutions (1).

Implementation of the recommendations will not be easy considering limited state and federal financial resources at this time. Even with obvious long term cost effectiveness, many of the ideas recommended to reduce flood damages will still require initial funding. Recommendations that agencies modify existing programs or improve coordination stand the best chance of being implemented first. Funds to implement the more costly items should be sought from the Legislature or the Federal government. Follow-up activities are being planned to allow state agencies to investigate the feasibility of implementing the recommendations and to report on their progress.

". . . During the night I heard what sounded like a freight train and just thought a storm was whipping up and fell back to sleep. . . ."

". . . I awoke and heard a roar. At the time I assumed it was just wind; however, I thought it strange that the tent was not fluttering. . ."

Park visitors from
Wooster, Ohio camped
at Lawn Lake

1.0 INTRODUCTION

1.1 Purposes

The purposes of this Flood Hazard Mitigation Plan are briefly listed below:

- To document the flood and recovery process resulting from the Lawn Lake dam failure.
- To identify general flood hazards in Colorado.
- To identify state and local agencies that are or have the potential to become active in flood hazard mitigation.
- To document existing state programs that relate to flood hazard mitigation.
- To identify and discuss critical issues which if resolved would enhance mitigation efforts.
- To identify opportunities for governmental actions to avoid flood damage from future dam failures.
- To guide the State of Colorado and its local jurisdictions in taking action as may be reasonably expected which will reduce flood damages.

1.2 Scope

The scope of the report is not necessarily limited to the short reach of river between Lawn Lake and Lake Estes but must include all streams in Colorado where there is the potential for such a disaster.

The focus will be on flood caused by dam failure, but floods caused by other more "natural" factors are a significant hazard and must also be addressed. Both short term and long term opportunities for flood hazard mitigation will be considered.

Furthermore, ideas for mitigation measures that go beyond existing federal, state or local funding framework will be encouraged and 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, grasshoppers, and wild fires. Such plans, if necessary, could be developed in the future to supplement this Flood Hazard Mitigation Plan. Future floods in Colorado are inevitable, and this plan should be reviewed and updated as necessary following each major disaster.

The Mitigation Plan is not a manual on what State agencies are to do when the next flood or dam break occurs. Such response procedures are covered in the "Colorado Natural Disaster Emergency Operations Plan" prepared and updated by the Division of Disaster Emergency Services (Reference 12).

1.3 Authority

This 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. That agreement was signed by Governor Lamm 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). Portions of the agreement are included in the Appendix.

The requirement for state governments to prepare a Hazard Mitigation Plan following a Presidential Disaster Declaration is stated in Section 406 of Public Law 93-288, as amended. Details of this law are explained in the Federal Regulations, Title 44 CFR, Part 205, Subpart M-Hazard Mitigation and were published in the Federal Register on Thursday, November 8, 1979.

1.4. 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.

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" (Reference 4). "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" (Reference 1).

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" (Reference 11).

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 (Reference 13).

Emergency Preparedness - A process 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" (Reference 12).

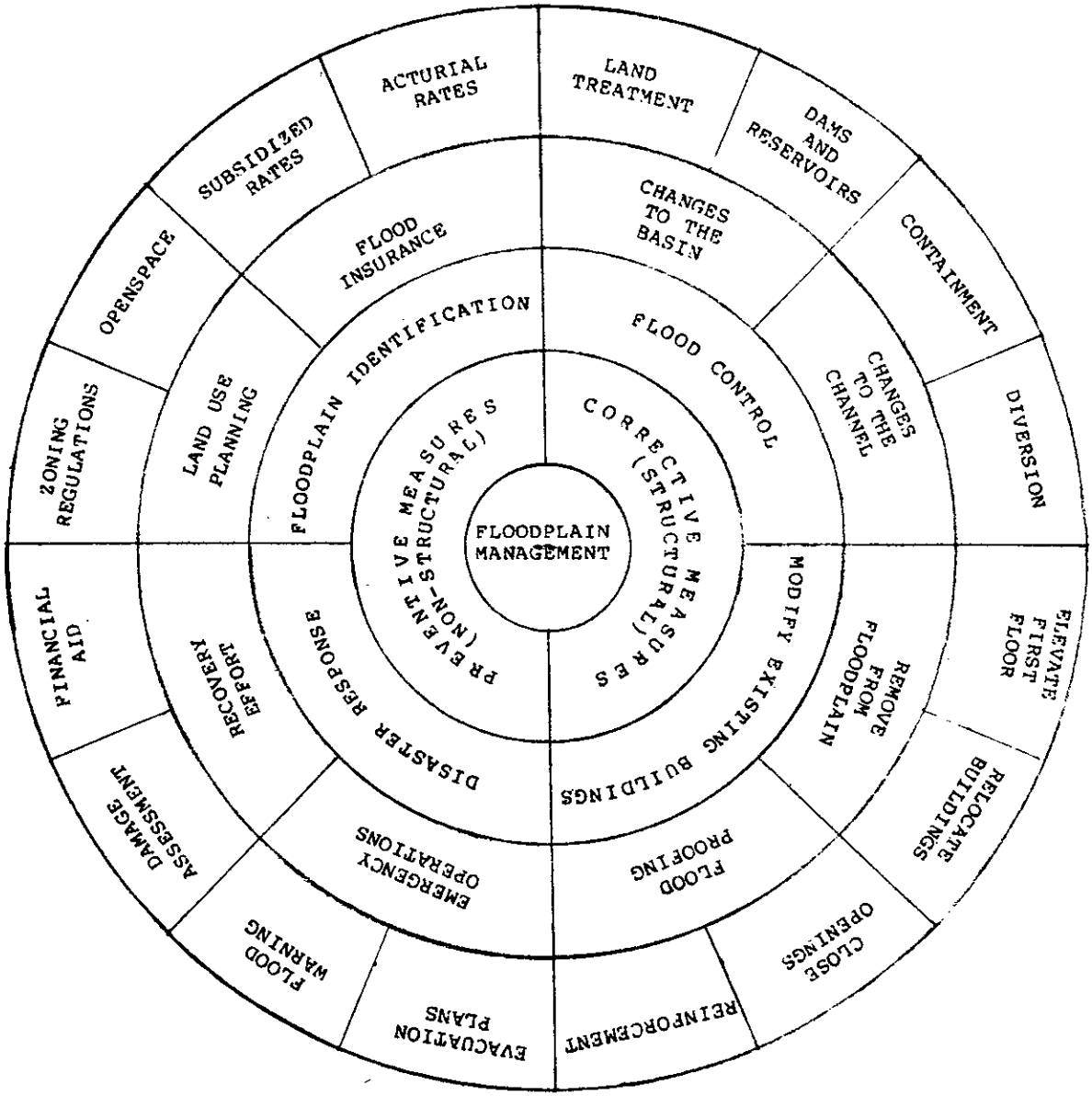


Figure 1.1, Floodplain Management Strategies

1.5 Conceptual Emphasis

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. Some of these strategies utilized by various levels of government and their inherent structural and non-structural differentiation are apparent in figure 1.1. Warnings and land use applicaton, such as flooplain regulations and acquisition of open space, are particularly 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, as depicted in the trends graph, figure 1.2. Note that 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.

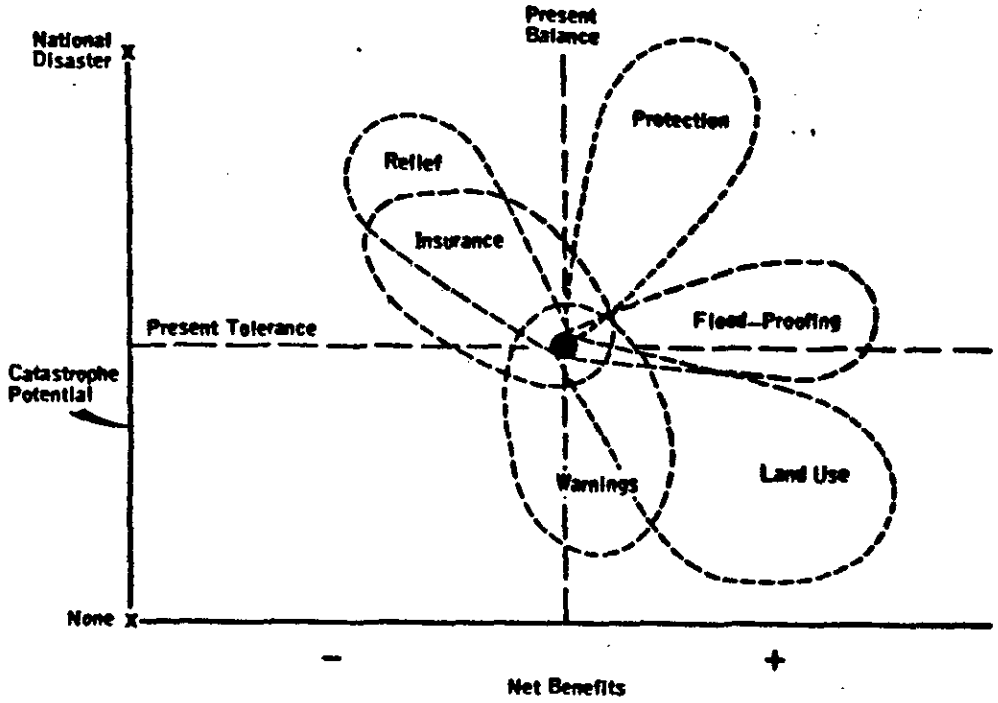


Figure 1.2. Trends and Limits of Adjustments to Floods

From: "Assessment of Research on Natural Hazards," Gilbert F. White and J. Eugene Haas

". . . (I) awoke at 5:50 a.m. and began to hear what sounded like thunder. Then came crashing noises and we all looked out and saw a 25-30 foot wall of water scything through the trees. . . ."

Park Visitor from
Chicago, Illinois
camped at Ypsilon
Creek campsite

2.0 BACKGROUND

2.1 Lawn Lake Dam Failure

Perhaps one of the few positive aspects of the Lawn Lake dam failure is that it occurred in broad daylight. The location and timing of the event have provided a unique opportunity to observe and record flood phenomena and recovery efforts to a degree not normally available during a flood disaster.

2.1.1 Setting

Lawn Lake is a relatively small reservoir situated high (elevation 10,987 feet above mean sea level) in Rocky Mountain National Park, about 10 miles northwest of the Town of Estes Park in Larimer County, Colorado. The lake was formed in a natural depression along the course of the Roaring River carved out by glacial action. Roaring River is a steep mountain tributary of Fall River, which in turn flows into the Big Thompson River within the central business district of the Town of Estes Park. This town is one of Colorado's important tourist attractions, located near the upper entrance to the Big Thompson River Canyon. In 1976, concentrated rainfall in the upper canyon area resulted in a catastrophic flash flood and a disaster to canyon residents living downstream of Estes Park. The setting for the flood is shown in figure 2.1.

In 1902, the natural volume of the Lawn Lake was surveyed and a pipe and control valve were installed through the natural moraine across the outlet. The capacity of the lake was surveyed to be 611.98 acre-feet at that time. Between 1908 and 1910, the capacity of the lake was increased by construction of an earthen dam.

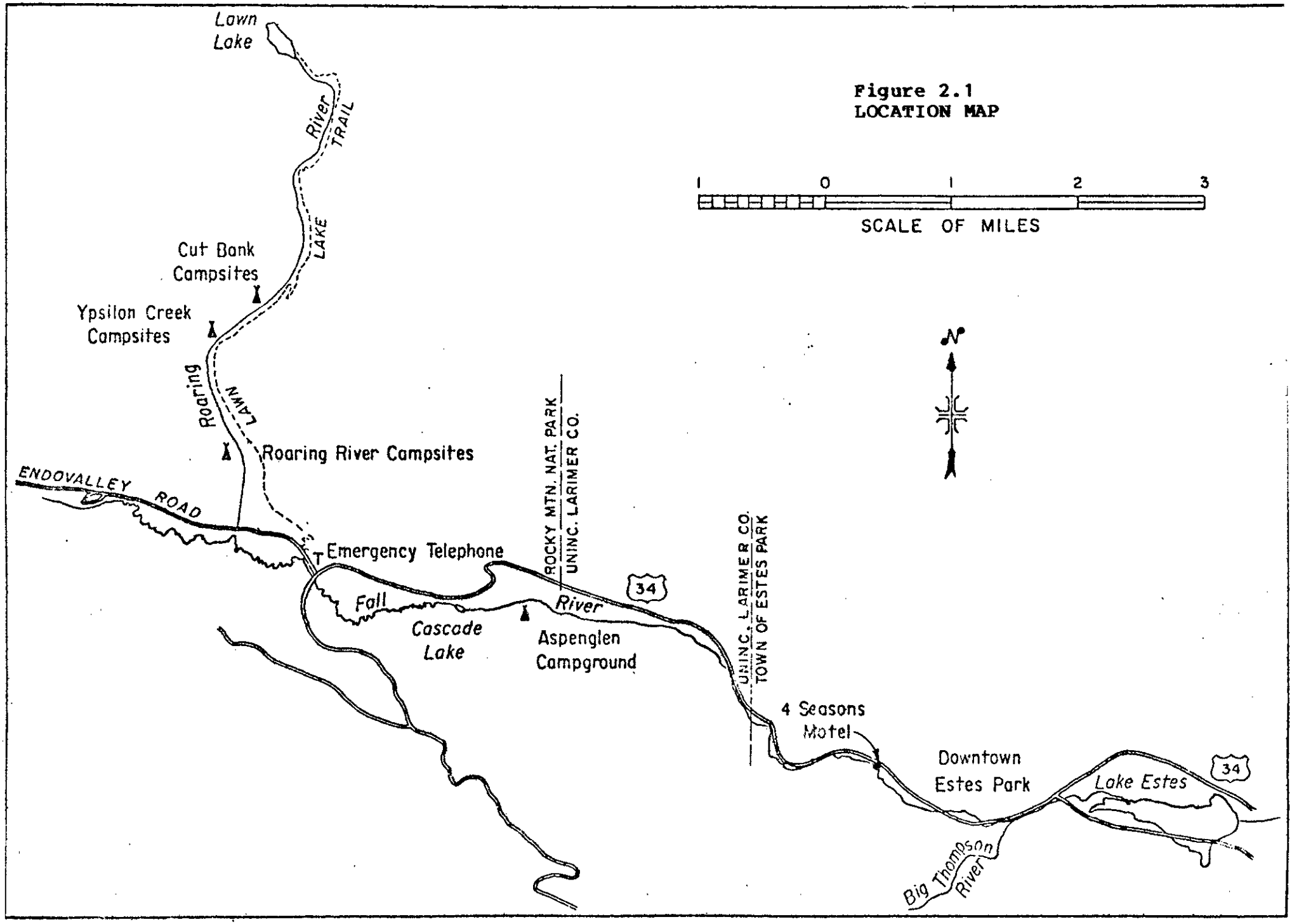


Figure 2.1
LOCATION MAP

The original water right was for storage of 759.6 acre-feet and was decreed on March 18, 1912 to the Farmer's Irrigation Ditch and Reservoir Company of Loveland, Colorado. The water was used for irrigation purposes on the rapidly developing agricultural areas of Larimer County in the South Platte River basin approximately 50 miles downstream.

When Rocky Mountain National Park was established by Congress on January 26, 1915, Lawn Lake, along with several other privately owned dams, was included within its boundaries. In 1946, a new survey showed the capacity of the reservoir to be 817.18 acre-feet.

Approximately eighty years after its construction, at about 5:30 a.m. and only a few minutes before sunrise on the calm and cloudless morning of Thursday, July 15, 1982, the embankment of Lawn Lake was breached. Some people camped near Lawn Lake reported hearing a roar between 2 and 4 a.m. indicating partial failure may have started at that time.

2.1.2 The Flood

It is estimated that the maximum rate of release from the reservoir (peak discharge) was approximately 21,200 cubic feet per second (cfs). All discharges are preliminary estimates by the U.S. Geological Survey based on slope-area measurements. The flood front tumbled down Roaring River (average slope = 0.1029) at about 5.0 miles per hour reaching its confluence with Fall River at Horseshoe Park at about 6:15 a.m. A profile of the flood is shown in figure 2.2. Preliminary flood travel times, a discharge profile, a summary of discharges, discharge frequency curves, and a flood profile are included in the Appendix.

The slope of Fall River through Horseshoe Park is relatively flat (S=0.0047) and the force of the flood was significantly dampened. It is estimated that the flood water reached Highway 34 in Horseshoe Park just after 6:30 a.m. The flood velocity through Horseshoe Park, which was created by a terminal moraine during the glacial period, was reduced to less than 3.0 miles per hour.

At about 7:15 a.m., the front of the flood arrived at Cascade Lake, located at the outlet of Horseshoe Park. The peak rate of flow into Cascade Lake is estimated to have been about 7,210 cfs.

Cascade Lake was formed by a 24-foot concrete gravity dam and contained approximately 5 acre-feet of live storage. It was built in 1908 and the Town of Estes Park used it to control the intake to the town's hydroelectric plant.

Since Cascade Lake was nearly full, flood waters began to trickle over the top of the dam at about 7:25 a.m. Then, at 7:42 a.m., this dam suddenly failed, releasing water at a peak rate of flow of 13,100 cfs down Fall River.

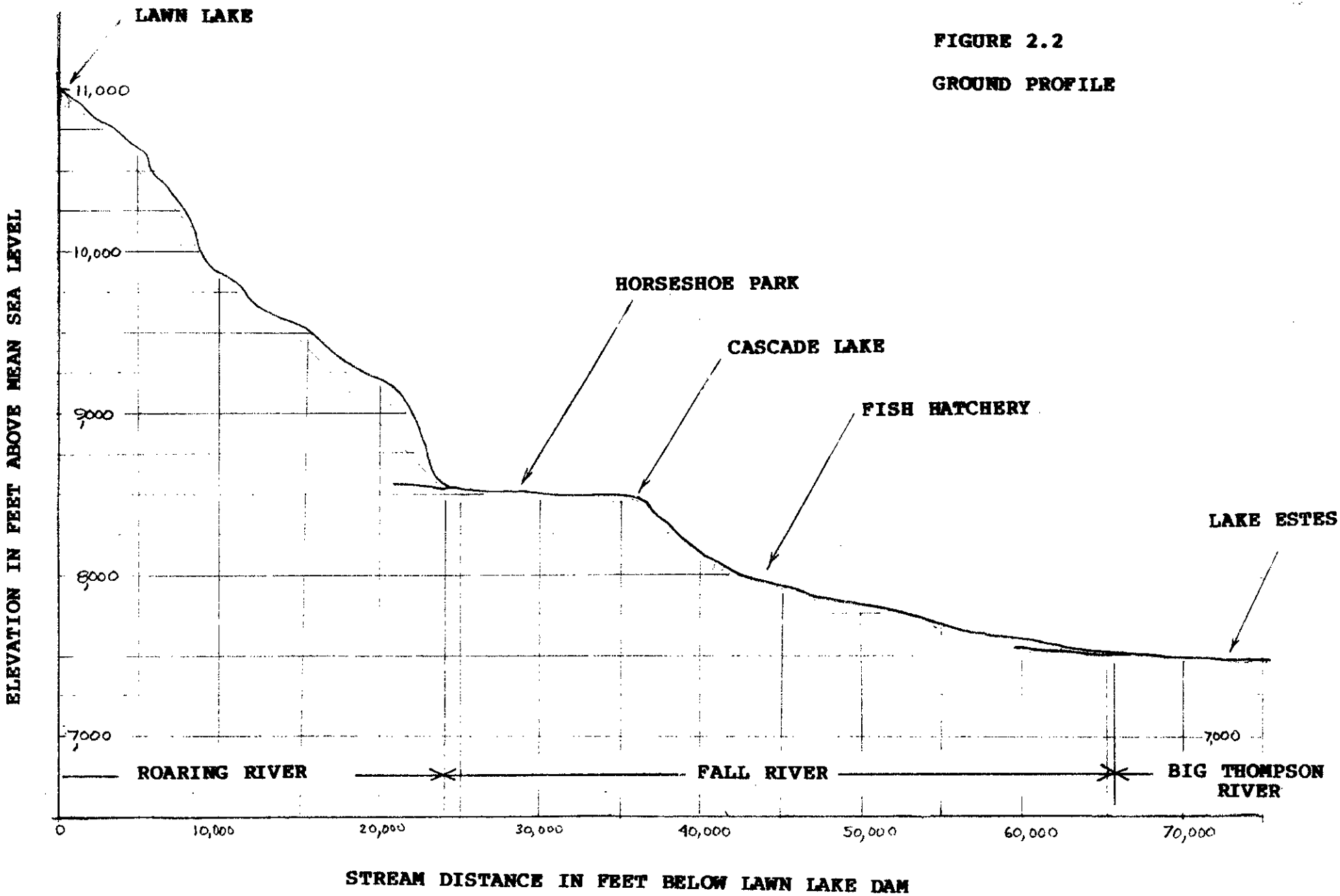


FIGURE 2.2

GROUND PROFILE

The average channel slope below Cascade Lake through Aspenglen Campground was again steep (S=0.0880), and this second surge traveled at about 8.0 miles per hour.

Below the National Park Boundary, the slope of Fall River gradually begins to flatten (S=0.0200), and the flood velocity reduced to about 4.0 miles per hour.

At Estes Park, the estimated rate of flow was 5,500 cfs. Maximum channel flood depths in Fall River were typically 10 to 12 feet or about 2.5 times the average 500-year flood depth estimated in the Flood Insurance Study. In comparison, the 100-year flood discharge for Fall River at Estes Park was computed to be only 680 cfs and the 500-year discharge was only 830 cfs.

After passing through the business district of the town of Estes Park, the flood reached the confluence with the Big Thompson River shortly after 8:30 a.m. The Big Thompson River at this point serves a larger drainage basin, and the channel was slightly better able to convey the flood. The boundaries of the flood are shown in figure 2.3.

The 100- and 500-year discharges for the Big Thompson river at Estes Park were previously calculated to be 1,460 and 1,760 cfs, respectively.

At about 8:47 a.m the flood entered Lake Estes which rose approximately 2.0 feet by 11:00 a.m. but contained the flood. It has been estimated the flood deposited approximately 51,000 tons of debris in the town of Estes Park. Figure 2.4 is an aerial photograph showing the lower reaches of the floodplain.

2.1.3 People at Risk

The number of people at risk in the upper reaches of the Lawn Lake drainage was limited to about 25 to 30 people camped either at Lawn Lake or at other National Park campsites located along the banks of Roaring River.

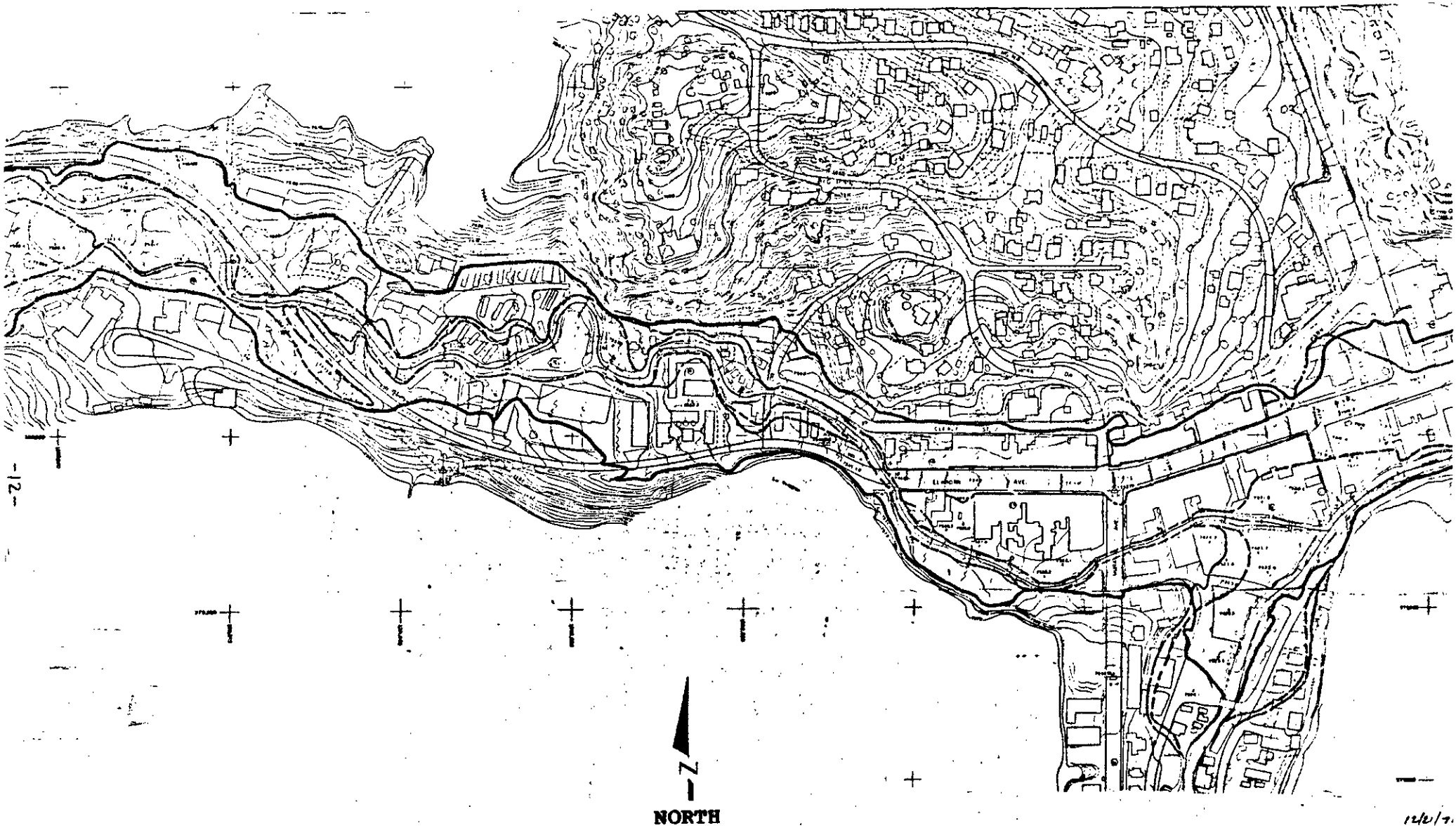
In Horseshoe Park above Cascade Lake there were probably fewer than 20 people at risk.

Approximately 275 people were reported camped in Aspenglen Campground in the early morning hours of July 15.

Downstream from the National Park boundary, however, a few thousand people were at risk as a result of the failure of the Lawn Lake dam and Cascade Lake dam.

FIGURE 2.3

FLOOD BOUNDARIES



NORTH

SCALE: 1 INCH = 400 FEET

2.1.4 The Warning

The first person to give warning was 26 year old Stephen Gillette, an employee for A-1 Trash, which was under contract to the National Park Service. He first sighted the flooding while making a pick up at the Lawn Lake Trailhead in Horseshoe Park, about four and one-half stream miles downstream from Lawn Lake. His prompt reaction was an essential link to the warning process. The A-1 trash collector was familar with the area and knew where to go to call for help.

A knowledgeable observer and an emergency telephone system combined to provide a report of flooding as early as could be conceived with the existing conditions. Had only tourists been in the area, or had the emergency phone not existed, the initial notification to the Park Service Dispatch Center would have been delayed.

Gillette's call to the Park headquarters was received at 6:23 a.m., and in the next 15 minutes at least six rangers or other Park Service officials were contacted. In the same period, the Estes Park Police Department was notified, which in turn alerted the Larimer County Sheriff's Department and the Colorado State Patrol to the emergency.

The police department was called again at 6:43 a.m. to be told, "It's going to go over the (Cascade Lake) dam when it hits down here." A park ranger began notifying campers in the walk-in sites at Aspenglen Campground of the danger at 6:50 a.m. By 7:12 a.m. the walk-in sites had been notified, but when one foot of water was observed flowing over the top of Cascade Lake dam a decision was made to evacuate the Aspenglen campground. However, a flooded access road prevented rangers from reaching the campground.

Larimer County law enforcement officals began their alerts between the Park and the city limits at 7 o'clock, and by 7:22, almost everyone between the Park and the city limits had been contacted.

Estes Park police began their warnings at 7:27 a.m., conveying the emergency message to people within 25 to 30 feet (horizontally) of Fall River. After Cascade Lake dam failed, however, the evacuation area was extended to within a 50 foot radius of the river. At that same time, evacuation of downtown Estes Park was ordered.

Figure 2.4, Aerial Photograph looking East towards Estes Park during Flood of July 15, 1982

Evacuation and warning procedures along Fall River in the minutes preceding the arrival of flood water from the Lawn Lake dam break are believed to have been highly effective in reducing the number of fatalities. Local law enforcement officals and radio station KSIR have been credited with saving "possibly hundreds of lives." In general, warning and evacuation messages were widely and adequately disseminated using a multitude of methods.

The success of the warning process following the Lawn Lake and Cascade Lake dam failures can be measured by comparing the ratio of property damage to lives lost with similar events. In general, the higher the ratio the more effective the warning process is believed to have been. In the Big Thompson flood of 1976, 60 percent of the survivors are estimated to have had no warning at all. In that flood, 139 lives were lost, which translates to one life lost per $365,000 in property damage (1981 dollars). The same ratio for the Lawn Lake and Cascade Lake dam failures is $10,200,000 in property damage for each life lost.

Part of the success of the warning process may have been due to the lessons learned by many people in the 1976 Big Thompson disaster. But whatever the measure of success of the warning process for the Lawn Lake dam failure, residents in the path of the flood can be thankful for the following chain of lucky events:

- The dam did not breach 2-3 hours earlier during total darkness
- A person knowledgeable of the area was able to detect the problem and take effective action
- A communication system was available in the National Park
- The local radio station was monitoring the National Park Service radio and took the initiative in spite of the difficulties in coordinating with local law enforcement officials

2.1.5 Loss of Life and Flood Damages

Due to the unique nature of this event, flooding was brief, lasting only a few hours, but it was of unprecedented severity.

Surprisingly few fatalites occurred as a result of the flood. Steven See had little chance to survive the flood because his campsite was located too close to Roaring River. Two other victims--Terry Coates and Briget Dorris--died from flooding in Aspenglen Campground, but both campers had been informed of the flood by other campers. One other person, an unidentified man, is still missing.

The flooding washed away 18 highway bridges, destroyed road systems, inundated 177 businesses (75% of all the town's commercial activity) and 108 private residences. It also destroyed a hydroelectric plant and a fish hatchery. The following table lists facilities and structures damaged by the flood by stream reach and political jurisdiction. An asterisk indicates "critical facilities."

List of Facilities and Structures Damaged in the Flood

Drainage Basin	Political Jurisdiction	Facility or Structure
Roaring River	National Park	Lawn Lake Dam*
		Lawn Lake Trail
		Campsites (4)
		Fall River Road
Fall River	National Park	State Highway Bridge
		Cascade Lake Dam*
		Estes Park Penstock*
		Aspenglen Campground
	Larimer County	Estes Park Power Plant*
		State Fish Hatchery
		3 County Bridges
		1 Sewer Line
		Private Wells
	Town of Estes Park	14 Private Bridges
		Private Wells
		108 Residences & Motels
		177 Businesses
		Sewer Lines
		Water Lines
Big Thompson River	Town of Estes Park	USBR Stream Gage
	Larimer County	Golf Course
		Lake Estes*

Most businesses in the downtown area reported 3 to 4 feet of water in their establishments. The flood occurred during the time of the year that most of the affected businesses depend upon tourism to generate a major portion of their gross yearly income. The Forward Estes Park Foundation, a consortium of local businessmen, estimates that the town receives 47 percent of its annual income between July 15 and September 1.

Fifteen days after the declaration, total dollar losses were estimated by Federal and State recovery officials to be approximately $30.7 million. A breakdown of these damage estimates follows:

Homes and Businesses (including economic losses)	$19,000,000
Agricultural	2,550,000
Public (Federal, State and local)	4,130,000
Rocky Mountain National Park	5,000,000
	$30,680,000

This estimate was almost $10 million higher than the $21 million estimate of three weeks earlier which was the basis for President Reagan to declare the area eligible for Federal disaster relief. Subsequently, the damage estimates have escalated to $4.6 million for the Town of Estes Park alone.

2.1.6 Local and State Agency Response

2.1.6.1 Town of Estes Park

The role of the Town of Estes Park during the recovery from the July 15, 1982 disaster was a working role. Major Harry B. Tregent, Town Manager Dale Hill, and Public Works Director Richard Widmer were key figures in spearheading recovery efforts to assess damages, request assistance, coordinate with state and federal agencies, and expedite a return to normalcy.

2.1.6.2 Larimer County

Roles of the Larimer County agencies in the Estes Park disaster were:

a. The Office of Emergency Management was responsible to the Board of County Commissioners for preparedness, planning, notification, establishment of an emergency management center, and coordination of emergency resource assistance, recovery and rehabilitation measures.

b. The Larimer County Sheriff's department provided for emergency warning, evacuation, search and rescue, law enforcement and command post operations. Health, mental health, and sanitation efforts were conducted by the county Health and Mental Health Departments. Cleanup, landfill, rebuilding and mitigation measures were organized by the Public Works Department. Food, shelter, resettlement, coordination of relief agencies, and individual and family grant programs were administered by the Social Services Department. The County Finance Department also assisted in the recovery effort.

2.1.6.3 Governor's Office

The Governor's Office made the request to the President for a major disaster declaration and managed the state public information program in the Disaster Field Office.

2.1.6.4 Department of Military Affairs

The Department administered the Letter of Credit from the federal government to support financial activities of the State in implementing the Disaster Public Assistance and Individual and Family Grant Programs.

2.1.6.4.1 Colorado Division of Disaster Emergency Services

The recovery activities of the Division of Disaster Emergency Services (DODES) in the Lawn Lake Disaster consisted of:

- Alerting state and federal agencies, as well as key private relief agencies, of the ongoing situation as it developed.
- Developing the situational status and making continual updates and recommendations for state response action to support impacted localities.
- Providing an on site liason representative to coordinate requests for state life saving initial relief resources.
- Coordinating state resources provided for lifesaving and initial relief.
- Coordinating state agency participation in joint federal state local damage assessment effort to determine scope and magnitude of the event.
- Developing the Governor's Request for a Presidential Major Disaster Declaration.
- Organizing, coordinating and managing State Recovery Team activities to insure integration of effort with Federal and Local Government activities and programs.
- Providing personnel to fill three critical leadership management positions in the recovery effort. These are:

  1. State Coordinating Officer
  2. Governor's Authorized Representative (Public Assistance Program Officer)
  3. Individual Assistance Program Officer

- Assisting the Water Conservation Board in the development of the Hazard Mitigation Report and the State Hazard Mitigation Plan.

2.1.6.4.2 Colorado National Guard

The Guard was called in to assist with traffic control, security, and aircraft for aerial reconnaissance of damages.

2.1.6.4.3 Radio Amateur Communication Emergency Services (RACES)

This group provided radio communication links in support of state and local government.

2.1.6.5 Department of Highways

2.1.6.5.1 Division of Highways

Through the Division of Disaster Emergency Services, the Department of Highways participated in the flood relief effort following the Lawn Lake Dam failure and Estes Park disaster of July 15, 1982. The Department's involvement included: traffic control, roadway repairs, debris removal, damage estimates, inspections, and restoration of U.S. Highway 34.

Traffic-control efforts consisted of helping to secure the Estes Park area immediately following the flood. Signs and barricades were established on U.S. 34 and U.S. 36 to keep people out of the damaged portion of town. However, since the disaster occurred at a time of heavy tourist traffic, a route to Rocky Mountain National Park was kept open.

Road repair efforts were begun as soon as heavy equipment could be moved into the area. The first priority was to re-open the major roadways and remove debris which was endangering roads and bridges. Private contractors were brought in to help with this work, and the Department set up a bookkeeping system for all contractors. Some road repair work was performed within Rocky Mountain National Park, and a low-water crossing was provided for a group of 70 people who had been isolated by the flood.

An important administrative task involved the preparation of damage estimates to determine the scope of the disaster in anticipation of a Presidential Major Disaster Declaration. The Department assisted the Federal Highway Administration in estimates for the Federal-Aid Highway System. The same type of assistance was provided through the Federal Emergency Management Agency to the City of Estes Park, Larimer County, and the U.S. Corps of Engineers.

Debris removal throughout the affected area became a major part of the Department's contribution to the recovery effort. In addition to coordination of the the actual clean-up work, the Department administered the contracts with private contractors for debris removal. This was done at the request of Estes Park, Larimer County, and the State Division of Game and Fish. Administration of these contracts included obtaining rights of entry, the writing of specifications, description of the work areas, inspection of work performed, and documentation of payment.

At the time of this report, the Department is administering a $106,579.25 Title 23, Emergency Relief Project for the restoration of U.S. Highway 34 in, and immediately west of, Estes Park. The object of this project is to restore the highway to pre-flood conditions. This work consists of fence removal and replacement, debris removal, slope stabilization, bridge rail repair, and selected highway overlays. If weather conditions are favorable, this work should be completed by early January 1983.

2.1.6.5.2 Colorado State Patrol

The role of the Colorado State Patrol in the Lawn Lake Flood was to provide personnel at the command post to assist in planning and implementing emergency action, assistance with traffic control points, and mobile and portable radio equipment and personnel. Information received though this equipment was disseminated to all governmental agencies and the news media.

2.1.6.6 Department of Natural Resources

2.1.6.6.1 Division of Water Resources (State Engineer)

The State Engineer's Office is responsible for Colorado's Dam Safety Program and as a result of this responsibility was deeply involved in responding to questions from the Governor, legislators, and the media on the Lawn Lake dam failure.

Their office also was responsible for preparing the report on the Lawn Lake dam failure which identified the most probable cause of failure. Their report has required extensive field investigations, technical analyses, and other research to determine the cause of failure.

Their staff also participated in flood damage surveys on Cascade Dam and the town's hydroelectric facility.

Members of the staff have attended several interagency meetings on Lawn Lake dam to coordinate various government activities in response to the failure and resultant flood.

2.1.6.6.2 Colorado Water Conservation Board

The Colorado Water Conservation Board (CWCB) staff provided technical services towards flood documentation and the hazard mitigation effort on both the federal 15-day and state 180-day reports.

a. Documentation

Staff of the Water Conservation Board conducted field reconnaissance of flood high water marks and flood boundaries on July 15 and 16, 1982 for Fall River and Big Thompson River. A water surface profile and flood boundary map has been prepared and compared to the 10-, 50-, 100-, and 500-year flood profiles and flood boundaries in the flood insurance study published by FEMA for the Town of Estes Park. Other documentary efforts include assistance in obtaining aerial photography through the Omaha District of the Army Corps of Engineers, comparison of flood hydrology, estimation of flood volume, and calculation of flood travel times. A photo scrapbook has been compiled, and a slide presentation is being prepared.

b. Hazard Mitigation - 15-Day Report

A member of the staff was designated as the State Hazard Mitigation Coordinator and acted as the State's representative on the federal Interagency/Intergovernmental Hazard Mitigation Team. This team was responsible for preparing the report identifying mitigation opportunities primarily aimed at federal agencies within 15-days following the presidential declaration.

c. Hazard Mitigation - 180-Day Report

The CWCB was identified as the state agency responsible for preparing the state hazard mitigation (406) plan within 180 days following the presidential declaration pursuant to the Federal/State Agreement signed on July 22, 1982. In cooperation with DODES, a task force was set up to provide input for the report. The 180-day report was prepared under the direction of the task force chairman who is a member of the CWCB staff.

2.1.6.6.3 Division of Parks and Outdoor Recreation

The Colorado Division of Parks and Outdoor Recreation received notification of the Lawn Lake Disaster from the Colorado Department of Military Affairs, Division of Disaster Emergency Services. Assistance in inventorying and assessing the property damage incurred by the community within the impact area of the disaster was requested.

Utilizing the Division of Parks and Outdoor Recreation's Disaster Emergency Response operational procedure, the appropriate Division employees were notified and immediately responded to the disaster area. Two Division employees, a Park Manager and a Senior Park Officer, were involved in the inventory and assessment of property damage to recreational resources within the impact area. These recreational resources were under the management of various levels of government: the Rocky Mountain Recreation District, the City of Estes Park, and Larimer County.

Special note was made of those recreational resources damaged where Land and Water Fund Conservation Act of 1965 federal moneys were utilized. By state law, the Division of Parks and Outdoor Recreation is the agency designated and authorized to accept and administer funds provided under the congressional act. The Division's active role in the Lawn Lake Disaster ended when the employees involved reported their findings to the Operations Officer of the Division of Disaster Emergency Services.

2.1.6.6.4 Division of Wildlife

The Division of Wildlife maintained the Estes-North Fork fish hatchery and provided an assessment of the damages to it.

2.1.6.7 Department of Local Affairs

The Division of Local Government provided $10,075 in funding to meet emergency water and sewer problems arising from the flood. The Division also analyzed the fiscal capacity of various local government jurisdictions within the flood area in order to identify those jurisdictions which were in greatest need of funding assistance. The fiscal analysis was also used by the state as part of its presentation to HUD for emergency funding. Staff from the Division also particiated in the state committee to coordinate use of emergency funds.

The Division of Housing contributed one staff member to be on site in the Estes Park area after the flood to assist and observe the implementation by the federal government of the Disaster Temporary Housing Program.

The Division of Commerce and Development provided data concerning business characteristics of the Town of Estes Park and contacts with the local business community.

2.1.6.8 Other State Departments

The Department of Personnel provided an assistant manager to the one-stop Disaster Assistance Center and an assistant office manager to the Disaster Field Office.

The Department of Administration provided vehicles from the State motor pool to support the State Recovery Team. The Division of Accounts and Controls managed a special account to process state disaster/emergency funds.

The Office of State Planning and Budgeting provided financial advice to state agencies concerning the use of state funds to support response and recovery activities. The State Buildings Division assessed flood damages to publically owned buildings.

The Department of Labor and Employment was responsible for implementation of the Disaster Unemployment Assistance Program. The Boiler Inspection Division inspected all water damaged boilers in the disaster area and provided technical assistance for their repair.

The Health Department conducted a damage assessment of water and sewer facilities.

The Department of Social Services assisted in implementing the Individual and Family Grant Program and the Food Stamp Program in cooperation with the Larimer County Department of Social Services.

The Department of Institutions, in cooperation with Larimer County Mental Health, provided active assistance to disaster victims in crisis counseling.

The Department of Law provided legal assistance in preparing intergovernmental agreements, Executive Orders, Proclamations by the Governor, and other legal matters of the State during the recovery effort.

2.1.7 Mitigation Measures

Within 15-days of the Lawn Lake disaster, a Flood Hazard Mitigation Report was prepared by an intergovernmental team under the leadership of the Federal Emergency Management Agency with membership from Federal, state and local agencies. This report, dated August 6, 1982, contained several recommendations or work elements organized into four major categories: (a) identification and regulation, (b) minimizing flood recurrences, (c) hazard warning and education, and (d) structural and non-structural measures.

Federal, state, and local agencies immediately began work on these four areas and significant progress has been made. More specifically, on August 23, 1982, the town of Estes Park hired a full-time disaster recovery manager to stimulate and manage these mitigation efforts. The hiring of the manager, Mr. Robert Kistner, entirely out of local funds, was a particularly useful and unique step in mitigation for a town this size. His position at the focus of activity has provided the expected stimulus and momentum.

The status of the recommendations specified in the intergovernmental 15-day report has been described in detail by the Federal Emergency Management Agency (FEMA) in two Post Flood Recovery Progress Reports issued approximately 90 and 180 days following the disaster. Progress on major work elements that relate to local governments are briefly described below.

A. Identification and Regulation

Work Element 1. A re-study of the floodplain along Fall River has been requested of both the State of Colorado and the Federal Emergency Management Agency. On October 15, 1982, Dr. John Liou of FEMA and Brian Hyde of the Colorado Water Conservation Board were in the Town of Estes Park to examine the floodplain.

Dr. Liou indicated at that October 15th meeting that the Town of Estes Park would be placed on the FEMA priority list for a new flood insurance study.

Work Element 2. Estes Park adopted new floodplain regulations on January 17, 1979 that are more stringent than federal regulations in requiring the lowest flood (including basement) to be elevated one (1) foot above the base flood elevation. Estes Park has strict enforcement of regulations to ensure that new structures conform to the codes.

Work Element 3. Estes Park and Larimer County Public Works Department have contracted with the firm of Rocky Mountain Consultants to assess, design, inspect and laboratory test the replacement of private bridges along Fall River destroyed during the July 15, 1982 flood.

Work Element 8. Town of Estes Park has made an inquiry to the Omaha District Corps of Engineers to possibly include a Section 205, Small Flood Control Project into the Cascade Lake dam providing Estes Park is allowed to reconstruct the facility.

B. Minimizing Flood Recurrence

Work Element 2. Estes Park met with Colorado Division of Wildlife on October 20, 1982 in Estes Park to discuss the State Fish Hatchery. Preliminary negotiations to reshape the area to its original ground are in process.

Work Element 3. Debris, channel obstructions, destroyed structures and sediment/silt have been removed from the Fall River Channel.

C. Hazard Warning and Education

Work Element 1. The Town of Estes Park has been investigating alternative options for a flash flood warning system covering major drainage basins in and above the community. A flood warning conference to share information with interested agencies has been scheduled by the town to take place on January 19, 1983.

Work Element 3. The Emergency Management Coordinator, Chief of Police Robert Ault, is working with the Larimer County coordinator on an Emergency Plan for Estes Park.

D. Structural/Nonstructural Measures

Work Element 1. An application for an "Imminent Threat" grant was sent to Governor Lamm on August 20, 1982. Governor Lamm sent a letter to Grady Franklin Maples, of the U.S. Department of Housing and Urban Development (HUD), giving a strong support for the "Bridge Replacement Project." On October 26, 1982 the Town of Estes Park conducted a public hearing to support a HUD "Imminent Threat" grant application in the amount of $400,000. Formal application was delivered to HUD on October 28, 1982, and now has been approved.

Work Elements 2 and 5. The Town of Estes Park held a Public Hearing on October 26, 1982 for a Community Development Block Grant administered by the Colorado Department of Local Affairs in the amount of $400,000. Funds would be applied to convert floodplain land to open space in those locations where heavily damaged structures were removed. The Federal Emergency Management Agency through the National Flood Insurance program has indicated they will purchase the Villager Motel property and deed the land to the Town of Estes Park for Open Space.

Work Element 3. Acquisition of flood damaged properties under Section 1362 of the National Flood Insurance program is underway with the possible acquisition of the following properties:

1.	Peacock Ltd.	$150,000
2.	Villager Motel	220,000
3.	Hite Property	90.000
		$460,000

Work Element 4. It was not feasible to relocate the entrance road to Fall River Mobile Home Village due to high costs of land acquisition.

E. Other Hazard Mitigation Measures

1. Reconstruction money will be used to complement the overall Estes Park Comprehensive Plan.

2. Soil Conservation Service met with Estes Park Officials on October 4, 1982 to discuss channel restoration and bank stabilization. No action has been taken on this request.

2.2 Identificaton of the Hazards

The declaration of the Lawn Lake dam failure flood as a major disaster by the President has provided a special opportunity for the state and local governments to take a broader look at improving Colorado's existing flood hazard mitigation activities.

2.2.1 People and Floods

Relationships between flood hazard and population identify patterns of risk, as shown in figure 2.5. Relationships between patterns of risk and steps taken toward preparedness explain degrees of vulnerability to which various Coloradans are exposed.[1]

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.[1] Figure 2.6 depicts the geography of Colorado and figure 2.7 indicates the distribution of people from the same perspective.

People become vulnerable to flood 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.[1]

Today, flood prone areas have been identified in 212 cities and towns and in all of the 63 counties in Colorado. Using information supplied from local units of governments, there are estimated to be approximately 150,000 people now living in Colorado's floodplains. This is 5.2 percent of the population based on the 1980 census of population of 2,888,834 people in the State. Assuming 2.42 persons per housing unit as reported in the 1980 census of housing and other data, there are estimated to be approximately 62,000 homes and 12,000 commercial and industrial business structures 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 6 billion dollars.

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[1]Colorado Division of Disaster Emergency Services, "Colorado's Vulnerability to Very High Risk Natural Hazards".

