Flood Hazard Mitigation Plan

"The August 12, 1991 Flood"

City of Canon City
Colorado Department of Local Affairs
Division of Local Government
Office of Emergency Management

August 1993

Canon City Flood Hazard Mitigation Plan

"The August 12, 1991 Flood"

City of Canon City
and
Colorado Office of Emergency Management
Disaster Preparedness Improvement Grant Program

by

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August 1993

Acknowledgment of Federal Emergency Management Agency (FEMA) support - Federal Funds from the Federal Emergency Management Agency under assistance agreement award identification number 92-3-2500-4120-2-9081. The contents do not necessarily reflect the views and polices of the Federal Emergency Management Agency, nor does mention of trade names or commercial products constitute an endorsement or recommendation for use.

Acknowledgments

Roger Jensen, ***Mayor***
Barry Singleton, ***Mayor Pro Tem***

City Council

John Battin
Ruth Carter
Tom Ledbetter
Mike Starika
Gail Thomas
Glen Vaughn

City Manager

Steve Thacker

Recognition is given to the following individuals for their assistance and energy in the response to the August 12, 1991 flood.

Robert Kistner
Fred Sibley
Jeff Brislawn
Scott Roscoe
Colorado Office of Emergency Management

Jim Hoar
Fremont County American Red Cross

Joe Ashby
Douglas County Emergency Management

Tom Gorman
El Paso County Emergency Management

John Nichols
Bill Berthimune
El Paso County Assessor's Office

Butch Wodishek
Pueblo Regional Building Department

David Jones
Dan Bunting
Pikes Peak Regional Building Department

Allan Brooks
Pueblo County Public Safety

Dennis Maroney
City of Pueblo

Dale Snow
Warren Crammer
Colorado Department of Transportation

Harold May & Staff
U.S. Bureau of Land Management

Fremont County Public Works Employees

Larry Lang
Mark Matulik
Brian Hyde
Colorado Water Conservation Board

Maureen Potochnik
Fremont County Emergency Services

Phil Boawn
U.S. Army Corps of Engineers

Virginia Motoyama
Steve Pratt
Federal Emergency Management Agency

Brom Hunt
National Flood Insurance Program

Dave Wells
City of Greeley

Robert Smith, Terry Fead
City of Fort Collins

Rob Jackson
City of Denver

Dayle Smith
LKA Partners

Mohamed Worayeth
D & W, Inc.

Lester Litton
Terracon Engineers

Phil Weinert
Guenther Polok
Mike Bartusek
Professional Engineers of Colorado

Thom Willard
Greeley Gas

Alan Morrice
El Paso County Department of Public Works

Richard Cherry
Architect AIA

Special recognition goes to the field personnel of these departments that responded to the August 12, 1991 flood.

Public Works ***Engineering***
Parks & Foresty ***Police***
Administration

Table of Contents

Introduction

Purpose and Scope

Canon City residents continue to lose thousands of dollars in public and private investment due to flooding. The flash flood of August 12, 1991 was a recent reminder of Canon City's continuing vulnerability. The aftermath of that storm has prompted the development of this plan which identifies steps that Canon City can take to reduce the impacts of future flooding. The Canon City Flood Hazard Mitigation Plan highlights the city's flood problem, and outlines the current and future opportunities for flood hazard mitigation in the area.

This plan focuses on the incorporated limits of Canon City that are at risk to flooding, including areas affected by the nearby Arkansas River and those subject to flash floods from arroyos and cloudbursts. However, mitigation opportunities may lie outside city boundaries, which means that certain actions may require the cooperation of Fremont County as well.

Many people contributed to the development of this document, including local community members, city leaders and officials, and State and Federal Emergency Management officials. It will require the continued cooperation of these individuals to see that the hazard mitigation proposals presented in this plan are carried through.

Community Description

Canon City lies in south-central Colorado in the foothills of Colorado's Front Range and Sangre De Cristo Mountains. Canon City is approximately 46 miles southwest of Colorado Springs in the eastern portion of Fremont County. 1990 Census estimates a population of about 12,657 people within the 7.8 square mile corporate limits. Ranching, tourism, mining, and several state prisons support the local economy.

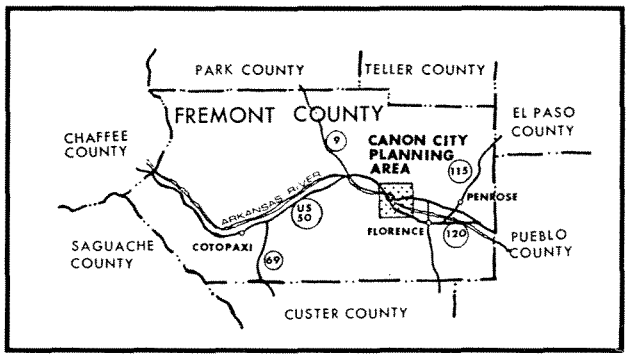


Figure 1 - Canon City Location

Commercial development is concentrated along Highway 50 and Main Street with residential areas spreading beyond. The floodplains of all the flooding sources considered in this plan are essentially fully developed. The semi-arid climate with frequent cloudbursts in the summer months of June, July, and August have produced recurrent floods of high intensity and short duration in these areas.

The August 12, 1991 Flood

Canon City's worst flood since 1965 hit hard at 3:45 p.m. on August 12, 1991. The city was yet another in Colorado to experience the devastating effects of flash flooding. Anywhere from 1 to 6 inches of rain had been reported to fall on portions of the city within a 45 minute period. Prior to this storm, the soil in the area had been saturated with water from previous rainfall, creating an ideal environment for flooding.