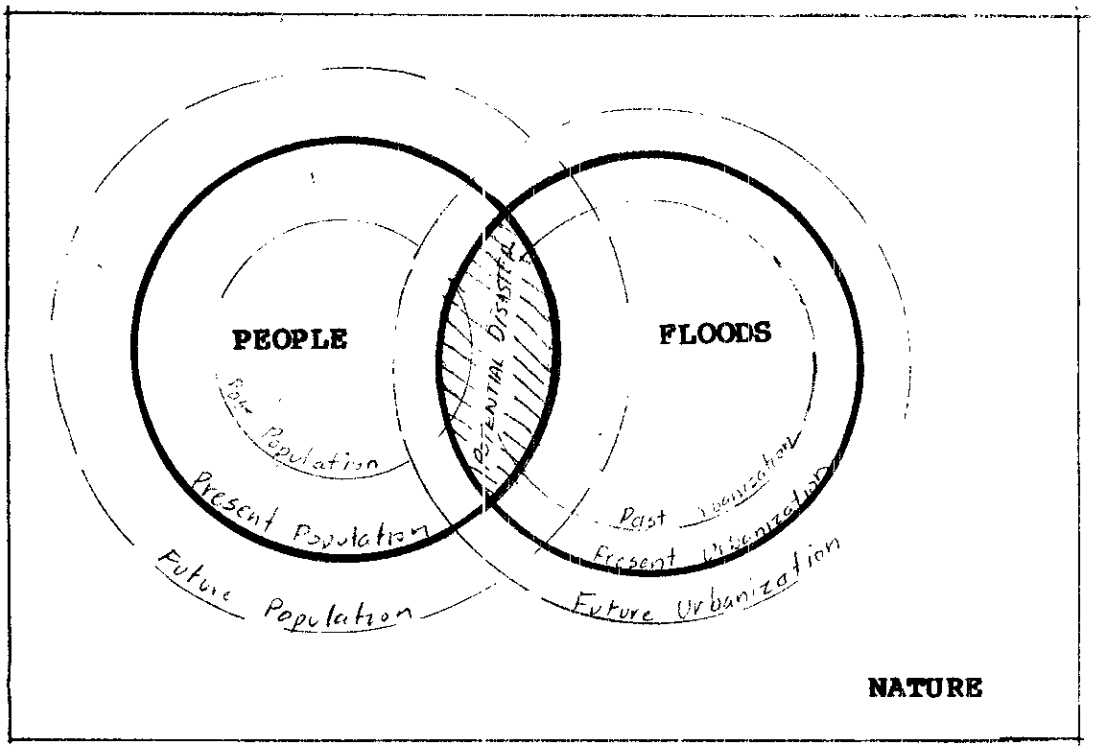
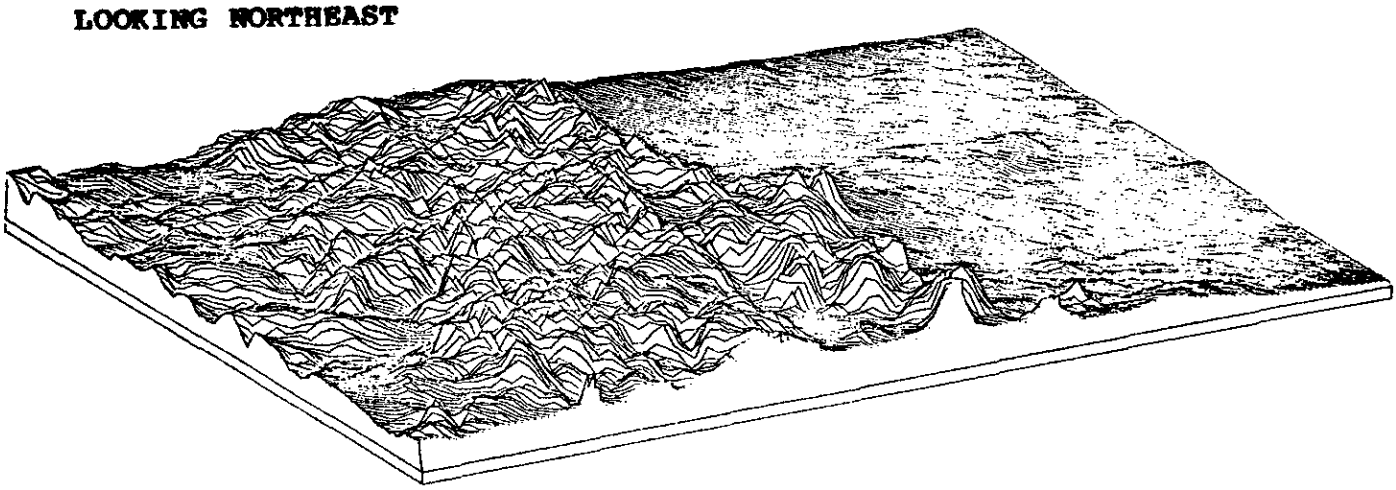


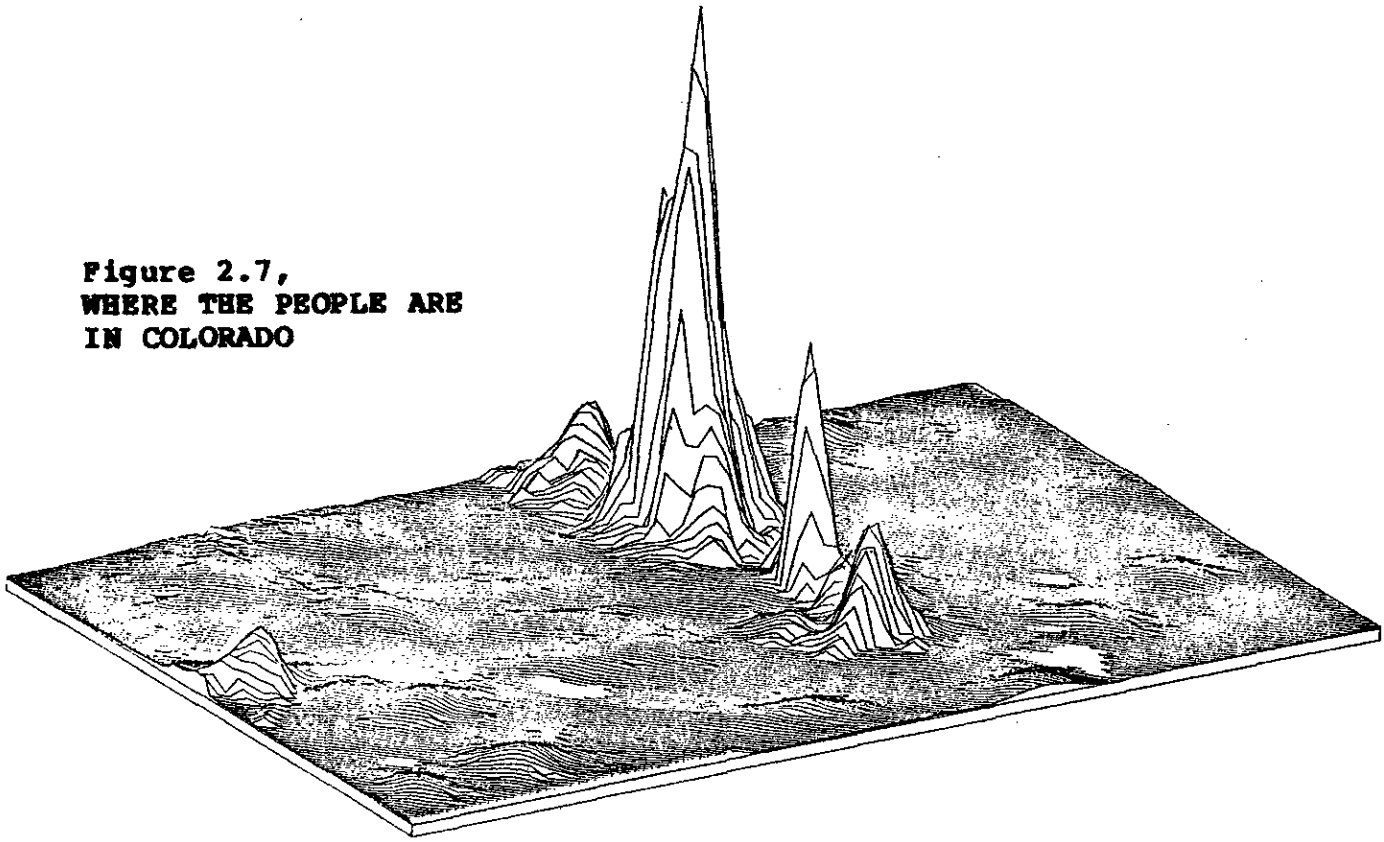
Figure 2.5, Relationship of People, Floods, and Potential Disasters.

Figure 2.6,
THE STATE OF COLORADO
LOOKING NORTHEAST



TOPOGRAPHY OF COLORADO -- AUTOMATED MAPPING SYSTEM, CO. DEPT. OF LOCAL AFFAIRS
AZIMUTH = 30 ALTITUDE = 20
WIDTH = 9.00 HEIGHT = .75
ALTMIN = 3389 ALTMAX = 14119

Figure 2.7,
WHERE THE PEOPLE ARE
IN COLORADO



COLORADO -- 1980 POPULATION , AUTOMATED MAPPING SYSTEM, DEPT. OF LOCAL AFFAIRS
AZIMUTH = 30 ALTITUDE = 20
WIDTH = 9.00 HEIGHT = 4.50
ALTMIN = 1 ALTMAX = 4913

2.2.2 Historic Flood Damages

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

The fourteen most damaging floods in Colorado recorded history are listed below:

Date	Major Stream and Location	Loss of Life	Damages
July 1896	Bear Creek at Morrison	27	--------
October 1911	San Juan River near Pagosa Spr.	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 Colo. Springs	18	1,760,000
May 1935	Kiowa Creek near Kiowa	9	------
May 1955	Purgatorie River at Trinidad	2	4,000,000
June 1965	South Platte River at Denver Basin	8	500,000,000
June 1965	Arkansas River at Colo. Springs	16	46,700,000
May 1969	Bear Creek in Boulder	0	5,000,000
Sept. 1970	Southwest Colorado	0	4,000,000
May 1973	South Platte River at Denver Basin	10	121,500,000
July 1976	Big Thompson River in Canyon	139	35,500,000
July 1982	Fall River at Estes Park	3	30,680,000
		314	$769,240,000

The most lives lost due to a single flood event occurred in the Big Thompson canyon on July 31, 1976 when 139 people were killed. Five people are still missing or unaccounted for.

The most damaging flood in Colorado occurred in June 1965 on the South Platte River when almost $500 million in damages was sustained in the Denver-metro area.

Cumulative flood losses for the 14 most damaging floods in Colorado since about the turn of the century were 314 people killed and $769,240,000 in property damages, as shown in figures 2.8 and 2.9. Using the consumer price index to adjust past flood damages at the time of each event to present (1982) worth, total flood damages are estimated at over $1,600,000,000.

On the average a major flood event has occurred every 6 years killing 22 persons and leaving $114,300,000 in damages (present worth).

The average annual flood loss in Colorado is at least 3.6 persons per year and $14,000,000 in property damages based on the trend from 1896 to 1976.

The President has declared areas in Colorado a major disaster during six of the past 20 years. Most of these disasters were caused by precipitation but two were caused by dam failure. A summary of these presidentially declared disasters is shown in the following table.

RECENT PRESIDENTIAL MAJOR DISASTER DECLARATIONS

Year	Location	Cause
1965	Front Range 33 counties	Sustained Rainfall
1969	Front Range 15 counties	Sustained Rainfall
1970	South West	Sustained Rainfall
1973	(1) Kersey	Dam Failure
	(2) Front Range 13 Counties	Sustained Rainfall
	(3) Southwest 13 Counties	Sustained Rainfall
1976	Big Thompson Front Range 2 counties	Flash flooding, heavy rainfall over short duration
1982	Lawn Lake Front Range 1 county	Dam failure

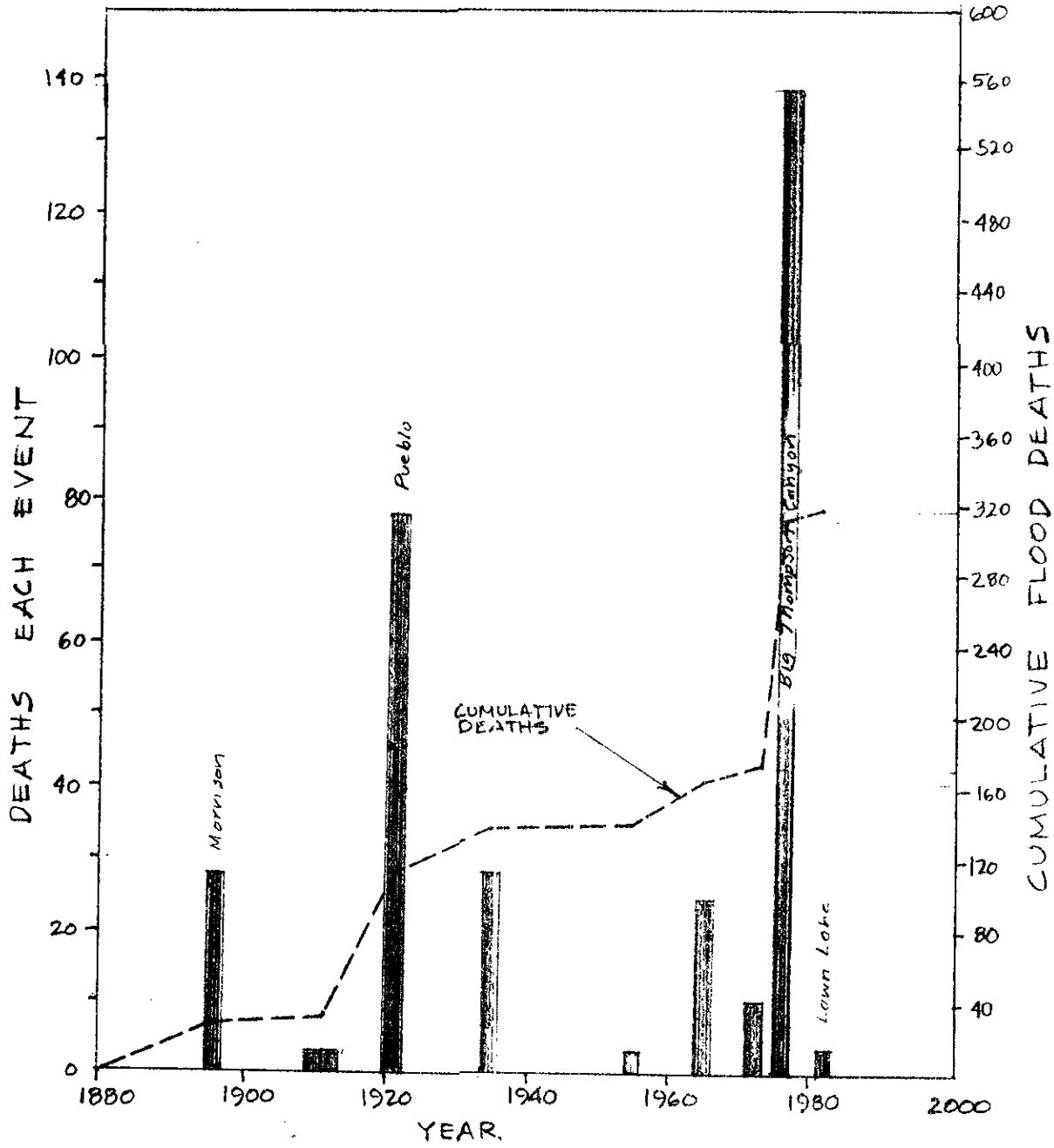


Figure 2.8, Deaths from Floods in Colorado

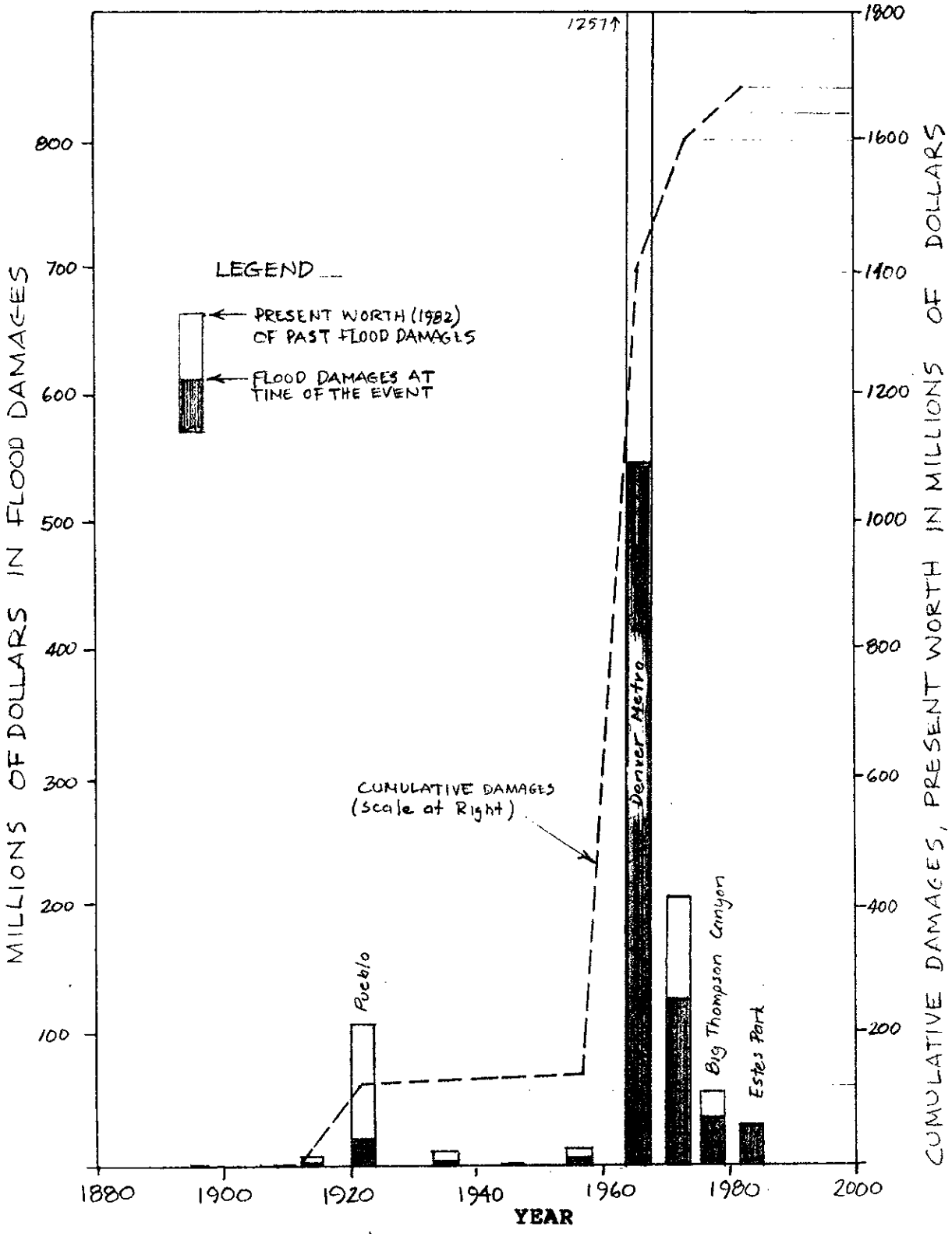


Figure 2.9, Damages from Floods in Colorado

2.2.3 Causes of Floods

Floods in Colorado occur on "riverine" systems consisting of a basin (or watershed) and a hierarchial 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. The 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.

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:

1. Rain in a general storm system
2. Rain in a localized intense thunderstorm
3. Melting snow
4. Rain on melting snow

Rainfall and melting snow in the mountains feed four major river systems with headwaters in Colorado as shown in figure 2.10. These are the Missouri, Arkansas, Rio Grande, and Colorado River Basins. These basins encompass many small streams and rivers as shown in figure 2.7.

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 man-made structures are a result of:

1. Hydrologic deficiencies
2. Structural deficiencies
3. Improper Operation or Sabotage

Each of these causes results in floods which have distinct characteristics relative to rate of rise, volume, duration, and flood season. Figure 2.11 is a comparison of typical flood characteristics using flood hydrographs.

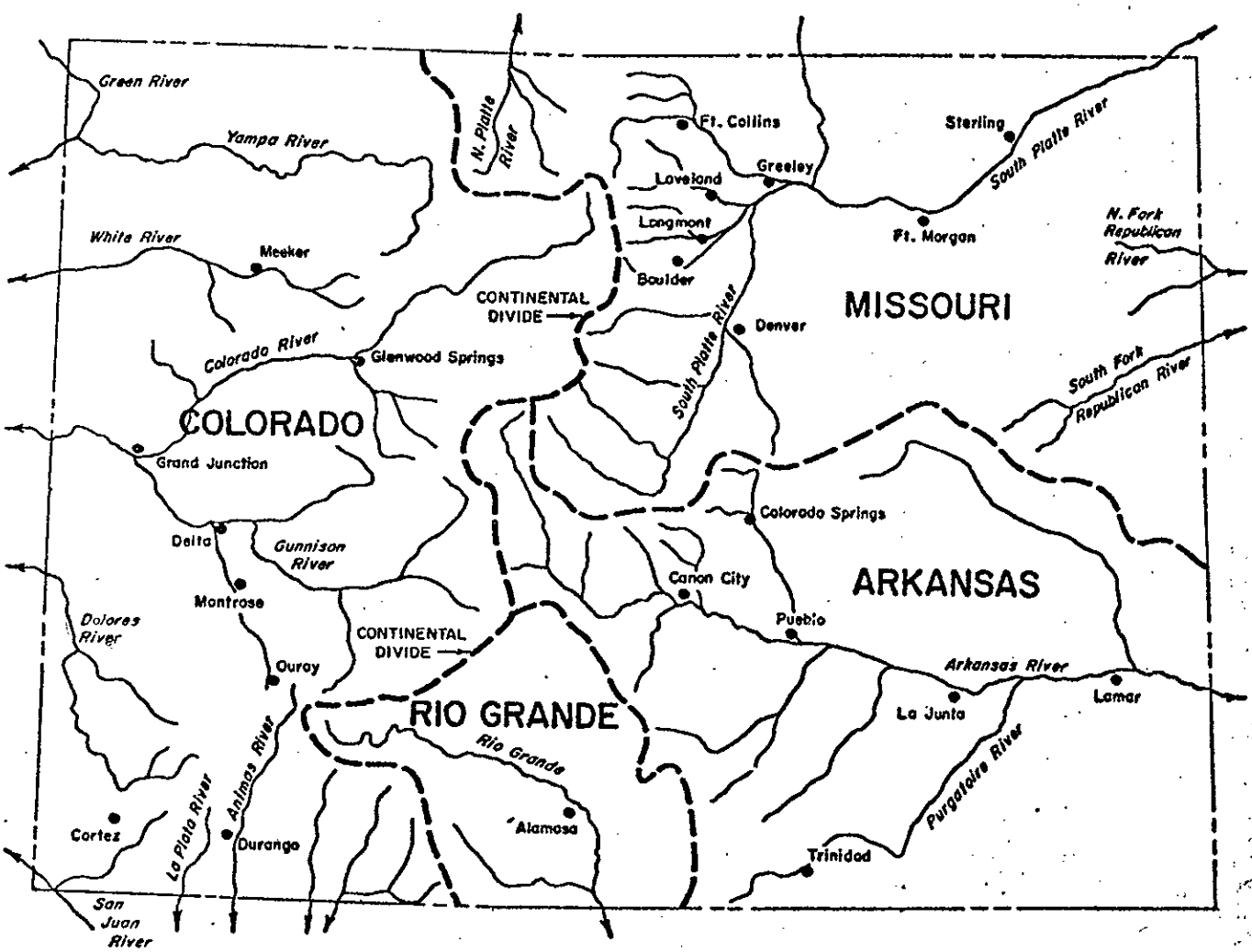


Figure 2.10, Major River Systems in the State of Colorado.

2.2.4 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 mainstem 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.

2.2.5 Thunderstorm Floods

Damaging thunderstorm floods are caused by intense rain over basins of relatively small aerial extent. 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 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.

2.2.6 Snowmelt Floods

Snowmelt floods are typically characterized by smooth diurnal fluctuation in discharge rate with each successive daily peak discharge slightly greater than in the previous day. The cumulative hydrograph exhibits a stair-step shape rising over a period of several days. Snowmelt floods generally yield a large volume of runoff water in comparison to thunderstorm floods.

Major snowmelt floods are usually a result of an early spring warming trend which lasts up to at least ten consecutive days. Experience has shown that if a single cold day or cold front interrupts the melting cycle, the rising waters will decline and stabilize until the stair-step process is started all over again. Major snowmelt floods occur along the streams just below the winter snowpack in the high mountains areas along the continental divide.

Floods in June 1957, which occurred in several western slope communities, were a result of melting snow.

2.2.7 Rain on Snow Floods

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.

Flooding in June of 1965 at higher elevations and moderate flooding on March of 1980 along the front range are examples of flooding from rain on melting snow.

2.2.8 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.

The most significant hydrologic deficiency is 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 hydrologic dam failure. 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, 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 liquifaction of sand layers in the embankment of a dam.

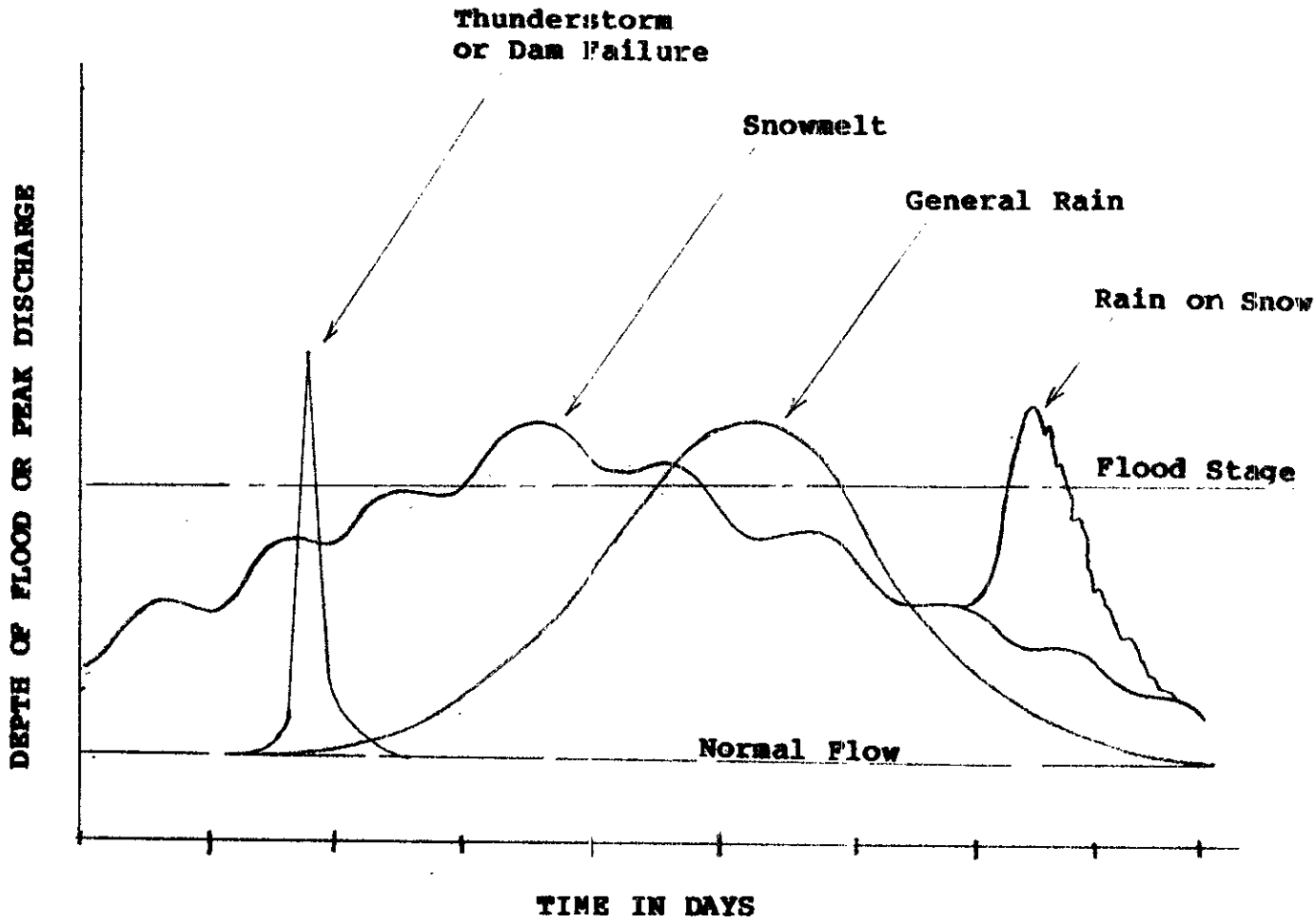


Figure 2.11, Comparison of Typical Flood Characteristics in Colorado.

The mechanics of a structural failure depends on the type of dam and the mode of failure. Earthen dams, the most common type of structure in Colorado, typically breach during failure. Flood waters are released through the breach at a rate controlled by the size of a widening opening and a decreasing water level in the reservoir.

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 2,249 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 drainageways. 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 1,000 acre-feet in order to to fall under the review of the state's dam safety program. Of the 2,249 inspected dams, 120 are federally owned, and 2,129 non-federally owned.

Although few lives have been lost from dam failures, property damage has been high. There have been as least 130 known dam failures in Colorado since 1890 (see Appendix). 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 occured on May 25, 1951 when Lilly Lake dam failed sending flood waters down Fish Creek and into Lake Estes.

In June 1965, a flood ocurred on Clay Creek in Prowers County from the failure of an earthen dam being contructed by the Colorado Game, Fish, and Parks Commission. This dam failure flood resulted in an important legal controversy known as the Barr Case. This case was finally decided in 1972 by the Colorado Supreme Court which recognized the concept of probable maximum flood as a predictable and foreseeable standard for spillway design purposes.

The most unusual dam failure flood 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, water was able to flush through a network of tunnels in an abandoned mine extending under the lake.

2.3 Legal Framework

Three critical aspects of flood hazard mitigation relevant to this plan are dam safety, floodplain management, 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.

2.3.1 Dam Safety

The safety of dams in Colorado is the primary responsibility of the Division of Water Resources (State Engineer) under the Department of Natural Resources. Dam Safety programs developed by this agency are administered under authority of the following:

- Title 35, Article 49, Colorado Revised Statutes 1973, Agriculture, Livestock Water Tanks.
- Title 37, Article 87, Colorado Revised Statutes 1973, Water and Irrigation, Reservoirs.
- Contracts signed pursuant to Public Law 92-367, National Dam Inspection Act of August 8, 1972.

The state engineer is required to approve plans for reservoirs (CRS 37-87-105), to supervise the construction of dams (CRS 37-87-106), to "annually determine the amount of water which is safe to impound in the several reservoirs within this state" (CRS 37-87-107) and "upon complaint" examine a reservoir and "determine the amount of water it is safe to impound therein" (CRS 37-87-109).

None of the above provisions relieve reservoir owners "from the payment of such damages as may be caused by the breaking of the embankment thereof, but in the event thereof of any such reservoir overflowing, or the embankments, dams, or outlets breaking or washing out, the owners thereof shall be liable for all damage occasioned thereby" (CRS 37-87-113). Another section provides that "the owner of a reservoir shall be liable for all damages arising from leakage or overflow of the waters therefrom or floods caused by the breaking of the embankments of such reservoir." It goes on to say, however, that shareholders, employees and members of boards of directors of an owner of a reservoir are not liable for such damages if an insurance policy, meeting certain requirements, has been purchased by the owner (CRS 37-87-104) "Neither the State Engineer nor any member of his staff or any person appointed by him shall be liable in damages for any act done by him in pursuance of the provisions of this article." (CRS 37-87-115).

The provisions about annually determining the amount a reservoir may fill has been frequently misinterpreted as requiring an annual inspection. Once a reservoir is restricted by the state engineer, that restriction remains in effect until the conditions for again fully utilizing it are met, whether or not an inspection is made within one year.

Laws calling for the inspection of high hazard dams under the National Dam Safety Program substantially influenced dam safety activities by the Division of Water Resources since 1978. The State of Colorado was requested by the Army Corps of Engineers to prepare an inventory to determine hazard ratings, and to conduct phase I inspections because the state has a viable dam safety program and because the Corps did not have the manpower or resources themselves to do the job. The Division of Water Resources subsequently signed contracts to update the inventory, re-evaluate hazard classifications, and supervise phase I inspections.

2.3.2 Floodplain Management

The statues 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 a economically justifiable benefit of reservoir construction. Major flood legislation was further enacted in 1966 by House Bill 1007--State approval and dsignation of storm runoff channels and basins; in 1973 by S.B. 35--Sub-division regulations including delineation of 100-year floodplins; 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 declaring 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 towards the identification of floodplains and providing technical services to Colorado communities. State statutes executive orders regarding floodplain management are listed below:

- Title 24, Article 65.1, Section 302, Colorado Revised Statutes 1973, 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 1973, 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, 1973, Government-County, County Planning and Building Codes, Zoning Plan.

- Title 30, Article 28, Section 133, Colorado Revised Statutes, 1973, Government-County, County Planning and Building Codes, Subdivision Regulations.

- Title 30, Article 30, Colorado Revised Statutes, 1973, Government-County, County Planning and Building Codes, Flood Control.

- Title 31, Article 23, Section 201, Colorado Revised Statutes 1973, Water and Irrigation, Water Conservation Board of Colorado, Duties of the Board.

- Title 37, Article 60, Section 106, Colorado Revised Statutes 1973, Water and Irrigation, Water Conservation Board of Colorado, Duties of the Board.

- Governor's Executive Order No. 8491, August 1, 1977, Evaluation of Flood Hazard in Locating State Buildings, Road and Other Facilities, and in Reviewing and Approving Sewage and Water Facilities, and Subdivisions.

- Governor's Executive Order No.8504, October 1, 1977. Requirements and criteria for State Participation in the National Flood Insurance Program.

- Memorandum of Understanding, Radioactive Materials License Reviews for Source Material Milling Operations, January 1982.

- Memorandum of Understanding between the Department of Natural Resources with the Department of Local Affairs regarding technical assistance in floodplain management for administration of the Community Block Grant Program, November 12, 1982.

Section 37-60-106(1)(c), CRS 1973, 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 1973, as amended, requires the CWCB to prescribe the standards for and coordinate all floodplain analyses conducted in the state. Finally, 37-60-106(1)(c), CRS 1973, as amended, provides that floodplain designations must first be reviewed and approved by the Board before they can be used by local units of government. 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(1)(d), CRS 1973, as amended, and Section 24.65.1-302(2)(a), CRS 1973, 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.

The August 1, 1977 Executive Order states that directors of state agencies will promote public health, safety, and welfare with regard to the use and development of floodplains. It also specifies that state agencies which implement projects, review and/or partially or fully fund projects by other public or private agencies, or are otherwise involved in land-use or utilities planning will consider flood hazard in their planning process. The Colorado Water Conservation Board and the Colorado Land Use Commission are the designated agencies which shall provide technical assistance and any other necessary information to help state agencies meet the intent of the Executive Order.

The October 1, 1977 Executive Order supplements the August 1, 1977 Executive Order with the provisions that state agencies will meet the requirements of the National Flood Insurance Program for state owned property in "Special Hazard Areas" and will attach any restrictions necessary to meet those requirements when considering the use of or conveyance of state property. In addition, it specifies that state agencies shall consider flood hazards and floodplain management in their actions. Again, the Water Conservation Board and the Land Use Commission are the designated agencies which shall provide assistance in meeting the requirements of the National Flood Insurance Program.

2.3.3 Emergency Preparedness

The Division of Disaster Emergency Service (DODES) within the Department of Military Affairs was established by the Colorado Disaster Emergency Act of 1973. It is the primary state agency responsible for emergency preparedness. The duties and responsibilities of this and other state agencies to prepare for flood emergencies and to coordinate recovery efforts are set forth in the following authorities:

- Title 28, Article 1, Colorado Revised Statutes, 1973, Emergency Preparedness, Civil Air Patrol.
- Title 28, Article 2, Colorado Revised Statutes 1973, Emergency Preparedness, Disaster Emergency Services.
- Governor's Executive Order, April 1, 1978, Colorado Natural Disaster Emergency Operations Plan.
- Memorandum of Understanding between the Division of Disaster Emergency Services and the Civil Air Patrol, June 1982.

2.4. Governmental Organization

Coping with floods in Colorado involves cooperation of many types of public and private institutions and all levels of government--federal, state, regional, county, city, and town.

2.4.1 City and Town Government

Local governments are free to draw upon any and all authority delegated by the General Assembly, and home rule cities derive additional authority from their charters. The statutory authorities available to local governments include the power to plan, to regulate uses within their boundaries (zoning, subdivison, "matters of state interest" and the extensive list contained in H.B. 1034), to regulate certain activities outside their jurisdictions, and to contract with other jurisdictions.

2.4.2 County Government

The Legislature has placed the majority of land use responsibility and control at the local level of government. Counties and municipalities have the duty to prepare and adopt comprehensive plans for the physical development of their respective jurisdictions (30-28-106 and 31-23-206, CRS 1973). A planning commission and adopted subdivision regulations have been required of counties since 1972 (30-28-133). The establishment of planning commissions and the regulation of subdivisions is optional for municipalities (31-23-202, 214).

2.4.3 Regional Planning Agencies

The need for interjurisdictional cooperation is becoming increasingly evident as areas on the urban fringe of municipalities continue to develop. The few interjurisdictional cooperative efforts presently known to exist vary from sharing a planning staff, to adopting joint plans, to establishing urban service area boundaries and agreeing upon the nature of devlopments that should occur therein. Some of the most innovative efforts include those between Aspen-Pitkin County, Pueblo-Pueblo County, Fort Collins-Loveland-Larimer County, Boulder-Boulder County and Summit County-incorporated municipalities.

On June 14, 1969, the Colorado General Assembly passed the Urban Drainage and Flood Control Act which created the Urban Drainage and Flood Control District to manage multigovernmental flood problems in the Denver metro area.

2.4.4 State Government

The State of Colorado has no explicit authority to regulate private or local government development in floodplains. The Legislature has limited the State's authority to advising county and municipal governments of flood hazards and providing local governments with financial and technical assistance in floodplain management.

Governor Lamm has demonstrated leadership in this area and many Executive agencies have conducted aggressive programs within the limits of Legislative authority and resouces.

State agencies concerned with flood hazard mitigation to various degrees in Colorado are listed below:

GOVERNOR

- Governor's Disaster Emergency Council
- Coordinator of Environmental Problems Office

DEPARTMENT OF NATURAL RESOURCES

- Division of Water Resources (State Engineer)
- Colorado Water Conservation Board
- Colorado Geological Survey
- Division of Parks and Outdoor Recreation
- State Land Board
- Division of Wildlife
- Division of Mined Land Reclamation
- Colorado Natural Areas Council

DEPARTMENT OF MILITARY AFFAIRS

- Division of Disaster Emergency Services

DEPARTMENT OF HIGHWAYS

- Division of Highways
- Colorado State Patrol

DEPARTMENT OF LOCAL AFFAIRS

- Division of Commerce and Development
- Division of Local Government
- Division of Housing
- Colorado Land Use Commission

DEPARTMENT OF HEALTH

- Water Quality Control Division
- Radiological Health and Hazardous Wastes Division

DEPARTMENT OF ADMINISTRATION

State Buildings Division

DEPARTMENT OF INSTITUTIONS

DEPARTMENT OF EDUCATION

DEPARTMENT OF HIGHER EDUCATION

Colorado Commission on Higher Education

2.5 Existing Mitigation Planning and Programs

During 1981, the staff of the Water Conservation Board met with selected State agencies whose work included aspects of flood hazard mitigation. One purpose of those meetings was to determine how these state agencies were implementing the Governor's Executive Orders on floodplain management and on the National Flood Insurance program. By evaluating what various state agencies were doing in regards to flood hazard mitigation, the following updated summary report on mitigation activities by state agencies was prepared to give a better overall picture of existing flood hazard mitigation planning and programs within Colorado State government.

2.5.1 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 1973, 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.

In 1967, the Division of Water Resources, Office of the State Engineer, published the latest version of a "Manual of Rules and Regulations for Filing Claims to Water and Plans and Specifications for the Construction of Dams."

All 2,249 dams in the state have been given high, moderate, or low hazard ratings based on the probability of loss of life and/or significant property damage below them. The hazard rating includes a "normal" rating based on "failure in the dry" which means looking at the consequences of a failure from structural deficiencies. There is also a rating based on the additional damages or loss of life caused by a failure of the dam when it is overtopped by a flood exceeding its spillway capacity (hydrologic deficiency).

If a dam is found to be "unsafe," the Dam Safety Branch can restrict the storage behind it to ensure safety. Any dam under restrictions remains restricted until specified hazardous conditions are corrected. Dams not under restrictions may fill to capacity.

In FY 1976-77, prior to the National Dam Safety Program (NDSP), the State Engineer's Office conducted more than 1,000 dam inspections with five field engineers and a supervisory engineer. This included all types of inspections such as safety evaluations, construction inspections, response to complaints, and a number of reinspections.

From 1978-1981, the Colorado dam safety program was primarily involved with the requirements of the National Dam Inspection Act. The National Dam Safety Program is 8 years old, and it is administered by the U.S. Army Corps of Engineers (COE). The Branch has updated the federal inventory of dams and prepared phase I reports under contract to the Corps of Engineers.

In order to accomplish the work in the time frame allotted, the State Engineer requested proposals for and hired consulting engineers to make hazard re-evaluations for the inventory of as many dams as fiscal resources would permit. The Field Engineering Unit made the hazard re-evaluations for the balance of the structures.

Temporary help was hired to assist in the monumental task of transcribing information from state files and records to the COE inventory forms as well as locating dam owners, obtaining their addresses, physical data on the dams, keypunching, updating, and other data.

Consulting engineers were also hired to do the phase I inspection reports in accordance with the COE's guidelines and directions. The State Engineer prepared proposals, selected the consultants, assisted them with the files, reviewed their reports, coordinated the Corps comments in the reports, and transmitted the final reports to the owners with additional recommendations.

One hundred ninety-seven (197) non-federal high hazard, thirty-five (35) moderate hazard, and one (1) low hazard dams were inspected during the four-year program. The 35 moderate hazard dams were sample inspections made by the COE personnel of private dams on Federal property. They did the low hazard one because it was convenient.

Present inspection schedules call for all high and moderate hazard dams to be inspected within FY 82-83. Those structures known to be of particular concern will be, or have been already, inspected first.

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

A Dam Owner's Safety Manual is being prepared with funds from the NDSP. It will be distributed to all dam owners, engineers, and others who are interested. It will instruct owners about the care, inspection and maintenance of dams, both to prolong the dam's useful life and to provide for its safe operation.

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.

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 and recommend that the subdivision developer pay a fair share of the cost.

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.

2.5.2 Colorado Water Conservation Board

The Colorado Water Conservation Board was legislatively created 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. . ."

The Colorado Water Conservation Board provides technical assistance to local governments in the development of floodplain information studies. Various programs developed within the Flood Control and Floodplain Management Section of the Board are shown in figure 2.12. The Board is the state coordinator of all floodplain management activities within the State of Colorado. The Water Conservation Board periodically issues an index map showing the availability of floodplain information in Colorado. This map shows reaches of streams in Colorado for which detailed floodplain information is known to be available and where studies are in progress. A library of completed floodplain information studies is maintained by the Board.

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. Figure 2.13 shows the progress of designated floodplain information studies by state fiscal year which begin on July 1. Since 1967, a total of 209 studies prepared by various government agencies for a total of approximately 2800 stream miles, have been designated by the board.

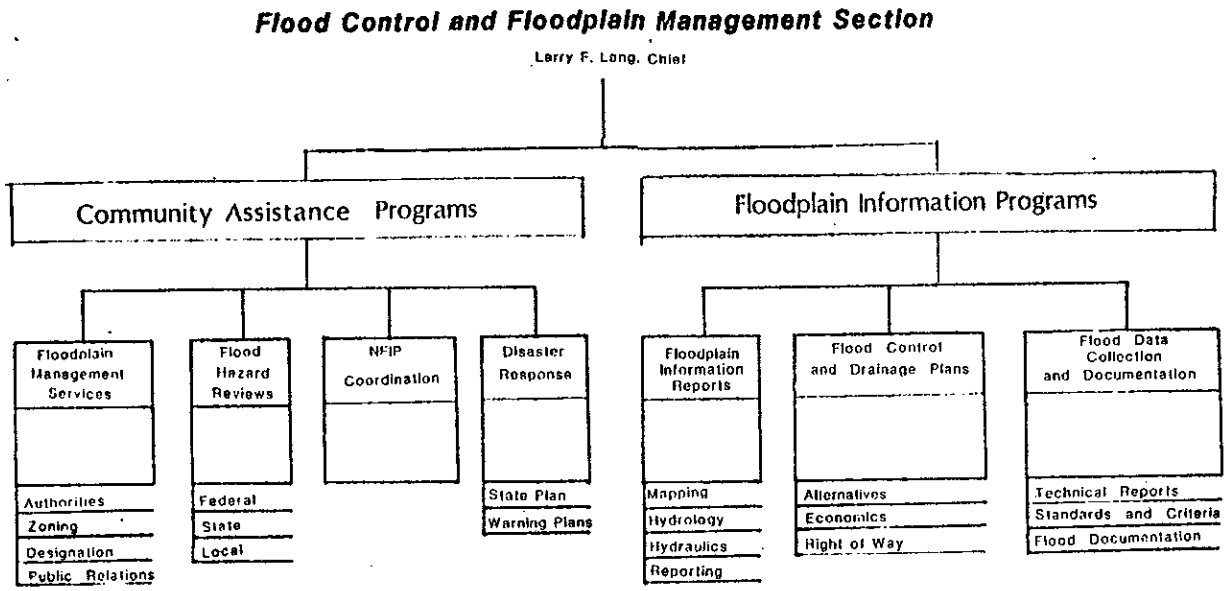


Figure 2.12, CWCB Floodplain Management Programs

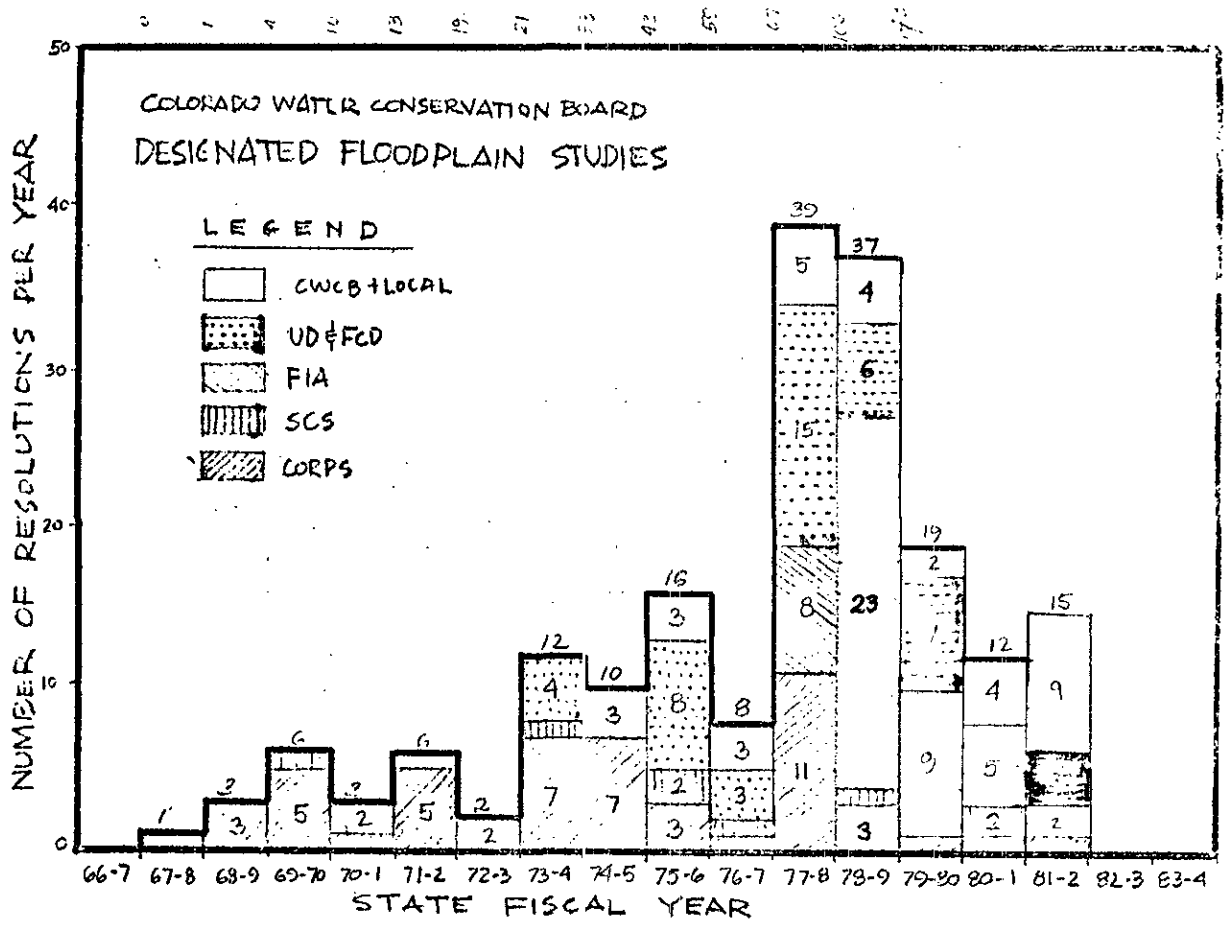


Figure 2.13, Designated Floodplain Studies

The Board's flood control and floodplain management activities fall into three broad categories:

1. Duties and responsibilities of the Board as directed by State statutes; activities which fall under category numbers 1 and 2 are rendered without charge. These specific activities which the Board has a statutory authority to perform, practically speaking, should be accomplished by a State agency include:

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

   b. Reviewing completed studies for approval and designation as required by 24-65.1-403(3)(b) and 37-60-106(1)(c), CRS 1973, as amended;

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

   d. Collecting date on and documentation of flood events.

2. Coordination and consultation activities with counties and incorporated municipalities for the implementation of Federal and State programs and activities;

   a. Providing coordination on federal studies and flood control projects when seeking Congressional authorization and funding;

   b. Providing general information and coordination to communities concerning participation in the national flood insurance program;

   c. Responding to emergency disaster response activities, including preparation of federally required post-disaster mitigation plans, and

   d. Providing general guidance, including preparation of "Scopes of Services," to communities performing floodplain studies or preparing grant applications for studies.

3. Engineering and technical assistance provided upon request to 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.

For category 3 activities, a direct benefit is enjoyed by the user. Therefore, a charge is assessed to the individuals, private organizations and entities, and local communities, that use the Board's services in lieu of the retention of a professional staff or consulting engineering services. These fee services include, but are not limited to:

a. Preparing flood hazard reviews on specific parcels of land, subdivisions, developments, etc.;

b. Providing information on the flood insurance ratings of specific parcels of land;

c. Overseeing and managing floodplain and major drainage studies, including negotiation of professional services contracts, study management, engineering work, etc.;

d. Preparing local floodplain regulations or ordinances, amendments to flood insurance rate maps, and base elevations for specific structures;

e. Performing site-specific engineering for and design of flood-proofing measures;

f. Acting as local communities' professional staff; and

g. Performing hydrologic and hydraulic investigations.

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 contacted about the fact that dam rehabilitation funds may be available.

The Water Conservation Board, and later the legislature, set a goal of using about one-third of the Water Conservation Board Construction Fund for dam rehabilitation.

Funds for the rehabilitation of unsafe dams could be advanced to dam owners from the Colorado Water Conservation Board 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% of the estimated project cost to the owners. The remaining 50% has to be obtained by the owner from another source.

2. The current service charge for State funds is a minimum of 5%.

3. The maximum pay-back period for these funds is 40 years.

2.5.3 Colorado Geological Survey

The CGS is a review agency for the State Clearinghouse that only addresses proposals by federal agencies and by the Department of Local Affairs. However, other state agencies refer proposals directly to the Geological Survey. These include the State Buildings Division and the Department of Health.

The most common geologic problem related to proposed buildings forwarded by the State Buildings Division is swelling soils. Flooding is an infrequent problem. With the Department of Health there are many referrals for review of sewage treatment plants, water treatment plants, and hazardous waste sites. Sewage treatment plants are frequently located in the floodplain, so they have to be protected with dikes or other floodproofing measures. There are also numerous uranium tailings piles in floodplains in communities like Durango and Grand Junction.

The Geological Survey also reviews subdivision proposals referred to them by the counties as required by Section 30-28-101 et seq., CRS 1973. The floodplain review is conducted whether floodplain mapping has been previously performed or not. The CGS works with the Water Conservation Board to maintain a current library of available floodplain information throughout the state. Where no mapping is available, the physiographic floodplain is examined, and if it is necessary, mapping of the floodplain is recommended. The possible flood impacts of upstream dams are included in this review process.

If a proposal involves development in the floodplain, the staff wants the developer to take that fact into account, which means a professional evaluation by a geologist or an engineer and the following of their recommended mitigating procedures. If the CGS feels it is necessary, they forward proposals to the Water Conservation Board for more detailed review. In a few cases--for example, if development proceeds in a floodplain and buildings are elevated--the CGS has required an emergency response plan with a warning system to let people in the buildings in the floodplain know that a flood is imminent.

In debris slide and mud slide areas, the Geological Survey is the lead agency. For example, upon request by Glenwood Springs they have been helping the community as a result of three separate slides in 1981.

A research project the Survey initiated but couldn't complete because of funding problems was a study of some floodplain and geologic hazards in mountain canyons using stratigraphic information to date historic floods in geologic time. An important element of these studies is the determination of debris-producing potential of various mountain watersheds. This project is intended to enhance the State's ability to determine relative vulnerability of the many canyon and canyon reaches of Colorado.

The Geological Survey recognizes the authority of local government to regulate land use, but if they see serious problems they will inform the local government to be sure they are also aware of the problem and the need to consider it.

The CGS will work with the private sector if they request information or assistance concerning certain parcels of land, but normally they will wait until a plan has been submitted to the local government. Through a continuing program of earthquake studies and risk evaluation any special concerns regarding dams, tailings impoundments, potential large landslides or other high risk situations are forwarded to designated agencies or persons.

The Geologic Survey formerly spent a lot of effort on public education, particularly of local governments and their staff. Recently they have spent less time in this area because their time was occupied doing required work. Because there is so much turnover in local government and support staff, the need to renew educational efforts for all the new people whom they have never contacted has become apparent.

The Colorado Geological Survey is involved in dozens of technical and informational meetings each year. Attending these meetings are various local land-use and elected officials, diverse technical or academic groups, and concerned citizens. These forums are often used to educate individuals about the threat of floods from dam failures or other geologic hazards.

2.5.4 Division of Wildlife

The Division of Wildlife (DOW) owns and controls a number of properties throughout the state. They have an ongoing inspection and maintenance program for all their 74 lakes, 215 wildlife areas and 14 fish hatcheries. They also have prepared an emergency action plan to be used in case of dam failure which considers four potential flooding scenarios. Approximately 25 such plans for about one third of all dams owned by the division have been developed and updated thus far. A list of Division-owned or constructed reservoirs and a list of state fish hatcheries are included in the appendix.

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, feed, 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. A familiar example is Cherry Creek, upstream of University Boulevard in Denver, where vegetation in the floodplain could pose a threat to people and property. There is a need for a policy on the protection of riparian habitat and its interaction with floodplain management objectives.

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 of 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 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 "minimum stream 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.

A recent project where there were some problems was during the Big Thompson recovery effort. Obviously, at the outset, assisting property owners and others who suffered in the flood was deemed more important than recovering wildlife habitat. Later in the project, the Division of Wildlife provided one staff person on site to assist in the planning and reconstruction process. It is still felt, though, that along with the important concerns for people and their property, recovery policy should delineate that the loss of wildlife resources should be recoverable.

2.5.5 Division of Parks and Outdoor Recreation

The programs the Division administers in floodplain areas include recreation development on reservoirs, the state trails program, the minimum streamflow 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 Division 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 Division are development plans for reservoir recreation facilities where reservoir high water lines are a factor in locating and designing those facilities.

2.5.6 Division of Mined Land Reclamation

The Division of Mined Land Reclamation 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 appplications, inspections of ongoing operations, and evaluation of final reclamation. The major flood plain problems and potential hazards associated with mining are located primarily in urban areas where gravel is mined along major drainages. Adverse affects of mining on flooding occur less frequently in rural and mountainous areas, due to the sparse population. The Mined Land Reclamation Division, 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 Water Conservation Board staff for review. Typical problems include the location of large gravel stockpiles or berms related to gravel mining operations within the flood plain and their affect 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 whereas, 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 10-year, 24-hour storm and the peak flows for the 25-year, 24-hour storm.

2.5.7 State Land Board

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 is just beginning to lease 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.

When developments are proposed, Land Board staff reviews them in their office. However, the detailed review for subdivision and zoning compliance is left to the local jurisdiction. Because performance standards and review capabilities vary so much throughout the state, it is difficult to guarantee any degree of uniformity with respect to floodplain management.

Besides being concerned about floodplains affecting homes and other buildings, such as would be the case if the abandoned Lowry Air Bombing Range were developed, the Land Board is concerned about bridges and assuring that they are adequately designed. An example is some State land near the Dowd Junction (close to Vail) on the Eagle River. To develop the land as proposed, a bridge had to cross the Eagle River and floodplain information from the Water Conservation Board was used to assist in the design.

2.5.8 Division of Disaster Emergency Services

The role of the Division of Disaster Emergency Services (DODES) addresses four basic aspects of disaster activity:

(1) Mitigation

(2) Preparedness

(3) Response

(4) Recovery

DODES is responsible for coordinating the work of other state agencies in these four areas. Statutory authorities are less strong in the area of mitigation than in the other three areas. These authorities have been strengthened in recent years through Executive Orders. However, it is important to understand that the authorities are to coordinate the work of other agencies. The Division has prepared the Colorado Natural Disaster Emergency Operation Plan which details response activities of State agencies during emergencies.

By Executive Order, DODES has responsibility to oversee the preparedness and emergency planning work of local governments. DODES also reviews the preparedness plans of local governments to see how well they address local potential hazards.

Once the threat of a specific flood is known, DODES 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, DODES tries to determine what happened and why it happened, and to take steps to assure that it

does not happen again. Following a disaster declaration, DODES coordinates the formulation of an agreement between involved entitites which specifies the preparation of a mitigation plan.

In the case of the Big Thompson flood of 1976, the entire process described above involved an ad hoc approach. In effect, DODES learned during that experience and developed procedures which are now used regularly.

DODES acts as the conduit for emergency assistance to local governments from the Governor's Office. DODES 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. This funding will be limited strictly to emergency repairs.

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

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

An example of aid provided after a flood damaged public facilities occurred in Loveland. A sewer line was broken by flooding on the Big Thompson River. The City of Loveland did not belong to the National Flood Insurance Program and at that time had not progressed very far toward qualifying for or seeking to join the program. DODES could not withhold aid, but they could consider that aid and Loveland's subsequent action or inaction if a future damaging flood occurred and Loveland again sought state assistance. In other words, there may not be restrictions placed on aid the first time it is provided, but subsequent requests for aid may be viewed differently.

The means by which DODES 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.

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

DODES reviews current research in the area of disaster preparedness and recovery to assure that the state is informed on recent trends. On a broader scale, they have prepared a report entitled Colorado's Vulnerability to Very High Risk Natural Hazards to provide a statewide perspective of hazards and preparedness.

2.5.9 Division of Highways

The Highway Department 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 the State fall into two categories:

(a) Federally funded highways, and

(b) Federal aid designated highways.

Criteria, policies, and methodologies used by the Highway Department 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 S.C.S. methodology, CUHP, USGS methodology for small basins, and others. The Highway Department uses flood histories as available. When floods occur, photographs are taken and report forms are filled out.

A couple of the older interstate highway segments in Colorado were built before these design standards were used, including I-25 through the City of Pueblo. If that segment were built now, it would be built to allow for the 100-year flow plus a calculated freeboard. The freeboard would be based on the

discharge for the 100-year flood. Another segment, I-70 from Frisco to Copper Mountain, through Tenmile Canyon, is a rural segment, so it is designed for the 50-year flood.

The Hydraulic Unit in Denver signs off on all projects throughout Colorado. They review any existing work by other agencies, such as 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 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 highway 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 Highway Department policies and procedures.

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

In the event of a flood disaster, the Highway department 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.

2.5.10 Colorado State Patrol

The role of the State Patrol in flood hazard mitigation is 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 16 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 the Governor's Office 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. As an example, in the 1965 flooding in the Front Range there was enough advance warning that people could be moved ahead of time and roads could be closed.

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 Department of Military Affairs, the State Patrol can establish and manage these posts where communications are handled.

An important function of the State Patrol is to keep sightseers and others out of the flood damaged area during the flood and after. In addition, property has to be protected from looting and vandalism.

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.

2.5.11 Division of Local Government

The Division of Local Government, Department of Local Affairs, works with two basic kinds of grants. These are sewer construction grants and emergency grants to pay for immediate repairs to water and sewer facilities. There are no longer any land use planning grants with the Division of Local Government. The only capital construction grants available from the Department of Local Affairs are the grants made by the Division of Commerce and Development through the Impact Assistance Program and the grants made under the Community Development Block Grant.

The East Fremont County Sanitation District is an example of an entity where flood information was available and, therefore, was requested. In any event, such planning study proposals are routed to the Water Conservation Board via the State Clearinghouse to assure that the Board is aware of any other potential floodplain problems. Applications to the Division of Impact Assistance are routed through the Clearinghouse also, so any of them that involve potential development in floodplain areas should be reviewed by the Water Conservation Board. No other state agencies send proposals through the Clearinghouse, so it only reviews proposals from the Department of Local Affairs and from federal agencies. When proposals do go through the Clearinghouse, it is up to the Clearinghouse, rather than the individual agency, to assure that floodplain information is provided and that the Water Conservation Board's floodplain section has an opportunity to comment on the proposal.

The Sewer Construction Grants Program provides state funding for the construction of sewer facilities. Although the money comes from the State Health Department and they administer the program, the Division of Local Government reviews local fiscal capabilities, relies on comments of its field representatives, and relies on comments received in the State Clearinghouse A-95 review process. The end result is a decision by the Division to issue or not to issue a certificate of eligibility for the community. The certificate is a prerequisite to funding. This process allows the Division to require any necessary floodplain information and any necessary review by the Water Conservation Board.

The emergency repair fund can be used to help communities repair public facilities like sewer systems, water systems, bridges, and so on. The emergency must be a financial emergency, where the community cannot pay for the repair, as well as a physical emergency. In addition to the analysis for these grants, the Division performs a similar analysis for disaster relief grants for state-declared disasters, where the Division of Disaster Emergency Services is involved. The City of Loveland was such a case. In either event the Division does not attach any conditions, such as improved floodplain management or joining the National Flood Insurance Program, to the grant.

One of the responsibilities of the Land Use Commission, whose staff is now in the Planning Services Section of the Division of Local Government, is to review rules and regulations used by the various state agencies to implement the Governor's Executive Orders.

The Land Use Commission does not do anything with regard to floodplain management except what is permitted under House Bill 1041. Under those provisions the Land Use Commission can request a 1041 designation hearing for hazards that are "matters of state interest." However, after the hearing the local jurisdiction can choose not to designate such hazards. An example of such a request for a designation hearing was Delta County.

The Planning Services Section interacts with local governments in floodplain management through its field representatives. In Mancos, for example, a grant for a comprehensive plan was amended to include development of floodplain information through the Water Conservation Board.

Field representatives attempt to notify the Water Conservation Board of communities with floodplain problems so technical assistance can be provided, if possible. In some cases, full-fledged studies are needed rather than just technical assistance.

2.5.12 Division of Housing

The Division of Housing administers a State Housing Grant Fund for the rehabilitation and repair of residential properties which 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 floodproofing 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 affects 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.

2.5.13 Department of Health

a. Drinking Water

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. There is no state funding assistance available for domestic water treatment facilities, except through the Division of Impact Assistance. The Health Department has control over the location of water treatment plants themselves but, having no money for assistance, they have little or no control over the location of distribution facilities.

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 preasure is applied to the distribution system and pumping costs are reduced. Therefore, floodplains are evaluated at the time plans and specifications are reviewed prior to construction of water treatement plants.

b. Waste Water

The role of the Colorado Department of Health, Division of Water Quality Control in floodplain management 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 state financial assistance in building a wastewater treatment facility, either concurrent with or after a site application. Third are permit applications; every year anyone who wishes to discharge waste (including treated waste) into a body of water in Colorado must receive a new discharge permit. All three of these processes have the potential to include floodplain management opportunities.

All proposed treatment plants are analyzed to see how they meet Governor Lamm'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 Division staff has limited expertise in hydrology, hydraulics, or geology, so they rely on the Geologic Survey to review approximately 150 proposals per year 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, adjacent cities and towns and the appropriate 208 Management Agency. However, the site application does include questions regarding floodplain issues. The staff in the Grants Section maintains a set of floodplain maps and relies on its own experience in screening applications for potential flood problems. The current review process allows the Geological Survey to forward to the Water Conservation Board any proposals it feels need additional review. There are some proposals where review by staff competent in hydraulics and floodproofing would be warranted.

The Department of Health has no authority with regard to sewage collection lines, so development in the floodplain is not generally controlled, even when state funding is involved.

The Division is sometimes involved in providing emergency help to communities suffering flood damage. Examples are the Big Thompson Canyon flood of 1976 and the City of Trinidad's flood in 1981 which damaged their water supply system.

c. Waste Management and Radiation Control

The Waste Management and Radiation Control divisions 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 in the 500-year floodplain.

2.5.14 Department of Administration

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.

Plans for any new state building must be approved by the State Buildings Division, Capital Construction and Control Maintenance Section. All of those plans are referred to the State Geological Survey to determine whether flooding (or any other geologic hazard) is a concern. 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 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 and their word is taken for it. Floodplain considerations are not reviewed formally. In the past, the Water Conservation Board has 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 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 which 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.

In the Big Thompson Flood, the Division of Accounts and Controls was involved in the disaster emergency coordination effort by the State. They will always be involved in similar efforts where large amounts of state money are spent.

2.5.15 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 Health is involved in the annual licensing of these facilities and may 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.

2.5.16 Department of Education

The Department of Education provides input to 181 local school boards on the location of their facilities, including advise 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, 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.

2.5.17 Colorado Commission on Higher Education

The Commission on Higher Education is the policy coordinating body for the 7 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 a recommendation is made by staff 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.

". . . At about 6:20 a.m. all in our party was awakened by a loud tree breaking thunder. By the time we looked out the first surge of water was 50 feet from our tent sending trees crashing downward along with tons of earth and boulders. Water and debris also reached our tent as we scrambled uphill with the first pieces of gear we could grab. When we finally realized the danger was over near our tent we pulled our gear and tent up the hill and watched the destruction. . ."

Visitor from
Chicago, Illinois
camped at Ypsilon
Creek Campsite

3.0 CRITICAL ISSUES

The Lawn Lake Dam failure raises continuing, perplexing and troublesome questions about how our citizens can be better protected from future flooding and how capital can be made available to maintain and rehabilitate the many dams in this state, built in many instances before and around the turn of the century. These questions have become more acute in recent years as a result of rapid urbanization in many areas of the state.

Of critical importance is the establishment of an effective flood hazard mitigation program which integrates aspects of dam safety, floodplain management, and emergency preparedness.

3.1 Dam Safety

The key dam safety issues in need of resolution are related to aging dams, hazard classification, frequency of dam inspection, spillway design criteria, unsafe dams, and improved dam safety legislation. Although hazard classification and spillway design criteria are not in themselves "critical issues," an understanding of these concepts is important to recognizing other issues which are critical. Some of the difficulties in each of these areas are briefly discussed below.

3.1.1 Aging Dams

The increasing age and possibility of failure of many dams in Colorado is becoming a major problem. Many dams were built around the turn of the century to capture surplus streamflow during snowmelt runoff. This water is used to supplement irrigation water requirements in the late summer for ditch systems with junior direct flow water rights. As a result, these dams are in need of additional maintenance and repairs as the aging and erosion forces continue to wear on a dam and its related appurtenances.

The State Engineer's list of certain dams in need of rehabilitation was made available to the CWCB late in 1981 (see Appendix). The dams on this list were those capable of storing water on streams with interstate compacts where Colorado was not using its full entitlement or where additional storage was needed. In the last two years, 26 projects were authorized for construction under the CWCB construction fund program, 20 in Senate Bill 439 (1981), and 6 in Senate Bill 87 (1982).

From the 20 projects on SB 439, two involved new dam construction at a State cost of $400,000; one involved repair of a dam not included on the State Engineer's list at a State cost of $112,000.

From the six projects on SB 87, two involved new dam construction at a State cost of $4,795,000; two involved repairs of dams not included on the State Engineer's list at a State cost of $2,182,000; and the Rio Grande Reservoir was on the State Engineer's list (State cost was $1,134,500--out of which $619,500 is non-reimbursable).

A letter was sent to 27 of the 34 project owners on the State Engineer's list (because the CWCB was already working with 4 owners and the State owned the other 3 dams) informing them about the CWCB program. Some telephone inquiries were made and three written responses were received, but no project application form was submitted to the CWCB for a project.

From the responses received to the CWCB program, it is apparent that owners of dams in need of rehabilitation have the following difficulties:

(1) They cannot afford the matching funds required which in most cases may have to be borrowed at interest rates that often may exceed 15%;

(2) Members of entities are reluctant to contribute more for their water project and think that a grant program through the State or Federal governments should be available.

3.1.2 Hazard Classification

About 10 years ago, the Dam Safety Branch of the Division of Water Resources developed a hazard rating procedure based upon a weighted analysis using dam height, reservoir capacity, estimated evacuation and potential downstream damage.

The procedure was used for several years and was the basis of the State's initial hazard ratings for the national inventory of dams. It was eventually replaced with the rating work for the National Dam Safety Program (NDSP).

Included in the federal NDSP are all artificial barriers together with appurtenant works which (1) are twenty-five feet or more in height or (2) have an impounding capacity of fifty acre-feet or more. Not included are barriers which are six feet or less in height, regardless of storage capacity, or barriers which have a storage capacity at maximum water storage elevation of fifteen acre-feet or less regardless of height. Classification of dams by size has not been adopted in Colorado.

Below is a table setting out hazard ratings for federal and non-federal dams in Colorado.

DAMS IN COLORADO

	High	Moderate	Low	Total
Non-Federal	197	327	1,605	2,129
Federal	35	10	75	120
Total	232	337	1,680	2,249

The hazards pertain to potential loss of human life or property damage in the area downstream of a dam in the event of structural failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Moderate hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. The following table sets forth the extent of development with respect to loss of life and economic loss for each category adopted in Colorado. The State criteria with respect to loss of life is more stringent than the present federal criteria.

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life	Economic Loss
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Moderate	None expected (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	Some	Excessive (Extensive community, industry or agriculture)

Information concerning the hazard classification associated with dams in Colorado is public record, but it is not generally disseminated to local city and county officials responsible for public safety. There is little public awareness of the extent of damage that could occur with the failure of dams. A list of high hazard dams in Colorado is included in the Appendix.

Local emergency preparedness officials are usually unaware if inundation maps of areas downstream from dams in their jurisdiction have been developed and, even if they existed, dam owners might be reluctant to bring them to their attention.

3.1.3 Inspection of Dams

The burden for inspection of dams must fall on the dam owners. They are at the dam frequently. They watch it fill. They watch it empty. They can best detect changes or points of stress. However, dam owners are often limited in their knowledge of how a dam functions, owner responsibilities, maintenance requirements, and inspection practices. This is often complicated by access problems and difficult terrain and weather at high elevation dams.

A lack of funding has made it difficult for the Division of Water Resources to provide adequate personnel and equipment to inspect dams in a consistent and regular manner. There are presently 8 full time employees approved for the field engineering unit consisting of 7 engineers and a supervisor. Additional engineers are needed to inspect dams and review construction plans on a timely basis. In addition, other resources are needed to support the engineers in order to allow maximization of their professional expertise.

These supporting services include helicopter transportation to remote dams, an automated data management system, additional clerical personnel to maintain records and files, funds to allow engineers to obtain additional state-of-the-art knowledge, and funds for research to allow data to be collected and analyzed on embankment properties on dams with structural deficiencies.

In order to improve Colorado's dam safety program and to participate in the National Dam Safety Program as requested by the Corps of Engineers, staff of the Dam Safety Branch were utilized to perform various activities related to this Federal program from 1978 to 1981. As a result, safety inspections of some dams, including Lawn Lake, were infrequently conducted or deferred for several years. Consequently, the goal during the last few years to inspect all high and moderate hazard dams was not achieved.

A guide on how many times a dam should be inspected based on hazard potential was developed by the Dam Safety Branch during the early 1970s. The guide indicated high hazard dams should be inspected more than once a year and low hazard dams should be inspected about once in five years. It was not implemented at that time because of a belief all dams should be inspected once a year.

If Colorado's dam safety program concentrated only on high and moderate hazard dams, the total number of dams which need to be inspected annually is 569, including Federal dams. The present staff can do this task if there are no other responsibilities added to their schedule. The present seven field engineers would be assigned 81 dams each for annual safety evaluations. Assuming the remaining 1,680 low hazard dams were inspected once every five years, another 48 dams would be added to each inspector's annual schedule for a total of 129. Secretarial, clerical, and technical support would still need to be increased. However, construction inspections on new projects could not be performed since the maximum number of inspections per engineer per year is approximately 130 if quality inspections are to be conducted.

By way of comparison, the State of California dam safety program uses a staff of 60 people to administer about 1,300 dams. The majority of these are engineers and geologists. California has had very few dam failures in the past 20 years. Its programs concentrate on dams greater than 25 feet in height and 50 acre-feet in capacity, which is the standard adopted by the NDSP. If Colorado adopted the same standard, the number of dams requiring safety evaluations could be reduced. In most instances, low hazard dams would be eliminated by this change in the standard.

If all 2,249 dams in Colorado are inspected once each year with the present staff, each field engineer would have about 320 dams to inspect annually, which is impossible. The State Engineer's Office has indicated it would take a total of twenty-two field engineers to make 2,249 safety inspections per year. Assuming 22 field engineers were available to make an equal number of safety inspections, each would be assigned about 102 dams. This would be a reasonable number of dams to inspect every year, along with the scheduling and follow-up work as well as 20 to 30 construction inspections and inspections of complaints.

Thus, an additional 16 engineers including at least two supervising engineers would be required to annually inspect all dams in the state. In order for a unit of this size to function properly, additional clerical, secretarial, and technical assistance would be required.

The options presented would greatly improve the safety of dams in Colorado, but neither would guarantee against failures. Beyond the provision of sufficient manpower to inspect every dam every year, the following actions would substantially enhance the existing inspection program:

(a) The provision of an automated data management system which would allow inspectors and managers to interact with the data base containing information pertaining to special requirements of a given dam, date last inspected, follow-up with owners, etc. Presently, the data files on the 2,249 dams are managed manually.

(b) Provision of adequate air transport to place inspectors in a position to inspect those dams in remote areas in the shortest time possible. Many dams are inaccessible to vehicle traffic requiring lengthy travel times by foot or horseback. Access to Lawn Lake Dam, for example, is limited by the National Park Service to foot travel, horseback, or helicopter.

(c) Provision of adequate soil boring and test equipment to allow determination of embankment properties. Knowledge of these facts can often provide advance warning of potential stability problems.

(d) Provision of sufficient opportunities for inspector personnel to participate in educational seminars and meetings in order to remain current on state-of-the-art technology with respect to dam design, construction and inspection.

3.1.4 Spillway Design Criteria

Present hydrologic criteria for evaluating the safety of a dam or the design of a dam spillway are based on the dams hazard classification and, in the case of federal dams, by hazard classification and size.

The federal classification for size is determined by the height of the dam and/or the storage capacity, whichever gives the larger size category, as indicated below.

SIZE CLASSIFICATION

Category	Storage (Ac-Ft)	Height (Ft)
Small	$\geq$ 50 and < 1000	$\geq$ 25 and < 40
Intermediate	$\geq$ 1000 and < 50,000	$\geq$ 40 and < 100
Large	$\geq$ 50,000	$\geq$ 100

The magnitude of the design flood is intended to represent the largest flood that need be considered in the evaluation of a given project. The discharge capacity of the spillway and/or the storage capacity of the reservoir should be capable of safely handling the recommended spillway design flood for the size and hazard potential classification of the dam. In Colorado, the sizing of dam spillways is a matter of state law. Colorado Revised Statute 1973, 37-87-105, as amended, states in part:

> "In making his determination, the state engineer shall be guided by criteria related to the probability that precipitaton will be exceeded once in five hundred years."

However, large reservoirs above inhabited areas may require a reservoir spillway capacity larger than a 500-year flood, and small remote reservoirs may not need a 500-year flood spillway. A comparison of State and Federal policy for approving reservoir spillways is shown below.

SPILLWAY DESIGN FLOODS

Hazard	Size	Federal Criteria	State Criteria
Low	Small Intermediate Large	50 to 100-yr frequency 100-yr to 1/2 PMF 1/2 PMF to PMF	100-year minimum or incremental damage analysis
Moderate (state) or Significant (Federal)	Small Intemediate Large	100-yr to 1/2 PMF 1/2 PMF to PMF PMF	100-year minimum or incremental damage analysis
High	Small Intermediate Large	1/2 PMF to PMF PMF PMF	Incremental damage analysis

100-yr = 100-Year Exceedence Interval. The flood magnitude expected to be exceeded, on the average, once in every 100 years. It may also be expressed as an exceedence frequency with a one-percent chance of being exceeded in any given year.

PMF = Probable Maximum Flood. The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

The incremental damage analysis used in Colorado compares the damages due to failure of the dam (caused by a flood which just exceeds the routing capacity of the reservoir) with the damages that would occur just before failure due to the design flood itself. Pre-failure conditions can include spillway discharge and any reasonable rainfall runoff occurring between the damsite and the point(s) of interest below the dam.

A dilemma has developed because the spillway design flood is related to the hazard classification which is a function of development below the dam. Unfortunately this development is beyond the control of the dam owner and, paradoxically, is often encouraged by a false sense of security created by the presence of the dam.

The State Engineer and the CWCB have no authority to require restrictive zoning downstream of a dam based on the potential dam failure. If people and their property downstream are subject to hazard, even if those people move in after the dam has been built, the dam owner is still responsible for damages and cannot require state or local government to minimize his responsibility through zoning or other means.

Owners of dams can protest at the hearings of the several commissions which approve developments that occur below their dams. In several cases, the dam owners have received relief from zoning and requirements of the approving authorities. It is the dam owners' responsibliity, however, to be diligent in regard to development that would affect their dams and make the protests to the commissioners.

The bottom line appears to be that all impoundments should ultimately be designed for the Probable Maximum Flood (PMF) as if they were a high hazard dam. The problem is that this is often too costly for the present dam owners, and continual upgrading or catching up is necessary as development takes place below dams.

3.1.5 Unsafe Dams

A dam is considered "unsafe" due to hydrologic deficiencies if additional significant damages or loss of life would occur due to failure of the dam from the spillway design flood. A list of 26 dams in the state that are considered unsafe as a result of inspections performed under the NDSP and presently under restrictions or study is included in the Appendix. In order to remove an order to limit the maximum allowable water surface elevation and utilize the full storage capacity of a reservoir, a dam owner must often expend large sums of money to improve the emergency spillway capacity. In some situations, certain dams on the unsafe dam list may be removed if study by the owner's consultant proves that there will be no additional damage or loss of life if it should fail during a flood event.

The incremental damage concept for spillway requirements recognizes that the volume of stored water could become insignificant with regard to additional loss of life or damage, in relation to the flood which is not only threatening the dam, but is also causing catastrophic damage downstream from the dam. In other words, everything of value is "wiped out" prior to the dam failure, or the increased stage-discharge due to the dam failure is insignificant. The dam owner is therefore liable only for the excess flow.

3.1.6 Legislation

The present dam safety law (Article 87 of Title 37, CRS 1973) needs refinement and improvement in certain areas. One important revision would permit the State Engineer to require the dam owner to provide additional technical information and studies regarding the safety of his dam.

The need for more authority to assure that dam owners comply with recommendations of the Dam Safety Branch should be examined.

3.2 Floodplain Management

There are several unresolved floodplain management issues which were brought to the surface as a result of the recent flooding on Fall River. These issues include the lack of a formal insurance zone for dam failure floods, the very low number of insured properties in Estes Park and the State, the availability of floodplain mapping, and the adequacy and enforcement of local floodplain management regulations.

Other floodplain management issues that have become apparent are the lack of a State program to acquire floodplain land for open space, management of State owned property in the floodplain, and the design of private bridges in the floodplain.

3.2.1 Dam Failure Flood Zone

The flood on Fall River was, on the average, about 2 1/2 times as deep as the estimated 500-year flood stage. Flood waters greatly surpassed the 500-year flood boundaries indicated in the town's flood insurance study.

Since the regulation of floodplains in the United States is based on the 100-year flood, the extent of flooding which may be expected to occur below a reservoir as the result of a dam failure has not, with few exceptions, been included in federal or State conducted floodplain studies.

In response to specific local requests, the CWCB has provided assistance to local communities by requesting the Soil Conservation Service to make a detailed study on the extent of flooding in the event of a dam failure. The SCS has conducted detailed dam failure flood studies on Box Elder Creek in Weld County and on three watersheds at Limon in Lincoln County, Colorado. Flood insurance rate maps, which are a product of the federally subsidized flood insurance program, take into account only flooding from natural runoff and precipitation events.

In fact, as a matter of common practice, most engineers will exclude from the calculation of peak discharge the drainage area above any dam built with and operated for flood control benefits. This will indicate lower peak discharges from rainfall due to a reduction in basin area. Otherwise the presence of a dam in flood hydrology studies is essentially ignored by assuming the reservoir at normal operating level and routing the flood through the emergency spillway.

Evaluation of the flood hazards of existing or proposed dams should they break would assist planning for development in downstream areas and help emergency preparedness and rescue agencies prepare for disasters. Due to lack of funding, however, the State has never been able to implement a program for methodically evaluating the flood hazards associated with the failure of dams in Colorado.

3.2.2 Flood Insurance

The number of communities in Colorado enrolled in the National Flood Insurance Program (NFIP) as of December 31, 1982 is summarized below:

COLORADO COMMUNITIES IN THE NFIP

	Emergency	Regular	Total in NFIP	Total in State
Counties	25	17	42	63
Cities and Towns	76	80	156	265
Totals	101	97	198	328

The number and value of flood insurance policies in effect in Colorado rapidly increased from 1974 to a peak during 1980. This dramatic increase was due primarily to the effort by the Federal Emergency Management Agency (FEMA) from 1978-80 to convert as many Colorado communities to the regular program as possible. Since 1981, the number of policies in force has been declining gradually at an average rate of about 26 policies per month. The trend in flood insurance including separate policies for structures and contents is shown in figure 3.1. A list of communities participating in the National Flood Insurance Program is included in the Appendix.

The table below shows the annual status of flood insurance policies for both the regular and emergency programs. The average amount of each policy appears to have more than doubled since records are available.

ANNUAL STATUS OF FLOOD INSURANCE POLICIES IN COLORADO

	Number of Policies			
Date	Regular	Emergency	Total	Amount
Dec. 31, 1974*	600	1400	2000	$50,000,000
Dec. 31, 1975*	800	2700	3500	95,000,000
Dec. 31, 1976*	1000	3600	4600	140,000,000
Dec. 31, 1977*	1200	4800	6000	200,000,000
Dec. 31, 1978	2333	5117	7450	270,192,800
Dec. 31, 1979	5962	4742	10704	455,865,300
Dec. 31, 1980	6278	4008	10286	492,996,100
Dec. 31, 1981	5455	2958	8413	439,193,200
Dec. 31, 1982*	5300	2800	8100	439,000,000

* estimated from graph in figure 3.1

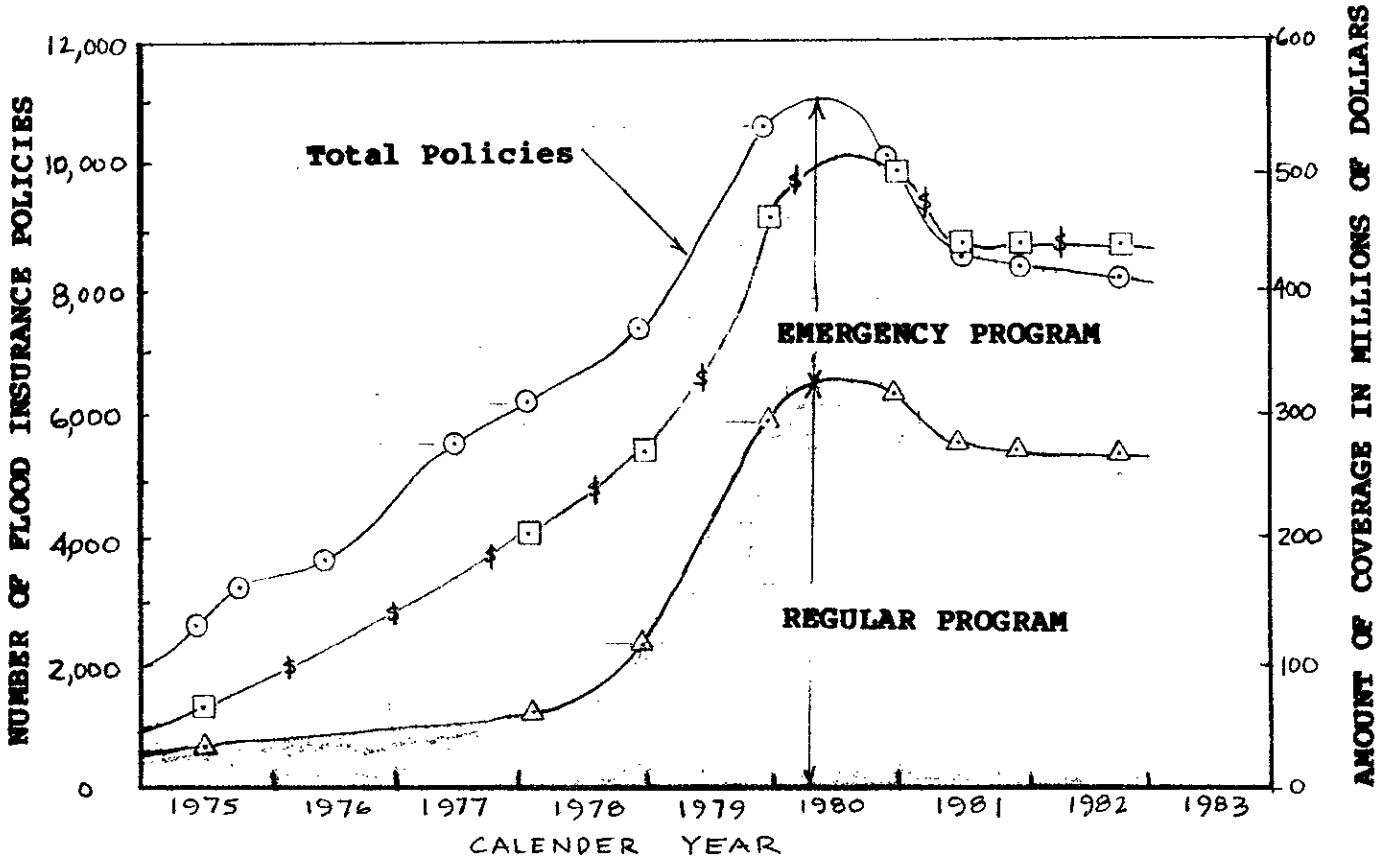


Figure 3.1, Trends in Flood Insurance Policies in Colorado.

A breakdown of policies by structures and contents for flood insurance policies actually in force in Colorado as of October 3, 1982 is shown below. Approximately 80 percent of all policies are for structures. Assuming there are 62,000 homes and 12,000 businesses exposed to the 100-year flood in Colorado, only about 9 percent of these structures are covered by flood insurance.

FLOOD INSURANCE POLICIES IN COLORADO

Program	Structures	Contents	Total
Regular	4344	996	5340
Emergency	2205	635	2840
Total	6549	1631	8180

The amount of flood insurance coverage in Colorado as of October 3, 1982 is shown below. The value of structures insured is approximately two-thirds the total amount covered. If the estimate of the total value of exposed property in Colorado of 6 billion dollars is correct, it appears only about 7 percent of it is presently covered by insurance.

AMOUNT OF FLOOD INSURANCE IN WHOLE DOLLARS

Program	Structures	Contents	Total
Regular	222,779,400	108,054,400	330,833,800
Emergency	72,855,800	35,174,800	108,030,600
Total	$295,635,200	$143,229,200	$438,864,400

The declining enrollment and low level of participation in the National Flood Insurance Program in Colorado as demonstrated by the above statistics highlight a significant problem.

3.2.3 Identification of the Floodplain

The starting point of any floodplain management program is the identification of flood hazard areas.

Most of the incorporated cities and towns and all counties in Colorado have some kind of stream, lake, pond, or drainageway within their boundaries. Flood hazard problems can be identified through a flood hazard study based on observation of an actual flood event or on the projection of such an event. The occurrence of floods are not predictable; however, the probability of their occurrence can be quantified. The hydrologic (peak rate of flow and flood volume) and hydraulic (flood depth and velocity) parameters of each flood problem can be estimated through application of engineering principles and procedures.

A Floodplain Information Report or a Master Drainage Plan is a means of providing community officials with information to describe flooding and find solutions to drainage problems. Community officials then know how high the water might rise, which structures and dwellings might be flooded, and which areas would be safe. With basic floodplain information and data, a community can enter the National Flood Insurance Program and enforce floodplain zoning regulations for managing its floodplains. With the aid of an engineering investigation of a community's flood and drainage problems, local planners can begin to address those problems and prioritize expenditures in a systematic order.

To date, about 2,800 stream miles have been studied in detail for flood hazards as shown in figure 3.2. It is believed that approximately 6,000 stream miles in Colorado are developable and need to be evaluated. The stream miles which have been studied thus far are estimated to represent about 60% of the present potentially endangered population. Figure 3.2 indicates the status of floodplain mapping in Colorado.

Colorado floodplains have been studied by the Federal Insurance Administration formerly under the U.S. Department of Housing and Urban Development (HUD) and now under the Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers, the USDA Soil Conservation Service, the Colorado Water Conservation Board, the Urban Drainage and Flood Control District, local governments, and private consultants.

The first floodplain information report in Colorado intended for land use management was prepared by the U.S. Army Corps of Engineers (COE) in 1963 for the South Platte River through Denver. From the middle 1960s through the late 1970s, the COE was the most aggressive federal agency doing floodplain mapping in five regional corps districts which extended into the state. The engineering for these studies was provided at no cost to the state provided the CWCB furnished the COE with suitable base maps.

Beginning in 1972, the CWCB initiated a state program to map floodplains which required matching funds from the local government having jurisdiction on the river being mapped. From 1974 up to 1980, the Board's mapping program received $150,000 annually from the Legislature which, with matching funds from local governments, leveraged the amount to at least $300,000.

With the creation of the National Flood Insurance Program, a shift in federal emphasis in floodplain mapping from the Corps of Engineers to the FEMA occurred in the mid 1970s. In 1977, the first Flood Insurance Study for Colorado was designated, and the Corps involvement declined. However, the same base mapping arrangement that existed with the Corps still exists with FEMA, except the CWCB no longer has funds directly available for this activity.

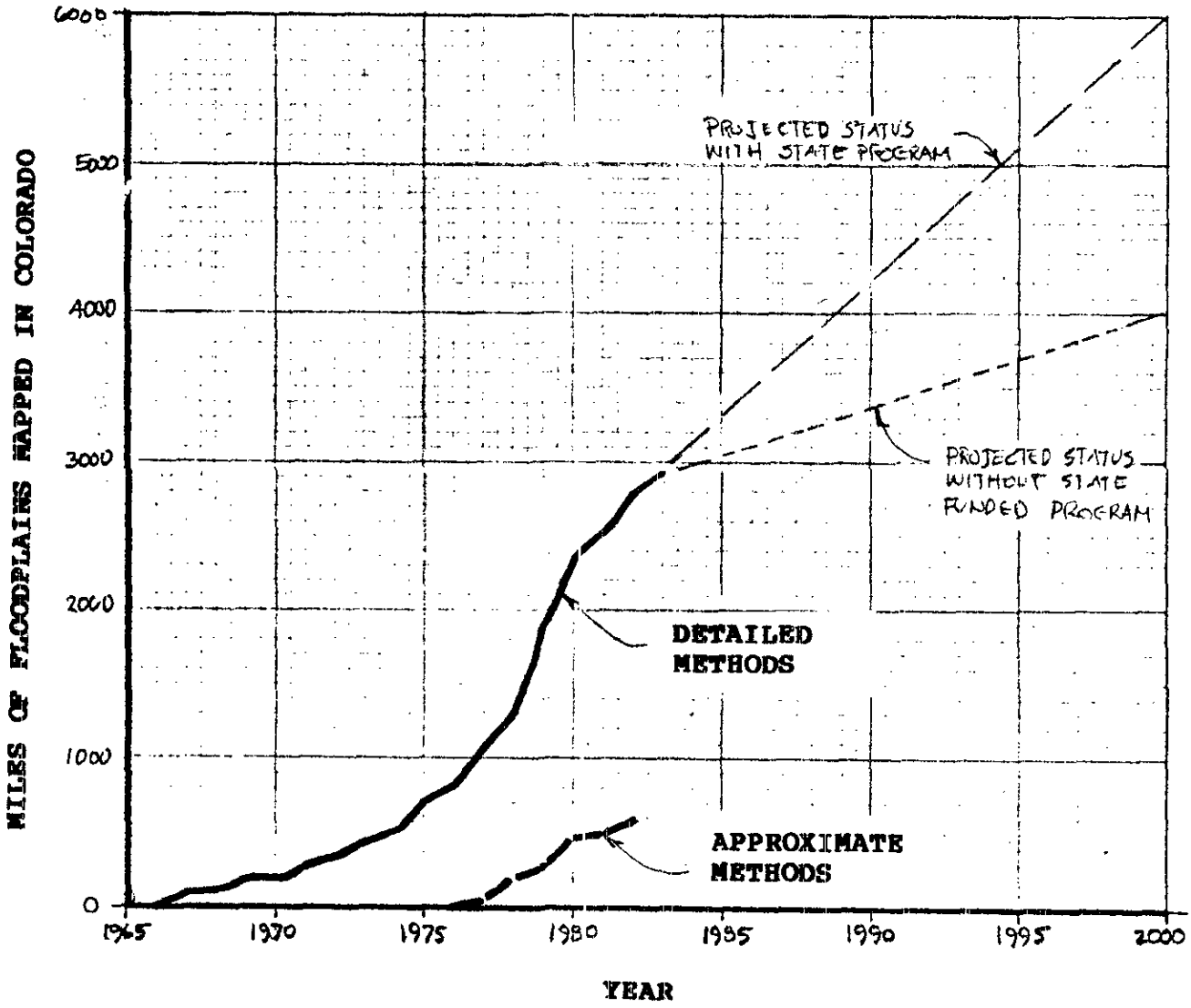


Figure 3.2, Status of Floodplain Mapping Colorado

In FY 1980-81, the CWCB's mapping program funds were reduced to $100,000, and the Legislature specified a cost-share ratio of 2/3 local to 1/3 state funds be required. In FY 1981-82 the Legislature provided no funds at all for the mapping program. In FY 1982-83 the General Assembly's appropriation to theboard was reduced by $116,000 and contained a provision which required, for the first time, that the board staff charge local governments a fee to perform other floodplain management services.

To best utilize the limited funds that remain available for mapping from other agencies each year, the CWCB prepares an annual floodplain study priority list. The list shows floodplain study needs of all the communities in the state and prioritizes those needs according to the magnitude of the flooding possible, current population, ongoing and anticipated population growth, and other related factors. Federal and State agencies with funds available for floodplain studies in Colorado use the list to develop work programs.

The reduced availability of public funds for floodplain studies and continued development pressure on floodplain areas in the state could result in two scenarios:

1. Either developers will have to study and delineate more miles of floodplains themselves in compliance with State standards, or;

2. More miles of floodplains will undergo development without adequate delineation of flood hazard areas, increasing vulnerability to future flood damages and loss of life.

3.2.4 Development and Enforcement of Floodplain Regulations

Choosing appropriate floodplain management concepts is an important step towards developing a local floodplain ordinance. Within Colorado, two basic concepts for dividing the 100-year floodplain into an inner, more restrictive subdistrict and an outer subdistrict where development may be allowed are suggested in the CWCB Model Regulations as options to local units of government. These options are:

1. The Floodway Concept which specifies an allowable rise (.5') in water surface elevations to pass the 100-year flood provided hazardous velocities are not produced.

2. The Hazard Area Concept where a depth of 18 inches or greater and a velocity of 3 feet per second or greater is considered the high hazard area which must be kept free of development.

It has been discovered throughout the state that both concepts have their merits. The Floodway Concept, based on a rise criteria, is a sophisticated engineering solution. It is quite compatible for wide, flat-sloped floodplains where conveyance capacity must be preserved. By assuming encroachment from both sides of the channel, the floodway line may be conservative since development may not take place at every point. Unfortunately, the floodway is more expensive to determine and can involve some political decisions such as in the assumption of the distribution of reduction in conveyance capacity from each side of the channel. On steep gradient streams in Colorado, encroachment on the floodplain can appear to lower water surface profiles as the computer solution of flow passes into the super-critical regime with shallow depths and high velocities. Another limitation of the floodway concept is that the specificed but arbitrary rise criteria of 1.0 feet or 0.5 feet may not relate to actual damage potential.

The Hazard Area Concept is based on a depth criteria, and its application, simple to understand, does not require as much detailed engineering. This concept is most applicable to the narrower and steeper gradient streams found in the mountain regions of the state. The criteria relates to potential damages produced by static and dynamic flood forces caused by depth and velocity. The Hazard Area Concept does not work well in wide floodplains where development pressure is great.

The Board's initial model floodplain regulations were adapted in 1975 pursuant to Section 24-65.1-202(2)(a)(I), CRS 1972 as amended. Because of changes in federal laws, rules and regulations, particularly relating to the National Flood Insurance Program, the model was recently revised to incorporate elements of the model regulations promulgated by FEMA.

The Board's revised model was formally adopted by the CWCB on June 2, 1982 and is responsive to the needs of the local government. Any deviations from the FEMA model regulations are justified by circumstance unique to Colorado. However, FEMA has not responded to repeated requests for formal endorsement.

By state law, the enforcement of floodplain regulations in Colorado is in the hands of local governments. In 1980, the Land Use Commission conducted a survey of all counties and municipalities in Colorado to determine the status of their planning, regulations, and interjurisdictional activities. Their findings were:

- 63 out of 63 counties have adopted subdivision regulations
- 49 out of 63 counties have adopted zoning resolutions

- 26 of 63 counties have adopted a current master plan for all or part of the unincorporated area of the county

- 9 of 63 counties have an operational land use management system inplace, including adopted policies, plans, regulations and the administrative structure adequate to manage anticipated growth.

The adoption and enforcement of floodplain regulations is a prerequisite to entering and staying in the National Flood Insurance Program. As of November 15, 1982, there were 26 cities and 4 counties which have had flood hazard areas identified by FEMA but were not in the federal Flood Insurance Program. Five communities in Colorado have been suspended from the regular program presumably for not enforcing acceptable floodplain ordinances.

3.2.5 Acquisition of Floodplains

A significant number of improved or developed properties along streams in Colorado are now located in identified flood hazard areas. The potential for development in the floodplain at other locations is high and will increase directly with the increase in state population.

Immediately after a flood disaster occurs, special opportunities exist to acquire these properties and convert them to appropriate land uses. The Federal government has developed a program under Section 1362 of PL 93-288 to acquire damaged properties, but the use of strict damage criteria often prevents implementation.

Many Colorado communities have developed master plans for public improvements which often include acquisition of open space as an objective. No formal state level program exists to acquire damaged floodplain land, although the Land and Water Conservation Fund administered by the Division of Parks and Outdoor Recreation might be applicable.

3.2.6 State Property in the Floodplain

The Department of Natural Resources through the Division of Wildlife, the Division of Parks and Outdoor Recreation, and the State Land Board owns considerable property in the floodplain including dams, fish hatcheries, wildlife areas, state parks, and leased property.

In addition, the Colorado Water Conservation Board, in the administration of the CWCB construction fund for dam rehabilitation and other water resource development projects, has set a practice of taking title to the constructed improvements as a way of obtaining financial security on monies essentially borrowed by the entity. Thus, on paper the CWCB has also become the apparent owner of several dams in the state.

Although a few emergency preparedness plans exist for many of the dams owned by the State, this task is not complete. Few state agencies have adopted formal rules and regulations following the Governor's Executive Orders on floodplain management. Thus, flood hazard areas (including dam failure inundation zones) have not been identified in State owned recreational areas.

The matter of liability, should a dam owned by the State fail, has not been tested.

3.2.7 Bridges

Many private and public bridges located within the Fall River floodplain were significantly damaged or destroyed by the flood waters and the debris they carried. Private bridges and roads which are lost during a flood result in temporary inconvenience to the affected public and insignificant reconstruction costs. These facilities have often been built with little attention to proper hydrologic design standards.

The shape and amount of fill or rip-rap material placed on the upstream side of a bridge has an effect on backwater during a flood. If fill material is allowed to constrict the area under the bridge, the force of the floodwaters is concentrated, resulting in greater damage. Serious erosion problems can occur during flash flooding if the existing stream channel has not been properly stabilized in the vicinity of roadways or structures. Utility lines and other obstructions around bridges can impede debris removal. These obstructions can make it difficult to provide temporary bridge structures and for heavy equipment to remove debris or make emergency repairs.

Cities and counties may not have adopted standards for roadway and bridge design. Some local governments lack specific design standards for road and bridge construction. To qualify for federal participation to reconstruct these facilities, it is necessary to have standards in effect prior to the need for reconstruction. Failure to do so could jeopardize federal participation in reconstruction.

The following standard references are available to local governments in the design of bridges:

1. Colorado Roadway Design Manual, 1980 as amended.
2. Colorado Standard Specifications for Road and Bridge Construction, 1981
3. A Policy on Design of Urban Highways and Arterial Streets, American Association of State Highway and Transportation Officials.

4. Hydraulic Design Series, published by the Federal Highway Administration, U.S. Department of Transportation.

The Colorado Department of Highways Underground and Utility Permit Process and the Corps of Engineers 404 Permit Process can also play a role in the proper design of bridge structures in the floodplain.

The Town of Estes Park and Larimer County have recently designed and tested standard bridge replacements to insure they can adequately handle a 100-year flood. They have also adopted and enforced bridge standards requiring that new bridges located in identified floodplain areas must be capable of handling 100-year floods without sustaining significant damage. The use of these standards by other Colorado communities could significantly reduce flood damages.

3.2.8 Legislation

Several bills have been passed in Colorado that have dealt to varying degrees with floodplains and their regulation or management. However, there is no single comprehensive floodplain management authority for the state. Instead there are seven separate bills relating to land use controls and six separate bills relating to flood control projects which have been incorporated into the Colorado Revised Statutes. Because these bills were developed and adopted separately, there is a lack of coordination, and in some cases there are conflicts among them. Definitions that differ slightly from statute to statute can create more than just a problem of semantics. The result is a set of floodplain management authorities which is less complete and less efficient than it could be.

3.2.8.1 Land Use Legislation

Section 30-28-111 for counties and 31-23-301, CRS 1973, for municipalities provide the Water Conservation Board with the authority and responsibility for designating and approving floodplains for local regulation. However, it does not refer to the 100-year flood or any specific standards defining what is or is not a floodplain.

In Section 24-65-105(1)(b), CRS 1973, it would appear that the word "floodway" is intended to mean "floodplain," but this is unclear. The 100-year "floodway" is not defined by any criteria or standards. The result of these two problems is a need to clarify what the areas are in the State that "should be identified" and what standards should be used in "identifying" them.

Section 30-28-133, CRS 1973, Sub-division Regulations, makes general references to "storm drainage," "geologic factors," "floodwater problems" and "flood control," but no specific references to the 100-year floodplain (or any other technically defined floodplain) or to development standards for any such floodplain. There is a reference to "a one hundred year storm," but it addresses the need for detention facilities for runoff from a developed subdivision that exceeds "historic runoff" from the same area "in its undeveloped . . . condition." As with other bills the enabling authority is general in nature, and no agency is given responsibility for technical review or for development of technical standards.

H.B. 1041, embodied in Section 24-65.1-101 et seq., CRS 1973, is more specific than much of Colorado's land use legislation, but is still fairly general with regard to floodplains. Tied to the legislation are model regulations which specifically define the 100-year floodplain. The model regulations are described as guidelines to be followed by local governments in locally administering natural hazard areas. The Colorado Land Use Commission is one of the links holding the above sequence together. Because the Commission's staff is so small and because the Commission has not traditionally received much legislative support, it is less likely that local governments will be required to regulate floodplains.

Floodplain studies that are carried out pursuant to 24-65.1 (CRS 1973) must meet CWCB standards, but no standards or criteria are tied to the legislation. Requiring CWCB standards to be met by floodplain studies and requiring CWCB designation prior to local designation and administration give the Water Conservation Board authority to set standards, but standards need to be tied to the legislation to complete the sequence.

Municipalities may create planning commissions under authority of 31-23, CRS 1973. If a commission is created, its duty is to prepare a master plan including "the promotion of safety from flood waters." Also, the community may adopt subdivision regulations. However, the enabling language for subdivision regulations does not mention floodplains or natural hazards or their regulation.

3.2.8.2 Flood Control Legislation

A number of counties have requested technical and financial assistance to accomplish flood control projects under authority of Section 30-20-102 et seq., CRS 1973. With a limit of 7 percent in total state agency budget increases per year, no money has ever been available for such a program.

Section 37-2-101 et seq., CRS 1973, describes the formulation of Flood Control Conservancy Districts. Apparently there were such districts in the 1930s, but none are currently active.

Conservancy districts today are primarily involved with irrigation activities. The legislation was passed sixty years ago, so the flood control aspects are somewhat outdated.

Paragraph (c) of Section 37-60-106 et seq., CRS 1973, can be interpreted to say that the Board has authority to develop plans for flood control measures; however, the word "control" is not present. Paragraph (j) clearly states that the Board can participate in the construction of a flood control project; however, the project must be an authorized federal project. Federal requirements may be too complex and stringent for many of these projects to be realized. Otherwise an attempt can be made to fund local flood control projects through a CWCB line item appropriation or through a special bill.

Section 37-60-119 CRS, 1973, describes the construction of water and power facilities, including flood control projects, from the CWCB construction fund.

Since a flood control project is non-revenue generating, many units of local governments find the CWCB construction fund to be of little use because all borrowed monies must be repaid. Traditionally, monies for flood control have been made available to local governments on a cost-sharing grant basis. For a small local protection project, this fund source would not be applicable, because a special district would need to be formed prior to receiving the first dollar of construction monies.

3.3 Emergency Preparedness

3.3.1 Public Awareness and Education

Successful hazard mitigation activities and disaster preparedness programs in general are directly related and highly dependent on the level of threat awareness and education the general public may have. Colorado has a constantly growing resident population, as well as large numbers of tourists who come here to enjoy year-round recreational opportunities. Many newcomers and tourist visitors are unaware of the natural hazards that exist in Colorado and what they should do if they are exposed to a hazardous event.

Colorado has classified numerous high and moderate hazard dams, as well as a number of high hazard canyons. History has shown a flash flood caused by either a dam failure such as Lawn Lake or a meteorological event such as the Big Thompson flood can have disastrous consequences. These threats are magnified since little has been done on a systematic basis to identify in layman's terms for the general public on a site specific basis where these hazards exist, who and what is threatened and what are the positive response actions that should be taken. Hazard determination, pamphlets, warning signs, and public service announcements are the means that can be used to begin to address this issue, but progress will depend on an organized and systematic approach.

3.3.2 Warning Systems

To warn residents of impending floods, a mixture of human and technological means should be utilized to form an effective system. Spotters who live along streams comprise important elements of warning systems in existence in Colorado, largely under sponsorship of the National Weather Service. But many potential floodplains need stream gauges and warning instruments to cover areas where spotter activity is impractical.

Non-automated stream staff gauges are needed at selected free-standing and bridge sites which can be read out by passing observers and law enforcement personnel. They should clearly indicate water depth and the significance of flood stages. A depth-discharge relationship must be developed for each site.

These instruments have been effectively utilized--for example, in Boulder Canyon--but many governments find their cost prohibitive. Most potential dam failure inundation zones are not equipped with the instrumentation that could save lives should failure occur. Many of the areas that need to be monitored are located in low tax base jurisdictions; therefore, a federal/state program that provides funding incentives may be essential for providing needed instrumentation. Advancements in technology are lowering costs and providing for wider and more timely coverage.

The authority for the federal government to make river forecasts is set forth in Department of Commerce Organization Order 25-2B, Section 12. This authority is vested in various offices of the National Weather Service (NWS).

This responsibility includes the issuance of flash flood watches and warnings in the event of dam failures. Obviously such warnings are not always possible. There are times, however, when timely information on dam breaks would allow the National Weather Service to warn persons downstream of potential floods. To accomplish this, it is imperative that the NWS be informed as soon as possible of actual or imminent dam failures.

The River Forecast Center (RFC) in Kansas City, Missouri, prepares stage forecasts for the Cache La Poudre River in Colorado with a lead time of 12 hours or more, based on basin configuration and antecedent rainfall. Also, the RFC-produced Headwater Guidance Advisory, issued twice weekly, is a notice of rainfall needed over a period of three hours or so to produce bankfull stages in various front range canyon areas. With this information, local observers can be made alert to the possibility of flooding and aware of the importance of rainfall measurements.

The NWS has developed a forecasting table for the municipality of Rustic, Colorado in the Poudre River Basin which relates a range of generalized rainfall distribution on the basin upstream from the community to the resulting streamflow at Rustic. This sort of forecasting relationship, for internal use by the Weather Service Forecasting Office in Denver, would be equally useful to local emergency preparedness offices.

3.3.3 Integration of Emergency Response

In any emergency situation, especially one of the magnitude of the Lawn Lake flood, there may be numerous individuals who respond with a variety of professional backgrounds representing various agencies of several political jurisdictions and authorities.

Without a preplanned system that allows for integration, direction and control, and establishment of resource priorities and which recognizes political, professional, statutorial and financial considerations of those involved, there will be gaps and overlaps in emergency response. In the Lawn Lake emergency there was some verbal coordination before the event, but nothing of a formal nature. Consequently, the Park Service operated in partial isolation from the town and county. The County Sheriff and Town Police Chief did coordinate their activities, but a pre-existing agreement for identifying interagency and interjurisdictional responsibilities would have enhanced the effectiveness of these two agencies as well as the various other agencies involved.

A standardized structure to address interagency and inter-jurisdictional decision making should be developed and modified to suit local entities.

3.3.4 Coordination of Mitigation Activities

Many federal, state, local and private agencies can and should play important roles in mitigating the impacts of disasters. A mechanism to facilitate and ensure coordination among all entities involved in hazard mitigation is an urgent need that would be particularly cost effective in the future. This mechanism would be comprised of a council of agency representatives and a hazard mitigation officer. Through their work, such a State Hazard Mitigation Council could develop a State Hazard Mitigation Plan to guide future progress in this vital area.

"...I started to hear a sound like an airplane. Also there were loud booms. It got louder and louder. I thought it was breaking the (sound barrier). I kept looking for a plane but couldn't see one. I got suspicious and started to look upstream. I saw trees crashing over and a wall of water coming down. I started to run as fast as I could for high ground. There was a deafening roar. I fell and got up and kept running. I stood on high ground and watched it wipe out our camp site. It knocked everything in its path over. Steve didn't stand a chance..."

Park Visitor from
Appleton, Wisconsin
camped at Roaring River
campsite

4.0 MITIGATION RECOMMENDATIONS

The following recommendations for changes in existing state programs or development of new programs in the areas of dam safety, floodplain management, and emergency preparedness are intended to contribute toward reducing future flood damages. Most of the recommendations are logical responses to the problems identified in the previous discussion of critical issues. The majority of the ideas were developed by task force members after reviewing their own agency programs.

Each recommendation includes a brief statement of the problem, a general statement of the recommended solution, ideas for short and long term initiatives, the lead agency and any cooperating agencies if appropriate, and a preliminary estimate of the cost to implement the idea. The preliminary cost estimates are intended to indicate the relative level of effort for each recommendation.

4.1 Dam Safety

4.1.1 Increase Frequency of Dam Inspection

Problem: There is a lack of funding to provide adequate resources to inspect dams in a consistent and regular manner. Additional engineers are needed to inspect dams and review construction plans on a timely basis. In addition, other resources are needed to support the engineers in order to allow maximization of their professional expertise. These supporting services include helicopter transportation to remote dams, an automated data management system, additional clerical personnel to maintain records and files, funds to allow engineers to obtain additional state-of-the-art knowledge, and funds for research to allow data to be collected and analyzed on embankment properties, etc. on problem dams.

Solution: Request additional funds from the Legislature.

Short Term Initiative: The State Engineer's budget request for the 1983-84 fiscal year, as in past years, recognizes the need for additional resources in dam safety and contains a request for the following additions to the existing program:

a. Field Engineers - 1 supervisor and 4 engineers

b. Design Review Engineers - 3 engineers

c. Clerical Support - 3 administrative clerk typists

d. 80 hours of helicopter rental

e. Rental of drilling equipment and soil testing

f. Professional training fund

g. Consultant fund for problems requiring special expertise.

Long Term Initiative: Increase field inspection unit staff to 22 inspectors so that all dams can be inspected annually.

Lead Agency: State Engineer.

Cost: The State Engineer's budget request for additions to the Dam Safety Program will require $523,000 in additional funding. This budget request has been approved by the Director of the Department of Natural Resources and now is under review by the Office of State Budgeting and Planning. The exact budget request to be forwarded by the Governor to the Legislature's Joint Budget Committee is not known at this time.

4.1.2 Coordinate Dam Safety Activities Among State Agencies

Problem: A formal system to integrate and coordinate the broadest range of dam safety issues does not exist in State Government. The State Engineer is responsible for the State's Dam Safety Program, and his orientation is primarily on structural issues related to maintaining the integrity of dam structures. But many other State agencies have associated responsibilities, such as the mapping of geologic and seismic hazards, reduction of flood damages, development of water resources, and the safety of downstream population. Well before Lawn Lake, major efforts in coordination have been made by the State Engineer, the Geological Survey, the CWCB and DODES; but there is no formal system to include the activities of these and other interested state agencies in the area of dam safety.

Solution: Form a State Dam Safety Coordinating Task Force of concerned State agencies to coordinate dam safety activities. This program would be coordinated with the National Dam Safety Program and would include work elements to satisfy a range of structural and non-structural objectives.

Short Term Initiative: Create by Executive Order a Dam Safety Coordinating Task Force of representatives from concerned State agencies under chairmanship of the State Engineer, Department of Natural Resources. This group would include the following agencies: State Engineer, CWCB, DODES, Department of Local Affairs, Geological Survey, Division of Parks and Outdoor Recreation, Division of Wildlife, and others as appropriate. The Geological Survey contributions from field work and associated earthquake analyses and DODES work on non-structural planning are particularly important. The Department of Natural Resources should submit a proposal for Executive Order by March 1, 1983.

Long Term Initiative: The Dam Safety Coordinating Task Force should annually review the activities of the various representatives in the area of dam safety to maximize coordination and cooperation among state agencies to assure public safety.

Lead Agency: State Engineer in cooperation with DODES, the CGS and the CWCB.

Cost: $1,000 per year.

4.1.3 Require Dam Owners to Develop Additional Technical Information

Problem: The present dam safety law (Article 87 of Title 37, CRS 1973) needs refinement and improvement to permit the State Engineer to require dam owners to provide additional technical information and studies regarding the safety of their dam(s). This is a problem since dam owners are often limited in their knowledge of owner responsibilities, maintenance requirements, and inspection practices.

Solution: A comprehensive Dam Safety Law is needed to modernize the existing law and clarify safety requirements to dam owners.

Short Term Initiative: The State Engineer has drafted a revised Dam Safety Law and submitted it to the Interim Committee on Agriculture and Natural Resources (SB 15). This proposed law is comprehensive (in structural terms) and should address most of the concerns that have arisen since the failure of Lawn Lake dam.

Long Term Initiative: Legislative action should be sought to give the State Engineer authority to impose sanctions on dam owners who fail to comply with directives and recommendations emanating from official dam inspections.

Lead Agency: State Engineer.

Cost: Variable to be paid for by the dam owner.

4.1.4 Promote the Rehabilitation of Aging Dams

Problem: Many dams in Colorado are old, having been built around the turn of the century to capture surplus streamflow during snowmelt runoff to supplement irrigation water requirements in the late summer. As a result, these dams are in need of increasing maintenance and repairs as aging and erosion forces continue to wear on the dams and their related appurtenances. However, money in the form of low interest loans available through the Colorado Water Conservation Board is difficult for most dam owners to obtain. The Board's program is primarily directed at putting water to beneficial use to maximize interstate compact allocations.

The problem of aging dams may become worse as new deficiencies are discovered through the combination of frequency of increased inspection; passage of the revised dam safety law which would allow the State Engineer to request additional studies, investigations, and data for problem dams; and the Dam Owners Safety Manual which will educate owners in detail on their responsibilities.

Solution: The CWCB Construction Fund program should be promoted to enhance participation by dam owners.

Short Term Initiative: Re-evaluate the existing criteria for participation in the CWCB construction fund program to recognize the significant benefits to be derived from reducing potential flood damages.

Long Term Initiative: The capital investment plan should be pursued with owners and with future legislatures.

Lead Agency: CWCB in cooperation with the State Engineer.

Cost: $1,000.

4.1.5 Reduce Cost for Dam Spillway Rehabilitation by Investigating New Ideas

Problem: Recent changes in hydrologic criteria used to evaluate dam safety have caused many dams in Colorado to be classified as unsafe due to inadequate spillway capacity. However, costs to increase spillway capacity by enlargement are often beyond the financial resources of dam owners.

Solution: Fuse plugs constructed in a low spot in the embankment of existing dams have been suggested as a low-cost alternative to increasing spillway capacity. Essentially, the method attempts to control the rate and location of failure during a large flood when overtopping of the main embankment is imminent.

Short Term Initiative: Investigate the need to contract with Colorado State University to conduct model studies in their hydraulic laboratory and prepare a report on the feasibility of using fuse plugs to increase emergency spillway capacity.

Long Term Initiative: Identify from the list of dams in need of rehabilitation those structures where the recommended method might be a feasible option.

Lead Agency: State Engineer

Cost: $50,000.

4.1.6 Develop a Means for Dam Owners to Obtain Relief to Support Dam Rehabilitation or Improve Spillway Capacity Due to Downstream Development

Problem: Dam owners are responsible for flood damages below their dams if they fail, but they cannot require State or local governments to minimize their responsibility through restrictive zoning. They can only protest and rely on the judgement of several commissions that approve development below their dams. People who settle in the dam failure inundation zone long after a dam has been built raise the hazard classification of the dam.

Solution: Establish special improvement districts in the dam failure inundation zone which can be used to finance dam rehabilitation or improve spillway capacity. Require new developments in the inundation zone to pay a fee for maintenance of dam safety.

Short Term Initiative: Request the Attorney General to (1) research past case histories where dam owners have protested development below their dams and obtained relief, and (2) the legal feasibility of establishing restructure zoning or improvement districts based on the dam failure flood boundaries.

Long Term Initiative: Draft new legislation which would make it possible for dam owners to generate revenue in proportion to the rate of development below their dams.

Lead Agency: CWCB in cooperation with the State Engineer.

Cost: $5,000.

4.1.7 Provide Concerned Local Government Officials with Dam Information in State Files

Problem: Information relative to dam operations and safety inspections is not routinely distributed among all parties who need that information. This information is required by local officials to prepare more adequately for emergencies within their geographical areas of responsibility.

Solution: State offices and agencies having dam data must take steps needed to improve accessibility and provide the latest inspection reports and other appropriate information on all high and moderate hazard dams to concerned County officials responsible for emergency preparedness.

Short Term Initiative: Send a letter to county disaster coordinators advising them what dam information exists and how it can be obtained. Existing dam information in state files should be reproduced and sent to the concerned county emergency management officials.

Long Term Initiative: Seek authority to require dam owners to provide the State with listings of responsible parties, notification of change in ownership, emergency preparedness plans, and inundation maps for all dams in Colorado. It might be necessary to require dam owners to update this material at periodic intervals, perhaps every two or three years. This information should be reproduced and sent to the local emergency management coordinator concerned.

Lead Agency: State Engineer in cooperation with DODES.

Cost: Variable cost to dam owner for reproduction expenses.

4.2 Floodplain Management

4.2.1 Re-establish a State Program to Map Flood Hazard Areas in Colorado Communities

Problem: Many floodprone areas in Colorado have not been mapped. The threat to many Coloradans who reside or may build in these areas has not been delineated due to insufficient funding at all levels of government. The benefits of a floodplain mapping program have not been well documented, and the potential for such information to reduce flood damages is not understood by the public.

Solution: State government should reinstate the CWCB program and continue mapping floodplains in Colorado.

Short Term Initiative: The Colorado Water Conservation Board should document the cost effectiveness of floodplain mapping to reduce flood damages and continue to seek an appropriation during the next legislative session to continue mapping of flood hazard areas.

Long Term Initiative: The CWCB should continue to advise FEMA of State priorities for funding of flood insurance studies in Colorado.

Lead Agency: Colorado Water Conservation Board.

Cost: $200,000 per year to be matched 50-50 by local governments.

4.2.2 Create a State Managed Permit System for Proposed Development in the Floodplain.

Problem: Many local governments in Colorado, including Larimer County, have enacted and are implementing floodplain land use regulations. However, there are some local governments which either have not enacted nor adequately enforced floodplain regulations. Many manmade structures appear to be constructed too close to the river channel in Colorado, in spite of local (city and county) regulations which may be in force. Manmade structures, particularly homes, which are constructed too close to the river channel can be damaged during a flood. This loss to the private landowner contributes significantly to flood damages and to the debris clean-up problems during and after a flood.

Solution: Regulate floodplain development at the State level of government by establishing a permit system. A State permit system should be established for regulating land use in floodplains only in those counties and municipalities which have not adopted and implemented floodplain regulations which meet minimum standards. Local governments would be free to establish requirements which are equally strict or more strict than published State standards, and in such a case, the local standards would be in effect and the rules would be administered locally. If however, local government failed to adopt or implement a regulation, the State, through the Water Conservation Board, could enact a permit system for the jurisdiction. The State would continue, in all cases, to provide technical assistance for floodplain administration. Fees generated by permit applications would eventually make the system self supporting.

Short Term Intiatives: Identify which communities may be having difficulties in administering floodplain regulations to quantify the problem. Review legislation adopted by other states which use a permit system to regulate floodplain development.

Long Term Initiative: Draft new legislation establishing authority for the State to manage land use in flood hazard areas.

Lead Agency: Colorado Water Conservation Board.

Cost: $4,000

4.2.3 Improve Floodplain Management on State Owned Recreational Property

Problem: The Colorado Division of Parks and Outdoor Recreation and the Division of Wildlife own or manage a considerable amount of property located in floodplain and wetland areas. However, there are no state level guidelines published for floodplain management on such property.

Solution: Develop guidelines to improve floodplain management on property managed by the Division of Parks and Outdoor Recreation and the Division of Wildlife.

Short Term Initiatives:

a. Review the National Park Service Floodplain Management and Wetland Protection Guidelines and revisions. The Guidelines were published on May 28, 1980, in the federal Register, Vol. 45, No. 104, pages 35916 through 35922.

b. Determine if the guidelines or portions of the guidelines, would be applicable to Colorado's state recreation areas and state parks.

c. Determine if there are existing similar guidelines for floodplain management and wetland protection for Colorado's State parks and recreation areas.

d. In instances where there are no existing guidelines and it is determined that guidelines would serve a beneficial purpose for the state park system, establish the necessary guidelines.

Long Term Initiative:

a. Review and update floodplain management and wetland protection guidelines, flood impact area boundaries, list of artificial impoundments and pertinent information pertaining to artificial impoundments, and natural disaster evacuation operational procedures whenever necessary.

b. Continue to maintain interagency emergency planning and preparedness.

c. Communicate the flood hazard information and hazard mitigation recommendations, guidelines, etc., that are developed throughout the Division to all levels of administration and management.

Lead Agency: Division of Parks and Outdoor Recreation in cooperation with the Division of Wildlife.

Cost: $1,000.

4.2.4 Establish a Program to Map Flood Hazard Areas in State Owned Recreational Areas

Problem: No inventory of floodplain information for State owned parks exists, and little or no floodplain mapping has been done in the past.

Solution: Research existing floodplain mapping in State parks and establish a program to map the 100-year and dam failure floodplains in State owned recreational areas.

Short Term Initiative: Determine the feasibility of compiling definitive floodplain maps for Colorado state parks and other state recreation areas. Delineate the 100-year and dam failure floodplain boundaries to consistent standards established by the CWCB.

Long Term Initiative: Analyze the flood hazard associated with the acquisition of property for proposed state parks or state recreation areas. Other state owned property in the floodplain not used for recreation should also be mapped for flood hazard.

Lead Agency: Division of Parks and Outdoor Recreation and Division of Wildlife in cooperation with the CWCB.

Cost: $6,000 per mile for detailed studies.

4.2.5 Develop a Technique for Mapping Approximate Dam Failure Floodplains below All Dams in Colorado

Problem: Many dam owners do not have the necessary expertise or financial resources to prepare detailed dam failure inundation maps. Many local emergency preparedness officials would just like to know where the water would go. The CWCB has developed approximate methods to map these areas, but it has no funds for implementing a statewide program.

Solution: Develop a manual outlining a simple, cost-effective procedure which will allow dam owners and local officials to determine an approximate inundation zone themselves.

Short Term Initiative: The CWCB should prepare a handbook for dam owners and local officials to provide them with a simple, fast and inexpensive method for approximating flood boundaries and preparing inundation maps.

Long Term Initiative: Collect data on dam failure floods and revise handbook as necessary.

Lead Agency: Colorado Water Conservation Board in cooperation with the State Engineer and DODES.

Cost: $10,000.

4.2.6 Recommend a Dam Failure Flood Zone for Insurance Purposes

Problem: The National Flood Insurance Program does not specifically identify a dam failure flood zone. Consequently most people are under the misconception that low cost flood insurance for public and private structures threatened by dam failure floods is not available. Basement flooding caused by raised water table levels in the vicinity of manmade lakes and reservoirs is apparently not included in the FEMA program.

Solution: Add approximate, but conservative, potential dam failure flood zones to the National Federal Flood Insurance Program as flood prone areas.

Short Term Initiative: The CWCB should make a formal request to FEMA to extend the Federal Flood Insurance Program to cover areas of potential dam failure inundation.

Long Term Initiative: The federal government should review claims from dam failure flooding to make insurance premiums in dam failure flood zones consistent with actual experience.

Lead Agency: Colorado Water Conservation Board.

Cost: $100.

4.2.7 Develop a State Program to Encourage Acquisition of Floodplain Land for Open Space

Problem: Many improved or developed properties in Colorado are located in identified flood hazard areas. The potential for development in the floodplain at other locations exists and is increasing as more people move into Colorado.

Solution: State and local governments should acquire land including flood damaged properties in flood hazard areas for use as open space such as parks and golf courses.

Short Term Initiative: The State should initiate a program to address funding priorities for acquisition of floodplain land and flood damaged properties within established State and federal programs. Review the Land and Water Conservation Fund program to see if it could be used for acquisition purposes.

Long Term Initiatives:

a. Encourage local governments to develop plans to acquire undeveloped floodplain land and existing properties in the floodplain when they become damaged by a flood.

b. Develop a State funding mechanism to take advantage of the mitigation opportunities offered for acquisition of flood impacted properties inundated after a flood.

c. Make a written request to FEMA that federal funds be allocated for this purpose following a Presidential Major Disaster Declaration.

Lead Agency: Division of Parks and Outdoor Recreation and the Division of Wildlife in cooperation with the CWCB.

Cost: $2,000.

4.2.8 Floodproof Existing State Owned Recreational Facilities

Problem: Many existing campsites and other recreational facilities in state parks and wildlife areas are in a floodplain.

Solution: Evaluate floodproofing and structural elevation techniques for facilities that exist in a 100-year or 500-year floodplain or that are susceptible to water damage caused by upstream dam failure.

Short Term Initiative:

a. Determine to what extent floodproofing techniques are currently being utilized for the protection of existing facilities on state parks or state recreation areas. Propose floodproofing recommendations where they are determined to be feasible for the protection of existing facilities. Consider these recommendations when establishing preventative maintenance priorities for park facilities.

b. Determine to what extent flood-proofing and structural elevation techniques could be integrated into the design and construction of future facilities to be developed on state parks and state recreation areas.

Long Term Initiative:

a. Review and analyze the effectiveness of flood-proofing techniques following the inundation of facilities and areas on state parks and state recreation areas.

b. Continue to evaluate and utilize flood-proofing techniques in the design and construction of state parks and state recreation areas and facilities.

Lead Agency: Division of Parks and Outdoor Recreation and the Division of Wildlife.

Cost: $5,000.

4.2.9 Improve Public Awareness of Flood Hazards

Problem: The very high risk threats of dam failure and flooding facing Coloradans and visitors to Colorado are not sufficiently publicized in an appropriate forum and are not tourist oriented.

Persons who died in the Big Thompson Flood of 1967 and below Lawn Lake were either sleeping in the floodway or less than knowledgeable about the dangers of floods. Many persons returned to the floodplain after having been warned to evacuate.

Solution: Concerned agencies of State Government, particularly Division of the Department of Nautral Resources and the Division of Disaster Emergency Services should continue to promote public awareness of flood hazards.

Short Term Initiative: A book or series of reports on the history of floods in Colorado should be prepared.

Long Term Initiative: A high school curriculum in flood hazards and flood hazard mitigation should be developed by the State in cooperation with local school districts.

Lead Agency: CWCB in cooperation with the CGS and DODES.

Cost: $20,000.

4.2.10 Investigate Feasibility of State Funding to Remove Streamflow Obstructions

Problem: The Colorado Water Conservation Board is authorized to make grants to counties to assist them in removing streamflow obstructions (30-30-105 CRS 1973). However, no funds have ever been appropriated by the Legislature for this purpose.

Solution: Establish a fund to support flood control projects by county governments.

Short Term Initiative: Survey county governments to determine the need for such a program. If there is an indication of need, determine costs and draft legislation which would support such a program.

Long Term Initiative: Colorado Counties, Inc. should seek legislative support and introduce a bill for funding. The CWCB should manage the program. The Division of Wildlife should review projects to insure the protection of riparian habitat.

Lead Agency: Colorado Water Conservation Board.

Cost: $1,000 to survey counties.

4.2.11 Encourage Standard Design of Private Bridges

Problem: The improper selection and sizing of drainage structures for public and private transportation systems may result in extensive damage in the event of flooding or excessive expenditure of public and private funds for overdesigned facilities. An economic analysis which balances the damages against the cost of construction can determine the optimum design hydrologic loading but is not usually performed in the private sector. This often results in underdesigned drainage structures which are major contributors to flood damages.

Solution: Local governments should adopt bridge design standards requiring new private bridges located within identified Flood Hazard areas to be capable of handling 100-year floods without sustaining significant damage.

Short Term Initiatives: Survey and notify all local governments of the need to adopt standards, through the Colorado Municipal League and Colorado Counties Incorporated. The Department of Highways should provide technical assistance where necessary.

Highway Department maintenance forces should survey and identify areas of concern with follow-up by engineering personnel. This could be integrated with normal maintenance patrols with little cost to the Department of Highways.

Long Term Initiative: Construction permits involving appropriate local review should be required for all new bridges. Local governments which are not staffed to do this review should receive assistance from the State Department of Highways. Existing Larimer County and Estes Park standards for the replacement of private bridges should be utilized as a model.

Lead Agency: Colorado Department of Highways in cooperation with the CWCB.

Cost: $3000 to survey, notify, and promulgate a model.

4.3 Emergency Preparedness

4.3.1 Seek Funding for Disaster Relief

Problem: Although a State disaster emergency fund is authorized by statute, funds are not available for mitigation and crucial lifesaving response activities. Potentially lengthy time to obtain critical funding deter life, property and money saving initiatives that typically occur in front range counties and statewide disasters.

Also, funds to assure expeditious reimbursement to State agencies for significant emergency expenditures to facilitate recovery efforts (as in the Lawn Lake Disaster) do not exist. Recovery efforts and mitigation opportunities are thus retarded. Formal rules and regulations approved by the legislature and the Executive Branch of government to administer disbursement of the fund do not exist.

Solution: A request for appropriation for the Disaster Fund should be made to the Legislature.

Short Term Initiative: The Division of Disaster Emergency Services should seek this appropriation for FY 83 with other State agency support. A recommendation should be made by DODES for the Governor to include this appropriation in the Executive Budget Request.

Long Term Initiative: None.

Lead Agency: DODES.

Cost: $1,500,000.

4.3.2 Create a State Hazard Mitigation Officer

Problem: No one individual in State Government is assigned the task of monitoring and conducting activities within State Government for mitigation of natural and man caused disasters. Opportunities at both the State and local levels to reduce major impacts of future disasters are being lost since no responsibility has been assigned to a specific individual.

Solution: Establish and fund a position for a State Hazard Mitigation Officer within the Division of Disaster Emergency Services to conduct mitigation planning and to oversee and coordinate Statewide mitigation activities. This activity would be conducted in support of and with the authorization of the interagency Mitigation Council discussed in 4.3.3.

Short Term Initiative: DODES should prepare a job description and seek funding for 1 FTE for State FY 84.

Long Term Initiative: Serve as executive secretary of an interagency multi-hazard mitigation council, develop a plan (discussed in 4.3.3) under council guidance for council approval. Position will be developed upon establishment of the Mitigation Council (see 4.3.3).

Lead Agency: DODES.

Cost: $40,000 per year.

4.3.3 Form a State Hazard Mitigation Council

Problem: Although an extensive system for the mitigation of flood hazards exists, a variety of other mitigation activities occur or could occur in State agencies that can be utilized to mitigate the impacts of other hazards. Currenty these actions have not been fully identified, promoted, and coordinated on a systematic basis. Interagency recommendations for mitigation are not now made in a regularized way.

No long term plan to assist an organization (council) to systematically integrate interagency mitigation activities exists. Large savings through mitigation are not now being generated since a formal multi-hazard mitigation mechanism does not exist.

Solution: A State multi-hazard mitigation council should be formed to identify, promote, coordinate and manage State mitigation initiatives on a systematic basis. The council should develop a plan for interagency hazard mitigation. A system which is based on a long term plan operated by an interagency council and administered by a full time planner/executive secretary will produce large scale savings for the State.

Short Term Initiative: Draft an Executive Order for the Governor to establish a council from all agencies of State Government currently responsible for mitigation activities. Form the council to conduct meetings to develop, promote, and coordinate viable mitigation initiatives and make recommendations for interagency actions. The Council would be expected to report progress to the Governor.

Long Term Initiative: Upon formation of an interagency council and upon specification of current interagency problems, policies, activities and goals, develop a written plan which includes a series of agency actions based on milestones to measure progress.

Lead Agency: Division of Disaster Emergency Services.

Cost: $40,000.

4.3.4 Continue to Emphasize Mental Health Activities in Post Flood Disaster Response

Problem: Disastrous events of violent and rapid onset, short duration and traumatic loss of life are known to cause severe mental health problems among some of those associated with the event. These mental disturbances may not be readily apparent or surface up to 6 months after the flood event. While the Department of Institutions has actively and effectively engaged this problem early in the post disaster period, and while the Larimer County Mental Health Center also performed very effectively in this situation, additional priority and recognition are needed to insure the habitual inclusion of this program as a significant mitigative process.

Solution: The peculiarities and potentially long duration of this intense problem should be coordinated between the Department of Institutions and local community mental health services. Additional financial support and encouragement should be devoted to this vital but little known program.

Short Term Initiative: Local governments should take the necessary planning actions to have expertise available to provide crisis oriented services in the amount and type needed following a disaster.

Long Term Initiative: The Department of Institutions should study means to enhance and publicize this program and request financial support where necessary.

Lead Agency: Department of Institutions.

Cost: $1,000 per event.

4.3.5 Investigate Vulnerability to Loss of Life in Hazardous Canyons in Colorado

Problem: Increased use of the mountain-area canyons of Colorado, both for residential development and recreational opportunities, has placed people and human activities in direct conflict with several kinds of active, potentially hazardous geologic processes. The most serious of these processes are those associated with major mountain-torrent floods. A very preliminary evaluation of Colorado canyons suspectible to mountain-torrent floods and related processes indicates that at least 30 such canyons are found along and/or in the Front Range, the most populous area of the State. Many more such canyons exist in the central part of Colorado and in the Western Slope area.

Informal, cooperative efforts by both State and Federal participants have shown that certain innovative geological studies could greatly improve conventional hydrologic approaches to the evaluation of great-flood risk appraisal in canyon areas. Efforts to obtain USGS (Federal) funding for a full scale cooperative, prototype study have failed because of severe constraints in Federal funding.

Solution: The Department of Natural Resources should request funding from the State Legislature for this project as a special budget request.

Short Term Initiatives:

1. Prepare detailed geomorphic and surficial-geologic maps of selected Front Range area stream reaches that have the best preserved or most significant evidence of past catastrophic floods,

2. Measure and describe particle size, composition, and geomorphic character of selected flood-deposit sequences,

3. Determine by geophysical or other appropriate means the available sediment supply in selected watersheds, and

4. Determine radiocarbon (C_{14}) dates for approximately 50 additional flood-related deposits.

Long Term Initiative: Publish a series of reports available to the general public on the hazards of mountainous canyons.

Lead Agency: Colorado Geological Survey in cooperation with the CWCB.

Cost: $80,000 per year for 3 years.

4.3.6 Inform Local Governments of Exposure to Dam Failure Hazards

Problem: Although County Commissioners have been asked by DODES to undertake planning for communities threatened by dam failure, precise data on communities threatened by failure of high hazard and moderate hazard dams are difficult to obtain at the local level. As many as 300 communities may need information as to their risk status so they can begin to plan. Local resources are not sufficient to expeditiously carry out this program.

Solution: Inform local governments of upstream dam failure potential and the degree of exposure to flood hazard.

Short Term Initiative: A list of communities threatened by potential dam failure and the status of response plan development should be compiled. A task force should be formed by the State Engineer to develop this information from state agency resources.

Long Term Initiative: Draft a letter to each county or local emergency preparedness coordinator advising them of any unresolved problems and offer technical assistance. Stress the need for expedited and integrated county-city-town planning.

Lead Agency: DODES in cooperation with the State Engineer and the CWCB.

Cost: $1,000.

4.3.7 Improve Local Flood Warning Systems

Problem: Most of Colorado's very high risk canyons with potential for dam failure flooding do not have stream gauges to provide adequate warning in case of flash floods. Installation of these gauges will save many lives and future property loss far exceeding the cost of the gauges. The National Weather Service can assist State and local entities in emergencies, but these services cannot fulfill the need for early warnings possible through improved stream gauges.

Solution: Local entities should purchase and install gauges and effectively utilize them to develop more effective warning networks.

Short Term Initiatives: The State, local government, or private dam owner should notify the National Weather Service immediately in the event of any actual or imminent dam failure in Colorado.

Larimer and other Colorado counties should seek assistance from the National Weather Service in obtaining precipitation forecasts, flash flood alarm gauges and simplified forecasting charts, and in developing self-contained local warning systems.

Signs should be placed at all State owned camp sites to condition campers to the possibility and dangers of flash floods. Signs should indicate the direction to move for safety.

Long Term Initiatives: DODES should develop legislation to provide financial assistance and incentives to local entities with which to purchase, install and manage stream gauges as part of a warning network.

With State assistance, Larimer County should seek to obtain rain and stream gauges, automated sensors, and radios to transmit realtime input of rainfall and streamflow data to NWS microprocessors of the NWS River Forecast Center to predict flood discharges. (In a similar project in the Appalachian Region, NWS provided the hardware--Larimer County could provide the observer network and the coordinator.)

A floodplain study by the Corps of Engineers, similar to a study made of the Cache La Poudre River Basin, should be made of the Big Thompson River Basin. This report, under authorities granted by Section 206 of the Flood Control Act of 1960 (Public Law 86-645) as amended, would serve to assist local authorities in minimizing flood hazards in the southern third of Larimer County.

Lead Agency: DODES in cooperation with Colorado Counties and the CWCB.

Cost: $800,000.

4.3.8 Develop Emergency Evacuation Plans for Colorado State Recreational Areas

Problem: The State of Colorado, primarily through the Division of Wildlife and the Division of Parks and Outdoor Recreation, owns many dams or manages recreational property located below dams. However, few emergency evacuation plans exist to provide for the safe evacuation of park visitors.

Solution: Emergency Evacuation Plans should be prepared for all state managed recreational areas.

Short Term Initiative: Develop a natural disaster evacuation operational procedure for property managed by the Colorado Division of Parks and Outdoor Recreation and the Division of Wildlife. Provide necessary on-site training to State Parks Officers to prepare them for implementation of an evacuation plan.

Long Term Initiatives: Maintain interagency emergency planning and preparedness. Consider the feasibility of participating in local or community flood warning systems on a case-by-case basis. State agencies owning dams should complete emergency dam failure plans for all dams.

Lead Agency: Division of Parks and Outdoor Recreation and Division of Wildlife in cooperation with DODES.

Cost: $3,000 per plan.

4.3.9 Develop a Multi-Hazard, Incident Management System for Local Governments

Problem: In the lifesaving phase of a dam failure flood or any other extreme event, Local, State and Federal Government agencies have many and varied resources that require detailed coordination. In response to the Lawn Lake situation, agencies of the Town of Estes Park, Larimer County and Rocky Mountain National Park were immediately involved without written, pre-arranged working relationships.

Solution: Develop an all-risk incident management system in which inter-governmental and interagency plans for problem assessment, response and recovery actions can be coordinated.

Short Term Initiative: Develop a model incident management system in Larimer County to involve major entities in planning for operations when mutual interests are at stake.

Long Term Initiative: Assist other Colorado counties in establishing incident management systems.

Lead Agency: DODES in cooperation with Colorado Counties.

Cost: $5,000 per county.

4.3.10 Assist Local Governments in Developing Emergency Evacuation Plans

Problem: Many local entities threatened by potential dam failure do not have adequate capability to develop effective plans for evacuation of people from residences and businesses.

Solution: Expand provision of technical assistance to local governments in developing emergency evacuation plans.

Short Term Initiative: Develop a sample plan that can be offered to local planners for this use and establish a program to evaluate and review local dam failure response plans.

Long Term Initiative: Conduct a series of tests for all communities that have developed plans to insure validity.

Lead Agency: Division of Disaster Emergency Services in cooperation with the State Engineer.

Cost: $1,000 per community.

4.3.11 Compile a Library of Dam Failure Plans for Federal, State, Local, and Privately Owned Dams in Colorado

Problem: No compendium of Federal and State owned dam failure plans exists to assist community emergency planners in their efforts. Details of actions to be taken by dam personnel in event of impending or actual failure do not exist in one location to permit easy utilization by the planners who need details such as warning links, worst case estimates of inundation in event of catastrophic failure, water travel times.

Solution: Require Federal, State and local agencies owning dams to submit dam failure plans to the Division of Disaster Emergency Services for the development of a library or compendium.

Short Term Initiative: DODES should request federal agencies to submit plans required under the National Dam Safety Program for inclusion in a library. FEMA support of this initiative should also be formally requested so as to expedite federal input. Extracts from the library should be furnished to appropriate local disaster preparedness coordinators.

Long Term Initiative: Keep library current by annually contacting dam owners for latest information.

Lead Agency: DODES in cooperation with the State Engineer.

Cost: $5,000.

"...We woke up at 6:15 and about 6:30 we heard what sounded like a rock slide. We looked out the tent and saw a wall of water heading towards us. We immediately ran for higher ground leaving our equipment. The water did not hit our campsite so we were able to save our equipment which seemed inconsequential compared to the fact that our lives had been spared...."

Park Visitor from
Albion, Missouri
camped at Roaring
River Campground

5.0 IMPLEMENTATION

To accomplish the purposes of this plan a number of opportunities for governmental action have been identified and a preliminary value analysis of each potential project has been made. Both short and long term measures for project action have been identified, and all projects have potentially positive net benefits. To the extent that progress is made toward accomplishment of these projects, significant mitigation of future disasters and generation of large scale savings will be achieved. Some projects are inexpensive and may be funded by state agencies through the state budget process, while others will cost more than the State can presently afford. Ideally, costly projects will be funded over the long run through legislative action. In any case, all projects where net savings were probable were included in this plan to provide consistant direction to a long term mitigation effort.

5.1 State Budget Process

Budget requests by State agencies on any recommendations must be approved by their respective department heads before being forwarded to the Office of State Budgeting and Planning. That office then makes recommendations to the Governor, who prepares the final request. The budget request from the Executive Branch of State Government is then forwarded to the Legislature's Joint Budget Committee. The JBC reviews the request and makes

recommendations on any proposed legislation for funding. The Legislature may then consider a bill on the matter, usually called the "long bill." To control State government spending, State agencies are limited to an annual increase of 7.0% over the previous year's budget. Any decisions approved by the Legislature may be implemented by State agencies beginning July 1 of each State fiscal year.

5.2 Recapitulation of Lead Agency Responsibilities

The following is a summary of the mitigation recommendations arranged by lead agency to facilitate implementation. Cooperating agencies, if applicable, are indicated in parentheses following each recommendation.

Division of Water Resources

- Increase frequency of dam inspection.
- Coordinate Dam Safety Activities among State agencies (DODES, CGS and CWCB).
- Require dam owners to develop additional technical information.
- Reduce costs for dam spillway rehabilitation by investigating new ideas.
- Provide concerned local government officials with dam information in State files (DODES).

Colorado Water Conservation Board

- Promote the rehabilitation of aging dams (State Engineer).
- Re-establish a State program to map flood hazard areas in Colorado communities.
- Create a State managed permit system for proposed development in the floodplain.
- Develop a technique for mapping approximate dam failure floodplains below all dams in Colorado (State Engineer and DODES).
- Improve public awareness of flood hazards (CGS and DODES).
- Investigate feasibility of State funding to remove streamflow obstructions.

- Recommend a dam failure insurance zone for insurance purposes.

- Develop a means for dam owners to obtain relief to support dam rehabilitation or improve spillway capacity due to downstream development (State Engineer).

Colorado Geological Survey

- Investigate vulnerability to loss of life in hazardous canyons in Colorado (CWCB).

Division of Parks and Outdoor Recreation and Division of Wildlife

- Improve floodplain management on State owned recreational property.

- Establish a program to map flood hazard areas in State owned recreational areas (CWCB).

- Floodproof existing State owned recreational facilities.

- Develop a State program to encourage the acquisition of floodplain land for open space (CWCB).

- Develop emergency evacuation plans for Colorado State parks (DODES).

Division of Disaster Emergency Services

- Seek funding for disaster relief.

- Create a state hazard mitigation officer.

- Form a State Hazard Mitigation Council.

- Inform local governments of exposure to dam failure hazards (State Engineer and CWCB).

- Assist local governments in developing emergency evacuation plans.

- Compile a library of dam failure plans for federal, State, local, and privately owned dams in Colorado (State Engineer).

- Improve local flood warning systems (Colorado counties and the CWCB).

- Develop a multi-hazard, incident management system for local governments

Department of Highways

- Encourage Standard Designs of Private Bridges (CWCB)

Department of Institutions

- Continue to emphasize mental health activities in post-flood disaster response (DODES).

5.3 Follow-Through Activities

As vulnerabilities intensify with a growing population and as future disasters occur, the need to complete these projects will intensify. But progress towards mitigation of Colorado's vulnerabilities to flooding can continue only if "follow-through" action is taken by those agencies assigned "lead" responsibility. Follow-through action within each lead agency should include further project definition, development of alternative courses of action, decisions as to potential costs, benefits, net results and development of milestones and completion dates for project accomplishment.

To assist each lead agency in project initiation, the State Coordinating Officer for the Lawn Lake Disaster aided State Hazard Mitigation Coordinator responsible for development of this plan will hold a meeting to answer questions, coordinate interagency action, determine initial project status and record lead agency project completion dates. Later, another meeting of lead agencies will be announced and held by the State Coordinating Officer to report progress to the Governor.

REFERENCES

1. FEMA, Flood Hazard Mitigation Handbook of Procedures, Washington, D.C., September, 1981.

2. National Science Foundation, A Report on Flood Hazard Mitigation, Washington, D.C., September, 1980.

3. FEMA, Insurance and Mitigation Division, Guide for a State Hazard Mitigation Plan, Region VIII, Denver, Colorado, October 11, 1979.

4. Federal Register, "Disaster Assistance; Hazard Mitigation (Subpart M)," 44 CFR Part 205, Vol. 44, No. 218, Rules and Regulations, pages 64809-64815, November 8, 1979.

5. FEMA, Intergovernmental Flood Hazard Mitigation Report for the Lawn Lake Dam Failure and the Fall River Flood, Denver, Colorado, August 6, 1982.

6. Colorado Division of Disaster Emergency Services, Colorado's Vulnerability to Very High Risk Natural Hazards," Golden, Colorado, revised September 27, 1982.

7. Governor's Task Force, Flood Hazard Mitigation Program for North Dakota, Bismark, ND, October, 1979.

8. Colorado Department of Natural Resources, Memorandum to Governor Lamm on the Lawn Lake Dam Failure from Monte Pascoe, July 22, 1982.

9. Graham, Wayne J., "Values of Inundation Maps in Dam Failure Emergencies," Denver, Colorado, 1981.

10. McMahon, G.F., "Developing a Dam-Break Flood Zone Ordinance": ASCE, Vol. 107, No. WR2, p. 461-476, 1981.

11. U.S. Water Resources Council, Floodplain Management Handbook, Washington, D.C., September, 1981.

12. Colorado Division of Disaster Emergency Services, Colorado Natural Disaster Emergency Operations Plan, Golden, Colorado, 1978.

13. Department of the Army, Office of the Chief Engineers, Recommended Guidelines for Safety Inspection of Dams, Washington, D.C.

14. The Academy for State and Local Government, Natural Disaster Recovery and Mitigation Resource Referral Service, Dam Safety Reader, The Lawn Lake Dam Failure and Estes Park (Colorado) Flood, Washington, D.C., September 1982.

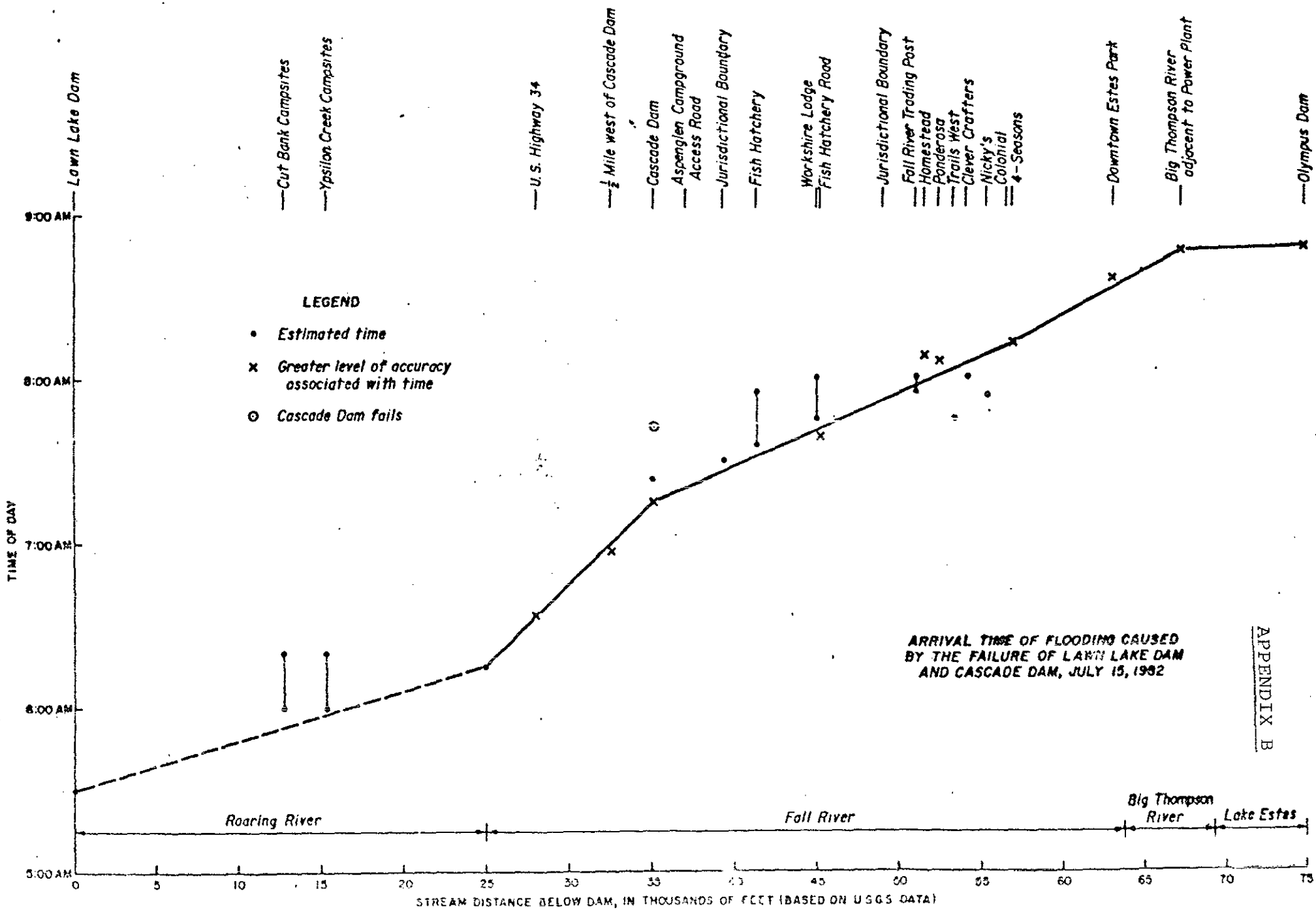
APPENDICES

7. A State Hazard Mitigation Coordinator will be designated to represent local and State interests in all hazard mitigation activities associated with this disaster. The State further agrees that, as a condition for any Federal loan or grant, the State or the applicant shall evaluate the natural hazards in the areas in which the proceeds of the grants or loans are to be used and shall make appropriate recommendations to mitigate such hazards for Federally-assisted projects. Lastly, the State agrees: (1) To follow up with applicants, within State capabilities, to assure that, as a condition for any grant or loan under the Act, appropriate hazard mitigation actions are taken; (2) to prepare and submit, not later than 180 days after the declaration, to the Regional Director for concurrence, a hazard mitigation plan or plans for the designated areas; and (3) to review and update as necessary disaster-mitigation portions of the emergency plans.

   The Regional Director agrees to make Federal technical advice and assistance available to support the above planning efforts and actions.

8. Federal assistance under the Act and this Agreement shall include Public and Individual Assistance limited to the following areas of the State of Colorado and such additional areas as may be subsequently designated by the Associate Director, State and Local Programs and Support Directorate, FEMA.

   Larimer County



ARRIVAL TIME OF FLOODING CAUSED BY THE FAILURE OF LAWN LAKE DAM AND CASCADE DAM, JULY 15, 1982

APPENDIX B

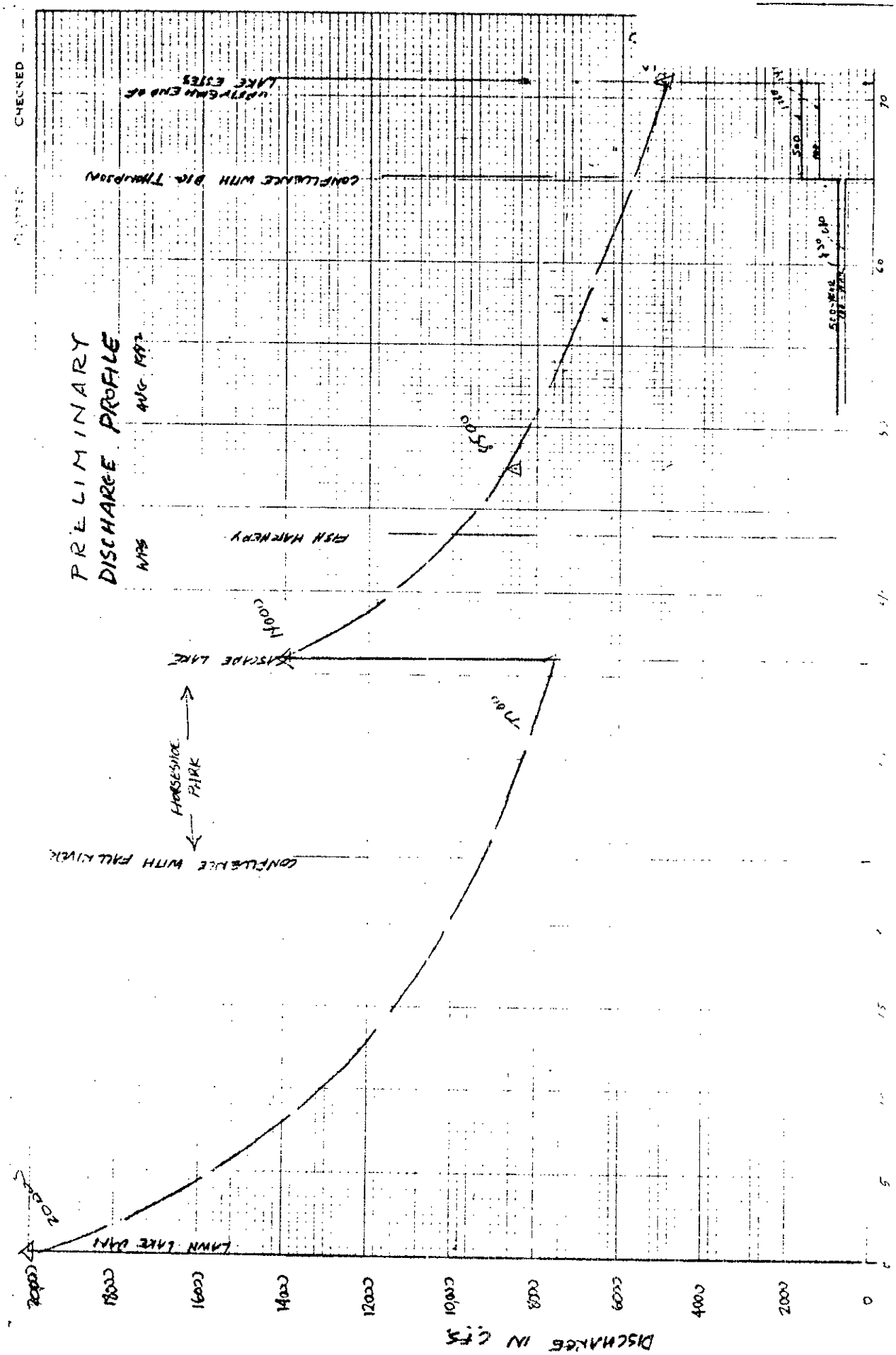
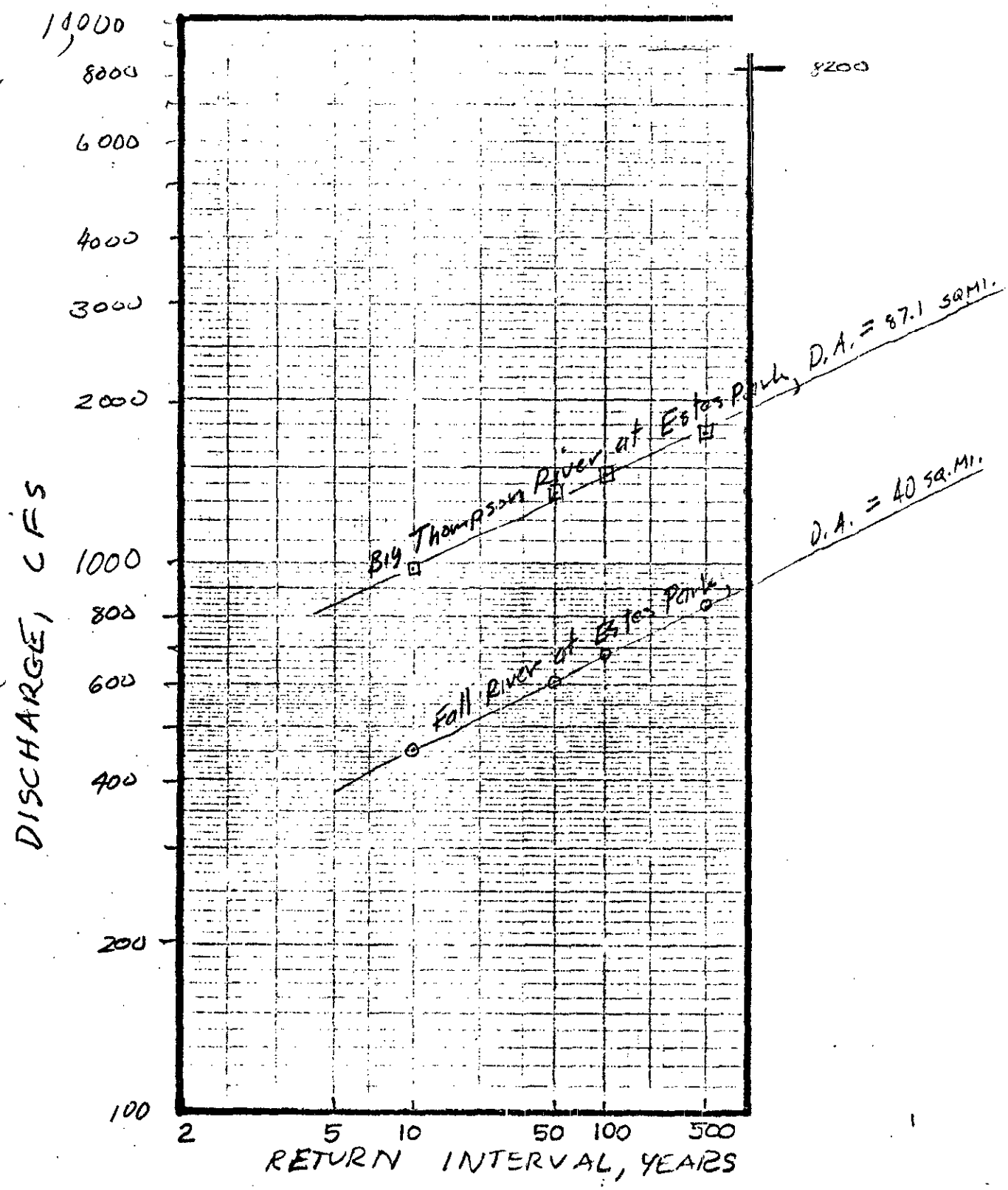
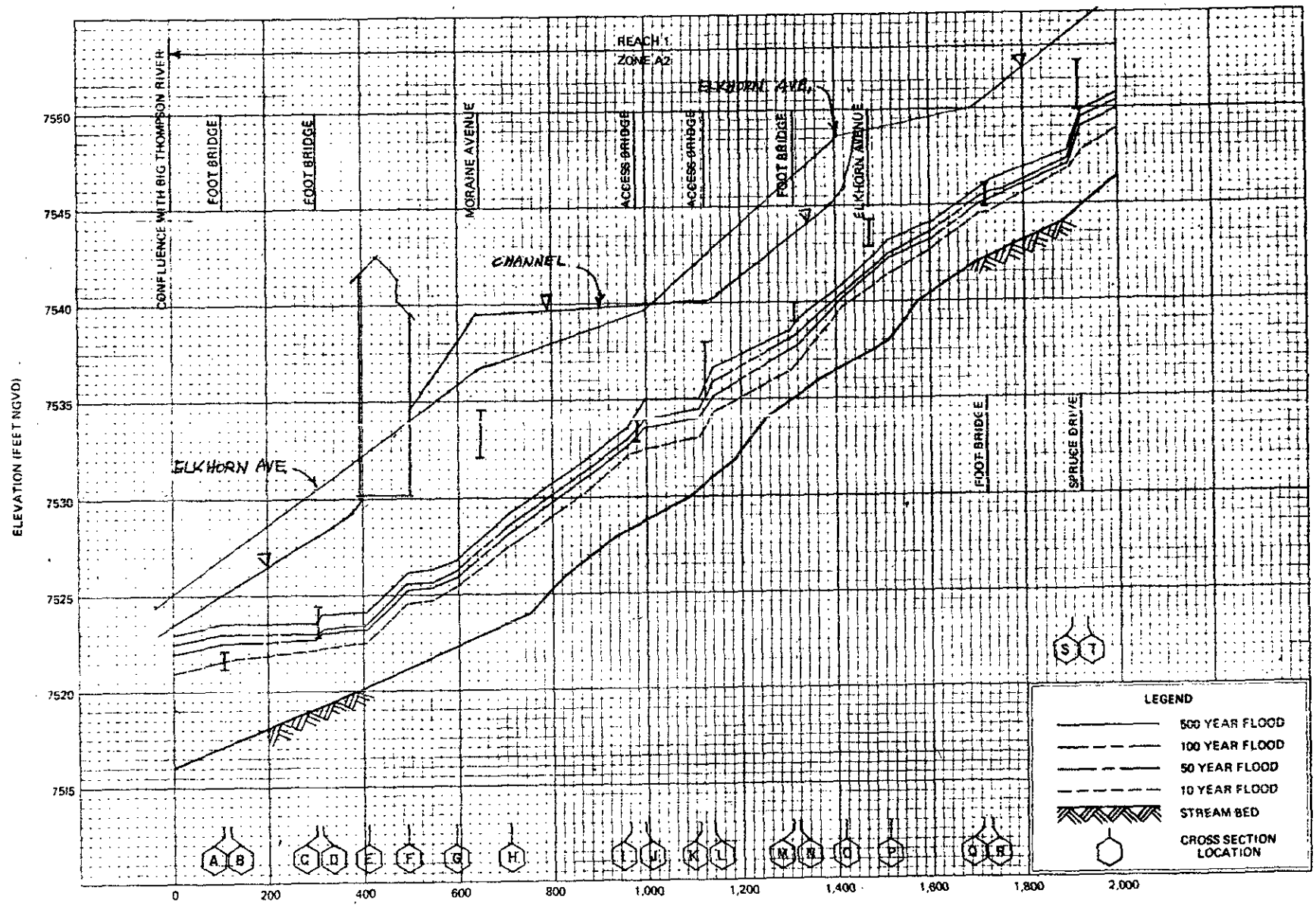

PRELIMINARY
DISCHARGE PROFILE
DISCHARGE IN CFS
DOWNSTREAM END OF LAKE ESTES
CONFLUENCE WITH BIG THOMPSON
FISH HATCHERY
MARIANNE LAKE
HORSESHOE PARK
CONFLUENCE WITH FALL RIVER
LAMAR LAKE DAM
CHECKED

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Big Thompson River					
At Lake Estes	137.5	1510	1990	2180	2600
At St. Vrain Avenue	136.9	1510	1990	2180	2600
At Confluence With Fall River	87.1	980	1340	1460	1760
At Crags Drive	87.0	980	1340	1460	1760
Fall River					
At Confluence With Big Thompson River	39.9	450	610	680	830
At Upstream Detailed Study Limit	37.3	450	610	680	830



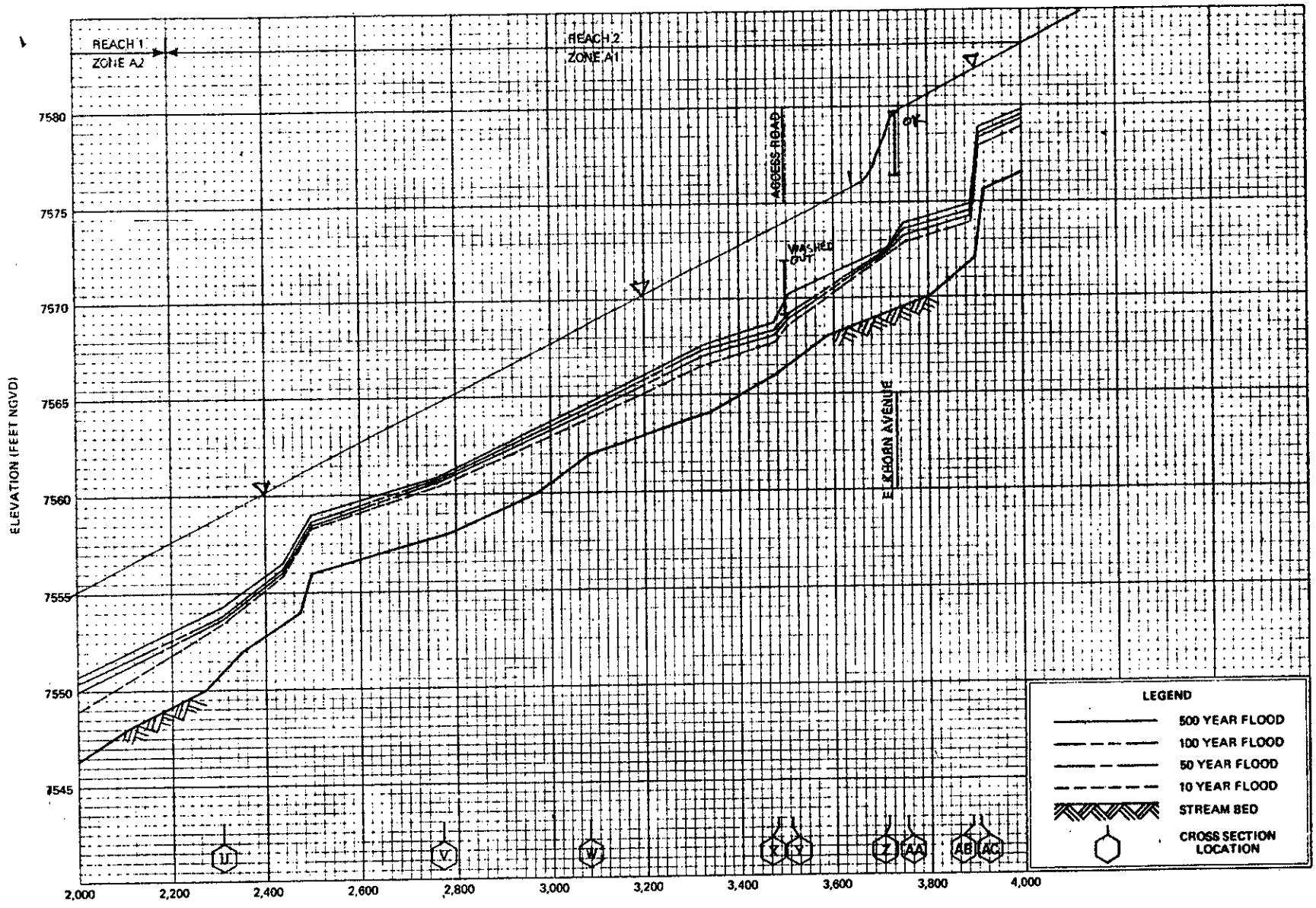
Fall River	Big Thompson	Roaring River at Horseshoe Park
530 cfs	980 cfs	?
610	1340	?
680	1460	?
630	1760	?



FLOOD PROFILES

FALL RIVER

APPENDIX F



FLOOD PROFILES

FALL RIVER

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF ESTES PARK, CO
(LARIMER CO.)

08P

Partial List of Dam Failure Floods in Colorado

Date	Name of Dam or Reservoir	River	Location	Type	Height (feet)
1890	Gunnison		Gunnison Co.	Earth	20
1895	Grass Valley Antlers Dam (Harvy Gap Res)			Earth	49
1897	Ward		Jefferson Co.	Earth	
1897	Lefthand Ditch Co.	Lefthand Creek	Boulder Co.	Earth	
1900	Cheesman Lake			Rockfill	38
1901	Victor		Teller Co.	Earth	25
1903	Bonham		Mesa Co.	Earth & Rockfill	37
Fall 1904	Jackson Lake		Morgan Co.	Earth	20
1904-1905	Reeder Res.	North Fork Kannah Creek	Mesa Co.	Earth	16
1905	Leroux Creek	Leroux Creek	Delta Co.	Earth	25
1907	Cache la Poudre			Earth	
July 1909	Empire		Weld & Morgan Co.	Earth	35
Aug. 19, 1909	Lake Lidderdale or Lake George		Park Co.	Earth	19
Aug. 20, 1909	Riverside		Weld Co.	Earth	25
Sept. 5, 1909	Middle or Upper Trout Dam		San Miguel Co.	?	30
Sept. 5, 1905	Trout Lake Dam		San Miguel Co.	Earth	
1910 ?	Englehart		Mesa Co.	Earth	

Mar. 11, 1910	Julesburg or Jumbo Res.		Logan & Sedgwick Co.	Earth	50
July 12, 1910	Turkey Creek Res. Dam		Pueblo, Co.	Earth	106
July 12, 1910	Turkey Creek alias Potter-Turkey Creek alias Red Rock	_____	Pueblo Co.	Earth	90
1911	Atkinson	Big Creek No. 3	Mesa Co.	Earth & Rockfill	___
1911	Military Park	Surface Creek	Delta Co.	Earth & Rockfill	
1912	Colo. Springs No. 4			Earth	50
Feb. 1914	Horse Creek	Horse Creek	Bent	Earth	?
1914	Horse Creek	_____	Weld Co.	Earth	65
1914	Lake George or Lidderdale	_____	Park Co.	Earth	19
1914-16	Standley Lake	_____	Jefferson Co.	Earth	113
1910-15	Fort Res.	_____	Weld Co.	Earth	___
April 1, 1915	Sand Creek Res.	_____	Weld Co.	Earth	27
May 1916	Casement	_____	Mesa Co.	Earth	__
May 1916	Hanson	_____	Delta Co.	Earth	23
June 17, 1917-18	Clear Creek	Clear Creek	Chaffee Co.	Earth	__
1918	Lefthand Ditch	Lefthand Creek	Boulder, CO	Earth	__
1919 (?)	Timberline Lake Dam	_____	Moffat Co.	Earth	23
Before 1920	Hankens Dam	_____	Bent Co.	Earth	35
June 1921	Marshall	_____	Boulder Co.	Earth	75
June 5, 1921	Schaeffer	Beaver Creek	Fremont	Earth	90

Aug. 22, 1923	Apishapa	Apishapa Creek	Las Animas Co.	Earth	105
1923	Buckhorn		Boulder Co.	Earth	100
July 17, 1923	Lake George or Lidderdale		Park Co.	Earth	
1924	Manitou			Concrete Arch	50
June 1927	Ryan	_____	Delta Co.	Earth	10
June 1927	Loungs Creek No. 1	_____	Delta Co.	Earth	___
June 1929	Womack No. 1	Ward Creek	Delta Co.	Earth	___
May 1931	Ward Lake	_____	Delta Co.	Earth	25
Aug. 3, 1933	Castlewood	Cherry Creek	Douglas Co.	Rockfill	70
Aug 18, 1935	Horse Creek Flood Control	Horse Creek	Prowers Co.	Earth	40
1930's ?	Williams & McCreary Dam alias Roger ?	_____	_____	Earth	46
1930's ?	San Arroys	_____	_____	Earth	____
Spring 1935	Pleasant Valley	_____	Boulder Co.	Earth	19
Spring 1937	Fruitgrowers	_____	Delta Co.	Earth	53
June 1937	Fruitgrowers	_____	Delta Co.	Earth	___
June 1, 1940	Fairmont (Hilltop)	_____	Delta Co.	Earth	15
1939-40	Ireland No. 5	_____	Weld Co.	Earth	12
1939-40	Ireland No. 1	_____	Weld Co.	Earth	18
1939-40	Badger Creek	_____	_____	Earth	38
June 19, 1941	Goodenough	_____	Delta Co.	Earth	25
1941	Archuleta	_____	Mineral Co.	Earth	14
May 26, 1942	Military Park	_____	Delta Co.	Earth	20
June 1946	Young Creek No. 3	_____	Delta Co.	Earth	____

PRELIMINARY

June 1947/8	Vela Res.		Delta Co.	Earth	
June 1949	Sheep Slough or Lake		Delta Co.	Earth	12
June 1949	Sheep Slough		Delta Co.	Earth	12
June 14, 1949	Lord Res.	Lost Creek	Weld Co.	Earth	11
Oct. 1949	Bruce Park		Delta Co.	Earth	41
May 25, 1951	Lilly Lake	Fish Creek	Larimer Co.	Earth	?
May 22, 1956	Ryun	_____	Delta Co.	Earth	13
1957	Terrace Res.	_____	Conejos Co.	Earth	167
1957	Great Western	_____	Jefferson Co.	Earth	____
July 28, 1957	Overland Res.	_____	Delta Co.	Earth	59
1958	Ward Lake Dam (Deep Ward)	_____	Delta Co.	Earth	24
April 9, 1958	Ward Lake	_____	Delta Co.	Earth	25
July, 1971	Kiser	_____	Delta Co.	Earth	24
June 1957	Georgetown Game & Fish	_____	Clear Creek	Earth	16
July 30, 1964	Sterner	_____	Routt Co.	Earth	30
June 1965	Georgetown Public Service	_____	Clear Creek Co.	Earth	25
1965	Skagway	_____	Teller Co.	Steel-faced	76
June 1965	Cripple Creek No. 3	_____	_____	_____	____
June 1965	Agate	_____	_____	Earth	29
June 1965	Kiowa Q-51	_____	_____	Earth	____
June 1965	Franktown-Parker W-1	_____	_____	Earth	____
June 1965	Franktown M-1	_____	_____	Earth	40

June 1965	Flagler			Earth	35
June 1965	Clay Creek		Prowers Co.	Zoned Earth	45
June 1965	Big Sandy S-1		El Paso Co.	Earth	31
June 1965	Two Buttes				
June 1965	Muddy Creek (Setchfield)	_____	Bent Co.	Earth	45
1965	Brown's No. 3		Hinsdale Co.	Earth	12
July 6, 1967	Standley Lake Res. Dam	_____	Jefferson Co.	Earth	105
Before July 6, 1968	Newton Gulch		Routt	Earth	37
?	Ross Res. Dam	_____	Jackson Co.	Earth	35
Spring 1969	Lake George Dam	_____	Park Co.	Earth	18
May 1, 1970	Marie Res. Dam	_____	Weld Co.	Earth	20
_____, 1970	Ruby Res.	Roaring Fork	Pitkin Co.	Earth	__
May 13-20, 1970	Little King Ranch Dam	_____	Grand Co.	Earth	55
May 13, 1970	YT Dam	_____	Mesa Co.	Earth	40
May or June 1970	Sheepdrive	_____	Delta Co.	Earth	58
April 1972	Woodmoor Lake	_____	El Paso Co.	Earth	58
Before May 24, 1972	McCoy	_____	Routt Co.	Earth	54
June 9, 1972	Porter Res. No. 1	_____	Delta Co.	Earth	31
1972	Standley Res.	_____	Adams Co.	Earth	113

Apr. 12, 1973	Lower Latham Res.	Weld Co.	Earth	
May 8, 1973	Ireland No.5 Dam	Weld Co.	Earth	18
May 10, 1973	Lower J.O. Hill	Douglas Co.	Earth	28
May 11, 1973	Upper J.O. Hill	Douglas Co.	Earth	22
May 1973	Blue Mountain	Park Co.	Earth	10
May 11, 1973	Slide Lake or Thomas Lake	------	Natural Rockfill	--
June 5, 1973	Bauer No. 2 Dam	Montezuma Co.	Earth	25
July 15, 1973	Hidden Treasure Dam		Concrete	100
May 10, 1973	Florissant	Teller Co.	Earth	15
May 10, 1973	Forest Glen	Teller Co.	Earth	10
Oct 3, 1973	Horseshoe Res. Dam	Larimer Co.	Earth	28
Nov. 13, 1973	Beaver Brook No. 3	Jefferson Co.	Earth	60
Sept. 15, 1973	Tony White Dam	Jefferson Co.	Earth	23
Before March 4, 1974	Donald T. Anderson Dam	Weld Co.	Earth	16
April 24, 1974	Cove Reservoir Dam	Conejos Co.	Rockfill Earth	32
May 8, 1974	Oberon Res. No. 1	Jefferson Co.	Earth	16
Nov. 14, 1975	Karva 1	Lincoln Co.	Earth	48
May 1, 9175	Canon City Sedimentation Pond	Fremont Co.	Earth	17
June 29, 1975	Newton Gulch	Routt Co.	Earth	37
June 23, 1976	Terminal	La Plata	Rockfill	56

June 1976	Standley		Adams Co.	Earth	113
June 1976	Barr Lake		Adams Co.	Earth	47
July 1975	Woodmoor No. 4		El Paso Co.	Earth	28
April 27, 1978	Wesley Raley		Moffat Co.	Earth	29
May 27, 1978	Myron Isabel		Weld Co.	Earth	27
June 4, 1979	Lake Emma	Cement Creek	Silverton, San Juan Co.	Natural	
Apr/May? 1980	Maplegrove	Wier Gulch	Lakewood, Jefferson Co.	Earth	?
Feb. 10, 1980	Prospect Valley Res.	Tributary to Lost Creek	Weld Co.	Earth	37
July 15, 1982	Lawn Lake	Roaring River	Larimer Co.	Earth	24
July 15, 1982	Cascade Res.	Fall River	Larimer Co.	Concrete	?

[illegible handwritten title]

APPENDIX H

CSU
COMPUTER CENTER

NOS 1.4-508
C S U   G O L D   M A C H I N E .
CREATOR FAMILY, USER NUMBER = GOLD   SPS4KLB

UNCLE SITE AF

TIME: 14.07.23.
DATE: 81/07/23.

List of high hazard dams by DODDS (alpha by County)
NOTE - Same dam is listed more than once if it is located in more than one section (from list)

NAME-OF-DAM	ARPHNO (inventory)	COD (County)	EMBANK-HEIGHT	NORM-RES-CAPY-AFT	DIV	WD
WADDING	2190	AD	24.0	44.	1	7
BARR LAKE	1668	AD	47.0	32150.	1	2
BARR LAKE	1668	AD	47.0	32150.	1	2
KALCEVIC	197	AD	42.0	112.	1	7
LOWER LATHAM	95	AD	23.0	6212.	1	2
LOWER LATHAM	95	AD	23.0	6212.	1	2
LOWER LATHAM	95	AD	23.0	6212.	1	2
NIVER CREEK DET.	470	AD	42.0	580.	1	2
NIVER CREEK DET.	470	AD	42.0	580.	1	2
CHERRY CREEK	1200	AP	140.0	246084.	1	8
CHERRY CREEK	1200	AP	140.0	246084.	1	8
C[illegible]Y CREEK	1200	AP	140.0	246084.	1	8
C[illegible]Y CREEK	1200	AP	140.0	246084.	1	8
[illegible]WOOD	300	AP	55.0	1050.	1	8
HOLLY	2214	AP	40.0	230.	1	8
MCLELLAN	1153	AP	111.0	6000.	1	8
PATRICK LAKE	1619	AP	10.0	1286.	1	8
QUINCY	104	AP	68.0	2800.	1	2
WINDSOR	1147	AP	20.0	200.	1	2
HATCHER	1094	AR	55.5	2735.	7	78
TWO BUTTES *	759	BA	106.0	40918.	2	67
ADOBE CREEK	515	BE	35.0	85000.	2	17
BARKER MEADOW	213	BL	177.0	11500.	1	6
BASELINE	214	BL	40.0	5300.	1	6
BEAVER PARK *	1200	BL	33.0	2161.	1	5
BOULDER	215	BL	44.0	17400.	1	6
BUTTON ROCK	171	BL	205.0	20100.	1	5
CLOVER BASIN	172	BL	34.0	596.	1	5
CLOVER BASIN	172	BL	34.0	596.	1	5
FOOTHILLS	173	BL	52.0	4346.	1	5
GROSS	247	BL	330.0	40987.	1	6
HAYDEN	227	BL	21.0	502.	1	6
LAGERMAN	1226	BL	22.0	923.	1	5
LAGERMAN	1226	BL	22.0	923.	1	5
LEFTHAND PARK	176	BL	50.0	1578.	1	5
LEGGETT & HILLCREST	232	BL	67.0	11100.	1	6
MARSHALL LAKE	241	BL	80.0	10462.	1	6
PLEASANT VALLEY	182	BL	19.0	3076.	1	5
SILVER LAKE	249	BL	71.0	3987.	1	6
SILVER LAKE	249	BL	71.0	3987.	1	6
SIX MILE	250	BL	35.0	1100.	1	6
VALMONT DAM	256	BL	67.0	11163.	1	6
VALMONT DAM	256	BL	67.0	11163.	1	6
VALMONT DAM	256	BL	67.0	11163.	1	6
WANEKA *	259	BL	30.0	710.	1	6
CEDAR LAKE *	1241	CC	35.0	700.	1	7
FALL RIVER	193	CC	85.0	890.	1	7
LOWER CABIN CR. HYDELE	1240	CC	66.0	1827.	1	7
UPPER CABIN CREEK HYDELE	1239	CC	174.0	1402.	1	7
CLEAR CREEK.	1143	CF	70.0	11444.	2	11
TWIN LAKES	2045	CF	60.0	141000.	2	11
PLATORO	1671	CN	165.0	60000.	3	22
PLATORO *	1671	CN	165.0	60000.	3	22
TERRACE	815	CN	162.0	17416.	3	21
MOUNTAIN HOME *	818	CS	125.0	18595.	3	35
SANCHEZ	790	CS	130.0	103155.	3	24
CHEESMAN	357	DG	221.0	79064.	1	80
FOOTHILLS HOLDING POND		DG	25.0	62.	1	8
CARL SMITH *	629	DL	55.0	864.	4	40
[illegible] MESA	476	DL	76.0	897.	4	40
C[illegible]D	556	DL	167.0	14250.	4	40
C[illegible]RD	556	DL	167.0	14250.	4	40

EGGLESTON	601	DL	31.0	2560.	4	40
FRUIT GROWERS	1683	DL	55.0	5873.	4	40
GARNETT MESA	747	DL	39.0	1333.	4	41
KENNICOTT SLOUGH	580	DL	36.0	495.	4	40
MARCOT PARK	594	DL	39.0	448.	4	40
MONUMENT	598	DL	72.0	501.	4	40
[illegible]IRELAND #1	606	DL	60.0	5990.	4	40
[illegible]	607	DL	46.0	3400.	4	40
[illegible]OUNDHOG	1084	DO	175.0	21711.	7	69
GETMAN-HOLY #4	668	EA	143.0	2430.	5	37
HOMESTAKE PROJECT	673	EA	245.0	45600.	5	37
ROBINSON	671	EA	103.0	3136.	5	37
SPRING PARK	684	EA	25.0	2823.	5	38
SPRING PARK	684	EA	25.0	2823.	5	38
BIG TOOTH RESERVOIR	445	EP	100.0	650.	2	10
CRYSTAL CREEK	418	EP	90.0	5330.	2	10
FOUNTAIN VALLEY NO 2	418	EP	54.0	3950.	2	10
GOLD CAMP	444	EP	105.0	380.	2	10
LAKE MORAINE	901	EP	37.0	800.	2	10
MANITOU	426	EP	123.0	700.	2	10
PALMER LAKE #2	436	EP	44.0	200.	2	10
PAHAN DET.-REC.	1347	EP	48.0	5388.	2	67
RAMPART	434	EP	230.0	38783.	2	10
SOUTH SUBURBAN	428	EP	47.0	231.	2	10
WOODMOOR LAKE	450	EP	57.5	890.	2	10
CANNON WTRSD. C-4	462	FR	38.0	207.	2	12
CANNON WTRSD. DET. C-3	461	FR	70.0	1141.	2	12
GRASS VALLEY	693	GA	46.0	5958.	5	39
HUGHES	681	GA	25.0	573.	5	38
RIFLE GAP	1092	GA	100.0	12600.	5	39
STILLWATER #1	1030	GA	75.0	6088.	6	58
YAMCOLO DAM	2248	GA	97.0	9980.	6	58
GRANBY USBR	1656	GR	65.0	543758.	5	51
MATHESON	701	GR	58.0	1074.	5	50
MEADOW CREEK	713	GR	86.0	5750.	5	51
SHADOW MTN. & GRAND LAKE USBR	1666	GR	46.0	18369.	5	51
WILLIAMS FORK	717	GR	224.0	93637.	5	51
WILLOW CREEK	1670	GR	125.0	10553.	5	51
BEAVER	397	GU	122.0	1620.	4	40
BLUE MESA USBR	1675	GU	340.0	940800.	4	62
CRYSTAL USBR		GU	218.0	27740.	4	62
PAONIA	1691	GU	180.0	20900.	4	40
PAONIA	1691	GU	180.0	20900.	4	40
SILVER JACK USBR	1693	GU	138.0	13520.	4	62
SPRING CREEK	146	GU	50.0	1631.	4	59
TAYLOR PARK USBR	151	GU	200.0	106250.	4	59
CUCHARAS #5	1146	HF	135.0	40960.	2	16
HORSESHOE LAKE	498	HF	30.0	2760.	2	16
MARTIN LAKE	1327	HF	27.0	4080.	2	16
N. WALSENBURG FLOOD CON.	511	HF	29.0	104.	2	16
WAHATOYA LAKE	513	HF	24.0	274.	2	16
CONTINENTAL	767	HI	92.0	22679.	3	20
RIO GRANDE	805	HI	100.0	51113.	3	20
[illegible] CREEK	4	JF	179.5	55290.	1	9
[illegible]EN EAST	1021	JF	40.0	587.	1	9
[illegible]N	980	JF	72.0	5800.	1	7
CHATFIELD	1281	JF	132.0	215000.	1	8
CHATFIELD USCE	1281	JF	132.0	215000.	1	8
CHATFIELD	1281	JF	132.0	215000.	1	8
EAST	267	JF	17.5	175.	1	8
EVERGREEN	328	JF	34.0	669.	1	9
GREAT WESTERN	91	JF	70.0	3253.	1	2
GREAT WESTERN	91	JF	70.0	3253.	1	2
MAIN	301	JF	45.0	840.	1	8
MAPLE GROVE	203	JF	56.0	406.	1	7
MARSTON LAKE	2012	JF	35.0	19795.	1	9
MARSTON LAKE	2012	JF	35.0	19795.	1	9
RALSTON	205	JF	180.0	12750.	1	7
SMITH	307	JF	22.0	466.	1	8
STANDLEY LAKE	101	JF	123.0	42380.	1	2
STRONTIA SPRINGS	2219	JF	299.0	7600.	1	8
TUCKER LAKE	1181	JF	28.0	1096.	1	1
WARD #1	338	JF	15.0	528.	1	9
WELLINGTON	345	JF	56.0	4399.	1	80
FISHER PEAK DET. FPC-1	533	LA	80.0	27.	2	19
FISHER PEAK DET. FPC-2	536	LA	55.0	94.	2	19
NORTH LAKE	544	LA	82.5	4214.	2	19
SPANISH PEAKS RANCH #9		LA	70.0	1.	2	18
TRINIDAD LAKE USCE	58	LA	185.0	86000.	2	19
LIMON WTRSD. L-3	751	LC	34.0	1200.	2	67
MARTIN, JOHN USCE	1283		170.0	631000.	2	67
MARTIN, JOHN	1283		170.0	631000.	2	67
SUGAR LOAF DAM	2196	LK	133.0	131054.	2	11
SUGAR LOAF DAM USBR	2196	LK	133.0	131054.	2	11
SUGAR LOAF DAM	2196	LK	133.0	131054.	2	11
NORTH STERLING	384	LO	80.0	87000.	1	64
NORTH STERLING	384	LO	80.0	87000.	1	64
DURANGO REGULATORY	1060	LP	40.0	223.	7	30
LEMON USBR	1688	LP	215.0	40700.	7	30
TERMINAL	295	LP	53.0	23254.	7	30
TURNER	1066	LP	30.0	472.	7	30
VALLECITO	1695	LP	162.0	129675.	7	31
BARNES MEADOW	123	LR	47.0	2349.	1	3
BOYD LAKE	157	LR	44.0	50574.	1	4
CACHE LA POUDRE	851	LR	43.0	9900.	1	3
CACHE LA POUDRE	851	LR	43.0	9900.	1	3
CACHE LA POUDRE	851	LR	43.0	9900.	1	3
CACHE LA POUDRE	851	LR	43.0	9900.	1	3
CARTER LAKE #1	1650	LR	214.0	112000.	1	4
CARTER LAKE #2 USBR	1651	LR	75.0	112000.	1	4
CARTER LAKE #3	1652	LR	55.0	112000.	1	4
CHAMBERS LAKE	127	LR	55.0	8854.	1	3
COB[illegible]AKE	129	LR	58.0	22300.	1	3
[illegible]	130	LR	40.0	2629.	1	3
DIX[illegible] CANYON USBR	1653	LR	240.0	157000.	1	3

DOUGLAS *	1163	LR	39.1	9364.	1	3
ELDER	1164	LR	25.1	7266.	1	3
FOSSIL CREEK	1165	LR	47.0	11508.	1	3
FOSSIL CREEK	1165	LR	47.0	11508.	1	3
FOSSIL CREEK	1165	LR	47.0	11508.	1	3
HALLIGAN	1169	LR	78.0	6428.	1	3
MANDY	1769	LR	31.0	4548.	1	4
MANDY	1769	LR	31.0	4548.	1	4
MANDY	1769	LR	31.0	4548.	1	4
MANDY	1769	LR	31.0	4548.	1	4
HORSETOOTH USBR	1659	LR	155.0	152000.	1	3
[illegible]SETOOTH	1659	LR	155.0	152000.	1	3
[illegible]RGLASS	138	LR	45.0	1694.	1	3
HOURGLASS	138	LR	45.0	1694.	1	3
INDIAN CREEK	139	LR	34.0	1906.	1	3
JOE WRIGHT	1766	LR	120.0	7200.	1	3
KLUVER	2036	LR	25.0	1747.	1	3
LAKE LOVELAND	1187	LR	46.0	12736.	1	4
LILY LAKE		LR	18.0	30.	1	4
LON HAGLER	165	LR	61.0	5032.	1	4
LONG DRAW	140	LR	84.0	11000.	1	3
LONG POND	1174	LR	35.0	4040.	1	3
MARIANO	166	LR	30.0	5570.	1	4
MILTON SEAMAN	143	LR	89.0	5008.	1	3
NORTH POUDRE #15	842	LR	48.0	5526.	1	3
NORTH POUDRE #2	837	LR	20.0	3916.	1	3
NORTH POUDRE #3	838	LR	38.0	3441.	1	3
NORTH POUDRE #5	2018	LR	33.0	8398.	1	3
NORTH POUDRE #6	841	LR	38.0	9968.	1	3
PANHANDLE	145	LR	47.0	2349.	1	3
PARK CREEK	146	LR	79.0	7343.	1	3
PARK CREEK	146	LR	79.0	7343.	1	3
PETERSON LAKE	150	LR	62.0	1184.	1	3
RAWHIDE		LR	90.0	15400.	1	3
RAWHIDE		LR	90.0	15400.	1	3
RAWHIDE		LR	90.0	15400.	1	3
RICHARDS	845	LR	21.0	726.	1	3
ROCKY RIDGE	2020	LR	35.0	4429.	1	3
ROCKY RIDGE	2020	LR	35.0	4429.	1	3
SATANKA DAM [illegible]	1665	LR	30.0	152000.	1	3
SOLDIER CANYON USBR [illegible]	1667	LR	226.0	152000.	1	3
SPRING CANYON	1668	LR	220.0	152000.	1	3
TERRY LAKE	850	LR	36.0	8145.	1	3
WATER SUPPLY NO 3	154	LR	41.0	4826.	1	3
WATER SUPPLY NO 4	1759	LR	28.0	1466.	1	3
WINDSOR #8	855	LR	60.0	10291.	1	3
INDIAN WASH DETN	960	ME	65.0	1615.	5	72
JERRY CREEK #1	1037	ME	56.0	1100.	5	72
JERRY CREEK #2	1376	ME	150.0	6320.	5	72
JUNIATA	89	ME	108.0	2684.	4	42
VEGA	1697	ME	162.0	33800.	5	72
CRAIG RAW WATER	1403	MF	58.0	547.	6	44
EMPIRE	9	MG	48.0	37700.	1	1
EMPIRE	9	MG	40.0	37700.	1	1
EMPIRE	9	MG	48.0	37700.	1	1
JACKSON LAKE	16	MG	38.0	35629.	1	1
WILLIAMS-MC CREERY	1994	MG	50.0	17616.	1	1
BIG MEADOWS	764	MI	55.0	2436.	3	20
[illegible]HREYS DAM	777	MI	85.0	842.	3	20
[illegible]A MARIA LAKE	780	MI	102.0	45070.	3	20
[illegible]LLARD	237	MS	53.0	775.	4	62
FAIRVIEW	462	MS	45.0	350.	4	41
MORROW POINT USBR	1669	MS	465.0	117000.	4	62
ONION VALLEY	[illegible]	MS	105.0	9511.	4	40
JACKSON GULCH	1685	MZ	180.0	9980.	7	36
NARRAGUINNEPP	[illegible]	MZ	100.0	19050.	7	32
NARRAGUINNEPP	1069	MZ	100.0	19050.	7	32
SUMMIT	1091	MZ	30.0	5954.	7	36
SUMMIT	1091	MZ	30.0	5954.	7	36
TOTTEN	1092	MZ	30.0	3495.	7	32
TOTTEN	1092	MZ	30.0	3495.	7	32
RIDGEWAY USBR		OU	233.0	125000.	4	68
RIDGEWAY		OU	233.0	125000.	4	68
ANTERO	351	PA	46.0	85564.	1	23
ELEVEN MILE CANYON *	359	PA	128.0	97800.	1	23
MONTGOMERY	372	PA	108.0	5068.	1	23
SPINNEY MOUNTAIN		PA	90.0	54500.	1	23
TARRYALL	342	PA	37.0	2617.	1	23
RUEDI USBR	1664	PI	330.0	96000.	5	38
PUEBLO		PU	200.0	357000.	2	10
ST. CHARLES #2	2069	PU	35.0	2700.	2	15
ST. CHARLES #2	2069	PU	35.0	2700.	2	15
ST. CHARLES #3	493	PU	53.0	8638.	2	15
ST. CHARLES #3	493	PU	53.0	8638.	2	15
[illegible] *	1015	RB	56.0	987.	6	57
BEAVER PARK *	763	RG	96.0	4739.	3	20
FISH CREEK Sheriff *	1020	RO	56.0	1850.	6	58
LAKE CATAMOUNT	2140	RO	52.0	7422.	6	58
LESTER CREEK	1022	RO	91.0	5657.	6	58
WILLOW CREEK	1036	RO	100.0	23064.	6	58
GURLEY	158	SM	66.0	10039.	6	60
MIRAMONTE	162	SM	87.0	6851.	6	60
TROUT LAKE	164	SM	43.0	3422.	4	60
CLINTON GULCH DAM	2093	SU	170.0	4370.	5	36
DILLON	875	SU	231.0	257678.	5	36
GOOSE PASTURE *	663	SU	64.0	912.	5	36
GOOSE PASTURE	663	SU	64.0	912.	5	36
GREEN MOUNTAIN	1658	SU	270.0	154645.	5	36
UPPER BLUE	871	SU	75.0	2140.	5	36
MASON	2049	TE	50.0	2653.	2	12
MC REYNOLDS	2050	TE	33.0	2050.	2	12
NORTH CATAMOUNT *	407	TE	200.0	12300.	2	10
SOUTH CATAMOUNT	408	TE	100.0	3934.	2	10
BLACK HOLLOW	1157	WE	42.0	6058.	1	3
BULL CANAL		WE	47.0	6000.	1	2
EMPIRE	9	WE	48.0	37700.	1	1
EMPIRE	9	WE	40.0	37700.	1	1
[illegible] CREEK	12	WE	64.0	29356.	1	1
[illegible]N LAKE	1899	WE	50.0	6970.	1	2
MILTON LAKE	1899	WE	50.0	6970.	1	2
RIVERSIDE	112	WE	41.0	65000.	1	1
RIVERSIDE	112	WE	41.0	65000.	1	1
RIVERSIDE	112	WE	41.0	65000.	1	1
RIVERSIDE	112	WE	41.0	65000.	1	1
RIVERSIDE	112	WE	41.0	65000.	1	1
RIVERSIDE	112	WE	41.0	65000.	1	1
WINDSOR	853	WE	43.0	17689.	1	3
WINDSOR LAKE *	854	WE	14.0	1466.	1	3

DAMS REQUIRING REHABILITATION

Map Key	Dam Name	District	Restricted	County	Work Required	Rough Cost Estimate
27	Barr Lake	2	N	Adams	Replace U/S face, improve outlet, install drains	$1,500,000
28	Julesburg	64	Y	Logan	Improve outlet and upstream face	1,050,000
3	North Poudre No. 6	3	Y	Larimer	Rehabilitate outlet; new spillway	540,000
30	Gurley	60	N	San Miguel	Sink holes U/S slope - piping	250,000
31	Leyden	7	Y	Jefferson	Rehabilitate embankment; new spillway	460,000
32	Terrace	21	N	Conejos	Enlarge Spillway	980,000
33	Milton	2	N	Weld	Repairs to U/S face - improve drains	450,000
34	North Sterling	64	N	Logan	Address embankment stability, enlarge spillway	1,000,000
1	Rio Grande	20	N	Mineral	Spillway enlargement	3,500,000
2	Riverside	1	N	Weld	Construct spillway	400,000
29	North Poudre No. 15	3	Y	Larimer	Enlarge spillway, improve stability	230,000
4	Halligan	3	N	Larimer	Improve Dam	5,700,000
5	Monument	40	Y	Delta	Enlarge spillway	800,000
6	Buckeye	61	Y	Montrose	Construct spillway	100,000
7	Cedar Mesa	40	N	Delta	Rehabilitate spillway	100,000
8	Spring Creek	59	N	Gunnison	Enlarge spillway	300,000
9	Carl Smith	40	N	Delta	Enlarge spillway, improve stability	500,000
10	Mountain Home	35	N	Costilla	Dam Break Study or enlarge spillway	50,000*
11	Elkhead	44	N	Moffat	Enlarge spillway	500,000
12	Sheriff	57	N	Routt	Enlarge spillway	100,000
13	Turner	30	N	La Plata	Enlarge spillway	1,000,000
14	Douglas	3	N	Larimer	Enlarge spillway	1,000,000
15	Beaver Park	5	N	Boulder	Enlarge spillway	500,000
16	Black Hollow	3	N	Weld	Enlarge spillway	60
17	Miramonte	60	Y	San Miguel	Control excessive seepage	320
18	Comanche	3	Y	Larimer	Control excessive seepage, enlarge spillway	550
19	Hour Glass	3	Y	Larimer	Control seepage, improve stability	330
20	Owl Creek	1	Y	Weld	Rehabilitate embankment and spillway	400
21	Waneka	6	Y	Boulder	Rehabilitation and enlargement	1,400
22	Atkinson	72	Y	Mesa	Control excessive seepage	300
23	Sterner	53	Y	Routt	Embankment repair	220
24	Hughes	38	Y	Garfield	Enlarge spillway, embankment repair	400
25	Hogland No. 1	36	Y	Summit	Rehabilitate embankment	530
26	Clear Creek	11	N	Chaffee	Enlarge spillway	1,500

* Cost of Dam Break Study

RICHARD D. LAMM
Governor

APPENDIX I

OFFICE OF THE STATE ENGINEER
DIVISION OF WATER RESOURCES

1313 Sherman Street-Room 818
Denver, Colorado 80203
(303) 866-3581

December 9, 1981

UNSAFE DAMS

as of 12/1/81

ARMY#	NAME	DIV. & DIST.	COUNTY
130	Comanche	1 - 3	Larimer
148	Spring Creek	4 - 59	Gunnison
259	Waneka	1 - 6	Boulder
359	Eleven Mile Canyon	1 - 23	Park
384	North Sterling (Point of Rock)	1 - 64	Logan
408	S. Catamount	2 - 10	Teller
410	Crystal Creek	2 - 10	El Paso
445	Big Tooth	2 - 10	El Paso
629	Carl Smith	4 - 40	Delta
663	Goose Pasture	5 - 36	Summit
681	Hughes	5 - 38	Garfield
759	Two Buttes	2 - 67	Baca
763	Beaver Park	3 - 20	Rio Grande
805	Rio Grande	3 - 20	Hinsdale
815	Terrace	3 - 21	Conejos
818	Mountain Home	3 - 35	Costilla
854	Windsor Lake	1 - 3	Weld
901	Lake Moraine	2 - 10	El Paso
976	Elkhead	6 - 44	Rio Blanco
1015	Sheriff	6 - 57	Routt
1066	Turner	7 - 30	La Plata
1143	Clear Creek	2 - 11	Clear Creek
1146	Cucharas #5	2 - 16	Huerfano
1163	Douglas	1 - 3	Larimer
1200	Beaver Park	1 - 5	Boulder
1347	Ramah Det.	2 - 67	El Paso

STATUS OF ARTIFICIAL IMPOUNDMENT DAMS ON PROPERTY MANAGED BY THE COLORADO DIVISION O PARKS AND OUTDOOR RECREATION

Area	Dam Constructed By	Based on Real Estate Section Records, Dam Owned by	Dam Maintained By	Major Downstream Rec. Facilities On Site	DPOR On Site Mgmt. Presence	Notes
Barbour Ponds	Gravel ponds excavated by Highway Dept.	Ponds owned by DPOR	Ponds & levee maint. by DPOR	No	No	Breach of levee if ponds could release additional volume of water to normal or flood stage
Barr Lake	Irrig. Co.	Irrig. Co.	Irrig. Co.	No	Yes	
Bonny	Fed.	Fed.	Fed.	DOW has vault toilets, pkg areas & habitat projects	Yes	
Boyd	Irrig. Co.	Irrig. Co.	Irrig. Co.	No	Yes	High water could reach some recreation structures on site
Castlewood	Not applicable	na	na	na	na	
Chatfield	Fed.	Fed.	Fed.	Yes. Flush toilets, fish rearing unit, pkg. lots, office complex	Yes	
Cherry Creek	Fed.	Fed.	Fed.	Yes. City of Denver Golf Course	Yes	
Crawford	Fed.	Fed.	Fed.	No	Yes	
Eldorado	Denver Water Board	DWB	DWB	Yes. Toilets, pkg. areas, road	Yes	
Eleven-Mile	Denver Water Board	DWB	DWB	No	Yes	
Golden Gate	Stock & fishing ponds, DPOR & private landowner. Since purchased by DPOR	DPOR	DPOR	Visitor Center, road, pkg, vault toilet, grp. picnic area	Yes	
Highline	GF&P	DOW	DOW	No	Yes	
Island Acres	Gravel ponds by Highway Dept.	DPOR	DPOR	No	Yes	
Jackson	Irrig. Co.	Irrig. Co	Irrig. Co.	Camping & swimming area	Yes	
Lathrop						
Martin	City of Walsenberg	City ?	City?	City golf course	Yes	
Horseshoe	Game & Fish	DPOR ?	DPOR?	Little effect on extg. facilities	Yes	
Lory	Not applicable	na	na	na	na	
Mueller	Stock ponds by private landowner	DPOR	DPOR	Not currently	Yes	
Navajo	Fed.	Fed.	Fed.			Dam is not on DPOR managed land. Dam & all downstream development is in New Mexico.
Paonia	Fed.	Fed.	Fed.	No	No	
Pueblo	Fed.	Fed.	Fed.	Yes. Swimming area & major day use developments	Yes	
Rifle	Fed.	Fed.	Fed.	No	Yes	
Roxborough	Not applicable	na	na	na	na	
State Forest						
N. Michigan	Game & Fish	DOW or Land Bd.?	?	Road & bridge	Yes	Responsibilities not clear and should be resolved.
Ranger Lakes	?	Land Board ?	?	Camping area	Yes	
Steamboat	GF&P & Colo. Ute	DPOR	DPOR	No	Yes	
Pearl Lake	Game & Fish	DPOR	DPOR	No	No (nearby)	
Sweitzer	Game & Fish	DPOR	DPOR	Maint. area	Yes	
Trinidad	Fed	Fed	Fed	Day use area w/roads, pkg. & toilets	Yes	
Vega	Fed	Fed	Fed	No	Yes	

DIVISION-OWNED OR CONSTRUCTED RESERVOIRS

Northwest Region	Emergency Action Plan Update
Bailey Lake	
Beaver Lake (Marble)	
Beaver Lake (Mesa #2)	
Bison Lake	
Black Lake #1	4/78
Black Lake #2	
Christine Lake	
Dumont Lake	
Elkhead	12/15/80
Freeman Lake	
Hahns Peak Lake	2/80
Heart Lake	
Highline	9/80
Lake Avery (Big Beaver)	
Lake of the Woods	
Lester Creek (Pearl Lake)	8/29/80
Mack Mesa Lake	
McGinnis Lake	
Meadow Creek	4/7/80
Ralph White (Fortification Creek)	
Rio Blanco (Johnny Johnson)	
Skinny Fish Lake	
Steamboat Lake (Willow Creek)	5/78
Sunset (Mesa #1)	
Supply Basin	
Swede Lake	
Sylvan Lake (O.Z., Zircher Reservoir)	4/78
Upper Stillwater (Bear Lake)	5/12/78
Vaughn Lake (Poose Creek)	

Southeast Region	Emergency Action Plan Update
Flagler	
Horseshoe Lake	
Karval Reservoir	
North Lake	
Skaguay Reservoir	
Tarryall Reservoir	9/79
Two Buttes Reservoir	5/27/81
Burchfield (Konantz)	

Southwest Region	Emergency Action Plan Update
Alberta Park	4/6/78
Andrew Lake	
Beaver Park	4/6/78
Big Meadows	4/6/78
Brown's Lake #2 (Lower)	2/19/79
Brown's Lake #3 (Upper)	2/19/79
Chipeta Lakes	2/22/79
Dome Lakes #1 (Lower)	
Dome Lakes #2 (Upper)	
Echo Canyon	
Haviland Lake	
LaJara Reservoir	4/12/79
Lake Irwin (Brennard Lake)	
Miramonte Reservoir	2/22/79
Pastorious Lake	
Rito Hondo	4/6/78
Road Canyon #1	2/19/79
Road Canyon #2	2/19/79
Spring Creek Lake	2/20/79
Swietzer Lake (Garner Mesa Reservoir)	2/22/79
Trujillo Meadows	4/6/78
Williams Creek	
Woods Lake	

Northeast Region	Emergency Action Plan Update
Belaire Lake	
Dowdy Lake	
Golden Gate	
Hohnholz 1, 2 & 3	
Jumbo Annex (Little Jumbo)	
Lake John	
Lost Lake	
Mesa Reservoir (Hank Roberts)	
Muddy Pass Lake	
North Michigan	
Parvin Lake	
Stalker Lake (Chief Creek Reservoir)	
Watson Lake	
West Lake (Twin Lake)	

COLORADO STATE FISH HATCHERIES

UNIT	DRAINAGE
Bellvue-Watson	Poudre River, S.P.
Chalk Cliffs Rearing Unit	Chalk Creek, A.
Durango Hatchery	Animas River, S.J., C.
Estes-North Fork	Fall River, Big Thompson, S.P.
Finger Rock Rearing Unit	Brinker Creek, Y.
Glenwood Springs Hatchery	Mitchell Creek, C.
Crystal River Unit	Crystal River, Roaring Fork, C.
Las Animas Hatchery	Adobe Creek, A.
Mt. Shavano Hatchery	Arkansas River
Pitkin Hatchery	Quartz Creek, Gunnison
Poudre Rearing Unit	Poudre River, S.P.
Rifle Falls Hatchery	East Rifle Creek, C.
Roaring Judy Hatchery	East River, Gunnison, C.
Wray Hatchery	Chief Creek, Republican

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COMMUNITY NUMBER	COMMUNITY NAME		DATE OF ENTRY EMERGENCY OR REGULAR PROG.	DATE OF CURRENT EFFECTIVE MAP (OR MAP INDEX)
080001#	ADAMS COUNTY *	ADAMS COUNTY	FEB 01, 1979(R)	FEB 01, 1979
080177	AKRON, TOWN OF	WASHINGTON COUNTY	MAR 06, 1975	MAR 05, 1976
080009#	ALAMOSA COUNTY *	ALAMOSA COUNTY	JAN 19, 1978(R)	JAN 19, 1978
080010#	ALAMOSA, CITY OF	ALAMOSA COUNTY	SEP 15, 1977(R)	NOV 09, 1982
080230	ANTONITO, TOWN OF	CONEJOS COUNTY	SEP 30, 1975	JUL 11, 1975
080011A	ARAPAHOE COUNTY *	ARAPAHOE COUNTY	AUG 15, 1977(R)	AUG 15, 1977
080273#	ARCHULETA COUNTY *	ARCHULETA COUNTY	JAN 03, 1979(R)	JAN 03, 1979
085072A	ARVADA, CITY OF	JEFFERSON COUNTY ADAMS COUNTY	JUN 23, 1972(R)	APR 23, 1976
080143A	ASPEN, CITY OF	PITKIN COUNTY	JUL 02, 1974	DEC 24, 1976
080179	AULT, TOWN OF	WELD COUNTY	JUN 10, 1980(R)	(NSFHA)
080002#	AURORA, CITY OF	ARAPAHOE COUNTY ADAMS COUNTY	JUN 01, 1978(R)	AUG 31, 1982
080052#	BASALT, TOWN OF	EAGLE COUNTY	MAR 18, 1980(R)	MAR 18, 1980
080098B	BAYFIELD, TOWN OF	LA PLATA COUNTY	SEP 29, 1978(R)	SEP 29, 1978
080271#	BENT COUNTY *	BENT COUNTY	JUN 26, 1975	NOV 15, 1977
080296	BERTHOUD, TOWN OF	LARIMER COUNTY	MAY 26, 1978(R)	(NSFHA)
080076A	BLACK HAWK, CITY OF	GILPIN COUNTY	SEP 25, 1975	AUG 13, 1976
080023#	BOULDER COUNTY *	BOULDER COUNTY	FEB 01, 1979(R)	FEB 01, 1979
080024#	BOULDER, CITY OF	BOULDER COUNTY	JUL 17, 1978(R)	FEB 24, 1981
080172#	BRECKINRIDGE, TOWN OF	SUMMIT COUNTY	JUN 04, 1980(R)	JUN 04, 1980
080004#	BRIGHTON, CITY OF	ADAMS COUNTY	NOV 16, 1977(R)	NOV 16, 1977
085073A	BROOMFIELD, CITY OF	BOULDER COUNTY	SEP 07, 1973(R)	AUG 22, 1975
080130#	BRUSH, CITY OF	MORGAN COUNTY	DEC 01, 1977(R)	OCT 13, 1981
080030#	BUENA VISTA, TOWN OF	CHAFFEE COUNTY	SEP 30, 1982(R)	SEP 30, 1982
080192	CALHAN, TOWN OF	EL PASO COUNTY	MAR 12, 1976	JAN 17, 1975
080068#	CANON CITY, CITY OF	FREMONT COUNTY	NOV 03, 1982(R)	NOV 03, 1982
080234	CARBONDALE, TOWN OF	GARFIELD COUNTY	FEB 07, 1975	AUG 29, 1975
080050B	CASTLE ROCK, TOWN OF	DOUGLAS COUNTY	AUG 15, 1978(R)	AUG 15, 1978
080077A	CENTRAL CITY, CITY OF	GILPIN COUNTY	JUN 18, 1975	APR 09, 1976
080269A	CHAFFEE COUNTY *	CHAFFEE COUNTY	APR 11, 1975	JUN 03, 1977
080013B	CHERRY HILLS VILLAGE, CITY	ARAPAHOE COUNTY	AUG 01, 1978(R)	AUG 01, 1978
080034A	CLEAR CREEK COUNTY *	CLEAR CREEK COUNTY	MAR 11, 1980(R)	MAR 11, 1980
080116#	COLLBRAN, TOWN OF	MESA COUNTY	APR 15, 1982(R)	APR 15, 1982
080060	COLORADO SPRINGS, CITY OF	EL PASO COUNTY	MAR 30, 1973	APR 04, 1978
080014#	COLUMBINE VALLEY, TOWN OF	ARAPAHOE COUNTY	JUN 15, 1978(R)	DEC 02, 1980
080006#	COMMERCE CITY, CITY OF	ADAMS COUNTY	FEB 15, 1978(R)	JAN 19, 1982
080037	CONEJOS COUNTY *	CONEJOS COUNTY	APR 17, 1979	
080121B	CORTEZ, CITY OF	MONTEZUMA COUNTY	APR 01, 1977(R)	APR 01, 1977
080119#	CRAIG, CITY OF	MOFFAT COUNTY	JUL 15, 1975	JUL 03, 1979
080118A	CREEDE, TOWN OF	MINERAL COUNTY	JUN 19, 1975	JAN 16, 1976

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FEDERAL EMERGENCY MANAGEMENT AGENCY
FEDERAL INSURANCE ADMINISTRATION
COMMUNITIES PARTICIPATING IN THE NATIONAL FLOOD INSURANCE PROGRAM
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COLORADO

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080079A	CRESTED BUTTE, TOWN OF	GUNNISON COUNTY	JUN 13, 1974	JUN 04, 1976
080174A	CRIPPLE CREEK, CITY OF	TELLER COUNTY	JUL 15, 1975	MAR 05, 1976
080111	CROOK, TOWN OF	LOGAN COUNTY	MAY 06, 1977	NOV 08, 1974
080211	CROWLEY, TOWN OF	CROWLEY COUNTY	DEC 23, 1975	AUG 15, 1975
080236#	DACONO, TOWN OF	WELD COUNTY	JUL 16, 1979(R)	JUL 16, 1979
080015	DEER TRAIL, TOWN OF	ARAPAHOE COUNTY	NOV 24, 1975	NOV 29, 1974
080154#	DEL NORTE, TOWN OF	RIO GRANDE COUNTY	SEP 30, 1982(R)	SEP 30, 1982
080041A	DELTA COUNTY *	DELTA COUNTY	APR 09, 1979	MAY 10, 1977
080043A	DELTA, CITY OF	DELTA COUNTY	AUG 02, 1974	JAN 16, 1976
080046A	DENVER, CITY OF	DENVER COUNTY	APR 16, 1971	APR 15, 1977
080279#	DOLORES COUNTY *	DOLORES COUNTY	JUL 08, 1976	JAN 24, 1978
080122	DOLORES, TOWN OF	MONTEZUMA COUNTY	JUL 15, 1975	FEB 07, 1975
080049#	DOUGLAS COUNTY *	DOUGLAS COUNTY	SEP 03, 1980(R)	SEP 03, 1980
080047A	DOVE CREEK, TOWN OF	DOLORES COUNTY	JUL 31, 1978	NOV 28, 1975
080099#	DURANGO, CITY OF	LA PLATA COUNTY	JAN 17, 1979(R)	SEP 14, 1982
080051#	EAGLE COUNTY *	EAGLE COUNTY	NOV 19, 1980(R)	NOV 19, 1980
080238#	EAGLE, TOWN OF	EAGLE COUNTY	MAR 18, 1980(R)	MAR 18, 1980
080180#	EATON, TOWN OF	WELD COUNTY	JUN 04, 1980(R)	JUN 04, 1980
080089B	EDGEWATER, CITY OF	JEFFERSON COUNTY	JUN 06, 1974	NOV 14, 1978
080059A	EL PASO COUNTY *	EL PASO COUNTY	MAR 09, 1973	AUG 02, 1977
085074#	ENGLEWOOD, CITY OF	ARAPAHOE COUNTY	FEB 11, 1972(R)	DEC 15, 1979
080193#	ESTES PARK, TOWN OF	LARIMER COUNTY	JAN 17, 1979(R)	JAN 17, 1979
080182#	EVANS, CITY OF	WELD COUNTY	APR 02, 1979(R)	APR 02, 1979
080239	FAIRPLAY, TOWN OF	PARK COUNTY	JUL 29, 1976	JUL 18, 1975
080240	FEDERAL HEIGHTS, TOWN OF	ADAMS COUNTY	JUL 28, 1976	JUL 11, 1975
080241#	FIRESTONE, TOWN OF	WELD COUNTY	DEC 18, 1979(R)	DEC 18, 1979
080112	FLEMING, TOWN OF	LOGAN COUNTY	MAR 18, 1977	NOV 08, 1974
080070B	FLORENCE, CITY OF	FREMONT COUNTY	JUN 25, 1975	FEB 11, 1977
080102#	FORT COLLINS, CITY OF	LARIMER COUNTY	JUL 16, 1979(R)	JUL 16, 1979
080183#	FORT LUPTON, TOWN OF	WELD COUNTY	APR 02, 1979(R)	APR 02, 1979
080061#	FOUNTAIN, CITY OF	EL PASO COUNTY	OCT 02, 1974	MAY 29, 1979
080244#	FREDERICK, TOWN OF	WELD COUNTY	JUL 16, 1979(R)	JUL 13, 1982
080067#	FREMONT COUNTY *	FREMONT COUNTY	JUN 25, 1975	JUN 27, 1978
080245#	FRISCO, TOWN OF	SUMMIT COUNTY	MAY 15, 1980(R)	MAY 15, 1980
080194#	FRUITA, TOWN OF	MESA COUNTY	DEC 01, 1981(R)	DEC 01, 1981
080131#	FT. MORGAN, CITY OF	MORGAN COUNTY	FEB 04, 1982	FEB 06, 1979
080205A	GARFIELD COUNTY *	GARFIELD COUNTY	DEC 15, 1977(R)	DEC 15, 1977
080035#	GEORGETOWN, TOWN OF	CLEAR CREEK COUNTY	APR 09, 1974	JAN 02, 1980
080213	GILCREST, CITY OF	WELD COUNTY	JUN 10, 1980(R)	(NSFHA)
080075A	GILPIN COUNTY *	GILPIN COUNTY	MAR 17, 1980	JUN 10, 1977
080071#	GLENWOOD SPRINGS, CITY OF	GARFIELD COUNTY	JUL 16, 1979(R)	JUL 16, 1979

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080090	GOLDEN, CITY OF	JEFFERSON COUNTY	JUN 19, 1975	NOV 05, 1976
080144	GRANADA, TOWN OF	PROWERS COUNTY	MAY 13, 1975	JUL 18, 1975
080117#	GRAND JUNCTION, CITY OF	MESA COUNTY	OCT 13, 1978	DEC 12, 1978
080214A	GRAND LAKE, TOWN OF	GRAND COUNTY	MAY 09, 1979	SEP 17, 1976
080062A	GREEN MOUNTAIN FALLS, TOWN	EL PASO COUNTY	MAR 18, 1975	DEC 12, 1975
080195#	GREENWOOD VILLAGE, CITY OF	ARAPAHOE COUNTY	JAN 05, 1978(R)	DEC 16, 1980
080078#	GUNNISON COUNTY *	GUNNISON COUNTY	MAY 28, 1975	AUG 09, 1977
080080A	GUNNISON, CITY OF	GUNNISON COUNTY	JUN 18, 1975	DEC 26, 1975
080295#	GYPSUM, TOWN OF	EAGLE COUNTY	SEP 16, 1981(R)	SEP 16, 1981
080140B	HAXTUN, TOWN OF	PHILLIPS COUNTY	AUG 07, 1975	AUG 22, 1975
080157B	HAYDEN, TOWN OF	ROUTT COUNTY	JUN 01, 1978(R)	JUN 01, 1978
080081	HINSDALE COUNTY *	HINSDALE COUNTY	JUN 26, 1975	MAY 24, 1977
080145A	HOLLY, TOWN OF	PROWERS COUNTY	AUG 07, 1974	JAN 16, 1976
080141A	HOLYOKE, TOWN OF	PHILLIPS COUNTY	AUG 07, 1975	JAN 09, 1976
080044A	HOTCHKISS, TOWN OF	DELTA COUNTY	SEP 26, 1978	SEP 17, 1976
080206A	HUERFANO COUNTY *	HUERFANO COUNTY	APR 04, 1974	NOV 22, 1977
080108A	HUGO, TOWN OF	LINCOLN COUNTY	AUG 08, 1975	SEP 26, 1975
080036#	IDAHO SPRINGS, CITY OF	CLEAR CREEK COUNTY	NOV 15, 1978(R)	NOV 15, 1978
080268A	IGNACIO, TOWN OF	LA PLATA COUNTY	AUG 05, 1977	JAN 16, 1976
080216	JAMESTOWN, TOWN OF	BOULDER COUNTY	JUN 25, 1975	JUL 11, 1975
080087	JEFFERSON COUNTY *	JEFFERSON COUNTY	JUL 05, 1973	JUL 05, 1977
080169A	JULESBURG, TOWN OF	SEDGWICK COUNTY	MAR 03, 1975	FEB 20, 1976
080251	KEENESBURG, TOWN OF	WELD COUNTY	AUG 24, 1981(R)	(NSFHA)
080038	LA JARA, TOWN OF	CONEJOS COUNTY	JUN 30, 1976(R)	(NSFHA)
080133#	LA JUNTA, CITY OF	OTERO COUNTY	JUN 13, 1975	NOV 21, 1978
080186	LA SALLE, TOWN OF	WELD COUNTY	MAY 25, 1978(R)	(NSFHA)
080084A	LA VETA, TOWN OF	HUERFANO COUNTY	DEC 24, 1975	SEP 26, 1978
080026#	LAFAYETTE, CITY OF	BOULDER COUNTY	MAR 18, 1980(R)	MAR 18, 1980
080082	LAKE CITY, CITY OF	HINSDALE COUNTY	JUN 17, 1975	AUG 13, 1976
085075B	LAKEWOOD, CITY OF	JEFFERSON COUNTY	JUL 21, 1972(R)	MAR 23, 1979
080146A	LAMAR, CITY OF	PROWERS COUNTY	APR 08, 1975	AUG 13, 1976
080101#	LARIMER COUNTY *	LARIMER COUNTY	APR 02, 1979(R)	APR 02, 1979
080022	LAS ANIMAS, CITY OF	BENT COUNTY	APR 17, 1975	
080109A	LIMON, TOWN OF	LINCOLN COUNTY	JUL 03, 1975	JAN 16, 1976
080017#	LITTLETON, CITY OF	ARAPAHOE COUNTY	DEC 01, 1978(R)	FEB 03, 1981
080110#	LOGAN COUNTY *	LOGAN COUNTY	JAN 03, 1977	APR 07, 1978
080027A	LONGMONT, CITY OF	BOULDER COUNTY	JUL 05, 1977(R)	JUL 05, 1977
085076#	LOUISVILLE, CITY OF	BOULDER COUNTY	MAY 04, 1973(R)	JAN 05, 1982
080029#	LYONS, TOWN OF	BOULDER COUNTY	AUG 01, 1980(R)	AUG 01, 1980
080253A	MANASSA TOWN	CONEJOS COUNTY	OCT 04, 1979	JUL 16, 1976
080123A	MANCOS, TOWN OF	MONTEZUMA COUNTY	JUL 25, 1975	MAY 17, 1974

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COMMUNITIES PARTICIPATING IN THE NATIONAL FLOOD INSURANCE PROGRAM
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080063A	MANITOU SPRINGS, CITY OF	EL PASO COUNTY	MAY 29, 1975	FEB 21, 1975
080134	MANZANOLA, TOWN OF	OTERO COUNTY	JUN 30, 1976(R)	(NSFHA)
080197A	MARBLE, TOWN OF	GUNNISON COUNTY	JAN 16, 1976	JUN 17, 1977
080151A	MEEKER, TOWN OF	RIO BLANCO COUNTY	APR 28, 1975	APR 09, 1976
080115#	MESA COUNTY *	MESA COUNTY	JUL 03, 1978(R)	JUL 03, 1978
080187#	MILLIKEN, TOWN OF	WELD COUNTY	AUG 01, 1979(R)	AUG 01, 1979
080284	MINERAL COUNTY *	MINERAL COUNTY	MAR 05, 1979	
080053#	MINTURN, TOWN OF	EAGLE COUNTY	SEP 17, 1980(R)	SEP 17, 1980
080270#	MOFFAT COUNTY *	MOFFAT COUNTY	AUG 02, 1982(R)	AUG 02, 1982
080155#	MONTE VISTA, CITY OF	RIO GRANDE COUNTY	SEP 30, 1982(R)	SEP 30, 1982
080285#	MONTEZUMA COUNTY *	MONTEZUMA COUNTY	FEB 03, 1976	NOV 15, 1977
080124	MONTROSE COUNTY *	MONTROSE COUNTY	MAY 23, 1975	AUG 30, 1977
080125A	MONTROSE, CITY OF	MONTROSE COUNTY	JAN 31, 1975	APR 30, 1976
080064A	MONUMENT, TOWN OF	EL PASO COUNTY	JUN 10, 1975	OCT 22, 1976
080129#	MORGAN COUNTY *	MORGAN COUNTY	APR 22, 1980	MAY 12, 1981
080092A	MORRISON, TOWN OF	JEFFERSON COUNTY	SEP 11, 1975	MAR 26, 1976
080126#	NATURITA, TOWN OF	MONTROSE COUNTY	JAN 06, 1982(R)	JAN 06, 1982
080255#	NEDERLAND, TOWN OF	BOULDER COUNTY	AUG 01, 1979(R)	AUG 01, 1979
080257#	NORTHGLENN, CITY OF	ADAMS COUNTY	SEP 15, 1978(R)	MAR 31, 1981
080167	NORWOOD, TOWN OF	SAN MIGUEL COUNTY	MAR 08, 1976	
080188#	NUNN, TOWN OF	WELD COUNTY	FEB 01, 1979(R)	FEB 01, 1979
080158A	OAK CREEK, TOWN OF	ROUTT COUNTY	JUN 16, 1975	DEC 19, 1975
080128#	OLATHE, TOWN OF	MONTROSE COUNTY	SEP 16, 1982(R)	SEP 16, 1982
080259	ORDWAY, TOWN OF	CROWLEY COUNTY	JUL 16, 1976	AUG 22, 1975
080132#	OTERO COUNTY *	OTERO COUNTY	AUG 08, 1975	NOV 08, 1977
080178B	OTIS, TOWN OF	WASHINGTON COUNTY	JUN 23, 1978	SEP 26, 1978
080136	OURAY COUNTY *	OURAY COUNTY	JUL 18, 1975	
080137B	OURAY, CITY OF	OURAY COUNTY	JUL 24, 1975	DEC 04, 1979
080019#	PAGOSA SPRINGS, TOWN OF	ARCHULETA COUNTY	DEC 01, 1978(R)	DEC 01, 1978
080198	PALISADE, TOWN OF	MESA COUNTY	SEP 27, 1982	
080065B	PALMER LAKE, TOWN OF	EL PASO COUNTY	JUL 03, 1978(R)	JUL 03, 1978
080045A	PAONIA, TOWN OF	DELTA COUNTY	JUN 10, 1975	MAY 24, 1974
080139#	PARK COUNTY *	PARK COUNTY	MAY 13, 1975	NOV 22, 1977
080189#	PIERCE, TOWN OF	WELD COUNTY	NOV 15, 1979(R)	NOV 15, 1979
080287#	PITKIN COUNTY *	PITKIN COUNTY	AUG 07, 1975	OCT 25, 1977
080190	PLATTEVILLE, TOWN OF	WELD COUNTY	FEB 29, 1980(R)	(NSFHA)
080220	PONCHA SPRINGS, TOWN OF	CHAFFEE COUNTY	MAY 27, 1975	AUG 29, 1975
080272#	PROWERS COUNTY *	PROWERS COUNTY	JUN 30, 1975	JUL 12, 1977
080147#	PUEBLO COUNTY *	PUEBLO COUNTY	JUN 21, 1974	JAN 03, 1978
085077B	PUEBLO, CITY OF	PUEBLO COUNTY	AUG 24, 1973(R)	APR 02, 1976
080066A	RAMAH, TOWN OF	EL PASO COUNTY	NOV 19, 1975	FEB 20, 1976

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080152B	RANGELY, TOWN OF	RIO BLANCO COUNTY	DEC 01, 1977(R)	DEC 01, 1977
080048	RICO, TOWN OF	DOLORES COUNTY	JUL 15, 1975	DEC 20, 1974
080138#	RIDGWAY, TOWN OF	OURAY COUNTY	MAR 18, 1977(R)	OCT 13, 1981
085078B	RIFLE, CITY OF	GARFIELD COUNTY	JUN 15, 1973(R)	SEP 01, 1978
080153A	RIO GRANDE COUNTY *	RIO GRANDE COUNTY	JUN 25, 1975	APR 29, 1977
080221B	ROCKVALE, TOWN OF	FREMONT COUNTY	SEP 21, 1979	MAY 08, 1979
080135B	ROCKY FORD, CITY OF	OTERO COUNTY	JUN 03, 1980(R)	JUN 03, 1980
080156	ROUTT COUNTY *	ROUTT COUNTY	MAY 09, 1979	
080031#	SALIDA, CITY OF	CHAFFEE COUNTY	SEP 30, 1982(R)	SEP 30, 1982
080267A	SAN JUAN COUNTY *	SAN JUAN COUNTY	SEP 01, 1978(R)	SEP 01, 1978
080039B	SAN LUIS, TOWN OF	COSTILLA COUNTY	OCT 02, 1975	DEC 24, 1976
080166A	SAN MIGUEL COUNTY *	SAN MIGUEL COUNTY	SEP 29, 1978(R)	SEP 29, 1978
080171	SEDGWICK, TOWN OF	SEDGWICK COUNTY	JUL 16, 1975	NOV 08, 1974
080018B	SHERIDAN, CITY OF	ARAPAHOE COUNTY	JUL 13, 1976(R)	JUL 13, 1976
080201#	SILVERTHORNE, TOWN OF	SUMMIT COUNTY	MAY 01, 1980(R)	MAY 01, 1980
080165B	SILVERTON, TOWN OF	SAN JUAN COUNTY	SEP 01, 1978(R)	SEP 01, 1978
080150#	STEAMBOAT SPRINGS, TOWN OF	ROUTT COUNTY	JAN 19, 1978(R)	MAR 16, 1979
080294#	STERLING, CITY OF	LOGAN COUNTY	AUG 04, 1977	JUL 03, 1979
080290#	SUMMIT COUNTY *	SUMMIT COUNTY	DEC 16, 1980(R)	DEC 16, 1980
080203#	SUPERIOR, TOWN OF	BOULDER COUNTY	SEP 28, 1979(R)	SEP 28, 1979
080173#	TELLER COUNTY *	TELLER COUNTY	SEP 24, 1976	SEP 06, 1977
080168B	TELLURIDE, TOWN OF	SAN MIGUEL COUNTY	SEP 15, 1978(R)	SEP 15, 1978
080007#	THORNTON, CITY OF	ADAMS COUNTY	JUN 15, 1978(R)	JAN 19, 1982
080107#	TRINIDAD, CITY OF	LAS ANIMAS COUNTY	JUL 03, 1978(R)	JUL 03, 1978
080054A	VAIL, TOWN OF	EAGLE COUNTY	AUG 13, 1976	SEP 19, 1978
080086A	WALDEN, TOWN OF	JACKSON COUNTY	JUL 25, 1975	JUN 28, 1974
080083#	WALSENBURG, CITY OF	HUERFANO COUNTY	JAN 27, 1975	NOV 28, 1978
080021A	WALSH, TOWN OF	BACA COUNTY	JUN 30, 1976(R)	(NSFHA)
080266#	WELD COUNTY *	WELD COUNTY	MAR 18, 1980(R)	SEP 28, 1982
080104#	WELLINGTON, TOWN OF	LARIMER COUNTY	FEB 15, 1979(R)	FEB 15, 1979
080008A	WESTMINISTER, CITY OF	ADAMS COUNTY	JUL 13, 1973	APR 23, 1976
085079A	WHEAT RIDGE, CITY OF	JEFFERSON COUNTY	MAY 26, 1972(R)	JUL 22, 1977
080204#	WIGGINS, CITY OF	MORGAN COUNTY	FEB 15, 1979(R)	FEB 15, 1979
080305	WINTER PARK, TOWN OF	GRAND COUNTY	JUL 30, 1980	
080175A	WOODLAND PARK, TOWN OF	TELLER COUNTY	APR 23, 1975	MAR 26, 1976
080191B	WRAY, CITY OF	YUMA COUNTY	AUG 28, 1974	FEB 18, 1977
080160A	YAMPA, TOWN OF	ROUTT COUNTY	NOV 08, 1976	JAN 02, 1976
080265	YUMA, TOWN OF	YUMA COUNTY	MAY 30, 1975	

TOTAL IN THE FLOOD PROGRAM 200

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TOTAL IN THE REGULAR PROGRAM		96	
TOTAL IN THE REGULAR PROGRAM BUT HAVING NO SPECIAL FLOOD HAZARD AREA		9	
TOTAL IN REGULAR PROGRAM BUT DESIGNATED AS MINIMALLY FLOOD PRONE		4	
TOTAL IN EMERGENCY PROGRAM		104	
TOTAL IN EMERGENCY PROGRAM WITH THE HAZARD AREA IDENTIFIED		95	

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FEDERAL INSURANCE ADMINISTRATION
AREAS WHICH HAVE HAD SPECIAL FLOOD HAZARD AREAS IDENTIFIED
--NOT IN THE PROGRAM--
AS OF NOV 15, 1982
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COMMUNITY NUMBER	COMMUNITY NAME		HAZARD AREA IDENTIFIED	DATE ON WHICH SANCTIONS APPLY
080229	AGUILAR, TOWN OF	LAS ANIMAS COUNTY	JUL 11, 1975	JUL 11, 1976
080148B	BOONE, TOWN OF	PUEBLO COUNTY	SEP 06, 1974	SEP 06, 1975
080210	COAL CREEK TOWN	FREMONT COUNTY	AUG 15, 1975	AUG 15, 1976
080040A	CUSTER COUNTY	CUSTER COUNTY	JAN 24, 1978	JAN 24, 1979
080120A	DINOSAUR, TOWN OF	MOFFAT COUNTY	AUG 30, 1974	AUG 30, 1975
080056#	ELIZABETH, TOWN OF	ELBERT COUNTY	SEP 06, 1974	SEP 06, 1975
080212	EMPIRE, TOWN OF	CLEAR CREEK COUNTY	MAY 02, 1975	MAY 02, 1976
080181#	ERIE, TOWN OF	WELD COUNTY	JUN 28, 1974(F)	JAN 17, 1979(S)
080073A	FRASER, TOWN OF	GRAND COUNTY	SEP 06, 1974	SEP 06, 1975
080215	GRAND VALLEY TOWN	GARFIELD COUNTY	AUG 13, 1976	AUG 13, 1977
080184#	GREELEY, CITY OF	WELD COUNTY	MAR 03, 1974(F)	JUL 16, 1979(S)
080074A	HOT SULPHUR SPRINGS, TOWN O	GRAND COUNTY	NOV 22, 1974	NOV 22, 1975
080207A	ILIFF, TOWN OF	LOGAN COUNTY	DEC 27, 1974	DEC 27, 1975
080057A	KIOWA, TOWN OF	ELBERT COUNTY	SEP 06, 1974	SEP 06, 1975
080033	KIT CARSON, TOWN OF	CHEYENNE COUNTY	DEC 13, 1974	DEC 13, 1975
080097#	LA PLATA COUNTY *	LA PLATA COUNTY	JUN 03, 1977(F)	DEC 15, 1981(S)
080282#	LAKE COUNTY *	LAKE COUNTY	OCT 18, 1977	OCT 18, 1978
080105	LAS ANIMAS COUNTY *	LAS ANIMAS COUNTY	SEP 01, 1977	NOV 02, 1977(S)
080103B	LOVELAND, CITY OF	LARIMER COUNTY	MAR 01, 1974(F)	SEP 01, 1978(S)
080256	NEW CASTLE TOWN	GARFIELD COUNTY	JUL 25, 1975	JUL 25, 1976
080127A	NUCLA, TOWN OF	MONTROSE COUNTY	MAY 24, 1974	MAY 24, 1975
080258#	ORCHARD CITY CITY	DELTA COUNTY	MAY 27, 1977(F)	MAY 27, 1978
080170#	OVID, TOWN OF	SEDGWICK COUNTY	NOV 15, 1974	NOV 15, 1975
080293#	PITKIN, TOWN OF	GUNNISON COUNTY	JUN 20, 1978	JUN 20, 1979
080260#	REDCLIFF TOWN	EAGLE COUNTY	SEP 19, 1975(F)	SEP 19, 1976
080150A	RYE, TOWN OF	PUEBLO COUNTY	JUL 18, 1975	JUL 18, 1976
080164	SAGAUCHE, TOWN OF	SAGUACHE COUNTY	MAY 28, 1976	MAY 28, 1977
080223	SILT TOWN	GARFIELD COUNTY	JUL 25, 1975	JUL 25, 1976
080200#	SILVER PLUME, TOWN OF	CLEAR CREEK COUNTY	DEC 13, 1974(F)	DEC 13, 1975
080106A	STARKVILLE, TOWN OF	LAS ANIMAS COUNTY	SEP 06, 1974	SEP 06, 1975

TOTAL SUSPENDED FROM EMERGENCY PROGRAM 0

TOTAL SUSPENDED FROM REGULAR PROGRAM 5

TOTAL NOT IN PROGRAM WITH HAZARD AREA IDENTIFIED 25

TOTAL NOT IN PROGRAM WITH HAZARD AREA IDENTIFIED FOR MORE THAN ONE YEAR 25

N/A - NOT APPLICABLE AT THIS TIME
(S) - SUSPENDED COMMUNITY
(P) - PARTICIPATION DEADLINE IS BEFORE NEXT PUBLICATION OF STATUS BOOK
(F) - EFFECTIVE MAP IS A FLOOD INSURANCE RATE MAP
* - UNINCORPORATED AREAS ONLY
ALL OTHER CODES OR SYMBOLS ARE EXPLAINED ON PAGE 2 OF THIS BOOK

ARTICLE 87

Reservoirs

Editor's note: The provisions of §§ 37-87-101 to 37-87-108 and §§ 37-87-113 to 37-87-11. do not apply to reservoirs constructed as livestock water tanks as defined in § 35-49-103.

37-87-101. Right to store waters. (1) Persons desiring to construct and maintain reservoirs for the purpose of storing water have the right to store therein any of the unappropriated waters of the state not thereafter needed for immediate use for domestic or irrigating purposes, and to construct and maintain ditches for carrying such water to and from such reservoirs, and to condemn lands required for the construction and maintenance of such reservoirs and ditches in the same manner as now provided by law; except that after April 18, 1935, the appropriation of water for any reservoirs constructed when decreed, shall be superior to an appropriation of water for direct application claiming a date of priority subsequent in time to that of such reservoirs.

(2) Underground aquifers are not reservoirs within the meaning of this section except to the extent such aquifers are filled by other than natural means with water to which the person filling such aquifer has a conditional or decreed right.

Source: Amended, L. 79, p. 1367, § 3.

Source: L. 1879, p. 106, § 38; G. S. § 1724; R. S. 08, § 3202; C. L. § 1682; CSA, C. 90, § 79; L. 35, p. 661, § 1; CRS 53, § 147-5-1; C.R.S. 1963, § 148-5-1.

I. In General.
II. Immediate Use of Water.

I. IN GENERAL.

Law reviews. For comment on People ex rel. Park Reservoir Co. v. Hinderlider, 98 Colo. 505, 57 P.2d 894 (1936), appearing below, see 9 Rocky Mt. L. Rev. 91 (1936). For article, "Revision of Water and Irrigation Statutes", see 31 Dicta 29 (1954). For article, "Water for Oil Shale Development", see 43 Den. L.J. 72 (1966). For note, "A Survey of Colorado Water Law", see 47 Den. L.J. 226 (1970).

As this section stands it is a grant, and the court is not at liberty to write into it, by way of interpretation, the word "only", so as to read "Persons desirous to construct and maintain reservoirs for the purpose of storing water, shall have the right to take * * * (only) any unappropriated water * * * for irrigating purposes." To do this would make this section a prohibition. People ex rel. Park Reservoir Co. v. Hinderlider, 98 Colo. 505, 57 P.2d 894 (1936).

The court said it assumed without deciding, that this section was in force, and that the general assembly was not prohibited by the constitution from passing it with the word "thereafter" inserted, so as to read "Persons desirous to construct and maintain reservoirs, for the purpose of storing water, shall have the right to take from any of the natural streams of the state and store away any unappropriated water not (thereafter) needed for immediate use for * * * irrigating purposes" and that such is its proper interpretation. People ex rel. Park Reservoir Co. v. Hinderlider, 98 Colo. 505, 57 P.2d 894 (1936).

Where a corporation constructed the embankment of a reservoir in the bed of a stream, but applied the water to no beneficial use, and it afterwards conveyed the reservoir site to another, reserving any appropriation of priority which it had acquired by reason of construction, it was held, that having never applied the water to any beneficial use, it had nothing to reserve, and the reservation accomplished nothing. Windsor Reservoir & Canal Co. v. Lake Supply Ditch Co., 44 Colo. 214, 98 P. 729 (1908).

Where plaintiff claiming to be entitled to the waters of a certain stream, for storage, between certain dates, brought an action to restrain the officials of the water service from enforcing an order of the division engineer which required the water commissioner of the district to cease the storing of water, during the same period, it was held that the appropriators for direct irrigation in other districts of the division would, of necessity, be affected by the decree and were indispensable parties. Comstock v. Larimer & Weld Reservoir Co., 58 Colo. 186, 145 P. 700, 1916A Ann. Cas. 416 (1914).

Where one claiming the right to water for storage seeks to restrain its application to direct irrigation, it is not sufficient to aver merely an appropriation for storage and a decree establishing the right because the complaint must go further and show that the plaintiff's right is relatively prior to that asserted by those against whom the relief is sought. Comstock v. Larimer & Weld Reservoir Co., 58 Colo. 186, 145 P. 700, 1916A Ann. Cas. 416 (1914).

When water has escaped from a reservoir and become a part of the underground waters, its identification as reservoir water is impracticable, if not impossible, and the rule to be applied in such a case must take account of the rights of others, and be of general and practicable application. Ft. Morgan Reservoir & Irrigation Co. v. McCune, 71 Colo. 256, 206 P. 393 (1922).

Hence, water escaping from a reservoir or a ditch, underground, and becoming percolating water which will naturally reach a public stream, must be regarded as a part of the stream, and it belongs to the appropriators in the order of their priorities when needed, and cannot be made the subject of a direct appropriation. Ft. Morgan Reservoir & Irrigation Co. v. McCune, 71 Colo. 256, 206 P. 393 (1922).

The justice of allowing reservoir companies to control the water which they have diverted is not to be questioned, but it should be borne in mind that they do not own the water, but have only a right to its use; which use must be consistent with the rights of other appropriators. Ft. Morgan Reservoir & Irrigation Co. v. McCune, 71 Colo. 256, 206 P. 393 (1922).

In addition, the water so diverted and stored must be beneficially applied; that is, in this instance, it must have been applied to lands for the purposes of irrigation. Thomas v. Guiraud, 6 Colo. 530 (1883); Sieber v. Frink, 7 Colo. 148, 2 P. 901 (1883); Wheeler v. Northern Colo. Irrigation Co., 10 Colo. 582, 17 P. 487, 3 Am. St. R. 603 (1887); Farmers High Line Canal & Reservoir Co. v. Southworth, 13 Colo. 111, 21 P. 1028, 4 L.R.A. 767 (1889); Ft. Morgan Land & Canal Co. v. South Platte Ditch Co., 18 Colo. 1, 30 P. 1032, 36 Am. St. R. 259 (1892); Woods v. Sargent, 43 Colo. 268, 95 P. 932 (1908); Highland Ditch Co. v. Union Reservoir Co., 53 Colo. 483, 127 P. 1025 (1912).

A decree awarding a priority to a reservoir providing that sufficient water should be permitted to flow from the source of supply into the reservoir to satisfy the volume of the priority when "not needed for immediate use for domestic or irrigation purposes", is presumably in part based upon this section. Highland Ditch Co. v. Union Reservoir Co., 53 Colo. 483, 127 P. 1025 (1912).

In an eminent domain proceeding to condemn land for a reservoir site, a report of commissioners based upon undisputed evidence but not supported by any findings, is not binding on the court, and where the question of the necessity of taking such site was not raised in either the pleadings or the evidence, a finding by the commissioners that the land proposed to be condemned was not necessary for the reservoir site was without force or effect. Mortensen v. Mortensen, 135 Colo. 167, 309 P.2d 197 (1957).

II. IMMEDIATE USE OF WATER.

This section confers the only authority for filling reservoirs. Water Supply & Storage Co. v. Tenney, 24 Colo. 344, 51 P. 505 (1897).

And water for storage in reservoirs can be used only when not needed for immediate domestic and irrigating use. Water Supply & Storage Co. v. Tenney, 24 Colo. 344, 51 P. 505 (1897).

And it is scarcely conceivable that a district court would deliberately enter a decree giving to a reservoir owner any priority to fill his reservoir which would [illegible] with any right of a ditch owner to use water for irrigation, even though the priority of the latter was junior in time to the construction of the reservoir. Water Supply & Storage Co. v. Tenney, 24 Colo. 344, 51 P. 505 (1897).

Where the defendant asked the court to charge the jury, which the court refused to do, that when needed for immediate use in irrigating lands by others having such right, one might not divert water from a natural stream for storage purposes in a reservoir, the court held that if the facts of the case called for an instruction on the law of defense of property, then this instruction should also have been given, for there was evidence that plaintiff was storing water in a fish pond when defendant needed it for immediate use in watering his crops. Newby v. People, 28 Colo. 16, 62 P. 1035 (1900).

Where there were senior appropriators of all the available flow of a natural stream who needed it for immediate use for domestic and irrigating purposes during the irrigation season from about June 1 to November 1 of each calendar year, this section does not allow water to be diverted for storage in reservoirs during such period of time, hence the storage system of the plaintiff could be operated only during the months comprising from November 1 of each year until June 1 of the next succeeding year, by reason of which the work of rebuilding plaintiff's ditch could be done, if at all, during that irrigating season. Aetna Cas. & Sur. Co. v. North Sterling Irrigation Dist., 75 Colo. 185, 225 P. 264 (1924).

And the construction of an irrigation ditch and the appropriation of water thereby to the irrigation of lands during the irrigation season, and a decree of priority for that purpose, give the appropriator no priority of right to water during the nonirrigating season for the purpose of storage for future use in a reservoir subsequently constructed. New Loveland & Greeley Irrigation & Land Co. v. Consolidated Home Supply Ditch & Reservoir Co., 27 Colo. 525, 62 P. 366, 52 L.R.A. 266 (1900).

The fact that at the time of commencing the construction of an irrigation ditch it was the intention of the appropriator to also use it as a feeder to a reservoir to be constructed sometime in the future, in which to store the water during the nonirrigating season for future use, would give the appropriator no prior right to water for storage during the nonirrigating season to date from the commencement of the ditch, unless the construction of the reservoir was so closely connected with the construction of the ditch as to show them to be one system, and the work thereon was prosecuted to completion and water thereby appropriated to a beneficial use with reasonable diligence. New Loveland & Greeley Irrigation & Land Co. v. Consolidated Home Supply Ditch & Reservoir Co., 27 Colo. 525, 62 P. 366, 52 L.R.A. 266 (1900).

The priority to the use of water for storage during the nonirrigating season depends upon the time of appropriation for that purpose, and an appropriator who first constructed his reservoir and appropriated water for that purpose is entitled to priority over a subsequent appropriator notwithstanding the subsequent storage appropriator was a prior appropriator for irrigation and supplied his reservoir through a ditch with prior rights for irrigation purposes. New Loveland & Greeley Irrigation & Land Co. v. Consolidated Home Supply Ditch & Reservoir Co., 27 Colo. 525, 62 P. 366, 52 L.R.A. 266 (1900).

It is not unreasonable to suppose that the provisions of this section intended that an owner of a reservoir for irrigation purposes shall have the right to take and store unappropriated waters, and also waters that already have been appropriated by others but that are not at the time needed by such prior appropriators for immediate use for domestic or irrigation purposes, because such storage would save the water from going to waste in a most desirable object in this "dry and thirsty land", where every drop of water is sorely needed, and such a construction would save this section from coming into conflict with the constitution. People ex rel. Park Reservoir Co. v. Hinderlider, 98 Colo. 505, 57 P.2d 894 (1936) (concurring opinion).

37-87-102. Owner of reservoir may conduct water into natural streams. The owners of any reservoir may conduct the waters legally stored therein into and along any of the natural streams of the state, but not so as to raise the waters thereof above ordinary high watermark, and may take the same out again at any point desired with due regard to the prior or subsequent rights of others to other waters in said natural streams. Due allowance shall be made for evaporation and other losses from natural causes for the protection of all rights to the waters flowing in said streams, such losses to be determined by the state engineer.

Source: L. 1879, p. 107, § 39; G. S. § 1725; R. S. 08, § 3203; C. L. § 1683; CSA, C. 90, § 80; L. 35, p. 638, § 1; CRS 53, § 147-5-2; C.R.S. 1963, § 148-5-2.

Law review. For article, "Foreign Water in Colorado—The City's Right to Recapture and Re-Use Its Transmountain Diversion", see 42 Den. L. Ctr. J. 116 (1965).

This section providing that the owners of reservoirs may conduct the water from the reservoirs into and along any of the natural streams of the state, emphasizes the doctrine that these are public streams. Hartman v. Tresise, 36 Colo. 146, 84 P. 685, 4 L.R.A. (n.s.) 872 (1906).

In some circumstances, dams, ditches, canals, and tunnels, taken together, may be considered as a reservoir within the meaning of this section. Twin Lakes Reservoir & Canal Co. v. Sill, 104 Colo. 215, 89 P.2d 1012 (1939).

This section should be so construed as to include inlets to, as well as outlets from, reservoirs in connection with natural streams, whereby the latter are used to carry abnormal amounts due to delivery therein of privately owned water. Twin Lakes Reservoir & Canal Co. v. Sill, 104 Colo. 215, 89 P.2d 1012 (1939).

37-87-103. Notice of release of stored waters. The owners of reservoirs who avail themselves of the provisions of this section and section 37-87-102 shall give reasonable prior notice to the irrigation division engineer of the irrigation division in which the reservoir is located or to the chief administrative water official of such irrigation division, of the date on which they desire to release stored waters into any natural streams, together with the quantity thereof in cubic feet per second of time, the length of period to be covered by such releases, and the name of the ditch, canal, pipeline, or reservoir to which the water so released from storage is to be delivered, to the end that the water officials in responsible charge of any stream into which such stored water is released shall have ample time in which to make the necessary observations, measurements of flow and storage and records thereof, and to provide for a proper patrol of the said stream, for the protection of the reservoir owner and also all other appropriators along the stream whose interests might be affected as a result of such reservoir release. Such notice may be given to the division engineer when the reservoir from which the water is to be released and the point where the water is to be taken from the stream or again stored are in the same water district.

Source: L. 35, p. 639, § 2; CSA, C. 90, § 81; CRS 53, § 147-5-3; C.R.S. 1963, § 148-5-3.

Where a mining company created large bodies of liquid tailings on its land and failed to contain those harmful and obnoxious materials, which contaminated a stream and were discharged by a flood on the land of another as the result of the failure of a wall surrounding the tailing ponds the correct measure of damage was recognized as the difference between the value of the land immediately before the alleged injury and after the injury. The reasonable cost to clear the land of debris was not the measure, but it is nevertheless recognized that evidence of cost of repair can be considered in arriving at this difference in market value. Freel v. Ozark-Mahoning Co., 208 F. Supp. 93 (D. Colo. 1962).

37-87-104. Liability of owners for damage. (1) Except as provided in subsection (2) of this section, the owner of a reservoir shall be liable for all damages arising from leakage or overflow of the waters therefrom or floods caused by the breaking of the embankments of such reservoir.

(2) No employee, shareholder, or member of a board of directors of an owner of a reservoir shall be liable for any damage arising from leakage or overflow of the waters from such reservoir or for any damage arising from floods caused by breaking of the embankments of such reservoir if a valid liability insurance policy has been purchased by the owner of the reservoir and is in effect at the time such damage occurs. Such insurance policy shall insure against such damages and provide coverage in an amount of not less than fifty thousand dollars for each claim and in an aggregate amount of not less than one million dollars for all claims which arise out of any one incident. The policy may provide that it does not apply to any act or omission of an employee, shareholder, or member of a board of directors of an owner if such act or omission is dishonest, fraudulent, malicious, or criminal. The policy may also contain other reasonable provisions with respect to policy periods, territory, claims, conditions, and other matters common to such policies of insurance. The limitation of liability pursuant to this subsection (2) shall not apply to any criminal, fraudulent, or malicious act by a member of the board of directors of the owner, a shareholder of the owner, or an employee of such owner nor shall it apply to any ultra vires act of the owner or of a member of the board of directors, a shareholder, or an employee of such owner. The provisions of this subsection (2) shall not be deemed to impose any liability upon a member of the board of directors, a shareholder, or an employee of the owner of a reservoir beyond that established by other principles or provisions of law.

(3) As used in this section, the word "owner" does not include public entities or public employees as defined in the "Colorado Governmental Immunity Act", article 10 of title 24, C.R.S. 1973.

Source: R & RE, L. 81, p. 1778, § 1.

I. IN GENERAL.

Law reviews.

For comment on Barr v. Game, Fish & Parks Comm'n, 30 Colo. App. 482, 497 P.2d 340 (1972), appearing in the original notes, see 50 Den. L.J. 381 (1973).

Source: L. 1879, p. 107, § 40; G. S. § 1726; R. S. 08, § 3204; C. L. § 1684; CSA, C. 90, § 82; CRS 53, § 147-5-4; C.R.S. 1963, § 148-5-4.

Cross reference: For liability for damages, see also § 37-87-113.

I. In General.
II. Extent of Owner's Liability.

I. IN GENERAL.

Am. Jur. See 56 Am. Jur., Waters, § § 167-174.

C.J.S. See 93 C.J.S., Waters, § 141.

Law review. For article, "Water for Oil Shale Development", see 43 Den. L.J. 72 (1966).

This section is simply an affirmation of a common-law principle, which was enacted in this state as part of an act with reference to irrigation, and in this act the right is given for the construction of reservoirs for certain purposes, and the context indicates, we think, that the paragraph relied upon was inserted as a precautionary measure, under the apprehension that without it, it would be possible to place such a construction upon the act as would relieve owners of reservoirs from liability for leakage and overflow. Sylvester v. Jerome, 19 Colo. 128, 34 P. 760 (1893).

The common-law principle referred to as being affirmed by this section is as follows:

"The person who, for his own purposes, brings on his own land and collects and keeps there anything likely to do mischief if it escapes, must keep it at his own peril; and if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape, but he can excuse himself by showing that the escape was owing to the plaintiff's default; or, perhaps, that the escape was the consequence of vis major, or the act of God." Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

And it does not deprive a court of equity of jurisdiction to restrain the filling of a reservoir, when the remedy at law given by the section is not adequate to a particular exigency. Sylvester v. Jerome, 19 Colo. 128, 34 P. 760 (1893).

But a writ commanding the defendants to refrain from diverting water, did not forbid the repairing or changing the reservoir so as to prevent the injury complained of, and whenever it was so changed they were at liberty to apply to the court for a modification or dissolution of the injunction. Sylvester v. Jerome, 19 Colo. 128, 34 P. 760 (1893).

The natural hillside or mesa, against which the embankment is constructed, and which aids in impounding the water, is part of the reservoir, within this section, and the owner is liable for injuries occasioned by its giving way, though the artificial embankment remains. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

Because the general assembly did not intend that one who appropriates a natural bank as part of his reservoir should be exempt from liability in the event of its washing out, but did intend the word "embankment" should include not only an artificial barrier, but a natural one as well, if used as a part of the reservoir, to prevent the escape of water, Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

It is true that the ditch owners have been held to the exercise of ordinary care only, for the statute does not hold them to an absolute liability, but there is a very good reason for the legislative distinction, a ditch carrying water can, by the exercise of ordinary care, be rendered harmless, and the carrying of water through ditches is not a dangerous or menacing vocation; the water is not restrained, and the pressure is but slight, while in a reservoir the water is restrained, and the pressure is very great, so great that the exercise of the greatest amount of care and skill may not prevent the water from effecting its escape. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910); Beaver Water & Irrigation Co. v. Emerson, 75 Colo. 513, 227 P. 54 (1927).

A recovery for past, present and prospective damages is a bar to an action for subsequent damages. Fort v. Bietsch, 85 Colo. 176, 274 P. 812 (1929).

And although a judgment in an action for damages may have been void or voidable, the successful party by accepting and retaining its fruits, is estopped from again suing for the same thing. Fort v. Bietsch, 85 Colo. 176, 274 P. 812 (1929).

The purpose of this section and section 37-87-113 is to protect persons owning property below the reservoir from having their situation impaired, not from having it improved. Ireland v. Henrylyn Irrigation Dist., 113 Colo. 555, 160 P.2d 364 (1945).

The owner of a reservoir acquires no vested right to have spillways of reservoirs on the stream above his storage basin maintained at the same size and elevation as constructed at the time he acquired his storage rights. Ireland v. Henrylyn Irrigation Dist., 113 Colo. 555, 160 P.2d 364 (1945).

And defendant dam owner, enlarging spillway, held not liable for injury to reservoirs by flood waters. Ireland v. Henrylyn Irrigation Dist., 113 Colo. 555, 160 P.2d 364 (1945).

II. EXTENT OF OWNER'S LIABILITY.

Under this section owners of reservoirs are made liable for all damages arising from leakage or overflow of the waters therefrom or by floods caused by breaking of their embankments. Ryan Gulch Reservoir Co. v. Swartz, 77 Colo. 60, 234 P. 1059 (1925). See Grand Valley Irrigation Co. v. Pitzer, 14 Colo. App. 123, 59 P. 420 (1899); Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910); Beaver Water & Irrigation Co. v. Emerson, 75 Colo. 513, 227 P. 547 (1924).

And no skill, care, or diligence, in construction or maintenance relieves him. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

The owner is liable whether he is negligent or not and whether the breaking of his dam was caused by the negligence of a third person or not. Beaver Water & Irrigation Co. v. Emerson, 75 Colo. 513, 227 P. 547 (1924).

The true rule of law is, that the person who, for his own purposes, brings on his own land and collects or keeps there anything likely to do mischief if it escapes, must keep it at his own peril; and if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape. Cass Company-Contractors v. Colton, 130 Colo. 593, 279 P.2d 415 (1955).

And Colorado cases have followed the doctrine of absolute liability for certain dangerous enterprises, such as the impounding of waters, and this was based on the common law which later became embodied in this section. Cass Company-Contractors v. Colton, 130 Colo. 593, 279 P.2d 415 (1955).

But an act of God or the public enemy is a good defense in an action under this section, even though the liability imposed thereby is fixed by statute, without regard to negligence of the defendants. Ryan Gulch Reservoir Co. v. Swartz, 77 Colo. 60, 234 P. 1059 (1925); Barr v. Game, Fish & Parks Comm'n, 30 Colo. App. 482, 497 P.2d 340 (1972).

However, in order for a flood to come within the term, "act of God", and therefore be a good defense under this statute, it must have been so unusual and extraordinary a manifestation of nature as could not under normal conditions have been reasonably anticipated or expected, and an "act of God" does not necessarily mean an operation of natural forces so violent and unexpected that no human foresight or skill could possibly have prevented its effect, it is enough that the flooding should be such as human foresight could not be reasonably expected to anticipate and whether it comes within this description is ordinarily a question of fact. Barr v. Game, Fish & Parks Comm'n, 30 Colo. App. 482, 497 P.2d 340 (1972).

But where the court found that with modern meteorological techniques, a maximum probable storm is predictable and a maximum probable flood is foreseeable, and the storm and flood which occurred were less than maximum, the defense of "act of God" is not available. Barr v. Game, Fish & Parks Comm'n, 30 Colo. App. 482, 497 P.2d 340 (1972).

An owner is defined in law to be, "He who had dominion over a thing which he may use as he pleases except as restrained by the law or by an agreement", and "includes any person having a claim or interest in real property, though less than an absolute fee". Larimer County Ditch Co. v. Zimmerman, 4 Colo. App. 78, 34 P. 1111 (1893).

Because the intention of the general assembly was to hold responsible the parties whose duty it was to construct and maintain, and to construe the statute otherwise would defeat the legislative intent, and might in any instance prevent redress to the injured party. Larimer County Ditch Co. v. Zimmerman, 4 Colo. App. 78, 34 P. 1111 (1893).

The responsibility is laid only upon the owners of reservoirs which store water for irrigation. This right of storage includes surface or flood waters, as well as waters diverted from a natural watercourse. Canon City & C. C. R. R. v. Oxtoby, 45 Colo. 214, 100 P. 1127 (1909).

A prima facie case is made when the damage and cause, by the breaking, are established. Larimer County Ditch Co. v. Zimmerman, 4 Colo. App. 78, 34 P. 1111 (1893).

And it is not necessary to allege and prove negligence. See Larimer County Ditch Co. v. Zimmerman, 4 Colo. App. 78, 34 P. 1111 (1893); Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

Where defendants created large bodies of liquid tailings upon their land and thus were statutorily obligated to prevent the escape of these materials and their failure to contain these harmful and obnoxious materials results in their being liable for the resultant damages, regardless of fault on their part, because liability for damage which directly results from floods is fixed by this section. Freel v. Ozark-Mahoning Co., 208 F. Supp. 93 (D. Colo. 1962).

37-87-105. Approval of plans for reservoir. No reservoir of a capacity of more than one thousand acre-feet, or having a dam or embankment in excess of ten feet in vertical height, from the bottom of the channel to the bottom of the spillway, or having a surface area at high waterline in excess of twenty acres shall be constructed in this state unless the plans and specifications for the same have first been approved by the state engineer and filed in his office. In making his determination, the state engineer shall be guided by criteria related to the probability that precipitation will be exceeded once in five hundred years. The state engineer shall act as consulting engineer during the construction thereof and shall have authority to require the material used and the work of construction to be done to his satisfaction. No work shall be deemed complete until the state engineer furnishes to the owners of such structures a written statement of the work of construction and the full completion thereof, together with his acceptance of the same, which statement shall specify the dimensions of such dam and capacity of such reservoir.

Source: Amended, L. 77, p. 1696, § 1; amended, L. 79, p. 1370, § 1.

Law reviews.

For article, "Synthetic Fuels—Policy and Regulation", see 51 U. Colo. L. Rev. 465 (1980).

Source: L. 1899, p. 314, § 1; R. S. 08, § 3205; C. L. § 1685; L. 25, p. 330, § 1; CSA, C. 90, § 83; CRS 53, § 147-5-5; C.R.S. 1963, § 148-5-5.

Law reviews. For note, "One Year Review of Civil Procedure", see 41 Den. L. Ctr. J. 67 (1964). For article, "Water for Oil Shale Development", see 43 Den. L.J. 72 (1966).

Knowing the imminent danger attendant upon the storage of water, and to avoid, as far as it was possible for human agency to avoid, damages to the lower proprietors, the general assembly provided the scheme of protection found in this and the following sections. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79, 1136 (1910).

It only applies to reservoirs having certain capacity or dams having certain dimensions. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79, 1136 (1910).

The enactment of this and the following sections did not repeal section 37-87-104. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

By this section, dams of the dimensions mentioned are required to be under the supervision of the state engineer, and it becomes his duty to supervise the construction of reservoirs and exercise a general supervision of them at all times, to the end that they may not overflow and that breakage or seepage may not occur. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79, 1136 (1910).

And the state has such an interest in the construction of reservoirs as to justify the statutory provisions declaring what shall constitute proper construction, and when such a structure is deemed complete. Riverside Reservoir & Land Co. v. Green City Irrigation Dist., 59 Colo. 514, 151 P. 443 (1915).

Moreover, the provisions of this section are to be read into every contract for the construction or enlargement of a reservoir. Riverside Reservoir & Land Co. v. Green City Irrigation Dist., 59 Colo. 514, 151 P. 443 (1915).

Doubtless, contracts may be entered into and enforced for the construction of a reservoir of such proportions, in such manner and of such materials as may be desired, but these must be limited by the provisions of this section, that where the reservoir is of or above specified dimensions, the plans and specifications must be first approved by the state engineer; that such public official shall be the consulting engineer during the construction; that he shall have authority to require the material used and the work of construction done to his satisfaction, and the reservoir may be regarded as completed only when he has accepted the same and has so certified to the owners. Riverside Reservoir & Land Co. v. Green City Irrigation Dist., 59 Colo. 514, 151 P. 443 (1915).

One agreeing to take shares in a reservoir company, in consideration of the company's agreement to enlarge and complete its reservoir to a certain capacity, cannot be required to accept the shares, until it is made to appear that this section has been complied with. Riverside Reservoir & Land Co. v. Green City Irrigation Dist., 59 Colo. 514, 151 P. 443 (1915).

In an action to recover for labor and materials, where the parties contracted for construction of reservoir, and neither party made an issue of the height or lawfulness of the dam, the trial court's finding that the dam was constructed without authorization in violation of this section was wholly voluntary, gratuitous, and immaterial, requiring reversal. Rippy v. Cowieson, 151 Colo. 504, 379 P.2d 396 (1963).

37-87-106. Cost of inspection and supervision. The owners of such reservoirs shall pay to the state engineer his actual expenses incurred in making personal inspection, including expenses for any person appointed by him to attend to such supervision, not to exceed one hundred twenty-five dollars per day for each day necessarily employed for such purposes.

Source: L. 1899, p. 314, § 2; R. S. 08, § 3206; C. L. § 1686; L. 25, p. 331, § 1; CSA, C. 90, § 84; CRS 53, § 147-5-6; C.R.S. 1963, § 148-5-6; L. 71, p. 1307, § 1.

37-87-107. Amount of water to be stored. The state engineer shall annually determine the amount of water which is safe to impound in the several reservoirs within this state, and it is unlawful for the owners of any reservoir to store in said reservoir water in excess of the amount so determined by the state engineer to be safe.

Source: L. 1899, p. 315, § 3; R. S. 08, § 3207; C. L. § 1687; CSA, C. 90, § 85; CRS 53, § 147-5-7; C.R.S. 1963, § 148-5-7.

37-87-108. Withdrawal of excess water. In the event of the owners of any such reservoir impounding water therein to a depth greater than that determined by the state engineer to be safe, it is the duty of the division engineer of the district wherein such reservoir is located to forthwith proceed to withdraw from said reservoir so much of the water as shall be in excess of the amount so determined by the state engineer to be safe, and shall close the inlets to the same to prevent said reservoir from being refilled to an amount beyond what said state engineer has designated as being safe. In the event of the owners of said reservoir, or any other persons, interfering with the division engineer in the discharge of said duty, the said division engineer shall call to his aid such persons as he deems necessary, and employ such force as the circumstances demand to enable him to comply with the requirements of this section.

Source: L. 1899, p. 315, § 4; R. S. 08, § 3208; C. L. § 1688; CSA, C. 90, § 86; CRS 53, § 147-5-8; C.R.S. 1963, § 148-5-8.

This section requires the division engineer of a district to draw off the excess water from reservoirs. Board of Comm'rs v. Hider, 47 Colo. 443, 107 P. 1068 (1910).

37-87-109. Complaint that reservoir is unsafe. Upon complaint being made to the state engineer by one or more persons residing or having property in such a location that their homes or property would be in danger of destruction or damage in the event of a flood occurring on account of the breaking of the embankment of any reservoir within the state, that said reservoir is in an unsafe condition, or that it is being filled with water to such an extent as to render it unsafe, it is the duty of the state engineer to forthwith examine said reservoir and determine the amount of water it is safe to impound therein. If, upon such examination, the state engineer finds that said reservoir is unsafe, or is being filled with water to such an extent as to render it unsafe, it is his duty to immediately cause said water to be drawn from said reservoir to such an extent as will, in his judgment, render the same safe. If water is then flowing into said reservoir, he shall cause it to be discontinued.

Source: L. 1899, p. 315, § 5; R. S. 08, § 3209; C. L. § 1689; CSA, C. 90, § 87; CRS 53, § 147-5-9; C.R.S. 1963, § 148-5-9; L. 71, p. 1307, § 2.

Whenever in the judgment of the state engineer, any of the structures become unsafe, it becomes his duty and the duty of the owners under his direction to draw off sufficient water or to otherwise prevent, if possible, overflow or breakage. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79, 1136 (1910).

37-87-110. Engineer may use force. The state engineer is authorized to use such force as is necessary to perform the duties required of him in section 37-87-109, and to have and exercise all of the powers conferred upon the division engineer by section 37-87-108. If, after any of such reservoirs have been examined by said state engineer, the owners thereof, or any other person, fills or attempts to fill them, or any of them, to a point in excess of the amount the state engineer has determined to be safe, then it is the duty of the division engineer of the district wherein such reservoir is located to proceed as directed by section 37-87-108.

Source: L. 1899, p. 316, § 6; R. S. 08, § 3210; C. L. § 1690; CSA, C. 90, § 88; CRS 53, § 147-5-10; C.R.S. 1963, § 148-5-10.

37-87-111. Expense of examination. The person calling upon the state engineer to perform the duty required of him by section 37-87-109 shall pay him in advance when requested or invoiced expenses, as provided in section 37-87-106, and mileage at the rate of ten cents per mile for each mile actually and necessarily traveled in going to and from said reservoir, and should the state engineer find upon examination that such reservoir is in an unsafe condition, the owners thereof shall be liable for all expenses incurred in such examination.

Source: L. 1899, p. 316, § 7; R. S. 08, § 3211; C. L. § 1691; CSA, C. 90, § 89; CRS 53, § 147-5-11; C.R.S. 1963, § 148-5-11; L. 71, p. 1308, § 3.

37-87-112. Appeal from decision of engineer. In the event of either party being dissatisfied with the decision of the state engineer, he may take an appeal to the district court of the county wherein said reservoir is located, and said court shall hear and determine the matter summarily at the earliest practicable time without written pleadings or the aid of a jury, subject to the right of either party to take an appeal as in other civil cases; except that the judgment of the state engineer shall control until final determination of the cause.

Source: L. 1899, p. 316, § 8; R. S. 08, § 3212; C. L. § 1692; CSA, C. 90, § 90; CRS 53, § 147-5-12; C.R.S. 1963, § 148-5-12; L. 64, p. 341, § 343.

37-87-113. Breakage of reservoir - damages. None of the provisions of sections 37-87-105 to 37-87-114 shall be construed as relieving the owners of any such reservoir from the payment of such damages as may be caused by the breaking of the embankments thereof, but, except as provided in section 37-87-104 (2), in the event of any such reservoir overflowing, or the embankments, dams, or outlets breaking or washing out, the owners thereof shall be liable for all damage occasioned thereby.

Source: Amended, L. 81, p. 1779, § 2.

Source: L. 1899, p. 316, § 9; R. S. 08, § 3213; C. L. § 1693; CSA, C. 90, § 91; CRS 53, § 147-5-13; C.R.S. 1963, § 148-5-13.

Cross reference: For liability for damage, compare § 37-87-104.

Am. Jur. See 56 Am. Jur., Waters, § 167.
C.J.S. See 93 C.J.S., Waters, § 141.

This section declares that in the event that any reservoir overflows, or in the event the embankments, dams, or outlets break or wash out, the owner shall be liable for all damage occasioned therefrom. Freel v. Ozark-Mahoning Co., 208 F. Supp. 93 (D. Colo. 1962).

And the object of this section is to protect persons owning property below reservoirs from having their situation worsened, and not to have it improved. Ireland v. Henryiyn Irrigation Dist., 113 Colo. 555, 160 P.2d 364 (1945).

Therefore, under this section owners are absolutely held liable for damages that are caused by the breaking of embankments. Ryan Gulch Reservoir Co. v. Swartz, 77 Colo. 60, 234 P. 1059 (1925). See Grand Valley Irrigation Co. v. Pitzer, 14 Colo. App. 123, 59 P. 420 (1899); Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910); Beaver Water & Irrigation Co. v. Emerson, 75 Colo. 513, 227 P. 547 (1924).

Moreover, under this section whether the owners of reservoirs have or have not complied with this article, and whether they were or were not guilty of negligence in the construction or maintenance or operation of their property, the liability is the same. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79, 1136 (1910).

Because the general assembly appears to have been willing to permit the impounding of water, and to provide the means by which structures built for that purpose should be rendered as harmless as skill and science could make them; but it does not show an intention to relieve the owners from liability upon the compliance with the statutory provisions, and to leave the persons and property of our citizens without remedy in the event of injury. Garnet Ditch & Reservoir Co. v. Sampson, 48 Colo. 285, 110 P. 79 (1910).

And where defendants created large bodies of liquid tailings upon their land and thus were statutorily obligated to prevent the escape of these materials and their failure to contain these harmful and obnoxious materials results in their being liable for the resultant damages, regardless of fault on their part, because liability for damage which directly results from floods is fixed by this section. Freel v. Ozark-Mahoning Co., 208 F. Supp. 93 (D. Colo. 1962).

The measure of damages for alleged injury to land on account of it being covered with trash, sediment and debris, is the difference between the value of said land immediately before said alleged injury, and immediately after said alleged injury. State v. Nicholl, 150 Colo. 84, 370 P.2d 888 (1962).

And although the reasonable cost to clear the land of debris was not the measure, it is nevertheless recognized that [illegible] of cost of repair can be considered [illegible] at this difference in market value. Freel v. Ozark-Mahoning Co., 208 F. Supp. 93 (D. Colo. 1962).

37-87-114. Penalty - disposition of fines. Any reservoir company failing or refusing, after ten days' notice in writing has been given, to obey the directions of the state engineer as to the construction or filling of any reservoir shall be subject to a fine of not less than two hundred dollars for each offense, and each day's continuance after time of notice has expired shall be considered a separate offense. Such fines shall be recovered by civil action in the name of the people, by the district attorney, upon the complaint of the state engineer, in the county where the injury complained of occurred. The proceeds of all fines, after payment of costs and charges of the proceedings, shall be paid into the county treasury for the use of the general fund of the county.

Source: L. 1899, p. 317, § 10; R. S. 08, § 3214; C. L. § 1694; CSA, C. 90, § 92; CRS 53, § 147-5-14; C.R.S. 1963, § 148-5-14; L. 71, p. 1308, § 4.

37-87-115. Damages. Neither the state engineer nor any member of his staff or any person appointed by him shall be liable in damages for any act done by him in pursuance of the provisions of this article.

Source: L. 03, p. 264, § 7; R. S. 08, § 3221; C. L. § 1701; CSA, C. 90, § 99; CRS 53, § 147-5-21; C.R.S. 1963, § 148-5-21; L. 71, p. 1308, § 5.

37-87-116. Tax reduction where reservoirs located. After April 8, 1937, anyone owning land in the state of Colorado not within the corporate limits of any city or town, who, by the construction of a dam across any watercourse, the channel of which is normally dry, as determined by the state engineer, and thereby forms upon his own land a reservoir for the collection and storage of unappropriated surface water, and who maintains such reservoir and dam in proper condition to safely impound water therein, or who donates to the state of Colorado or any of its agencies a tract of land on which it is feasible to construct and maintain one or more such storage reservoirs, as may be determined by the state engineer, shall be entitled to a reduction for general taxes in the valuation for assessment of the piece of land upon which such reservoir is located of forty dollars for each acre-foot of storage capacity provided by such reservoir; but the total amount of such reduction in the valuation for assessment shall not exceed twenty-five percent of the valuation for assessment of the contiguous acreage owned by such landowner, and upon which such reservoir is located. No reduction in the valuation for assessment shall be granted in cases wherein the storage is less than one and one-half acre-feet total capacity shown, and the total acreage so affected shall not exceed one hundred sixty acres. Nothing in sections 37-87-116 to 37-87-121 shall be construed as adversely affecting any presently vested water right, or valid appropriation of water.

Source: L. 37, p. 787, § 1; CSA, C. 90, § 99(1); CRS 53, § 147-5-22; C.R.S. 1963, § 148-5-22; L. 71, p. 1308, § 6.

37-87-117. Landowner to submit plans. If any such dam has a maximum height of ten feet or less, or will create a reservoir having a surface area of twenty acres or less, or has a capacity of sixty-five acre-feet or less, the landowner desiring to take advantage of sections 37-87-116 to 37-87-121 shall first submit to the state engineer sufficient engineering data, in the way of maps and plans, to show the location, type, and dimensions of the proposed dam, reservoir, and spillway and character of the foundation and of the materials available for construction purposes. The state engineer has authority to pass upon the adequacy of such data and plans for such proposed dam and to require that the work of construction be carried out and completed to his entire satisfaction. In making his determination, the state engineer shall be guided by criteria related to the probability that precipitation will be exceeded once in five hundred years.

Source: Amended, L. 77, p. 1696, § 2.

Source: L. 37, p. 788, § 2; CSA, C. 90, § 99(2); CRS 53, § 147-5-23; C.R.S. 1963, § 148-5-23; L. 71, p. 1309, § 7.

C.J.S. See 93 C.J.S., Waters, § 147.

37-87-118. State engineer's authority over construction. The provisions of sections 37-87-116 to 37-87-121 shall not in any way, manner, or degree exempt the sponsor of any proposed, or the owner of an existing, dam in this state from the provisions of law which now require the approval by the state engineer of plans and specifications for all dams having a maximum height in excess of ten feet or which will create a reservoir with a surface in excess of twenty acres, nor from compliance with the present or any future authority of the state engineer over the construction, supervision, and administration of such dams.

Source: L. 37, p. 788, § 3; CSA, C. 90, § 99(3); CRS 53, § 147-5-24; C.R.S. 1963, § 148-5-24; L. 71, p. 1309, § 8.

37-87-119. Completion of dam. Upon the completion of any dam by a landowner, under the provisions of sections 37-87-116 to 37-87-121 relating to a reduction in the valuation for assessment of his land, the state engineer, under whose supervision such dam has been constructed, may so certify to the board of county commissioners of the county in which such dam is located, which certificate shall show the type of dam, maximum height and length thereof, width of spillway, and depth of the bottom of spillway below crest of dam, general dimensions and side slopes of the dam, diameter and character of outlet conduit, maximum area of reservoir surface, capacity of reservoir in acre-feet, and approximate area of the drainage basin above the reservoir. The certificate shall also show the location of the reservoir described in terms of each quarter quarter section of land involved, or in terms of a metes and bounds survey of the proposed high waterline, the date of completion of the dam, and the name and address of the owner. The provisions of sections 37-87-116 to 37-87-121 shall not relieve the owner of such a reservoir of the obligation to install in any such dam a conduit of sufficient capacity to pass all the normal streamflow, for the satisfaction of the owners of water rights on the stream or streams below such reservoir.

Source: L. 37, p. 789, § 4; CSA, C. 90, § 99(4); CRS 53, § 147-5-25; C.R.S. 1963, § 148-5-25; L. 71, p. 1309, § 9.

37-87-120. Reduction in valuation for assessment. Upon receipt of such certifications from the state engineer, the county board of equalization shall thereupon make such reduction in the valuation for assessment of the land on which any such reservoir is located as the owner of such land may be entitled to receive under the provisions of section 37-87-116. Each year, at the time of making his annual assessment, the assessor shall first ascertain whether the dam is being maintained in a safe condition and for the purpose of impounding water. In the event that the assessor reports that any such dam is not being maintained in a safe condition and for the impounding of water, that fact shall be reported to the board of county commissioners, and the reduction in the valuation for assessment shall not be allowed so long as such dam is not maintained for such purpose.

Source: L. 37, p. 789, § 5; CSA, C. 90, § 99(5); L. 39, p. 444, § 1; CRS 53, § 147-5-26; C.R.S. 1963, § 148-5-26; L. 71, p. 1310, § 10.

37-87-121. Application to existing dams. The provisions of sections 37-87-116 to 37-87-120 shall extend to and include all dams constructed before April [illegible]37, in this state on watercourses which normally are dry, and which have been approved by the state engineer in accordance with sections 37-87-116 to 37-87-120.

Source: L. 37, p. 790, § 6; CSA, C. 90, § 99(6); CRS 53, § 147-5-27; C.R.S. 1963, § 148-5-27; L. 71, p. 1310, § 11.

37-87-122. Erosion control dams. (1) The provisions of sections 37-87-101 to 37-87-108 and 37-87-116 to 37-87-121 shall not apply to erosion control dams of the character defined in this section, unless such dams also come within the specification requirements of said sections.

(2) Erosion control dams for reservoirs may be constructed on watercourses, the channels of which have been determined by the state engineer to be normally dry, having a vertical height not exceeding fifteen feet from the bottom of the channel to the bottom of the spillway, and having a capacity not exceeding ten acre-feet at the emergency spillway level, upon approval of an application for such erosion control dam by the state engineer. When such reservoirs are to be constructed with such height exceeding fifteen feet and such capacity exceeding ten acre-feet, they shall be constructed in accordance with section 37-87-105.

(3) Such reservoirs may be constructed with a capacity in excess of two acre-feet if, at or below the two acre-feet level, an ungated outlet tube is installed, with twelve inches minimum diameter and large enough to assure adequate capacity to drain within thirty-six hours any impoundment in excess of two acre-feet.

(4) The state engineer shall prepare and keep on file in his office standard specifications for erosion control dams which shall be subject to revision by the state engineer and shall in general be used as a guide by persons proposing to construct such dams.

Source: L. 73, p. 1518, § 1; C.R.S. 1963, § 148-5-30.

24-65.1-302. Functions of other state agencies. (1) Pursuant to this article, it is the function of other state agencies to:

(a) Send recommendations to local governments and the Colorado land use commission relating to designation of matters of state interest on the basis of current and developing information; and

(b) Provide technical assistance to local governments concerning designation of and guidelines for matters of state interest.

(2) Primary responsibility for the recommendation and provision of technical assistance functions described in subsection (1) of this section is upon:

(a) The Colorado water conservation board, acting in cooperation with the Colorado soil conservation board, with regard to floodplains;

Source: Added, L. 74, p. 346, § 1.

24-65.1-403. Technical and financial assistance. (1) Appropriate state agencies shall provide technical assistance to local governments in order to assist local governments in designating matters of state interest and adopting guidelines for the administration thereof.

(3) (a) Any local government applying for federal or state financial assistance for floodplain studies shall provide prior notification to the Colorado water conservation board. The board shall coordinate and prescribe the standards for all floodplain studies conducted pursuant to this article, including those conducted by federal, local, or other state agencies, to the end that reasonably uniform standards can be applied to the identification and designation of all floodplains within the state and to minimize duplication of effort.

(b) No floodplains shall be designated by any local government until such designation has been first approved by the Colorado water conservation board as provided in sections 30-28-111 and 31-23-301, C.R.S. 1973.

Source: Added, L. 74, p. 347, § 1; (3) added, L. 77, p. 1241, § 1.

ARTICLE 30
FLOOD CONTROL

Control of Stream Flow

30-30-101. Definitions. As used in this article, unless the context otherwise requires:

(1) "Channel" means that area of a stream where water normally flows between banks and not that area beyond where vegetation exists.

(2) "Obstruction" means sandbars formed by the natural flow of a stream, temporary structures, planks, snags, and debris in and along the existing channel which cause a flood hazard.

Source: L. 74, p. 230, § 1.

30-30-102. Authority to remove obstructions in streams. (1) The board of county commissioners of each county shall have authority within its respective county, for flood control purposes only, to remove or cause to be removed any obstruction to the channel of any natural stream which causes a flood hazard, and for such purpose only the board of county commissioners shall have a right of access to any such natural stream, which access shall be accomplished through existing gates and lanes, if possible. Such authority includes the right to modify existing diversion or storage facilities at no expense to the diverter of a water right, but it shall in no way alter or diminish the quality or quantity of water entitled to be received under any vested water right.

(2) Except in case of imminent flood danger, such right of access shall be exercised only as follows:

(a) Upon five days' notice to the landowner and to the owner of any other property or leasehold interest in the area to be inspected, including public utilities, the board of county commissioners shall have a right of access to any natural stream for the purpose of inspecting it and determining if there are obstructions to its channel which create a flood hazard.

(b) If the board of county commissioners determines that there are obstructions on the property owner's property which in its opinion create a flood hazard, it shall give him written notice of those conditions. Thereafter the board of county commissioners shall negotiate with the owner to reach agreement as to the existence of such conditions and as to the procedures necessary for the elimination thereof. If such agreement is reached, the owner, if he requests, shall be given a reasonable time within which to eliminate such conditions himself, and such agreement may provide for compensation to the owner for such work.

(c) If the board of county commissioners and the owner cannot reach such agreement, then, unless the owner consents to access by the board of county commissioners, the board of county commissioners shall have access only through the institution of proceedings in the district court for a mandatory order compelling the owner to permit access for the purposes specified in subsection (1) of this section. In such court proceedings, it shall be appropriate for the court to consider the necessity for and the reasonableness of the request of the board of county commissioners for access and to award to the owner such payment, if any, as may be proper to compensate him for damages to his property resulting from the flood control work on his property as authorized by the board of county commissioners.

(d) Whenever such action occurs within the boundaries of a municipality, the board of county commissioners shall consult with the governing body of that municipality.

(3) Prior to the initiation of any flood control work under this article, the board of county commissioners shall give the division of wildlife written notice, specifying the conditions which in its opinion create a flood hazard and the location of such. This subsection (3) shall not apply in the case of imminent flood danger.

Source: L. 74, p. 230, § 1.

30-30-103. Contracts and agreements. The board of county commissioners of a county may enter into contracts and agreements with adjoining counties, the state of Colorado or any agency or political subdivision thereof, or the United States or any agency or political subdivision thereof for the purpose of implementing or carrying out the purposes of this article.

Source: L. 74, p. 231, § 1.

30-30-104. Adoption of plan. A board of county commissioners may by resolution adopt a plan to carry out the purposes of this article.

Source: L. 74, p. 231, § 1.

30-30-105. Colorado water conservation board - grants to counties. The Colorado water conservation board may make grants to counties, out of moneys appropriated by the general assembly or other funds available for such purpose, to assist them in removing stream flow obstructions in accordance with section 30-30-102. Grants under this section shall be made upon application by the county therefor and on the basis of the urgency of the flood control problem in the county and the county's financial need.

Source: Added, L. 74, p. 231, § 1.

30-28-111. Zoning plan. (1) The county planning commission of any county may, and upon order by the board of county commissioners in any county having a county planning commission shall, make a zoning plan for zoning all or any part of the unincorporated territory within such county, including both the full text of the zoning resolution and the maps, and representing the recommendations of the commission for the regulation by districts or zones of the location, height, bulk, and size of buildings and other structures, percentage of lot which may be occupied, the size of lots, courts, and other open spaces, the density and distribution of population, the location and use of buildings and structures for trade, industry, residence, recreation, public activities, or other purposes, and the uses of land for trade, industry, recreation, or other purposes. To the end that adequate safety may be secured, the county planning commission may include in said zoning plan provisions establishing, regulating, and limiting such uses on or along any storm or floodwater runoff channel or basin as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado water conservation board in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters.

(2) The county planning commission or the board of adjustment of any county, in the exercise of powers pursuant to this article, may condition any portion of a zoning resolution, any amendment thereto, or any exception to the terms thereof upon the preservation, improvement, or construction of any storm or floodwater runoff channel designated and approved by the Colorado water conservation board.

Source: L. 39, p. 299, § 10; CSA, C. 45A, § 10; CRS 53, § 106-2-10; C.R.S. 1963, § 106-2-10; L. 66, p. 42, § 5.

30-28-133. Subdivision regulations.

(3) Subdivision regulations adopted by a board of county commissioners pursuant to this section shall require subdividers to submit to the board of county commissioners data, surveys, analyses, studies, plans, and designs, in the form prescribed by the board of county commissioners, of the following items:

(b) Relevant site characteristics and analyses applicable to the proposed subdivision including the following, which shall be submitted by the subdivider with the sketch plan:

(I) Reports concerning streams, lakes, topography, and vegetation;

(II) Reports concerning geologic characteristics of the area significantly affecting the land use and determining the impact of such characteristics on the proposed subdivision;

(c) A plat and other documentation showing the layout or plan of development, including, where applicable, the following information:

(VII) Estimated construction cost and proposed method of financing of the streets and related facilities, water distribution system, sewage collection system, storm drainage facilities, and such other utilities as may be required of the developer by the county;

(VIII) Maps and plans for facilities to prevent storm waters in excess of historic runoff, caused by the proposed subdivision, from entering, damaging, or being carried by conduits, water supply ditches and appurtenant structures, and other storm drainage facilities;

(4) Subdivision regulations adopted by the board of county commissioners pursuant to this section shall also include, as a minimum, provisions governing the following matters:

(b) Standards and technical procedures applicable to storm drainage plans and related designs, in order to ensure proper drainage ways, which may require, in the opinion of the board of county commissioners, detention facilities which may be dedicated to the county or the public, as are deemed necessary to control, as nearly as possible, storm waters generated exclusively within a subdivision from a one hundred year storm which are in excess of the historic runoff volume of storm water from the same land area in its undeveloped and unimproved condition;

(6) No board of county commissioners shall approve any preliminary plan or final plat for any subdivision located within the county unless the subdivider has provided the following materials as part of the preliminary plan or final plat subdivision submission:

(c) Evidence to show that all areas of the proposed subdivision which may involve soil or topographical conditions presenting hazards or requiring special precautions have been identified by the subdivider and that the proposed uses of these areas are compatible with such conditions.

Source: L. 61, p. 592, § 2; CRS 53, § 106-2-35; C.R.S. 1963, § 106-2-34; L. 67, p. 110, § 1; L. 71, p. 1055, § § 1, 2; L. 72, p. 501, § § 6, 7; L. 73, p. 1085, § § 1, 2; L. 75, p. 1001, § 1.

31-23-201. Grant of power. (1) Except as otherwise provided in section 34-1-305, C.R.S. 1973, for the purpose of promoting health, safety, morals, or the general welfare of the community, the legislative body of each city and incorporated town is empowered to regulate and restrict the height, number of stories, and size of buildings and other structures, the percentage of lot that may be occupied, the size of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence, or other purposes. Such regulations may provide that a board of adjustment may determine and vary their application in harmony with their general purpose and intent and in accordance with general or specific rules therein contained. Subject to the provisions of subsection (2) of this section, and to the end that adequate safety may be secured, said legislative body also has power to establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin, as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado water conservation board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters. Any ordinance enacted under authority of this part 2 shall exempt from the operation thereof any building or structure as to which satisfactory proof is presented to the board of adjustment, provided for in this part 2 that the present or proposed situation of such building or structure is reasonably necessary for the convenience or welfare of the public.

(2) The power conferred by subsection (1) of this section for flood prevention and control shall not be exercised so as to deprive the owner of any existing property of its use or maintenance for the purpose to which it is lawfully devoted on and after February 25, 1966, but provisions may be made for the gradual elimination of uses, buildings, and structures, including provisions for the elimination of such uses when the existing uses to which they are devoted are discontinued, and for the elimination of such buildings and structures when they are destroyed or damaged in major part.

(3) The legislative body of any city or incorporated town, or the board of adjustment thereof, in the exercise of powers pursuant to this section, may condition any zoning regulation, any amendment to such regulation, or any variance of the application thereof, or the exemption of any building or structure therefrom upon the preservation, improvement, or construction of any storm or floodwater runoff channel designated and approved by the Colorado water conservation board.

Source: L. 23, p. 649, § 1; CSA, C. 26, § 16; CRS 53, § 139-60-1; C.R.S. 1963, § 139-60-1; L. 66, p. 40, § 2; L. 73, p. 1055, § 20.

State Statutes Regarding Floodplain Management:

Water Conservation Board of Colorado

37-60-106. Duties of the board. (1) It is the duty of the board 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; and in particular, and without limiting the general character of this section, the board has the power and it is its duty:

(a) To foster and encourage irrigation districts, public irrigation districts, water users' associations, conservancy districts, drainage districts, mutual reservoir companies, mutual irrigation companies, grazing districts, and any other agencies which are formed under the laws of the state of Colorado, or of the United States, for the conservation, development, and utilization of the waters of Colorado;

(b) To assist any such agencies in their financing, but not to lend or pledge the credit or faith of the state of Colorado in aid thereof, or to attempt to make the state responsible for any of the debts, contracts, obligations, or liabilities thereof;

(c) To devise and formulate methods, means, and plans for bringing about the greater utilization of the waters of the state and the prevention of flood damages therefrom, and to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated towns, and counties of this state;

(d) To gather data and information looking toward the greater utilization of the waters of the state and the prevention of floods and for this purpose to make investigations and surveys;

(e) To cooperate with the United States and the agencies thereof, and with other states for the purpose of bringing about the greater utilization of the waters of the state of Colorado and the prevention of flood damages;

(f) To cooperate with the United States, or any of the agencies thereof, in the making of preliminary surveys, and sharing the expense thereof, when necessary, respecting the engineering and economic feasibility of any proposed water conservation or flood control project within the state of Colorado, designed for the purpose of bringing about greater utilization of the waters of this state;

(g) To formulate and prepare drafts of legislation, state and federal, designed to assist in securing greater beneficial use and utilization of the waters of the state and protection from flood damages;

(h) To investigate the plans, purposes, and activities of other states, and of the federal government, which might affect the interstate waters of Colorado;

(i) To confer with and appear before the officers, representatives, boards, bureaus, committees, commissions, or other agencies of other states, or of the federal government, for the purpose of protecting and asserting the authority, interests, and rights of the state of Colorado and its citizens with respect to the waters of the interstate streams in this state;

(j) To acquire by grant, purchase, bequest, devise, or lease, any real property or interest therein for the purpose of the prevention or control of floods, or to acquire by eminent domain any real property or interest therein with respect to any project specifically authorized by the United States congress for the prevention or control of floods, including but not limited to easements and rights-of-way for ingress into and egress from such project, with the power in either event to lease such lands or interest therein to agencies of the federal government or to the state or any agency or political subdivision thereof for the construction, operation, or maintenance of flood control and prevention facilities;

Source: L. 37, p. 1304, § 11; CSA, C. 173B, § 11; CRS 53, § 148-1-11; C.R.S. 1963, § 149-1-11; L. 66, p. 44, § 8; L. 67, p. 294, § 5; L. 71, p. 1343, § 1.

State of Colorado
EXECUTIVE CHAMBERS
DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER

EVALUATION OF FLOOD HAZARD IN LOCATING STATE BUILDINGS, ROADS, AND OTHER FACILITIES, AND IN REVIEWING AND APPROVING SEWAGE AND WATER FACILITIES, AND SUBDIVISIONS

WHEREAS, hazardous uses of Colorado flood plains are occurring and potential flood losses and loss of life are increasing despite substantial efforts to control floods; and

WHEREAS, economic losses due to floods in Colorado during the last twelve years place Colorado near the top of the Nation's list for per capita losses; and

WHEREAS, past inadequate land use policy and controls led to the major disaster in the Big Thompson Canyon on July 31, 1976; and

WHEREAS, minimum flood plain and floodway regulation criteria have been promulgated by the Colorado Water Conservation Board and the Colorado Land Use Commission on the premise that wise use of our State's flood plains is the key to controlling and minimizing future economic losses and suffering of our citizens; and

WHEREAS, wise use of our flood plains will promote public health, safety and welfare, reduce future public costs for relief and rehabilitation and contribute to the State's economy; and

WHEREAS, the State of Colorado has extensive and continuing programs for the construction of buildings, roads, and other facilities and further, State Agencies are involved in the review and approval of water and sewer treatment plants, subdivisions, trailer parks, campgrounds, and many other facilities throughout the State of Colorado; and

WHEREAS, both Federal and State Agencies have compiled significant data and studies concerning the frequency of floods and the location of flood plains and are expert at estimating flood hazards;

NOW, THEREFORE, by virtue of the authority vested in me as Governor of Colorado, it is hereby ordered as follows:

1. The heads of State agencies shall provide leadership in encouraging a broad and unified effort to prevent uneconomic uses and development of Colorado flood plains and in particular, to promote the public health, safety and welfare and to reduce the risk of flood losses in connection with Colorado lands and installations and State financed or supported improvements.

2. All State agencies directly responsible for the construction of State buildings, structures, roads, overnight campgrounds, or other facilities shall evaluate flood hazards when planning the location for new facilities and as far as practicable shall preclude the uneconomic, hazardous, or unnecessary use of flood plains in connection with such facilities.

3. Whenever practical and economically feasible, flood proofing measures shall be applied to existing facilities to reduce flood damage potential.

4. The Colorado Water Conservation Board and the Land Use Commission in cooperation with the appropriate state and federal agencies shall continue to undertake the evaluation of hazardous flood plain uses in the State of Colorado, proceed with the identification of flood plains, and prepare suitable flood disaster preparedness plans in cooperation with affected cities and counties, including an effective flood insurance information program, early warning system, and related steps to protect against future loss of life and unnecessary economic losses. Priority shall be given to the numerous hazardous canyons in the State of Colorado.

5. All State agencies responsible for the review and/or approval of sewage treatment plants, water treatment plants, interceptor sewers, subdivisions, trailer parks, and other facilities within the State of Colorado shall evaluate flood hazards in writing in connection with such review and approval of facilties and take measures to minimize the exposure of facilities, and development which they may induce, to potential flood damage and the need for future State expenditures for flood protection and flood disaster relief.

6. All State agencies responsible for programs which entail land use planning shall take flood hazards into account when evaluating applications for planning grants, when reviewing water and wastewater facility plans, and area-wide wastewater management plans.

7. Requests for flood hazard information and hazard assessment may be addressed to the Colorado Water Conservation Board or the Land Use Commission.

8. Any requests for appropriations for State construction of new buildings, structures, roads, or other facilities by State agencies shall be accompanied by a statement on the findings of the agency's evaluation and consideration of flood hazards in development of such requests.

9. As used in this Order, the term "State agency" includes any department, commission, division, or other organizational entity of the executive branch of State Government.

10. The State agencies shall proceed immediately to develop such procedures, regulations, and information as are provided for in, or may be necessary to carry out, the provisions of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado, this first day August, A.D., 1977.

Richard D. Lamm
Governor

State of Colorado

EXECUTIVE CHAMBERS

DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER

REQUIREMENTS AND CRITERIA
FOR STATE PARTICIPATION
IN THE NATIONAL FLOOD INSURANCE PROGRAM

WHEREAS, on August 1, 1977, Executive Order Number 8491, entitled "Evaluation of Flood Hazard in Locating State Buildings, Roads, and Other Facilities, and in Reviewing and Approving Sewage and Water Facilities, and Subdivisions," was issued regarding State policy on the occupation and modification of Colorado floodplains by State agencies; and

WHEREAS, additional State procedures are to be established to meet the requirements of the National Flood Insurance Program; and

WHEREAS, the availability of programs for Federal loans and mortgage insurance, State financial assistance, and land use planning are determining factors in the utilization of lands; and

WHEREAS, the availability of flood insurance under the National Flood Insurance Program for state-owned properties as provided by the National Flood Insurance Act of 1968, as amended, and the Flood Disaster Protection Act of 1973 is dependent upon State coordination of Federal, State, and local aspects of floodplain, mudslide (i.e., mudflow) area, and flood-related erosion area management activities in the State; and

WHEREAS, the Colorado Water Conservation Board is the State agency responsible for state-wide programs for flood prevention, flood control, flood protection, and flood hazard study criteria, as provided by Section 37-60-106(1), Colorado revised Statutes 1973, and Section 24-65.1-402, Colorado Revised Statutes 1973, as amended, (S.B. 126) L. 77.; and

WHEREAS, the Colorado Water Conservation Board is the State agency designated to coordinate the National Flood Insurance Act of 1968, as amended, and the Flood Disaster Protection Act of 1973; and

WHEREAS, the Division of Disaster Emergency Services is the agency responsible for the coordination of Federal, State, and local disaster activities, and

WHEREAS, the primary concerns of the Colorado Land Use Commission are the protection, utility, value, and future of lands within the State; and

WHEREAS, the availability of flood insurance for stateowned properties is conditioned upon the State's compliance with minimum floodplain management criteria of the National Flood Insurance Program regulations (24 CFR 1909, et. seg.);

NOW, THEREFORE, by virtue of the authority vested in me as the Governor of Colorado, it is hereby ordered as follows:

1. The Colorado Land Use Commission is hereby designated as the State agency to provide implementation of Section 1910.12, Rules and Regulations of the Federal Insurance Administration.

2. Each State agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain, to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management.

3. Before taking action, each State agency shall determine whether the proposed action will occur in a floodplain. This determination shall be based on a Department of Housing and Urban Development flood hazard boundary map (FHBM) or, if available, on more detailed floodplain delineation maps of the area on file with the Colorado Water Conservation Board. If flood hazard information and data are not available, the Colorado Water Conservation Board shall assist in the determination and the evaluation of any flood hazard to the proposed facilities or structures.

4. For state-owned properties in Federal Insurance Administration designated "Special Hazard Areas," the State shall, as a minimum, comply with the floodplain management criteria set forth in Sections 1910.3, 1910.4, and 1910.5 of the National Flood Insurance Regulations.

5. If a State agency has determined that no feasible alternative exists to avoid siting a proposed structure or facility within a floodplain, the agency shall (a) prepare and transmit to the Colorado Land Use Commission a notice containing an explanation of why the development is proposed to be located in the floodplain; (b) require the structure to be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement; (c) require the structure to be constructed with materials and utility equipment resistant to flood damage; (d) site the lowest floor of any structure not less than one foot above the base flood, unless such structure has been adequately flood-proofed to one foot above said base water elevation; and (e) elevate residential dwellings to not less than one foot above the maximum water elevation of the computed base flood.

6. The Colorado Land Use Commission and the Colorado Water Conservation Board shall assist State agencies in carrying out the floodplain management criteria set forth in Sections 1910.3, 1910.4, and 1910.5 of the National Flood Insurance Regulations with the following provisions:

a. Subdivision proposals shall be consistent with the criteria established by Title 30, Article 28, Colorado Revised Statutes 1973, as amended.

b. Policy on floodplain management shall follow the directives of Executive Order 8491 of August 1, 1977.

c. Disaster Preparedness Activities shall be consistent with the criteria established by Title 28, Article 2, Colorado Disaster Emergency Act, Colorado Revised Statutes 1973, as amended, within the scope of their applicability to the Executive Order and to Executive Order 8491, dated August 1, 1977, and as administered by the Colorado Division of Disaster Emergency Services. Provided further, noting in this order or in Executive Order 8491 shall apply to assistance provided for emergency work to save lives, protect property, and public health and safety, performed pursuant to the Colorado Disaster Emergency Act.

d. The floodway (high-hazard zone) limits shall be consistent with the criteria established by the Colorado Water Conservation Board's Model Floodplain Regulation, dated February 26, 1975, which was prepared under the authority of Title 24, Article 65.1, Colorado Revised Statutes 1973, as amended.

7. All State agencies responsible for the disposal of lands or properties shall evaluate flood hazards in connection with lands or properties which are proposed for disposal to other public instrumentalities or private interests and, in order to minimize future State expenditures for flood protection and flood disaster relief, shall attach appropriate restrictions with respect to uses of the lands or properties from disposal.

8. When State property in floodplains is proposed for lease, easement, right-of-way, or disposal to non-state public or private parties, the State agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State or local floodplain regulations; and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (c) withhold such properties from conveyance.

9. As used in this Order:

a. "State agency" means any department, board, commission, or division; however, the directives as contained in this Order are meant to apply to those agencies which perform or regulate activities that are located in, or affect, floodplains.

b. "base flood" means the flood that has a one percent chance of being equalled or exceeded in any given year.

c. "floodplain" means an area in, and adjacent to, a stream, which area is subject to being inundated by the base flood in any given year.

d. "Flood-proofing" means a combination of structural provisions, changes, or adjustments to lands, properties, and structures subject to flooding, primarily for the reduction or elimination of flood damages to lands, properties, structures, and contents of buildings in a flood-hazard area.

10. As may be permitted by law, the head of each State agency shall issue appropriate rules and regulations to govern the carrying out of the provisions of this order in consultation with the Colorado Land Use Commission.

11. This Order shall take effect on October 1, 1977.

GIVEN under my hand and the Executive Seal of the State of Colorado, this 1st day of October, A.D., 1977.

Richard D. Lamm
Governor

State of Colorado
EXECUTIVE CHAMBERS
DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER
PROCLAMATION
FLASH FLOOD AWARENESS WEEK
May 17-23, 1982

WHEREAS, emergency preparedness is a function of government which is dependent upon the leadership of the executive officers and the efforts of many dedicated volunteers and career civil servants; and

WHEREAS, there exists a present and continuing threat to life and property of the citizens of the State of Colorado from flash floods; and

WHEREAS, 139 lives were lost and millions of dollars worth of damage was sustained when a flash flood occurred in the Big Thompson Canyon in Larimer County at the end of a long dry spell on July 31, 1976; and

WHEREAS, through the cooperation of the Federal Emergency Management Agency, the National Weather Service, and the Colorado Division of Disaster Emergency Services, a number of federal, state, local and volunteer agencies will be testing their emergency plans for coping with flash floods; and

WHEREAS, by being properly prepared, the people of Colorado can reduce the loss of life and property threatened by flash floods;

NOW, THEREFORE, I, Richard D. Lamm, Governor of the State of Colorado, do hereby proclaim May 17-23, 1982, as

FLASH FLOOD AWARENESS WEEK

in the State of Colorado, and urge all Coloradans to give their full attention to this worthy life-preserving effort.

GIVEN under my hand and the Executive Seal of the State of Colorado, this eleventh day of March, A.D., 1982.

Richard D. Lamm
Governor

State of Colorado

EXECUTIVE CHAMBERS

DENVER

R. D. LAMM
GOVERNOR

EXECUTIVE ORDER
PROCLAMATION
FLOOD AWARENESS DAY
IN MEMORY OF THE BIG THOMPSON FLOOD
July 31, 1981

WHEREAS, 1981 marks the fifth anniversary of the devastating Big Thompson flood; and

WHEREAS, many people were killed and many others suffered extensive property damage; and

WHEREAS, the flood cost the Federal, State, and Larimer County governments, as well as private contributors, a total of 56.1 million dollars; and

WHEREAS, the Big Thompson Flood of 1976 was the most recent and most highly publicized major flood disaster to affect Colorado, yet it was not a unique event; and

WHEREAS, throughout Colorado history severe flooding has occurred regularly in various regions of the State; and

WHEREAS, a comprehensive program of flood plain management can save lives, reduce property damage, and reduce public expenditures resulting from flood disasters;

NOW, THEREFORE, I, Richard D. Lamm, Governor of the State of Colorado, do hereby proclaim July 31, 1981 as

FLOOD AWARENESS DAY
IN MEMORY OF THE BIG THOMPSON FLOOD

in the State of Colorado and urge all Coloradans to remember those who died and suffered as a result of this disaster.

GIVEN under my hand and the Executive Seal of the State of Colorado, this twenty-third day of July, A.D., 1981.

Richard D. Lamm
Governor

ARTICLE 2

Disaster Emergency Services

PART 1

DISASTER EMERGENCY SERVICES

PART 2

COMPENSATION BENEFITS TO VOLUNTEER WORKERS

PART 3

LIABILITY — PUBLIC OR PRIVATE

PART 4

EVACUATION OF SCHOOL BUILDINGS

PART 5

DISASTER RELIEF

PART 1

DISASTER EMERGENCY SERVICES

Editor's note: The substantive provisions of this part 1, formerly contained in and known as the "Colorado Civil Defense Act of 1950", article 1 of chapter 24, C.R.S. 1963, were repealed and reenacted in 1973, causing some addition, relocation, and elimination of sections as well as subject matter. (Compare historical record prior to 1973 of article 1 of chapter 24, C.R.S. 1963, as amended through L. 72.)

28-2-101. Short title. This part 1 shall be known and may be cited as the "Colorado Disaster Emergency Act of 1973".

Source: R & RE, L. 73, p. 408, § 1; C.R.S. 1963, § 24-1-1.

Law review. For article, "The Need for State Atomic Energy Programs in the West", see 29 Rocky Mt. L. Rev. 296 (1957).

Right to hearing as to whether government unnecessarily destroyed property. A plaintiff is entitled to a hearing to present evidence that the government destroyed her property unnecessarily under the Colorado disaster emergency act. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1042 (1979).

28-2-102. Purposes and limitations. (1) The purposes of this part 1 are to

(a) 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, civil disturbance, or hostile military or paramilitary action;

(b) Prepare for prompt and efficient search, rescue, recovery, care, and treatment of persons lost, entrapped, victimized, or threatened by disasters or emergencies;

(c) Provide a setting conducive to the rapid and orderly start of restoration and rehabilitation of persons and property affected by disasters;

(d) Clarify and strengthen the roles of the governor, state agencies, and local governments in prevention of, preparation for, response to, and recovery from disasters;

(e) Authorize and provide for cooperation in disaster prevention, preparedness, response, and recovery;

(f) Authorize and provide for coordination of activities relating to disaster prevention, preparedness, response, and recovery by agencies and officers of this state and similar state-local, interstate, federal-state, and foreign activities in which the state and its political subdivisions may participate;

(g) Provide a disaster and emergency management system embodying all aspects of predisaster, preemergency preparedness, postdisaster, and postemergency response; and

(h) Assist in prevention of disasters caused or aggravated by inadequate planning for regulation of public and private facilities and land use.

(2) Nothing in this part 1 shall be construed to:

(a) Interfere with the course or conduct of a labor dispute; except that actions otherwise authorized by this part 1 or other laws may be taken when necessary to forestall or mitigate imminent or existing danger to public health or safety;

(b) Interfere with dissemination of news or comment on public affairs, but any communications facility or organization (including but not limited to radio and television stations, wire services, and newspapers) may be required to transmit or print public service messages furnishing information or instructions in connection with a disaster emergency;

(c) Affect the jurisdiction or responsibilities of police forces, fire-fighting forces, or units of the armed forces of the United States, or of any personnel thereof, when on active duty; but state, local, and interjurisdictional disaster emergency plans shall place reliance upon the forces available for performance of functions related to disaster emergencies; or

(d) Limit, modify, or abridge the authority of the governor to proclaim martial law or exercise any other powers vested in him under the constitution, statutes, or common law of this state independent of, or in conjunction with, any provision of this part 1.

Source: R & RE, L. 73, p. 408, § 1; C.R.S. 1963, § 24-1-2.

Cross reference. As to powers of the governor, see art. IV, Colo. Const.

28-2-103. Definitions. As used in this part 1, unless the context otherwise requires:

(1) "Disaster" means occurrence or imminent threat of widespread or severe damage, injury, or loss of life or property resulting from any natural or man-made cause, including but not limited to fire, flood, earthquake, wind storm, wave action, oil spill or other water contamination requiring emergency action to avert danger or damage, volcanic activity, epidemic, air pollution, blight, drought, infestation, explosion, civil disturbance, or hostile military or paramilitary action.

(2) "Political subdivision" means any county, city and county, city, or town and may include any other agency designated by law as a political subdivision of the state.

(3) "Search and rescue" means the employment, coordination, and utilization of available resources and personnel in locating, relieving distress and preserving life of, and removing survivors from the site of a disaster, emergency, or hazard to a place of safety in case of lost, stranded, entrapped, or injured persons.

Source: R & RE, L. 73, p. 409, § 1; C.R.S. 1963, § 24-1-3; L. 79, p. 1058, § 6.

28-2-104. The governor and disaster emergencies. (1) The governor is responsible for meeting the dangers to the state and people presented by disasters.

(2) Under this part 1, the governor may issue executive orders, proclamations, and regulations and amend or rescind them. Executive orders, proclamations, and regulations have the force and effect of law.

(3) There is hereby created a governor's disaster emergency council (referred to in this part 1 as the "council"), consisting of not less than five nor more than nine members. The attorney general and the executive directors of the following departments shall be members: Administration, highways, local affairs, military affairs, and natural resources. The additional member s, if any, shall be appointed by the governor from among the executive directors of the other departments. The governor shall serve as chairman of the council, and a majority shall constitute a quorum. The council shall meet at the call of the governor and shall advise the governor and the director of the division of disaster emergency services on all matters pertaining to the declaration of disasters and the disaster response and recovery activities of the state government. However, nothing in the duties of the council shall be construed to limit the authority of the governor to act without the advice of the council when the situation calls for prompt and timely action when disaster threatens or exists.

(4) A disaster emergency shall be declared by executive order or proclamation of the governor if he finds a disaster has occurred or that this occurrence or the threat thereof is imminent. The state of disaster emergency shall continue until the governor finds that the threat of danger has passed or the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation, but no state of disaster emergency may continue for longer than thirty days unless renewed by the governor. The general assembly, by joint resolution, may terminate a state of disaster emergency at any time. Thereupon, the governor shall issue an executive order or proclamation ending the state of disaster emergency. All executive orders or proclamations issued under this subsection (4) shall indicate the nature of the disaster, the area threatened, and the conditions which have brought it about or which make possible termination of the state of disaster emergency. An executive order or proclamation shall be disseminated promptly by means calculated to bring its contents to the attention of the general public and, unless the circumstances attendant upon the disaster prevent or impede, shall be promptly filed with the division of disaster emergency services, the secretary of state, and the county clerk and disaster agencies in the area to which it applies.

(5) An executive order or proclamation of a state of disaster emergency shall activate the disaster response and recovery aspects of the state, local, and interjurisdictional disaster emergency plans applicable to the political subdivision or area in question and be authority for the deployment and use of any forces to which the plans apply and for use or distribution of any supplies, equipment, and materials and facilities assembled, stockpiled, or arranged to be made available pursuant to this part 1 or any other provision of law relating to disaster emergencies.

(6) During the continuance of any state of disaster emergency, the governor is commander-in-chief of the organized and unorganized militia and of all other forces available for emergency duty. To the greatest extent practicable, the governor shall delegate or assign command authority by prior arrangement embodied in appropriate executive orders or regulations, but nothing in this section restricts his authority to do so by orders issued at the time of the disaster emergency.

(7) In addition to any other powers conferred upon the governor by law, he may:

(a) Suspend the provisions of any regulatory statute prescribing the procedures for conduct of state business or the orders, rules, or regulations of any state agency, if strict compliance with the provisions of any statute, order, rule, or regulation would in any way prevent, hinder, or delay necessary action in coping with the emergency;

(b) Utilize all available resources of the state government as reasonably necessary to cope with the disaster emergency and of each political subdivision of the state;

(c) Transfer the direction, personnel, or functions of state departments and agencies or units thereof for the purpose of performing or facilitating emergency services;

(d) Subject to any applicable requirements for compensation under section 28-2-111, commandeer or utilize any private property if he finds this necessary to cope with the disaster emergency;

(e) Direct and compel the evacuation of all or part of the population from any stricken or threatened area within the state if he deems this action necessary for the preservation of life or other disaster mitigation, response, or recovery;

(f) Prescribe routes, modes of transportation, and destinations in connection with evacuation;

(g) Control ingress and egress to and from a disaster area, the movement of persons within the area, and the occupancy of premises therein;

(h) Suspend or limit the sale, dispensing, or transportation of alcoholic beverages, firearms, explosives, or combustibles; and

(i) Make provision for the availability and use of temporary emergency housing.

Source: R & RE, L. 73, p. 409, § 1; C.R.S. 1963, § 24-1-4.

Am. Jur.2d. See 38 Am. Jur.2d, Governor, § 4, 54 Am. Jur.2d, Military, and Civil Defense, § § 351-357.

28-2-105. Division of disaster emergency services. (1) There is hereby created within the department of military affairs a division of disaster emergency services, referred to in this part 1 as the "division". Pursuant to section 13 of article XII of the state constitution, the head of the department of military affairs shall appoint a civilian deputy director as head of the division. The deputy director shall be under the direct administrative control of the adjutant general of the state.

(2) The division shall prepare and maintain a state disaster plan and keep it current, which plan may include:

(a) Prevention and minimization of injury and damage caused by disasters;

(b) Search for, rescue of, and recovery of persons lost, entrapped, victimized, or threatened by disaster;

(c) Prompt and effective response to disasters;

(d) Disaster and emergency relief;

(e) Identification of areas particularly vulnerable to disasters;

(f) Recommendations for zoning, building, and other land use controls, safety measures for securing mobile homes or other nonpermanent or semipermanent structures, and other preventive and preparedness measures designed to eliminate or reduce disasters or their impact;

(g) Assistance to local officials in designing local emergency action plans;

(h) Authorization and procedures for the erection or other construction of temporary works designed to protect against or mitigate danger, damage, or loss from flood, conflagration, or other disaster;

(i) Preparation and distribution to the appropriate state and local officials of state catalogs of federal, state, and private assistance programs;

(j) Organization of manpower and chains of command for disaster emergencies;

(k) Coordination of federal, state, and local disaster activities; and

(l) Coordination of the state disaster plan with the disaster plans of the federal government.

(3) The division shall take an integral part in the development and revision of local and interjurisdictional disaster plans prepared under section 28-2-107. To this end it shall employ or otherwise secure the services of professional and technical personnel capable of providing expert assistance to political subdivisions, their disaster agencies, and interjurisdictional planning and disaster agencies. These personnel shall consult with subdivisions and agencies on a regularly scheduled basis and shall make field examinations of the areas, circumstances, and conditions to which particular local and interjurisdictional disaster plans are intended to apply and may suggest or require revisions.

(4) In preparing and revising the state disaster plan, the division shall seek the advice and assistance of local government, business, labor, industry, agriculture, civic and volunteer organizations, and community leaders. In advising local and interjurisdictional agencies, the division shall encourage them also to seek advice from these sources.

(5) The state disaster plan or any part thereof may be incorporated in regulations of the division or executive orders which have the force and effect of law.

(6) The division shall:

(a) Determine resource requirements of the state and its political subdivisions and when deemed advisable procure equipment considered essential to augment emergency operations;

(b) Promulgate standards and requirements for local and interjurisdictional disaster plans;

(c) Periodically review local and interjurisdictional disaster and emergency plans;

(d) Provide for support from federal, state, and local agencies;

(e) Assist political subdivisions, their disaster agencies, and interjurisdictional disaster agencies to establish and operate training programs and programs of public information;

(f) Make surveys of industries, resources, and facilities within the state, both public and private, as are necessary to carry out the purposes of this part 1;

(g) Plan and make arrangements for the availability and use of any private facilities, services, and property and, if necessary and if in fact used, provide for payment for use under terms and conditions agreed upon;

(h) Maintain a register of search and rescue organizations, units, teams, or individuals operating within the territorial boundaries of the state;

(i) Assist search and rescue units to accomplish standards for training and proficiency;

(j) Prepare, for issuance by the governor, executive orders, proclamations, and regulations as necessary or appropriate in coping with disasters;

(k) Cooperate with the federal government and any public or private agency or entity in achieving any purpose of this part 1 and in implementing programs for disaster prevention, preparation, response, and recovery;

(l) Prepare and transmit annually, in the form and manner prescribed by the controller pursuant to the provisions of section 24-30-208, C.R.S. 1973, a report accounting to the governor and the general assembly for the efficient discharge of all responsibilities assigned by law or directive to the division;

(m) Insure that publications circulated in quantity outside the executive branch shall be issued in accordance with fiscal rules promulgated by the controller pursuant to the provisions of section 24-30-208, C.R.S. 1973; and

(n) Do other things necessary, incidental, or appropriate for the implementation of this part 1.

Source: R & RE, L. 73, p. 411, § 1; C.R.S. 1963, § 24-1-5; L. 79, p. 1121, § 1.

Am. Jur.2d. See 54 Am. Jur.2d, Military, and Civil Defense, § § 354, 368.

28-2-106. Financing. (1) It is the intent of the general assembly and declared to be the policy of the state that funds to meet disaster emergencies shall always be available.

(2) A disaster emergency fund is hereby established which shall receive moneys appropriated thereto by the general assembly. Moneys in the disaster emergency fund shall remain therein until expended.

(3) The council shall review in detail each expenditure of disaster emergency funds.

(4) It is the legislative intent that first recourse be to funds regularly appropriated to state and local agencies. If the governor finds that the demands placed upon these funds in coping with a particular disaster are unreasonably great, he may, with the concurrence of the council, make funds available from the disaster emergency fund. If moneys available from the fund are insufficient, the governor, with the concurrence of the council, may transfer and expend moneys appropriated for other purposes.

(5) The deputy director is authorized to establish the rules and regulations which will govern the reimbursement of funds to state agencies and political subdivisions and to promulgate such regulations.

(6) Nothing in this section shall be construed to limit the governor's authority to apply for, administer, and expend grants, gifts, or payments in aid of disaster prevention, preparedness, response, or recovery.

Source: R & RE, L. 73, p. 413, § 1; C.R.S. 1963, § 24-1-6; L. 79, p. 1121, § 2.

Am. Jur.2d. See 54 Am. Jur.2d, Military, and Civil Defense, § 354.

28-2-107. Local and interjurisdictional disaster agencies and services. (1) Each political subdivision within this state shall be within the jurisdiction of and served by the division and by a local or interjurisdictional agency responsible for disaster preparedness and coordination of response.

(2) Each county shall maintain a disaster agency or participate in a local or interjurisdictional disaster agency which, except as otherwise provided under this part 1, has jurisdiction over and serves the entire county.

(3) The governor shall determine which municipal corporations need disaster agencies of their own and require that they be established and maintained. He shall make his determination on the basis of the municipality's disaster vulnerability and capability of response related to population size and concentration. The disaster agency of a county shall cooperate with the disaster agencies of municipalities situated within its borders but shall not have jurisdiction within a municipality having its own disaster agency. The division shall publish and keep current a list of municipalities required to have disaster agencies under this subsection (3).

(4) The minimum composition of a disaster agency shall be a director or coordinator appointed and governed by the chief executive officer or governing body of the appointing jurisdiction. The director or coordinator shall be responsible for the planning and coordination of the local disaster services.

(5) Any provision of this part 1 or other law to the contrary notwithstanding, the governor may require a political subdivision to establish and maintain a disaster agency jointly with one or more contiguous political subdivisions if he finds that the establishment and maintenance of an agency or participation therein is made necessary by circumstances or conditions that make it unusually difficult to provide disaster prevention, preparedness, response, or recovery services under other provisions of this part 1.

(6) Each political subdivision which does not have a disaster agency and has not made arrangements to secure or participate in the services of an agency shall have an elected official designated as liaison officer to facilitate the cooperation and protection of that subdivision in the work of disaster prevention, preparedness, response, and recovery.

(7) The mayor, chairman of the board of county commissioners, or other principal executive officer of each political subdivision in the state shall notify the division of the manner in which the political subdivision is providing or securing disaster planning and emergency services, identify the person who heads the agency from which the services are obtained, and furnish additional information relating thereto as the division requires.

(8) Each local and interjurisdictional disaster agency shall prepare and keep current a local or interjurisdictional disaster emergency plan for its area.

(9) The local or interjurisdictional disaster agency, as the case may be, shall prepare and distribute to all appropriate officials in written form a clear and complete statement of the emergency responsibilities of all local agencies and officials and of the disaster chain of command.

(10) The sheriff of each county shall:

(a) Be the official responsible for coordination of all search and rescue operations within his jurisdiction;

(b) Make use of the search and rescue capability and resources available within the county and request assistance from the division only when and if he determines such additional assistance is required.

(11) When authorized by the governor and approved by the deputy director, expenses incurred in meeting contingencies and emergencies arising from search and rescue operations may be reimbursed from the disaster emergency fund.

Source: R & RE, L. 73, p. 414, § 1; C.R.S. 1963, § 24-1-7; L. 79, p. 1122, § 3.

28-2-108. Establishment of interjurisdictional disaster planning and service area. (1) If the governor finds that two or more adjoining counties would be better served by an interjurisdictional arrangement than by maintaining separate disaster agencies and services, he may delineate by executive order an interjurisdictional area adequate to plan for, prevent, or respond to disaster in that area and direct steps to be taken as necessary, including the creation of an interjurisdictional relationship, a joint disaster emergency plan, mutual aid, or an area organization for emergency planning and services.

(2) A finding of the governor pursuant to subsection (1) of this section shall be based on one or more factors related to the difficulty of maintaining an efficient and effective disaster prevention, preparedness, response, and recovery system on a separate basis, such as:

(a) Small or sparse population;

(b) Limitations on public financial resources severe enough to make maintenance of a separate disaster agency and services unreasonably burdensome;

(c) Unusual vulnerability to disaster as evidenced by a past history of disasters, topographical features, drainage characteristics, disaster potential, and presence of disaster-prone facilities or operations;

(d) The interrelated character of the counties in a multicounty area; and

(e) Other relevant conditions or circumstances.

(3) If the governor finds that a vulnerable area lies only partly within this state and includes territory in another state or territory in a foreign jurisdiction and that it would be desirable to establish an interstate or international relationship or mutual aid or an area organization for disaster, he shall take steps to that end as desirable. If this action is taken with jurisdictions that have enacted the interstate civil defense and disaster compact, any resulting agreements may be considered supplemental agreements pursuant to article VI of that compact.

(4) If the other jurisdictions with which the governor proposes to cooperate pursuant to subsection (3) of this section have not enacted that compact, he may negotiate special agreements with such jurisdictions. Any agreement, if sufficient authority for the making thereof does not otherwise exist, becomes effective only after its text has been communicated to the general assembly and if neither house of the general assembly has disapproved it before adjournment sine die of the next ensuing session competent to consider it or within thirty days of its submission, whichever is longer.

Source: R & RE, L. 73, p. 415, § 1; C.R.S. 1963, § 24-1-8.

28-2-109. Local disaster emergencies. (1) A local disaster may be declared only by the principal executive officer of a political subdivision. It shall not be continued or renewed for a period in excess of seven days except by or with the consent of the governing board of the political subdivision. Any order or proclamation declaring, continuing, or terminating a local disaster emergency shall be given prompt and general publicity and shall be filed promptly with the county clerk and recorder, city clerk, or other authorized record-keeping agency and with the division.

(2) The effect of a declaration of a local disaster emergency is to activate the response and recovery aspects of any and all applicable local and interjurisdictional disaster emergency plans and to authorize the furnishing of aid and assistance under such plans.

(3) No interjurisdictional disaster agency or official thereof may declare a local disaster emergency unless expressly authorized by the agreement pursuant to which the agency functions. However, an interjurisdictional disaster agency shall provide aid and services in accordance with the agreement pursuant to which it functions.

Source: R & RE, L. 73, p. 416, § 1; C.R.S. 1963, § 24-1-9.

Am. Jur.2d. See 54 Am. Jur.2d, Military, and Civil Defense, § § 354, 357.

C.J.S. See 57 C.J.S., Militia, § 2.

28-2-110. Disaster prevention. (1) In addition to disaster prevention measures as included in the state, local, and interjurisdictional disaster emergency plans, the governor shall consider steps that could be taken on a continuing basis to prevent or reduce the harmful consequences of disasters. At his direction, and pursuant to any other authority and competence they have, state agencies, including but not limited to those charged with responsibilities in connection with floodplain management, stream encroachment and flow regulation, weather modification, fire prevention and control, air quality, public works, land use and land-use planning, and construction standards, shall make studies of matters related to disaster prevention. The governor, from time to time, shall make recommendations to the general assembly, local governments, and such other appropriate public and private entities as may facilitate measures for prevention or reduction of the harmful consequences of disasters.

(2) All state departments, in conjunction with the division, shall conduct studies and adopt measures to reduce the impact of, and actions contributory to, a disaster. The studies shall concentrate on means of reducing or avoiding the dangers caused by such occurrences or the consequences thereof.

(3) If the division believes on the basis of the studies or other competent evidence that an area is susceptible to a disaster of catastrophic proportions without adequate warning, that existing building standards and land-use controls in that area are inadequate and could add substantially to the magnitude of the disaster, and that changes in zoning regulations, other land-use regulations, or building requirements are essential in order to further the purposes of this section, it shall specify the essential changes to the governor. If the governor upon review of the recommendations finds after public hearing that the changes are essential, he shall so recommend to the agencies or local governments with jurisdictions over the area and subject matter. If no action or insufficient action pursuant to his recommendations is taken within the time specified by the governor, he shall so inform the general assembly and request legislative action appropriate to mitigate the impact of disaster.

(4) The governor, at the same time that he makes his recommendations pursuant to subsection (3) of this section, may suspend the standard or control which he finds to be inadequate to protect the public safety and by regulation place a new standard or control in effect. The new standard or control shall remain in effect until rejected by joint resolution of both houses of the general assembly or amended by the governor. During the time it is in effect, the standard or control contained in the governor's regulation shall be administered and given full effect by all relevant regulatory agencies of the state and local governments to which it applies. The governor's action is subject to judicial review but shall not be subject to temporary stay pending litigation.

Source: R & RE, L. 73, p. 416, § 1; C.R.S. 1963, § 24-1-10; L. 77, p. 1384, § 1.

28-2-111. Compensation - liability when combatting grasshopper infestation. (1) Each person within this state shall conduct himself and keep and manage his affairs and property in ways that will reasonably assist and will not unreasonably detract from the ability of the state and the public successfully to meet disasters or emergencies. This obligation includes appropriate personal service and use or restriction on the use of property in time of disaster emergency. This part 1 neither increases nor decreases these obligations but recognizes their existence under the constitution and statutes of this state and the common law. Compensation for services or for the taking or use of property shall be only to the extent that the obligations recognized in this subsection (1) are exceeded in a particular case and then only to the extent that the claimant has not volunteered his services or property without compensation.

(2) No personal services may be compensated by the state or any subdivision or agency thereof, except pursuant to statute or local law or ordinance.

(3) Compensation for property shall be only if the property was commandeered or otherwise used in coping with a disaster emergency and its use or destruction was ordered by the governor or a member of the disaster emergency forces of this state.

(4) Repealed, L. 77, p. 1176, § 2, effective January 1, 1978.

(5) The amount of compensation shall be calculated in the same manner as compensation due for taking of property pursuant to eminent domain procedures, as provided in articles 1 to 7 of title 38, C.R.S. 1973.

(6) Nothing in this section applies to or authorizes compensation for the destruction or damaging of standing timber or other property in order to provide a firebreak or applies to the release of waters or the breach of impoundments in order to reduce pressure or other danger from actual or threatened flood.

(7) The state and its agencies and political subdivisions and the officers and employees of the state and its agencies and political subdivisions shall not be liable for any claim based upon the exercise or performance or the failure to exercise or perform an act relating to the combatting of grasshopper infestation of this state except for negligence or willful disregard of the rights of others, and then only to the extent of one hundred thousand dollars for any injury to or damage suffered by one person and the sum of three hundred thousand dollars for an injury to or damage suffered by two or more persons in any single occurrence (except in such latter instance, no person may recover in excess of one hundred thousand dollars). This subsection (7) is the total extent of liability of the state and its agencies and political subdivisions and the officers and employees of the state and its agencies and political subdivisions with regard to combatting of grasshopper infestation of the state and abrogates any common law cause of action thereto. Except to the extent of insurance coverage, no person acting as a contractor with the state or any of its political subdivisions, or any officer or employee of such contractor, shall be liable on any claim alleging strict liability on contract or tort for actions taken relating to combatting grasshopper infestation of the state under this part 1 or under House Bill No. 1001, enacted at the second extraordinary session of the fifty-first general assembly.

Source: R & RE, L. 73, p. 417, § 1; C.R.S. 1963, § 24-1-11; L. 77, p. 1176, § 2; L. 78, 2d Ex. Sess., p. 5, § 1; L. 79, p. 1640, § 49.

Cross reference. As to compensation benefits to volunteer workers, see § 28-2-201 et seq.

Section does not create right to make claim for compensation in district court. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1082 (1979).

Section is merely declarative of already existing right of a citizen to prevent his claim against the state to the general assembly by way of special or private bill. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1082 (1979).

Plaintiff is entitled to hearing to present evidence that government destroyed her property unnecessarily under the Colorado disaster emergency act. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1082 (1979).

But prior hearing not required in emergency situation. Although ordinarily, notice and hearing must be given before the property is taken, when an emergency situation exists and it is necessary for the protection of the public health, safety, or welfare for the state to take immediate action, due process is satisfied if the property owner is given the opportunity to challenge the act of the state after the taking. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1082 (1979).

And no compensation due landowner. When property is taken by the state or one of its political subdivisions under circumstances of imminent necessity, the failure justly to compensate the owner does not violate § 15 of art. II, Colo. Const. Srb v. Board of County Comm'rs, 43 Colo. App. 14, 601 P.2d 1082 (1979).

28-2-112. Communications. The state communications coordinator, in accordance with the provisions of part 9 of article 30 of title 24, C.R.S. 1973, and working in coordination with the division, shall ascertain what means exist for rapid and efficient communications in times of disaster emergencies. Operational characteristics of the available systems of communications shall be evaluated by the division, and recommendations for modifications shall be made to the communications coordinator. It is the intent of this section that adequate means of communications be available for use during disaster emergencies.

Source: R & RE, L. 73, p. 417, § 1; C.R.S. 1963, § 24-1-12.

28-2-113. Mutual aid. (1) Political subdivisions not participating in interjurisdictional arrangements pursuant to this part 1 nevertheless shall be encouraged and assisted by the division to conclude suitable arrangements for furnishing mutual aid in coping with disasters. The arrangements shall include provision of aid by persons and units in public employ.

(2) In passing upon local disaster plans, the governor shall consider whether they contain adequate provisions for the rendering and receipt of mutual aid.

(3) It is a sufficient reason for the governor to require an interjurisdictional agreement or arrangement pursuant to section 28-2-108 that the area involved and political subdivisions therein have available equipment, supplies, and forces necessary to provide mutual aid on a regional basis and that the political subdivisions have not already made adequate provision for mutual aid; but, in requiring the making of an interjurisdictional arrangement to accomplish the purpose of this section, the governor need not require establishment and maintenance of an interjurisdictional agency or arrangement for any other disaster purposes.

Source: R & RE, L. 73, p. 418, § 1; C.R.S. 1963, § 24-1-13.

Am. Jur.2d. See 54 Am. Jur.2d, Military, and Civil Defense, § § 354, 355.

C.J.S. See 57 C.J.S., Militia, § § 2, 26.

28-2-114. Weather modification. The division shall keep continuously apprised of weather conditions which present danger of precipitation or other climatic activity severe enough to constitute a disaster. If the division determines that precipitation that may result from weather modification operations, either by itself or in conjunction with other precipitation or climatic conditions or activity, would create or contribute to the severity of a disaster, it shall recommend to the executive director of the department of natural resources, empowered to issue permits for weather modification operations under article 20 of title 36, C.R.S. 1973, to warn those organizations or agencies engaged in weather modification to suspend their operations until the danger has passed or recommend that said executive director modify the terms of any permit as may be necessary.

Source: R & RE, L. 73, p. 418, § 1; C.R.S. 1963, § 24-1-14.

PART 5

DISASTER RELIEF

28-2-501. Power to make rules. The governor is authorized to make rules and regulations necessary to carry out the purposes of this part 5, including, but not limited to, standards of eligibility for persons applying for benefits; procedures for applying and administration; methods of investigating, filing, and approving applications; and formation of local or statewide boards to pass upon applications and procedures for appeal.

Source: L. [illegible], p. 1384, § 2.

28-2-502. Emergency relief. (1) In an emergency, the governor may provide assistance to save lives and to protect property and public health and safety.

(2) The governor may provide such emergency assistance by directing state agencies to provide technical assistance and advisory personnel to the affected state and local governments in giving:

(a) Aid in the performance of essential community services, warning of further risks and hazards, public information and assistance in health and safety measures, technical advice on management and control, and reduction of immediate threats to public health and safety; and

(b) Assistance in the distribution of medicine, food, and other consumable supplies or emergency assistance.

(3) In addition, in any emergency, the governor is authorized to provide such other assistance under this part 5 as he deems appropriate.

Source: L. 77, p. 1384, § 2.

28-2-503. False claims - penalties. Any person who fraudulently or willfully makes a misstatement of fact in connection with an application for financial assistance under this part 5 and who thereby receives assistance to which he is not entitled commits a class 5 felony and shall be punished as provided in section 18-1-105, C.R.S. 1973.

Source: L. 77, p. 1385, § 2; L. 79, p. 703, § 80.

28-2-504. Temporary housing for disaster victims. (1) Whenever the governor has proclaimed a disaster emergency under the laws of this state or the president of the United States has declared an emergency or a major disaster to exist in this state, the governor is authorized:

(a) To enter into purchase, lease, or other arrangements with any agency of the United States for temporary housing units to be occupied by disaster victims and to make such units available to any political subdivision of the state;

(b) To assist any political subdivision of the state which is the locus of temporary housing for disaster victims to acquire sites necessary for such temporary housing and to do all things required to prepare such site to receive and utilize temporary housing units by:

(I) Advancing or lending funds available to the governor from any appropriation made by the general assembly or from any other source;

(II) "Passing through" funds made available by any agency, public or private; or

(III) Becoming a copartner with the political subdivision for the execution and performance of any temporary housing project for disaster victims; and

(c) Under such regulations as he shall prescribe, to temporarily suspend or modify for not to exceed sixty days any public health, safety, zoning, transportation (within or across the state), or other requirement of law or regulation within this state when by proclamation he deems such suspension or modification essential to provide temporary housing for disaster victims.

(2) Any political subdivision of the state is expressly authorized to acquire, temporarily or permanently, by purchase, lease, or otherwise, sites required for installation of temporary housing units for disaster victims and to enter into whatever arrangements (including purchase of temporary housing units and payment of transportation charges) which are necessary to prepare or equip such sites to utilize the housing units.

Source: L. 77, p. 1385, § 2.

28-2-505. Debris removal. (1) Whenever the governor has declared a disaster emergency to exist under the laws of this state or the president of the United States, at the request of the governor, has declared a major disaster or emergency to exist in this state, the governor is authorized:

(a) Notwithstanding any other provision of the law, through the use of state departments or agencies or the use of any of the state's governmental facilities, to clear or remove from publicly or privately owned land or water debris and wreckage which may threaten public health or safety or public or private property; and

(b) To accept funds from the federal government and utilize such funds to make grants to any local government for the purpose of removing debris or wreckage from publicly or privately owned land or water.

(2) Authority under this part 5 shall not be exercised unless the affected local government, corporation, organization, or individual first presents an unconditional authorization for removal of such debris or wreckage from public or private property and, in the case of removal of debris or wreckage from private property, first agrees to indemnify the state government against any claim arising from such removal.

(3) Whenever the governor provides for clearance of debris or wreckage pursuant to subsections (1) and (2) of this section, employees of the designated state agencies or individuals appointed by the state are authorized to enter upon private land or water and perform any tasks necessary to removal or clearance operations.

Source: L. 77, p. 1386, § 2.

28-2-506. Grants to individuals. (1) Whenever the president of the United States, at the request of the governor, has declared a major disaster to exist in this state, the governor is authorized, upon his determination that financial assistance is essential to meet disaster-related necessary expenses or serious needs of individuals or families adversely affected by a major disaster which cannot be otherwise adequately met from other means of assistance, to accept a grant from the federal government to fund such financial assistance subject to such terms and conditions as may be imposed upon the grant.

(2) Notwithstanding any other provision of law or regulation, the governor is authorized to make financial grants to meet disaster-related necessary expenses or serious needs of individuals or families adversely affected by a major disaster which cannot otherwise adequately be met from other means of assistance, which grants shall not exceed five thousand dollars in the aggregate to an individual or family in any single major disaster declared by the president.

Source: L. 77, p. 1386, § 2.

28-2-507. Community loans. (1) Whenever, at the request of the governor the president of the United States has declared a major disaster to exist in this state, the governor is authorized:

(a) Upon his determination that a local government of the state will suffer a substantial loss of tax and other revenues from a major disaster and has demonstrated a need for financial assistance to perform its governmental functions, to apply to the federal government, on behalf of the local government, for a loan and to receive and disburse the proceeds of any approved loan to any local government making application therefor;

(b) To determine the amount needed by any local government making application therefor to restore or resume its governmental functions and to certify the same to the federal government; except that no application shall exceed twenty-five percent of the annual operating budget of the applicant for the fiscal year in which the major disaster occurs; and

(c) To recommend to the federal government, based upon his review, the cancellation of all or any part of repayment when, in the first period of three full fiscal years following the major disaster, the revenues of the local government are insufficient to meet its operating expenses, including additional disaster-related expenses of a municipal character.

Source: L. 77, p. 1386, § 2.

28-2-508. Bar against suits. Except in cases of willful misconduct, gross negligence, or bad faith, any state employee or agent complying with orders of the governor and performing duties pursuant thereto under this part 5 shall not be liable for death of or injury to persons or damage to property.

Source: L. 77, p. 1387, § 2.

28-2-509. Interstate compacts. The governor is authorized to enter into interstate compacts for prevention of disasters and for carrying out the purposes of this part 5.

Source: L. 77, p. 1387, § 2.

State of Colorado
EXECUTIVE CHAMBERS
DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER

COLORADO NATURAL DISASTER EMERGENCY OPERATIONS PLAN

WHEREAS, the State of Colorado may be subjected to a variety of disasters or emergencies; and

WHEREAS, it is the statutory responsibility of each county to maintain a disaster emergency plan and response agency, and of each political subdivision to be within the jurisdiction of such an agency, (Colorado Disaster Act of 1973); and

WHEREAS, the State of Colorado should be prepared to respond to the effects of such emergencies and disasters; and

WHEREAS, the effects of such emergencies and disasters may be mitigated by effective planning and operations; and

WHEREAS, this plan represents an initial step in what must necessarily become a continuous planning process; and

WHEREAS, such planning and operations should be a coordinated effort of all state departments and agencies; and

WHEREAS, the coordinated effort may best be obtained through the Division of Disaster Emergency Services, Department of Military Affairs; and

WHEREAS, the coordinated effort may include functions which cut across normal departmental or agency lines;

NOW, THEREFORE, BY THE AUTHORITY VESTED IN ME AS GOVERNOR, IT IS HEREBY PROMULGATED AND ISSUED:

that the State of Colorado Disaster Emergency Operations Plan shall specify the response tasks of state government in support of local agencies and foster interagency continuity of response in the protection of life and property;

AND IT IS FURTHER ORDERED:

1) that each department or agency assigned tasks within this plan will prepare a departmental internal plan and standard operation procedures (SOP's) and provisions for carrying out the various emergency functions, and supporting documents on a current basis;

2) that departmental internal plans be completed and submitted to the Division of Disaster Emergency Services for review and revision by June 1, 1978;

3) that upon completion of review by the Division of Disaster Emergency Services, internal plans shall be returned to their respective departments where approval of the department head, designated by his signature, shall constitute adoption;

4) that all adopted departmental internal plans shall be filed and maintained by the Division of Disaster Emergency Services;

5) that following the receipt of all departmental internal plans, the Division of Disaster Emergency Services shall develop an operational field document which shall delineate a statewide initial notification and communications network;

6) that all other departments or agencies not charged specifically in this plan with a role in emergency or disaster operations will carry out whatever functions the Governor shall specify;

7) that every state department or agency will appoint a department or agency disaster coordinator and furnish that name to the Division of Disaster Emergency Services, along with a copy of its internal department plans and SOP's;

8) that in the event the Governor declares a state of emergency or disaster, the Colorado State Patrol, assisted by other law enforcement departments or agencies, including the Colorado National Guard, will, at the direction of the Governor, be empowered to assist or aid any Sheriff, or other peace officer, in the performance of his duties upon his request or the request of other local officials having jurisdiction;

9) that the Division of Disaster Emergency Services be responsible for overseeing and coordinating the development of local disaster emergency preparedness planning;

10) that the Division of Disaster Emergency Services submit periodic reports to the Governor, outlining the condition of Colorado's disaster emergency response system highlighting the deficiencies and problems so that they may be addressed as needed;

11) that any Executive Order in conflict with this order is hereby rescinded.

GIVEN under my hand and the Executive Seal of the State of Colorado, this twenty-first day of April, A.D., 1978

Richard D. Lamm
Governor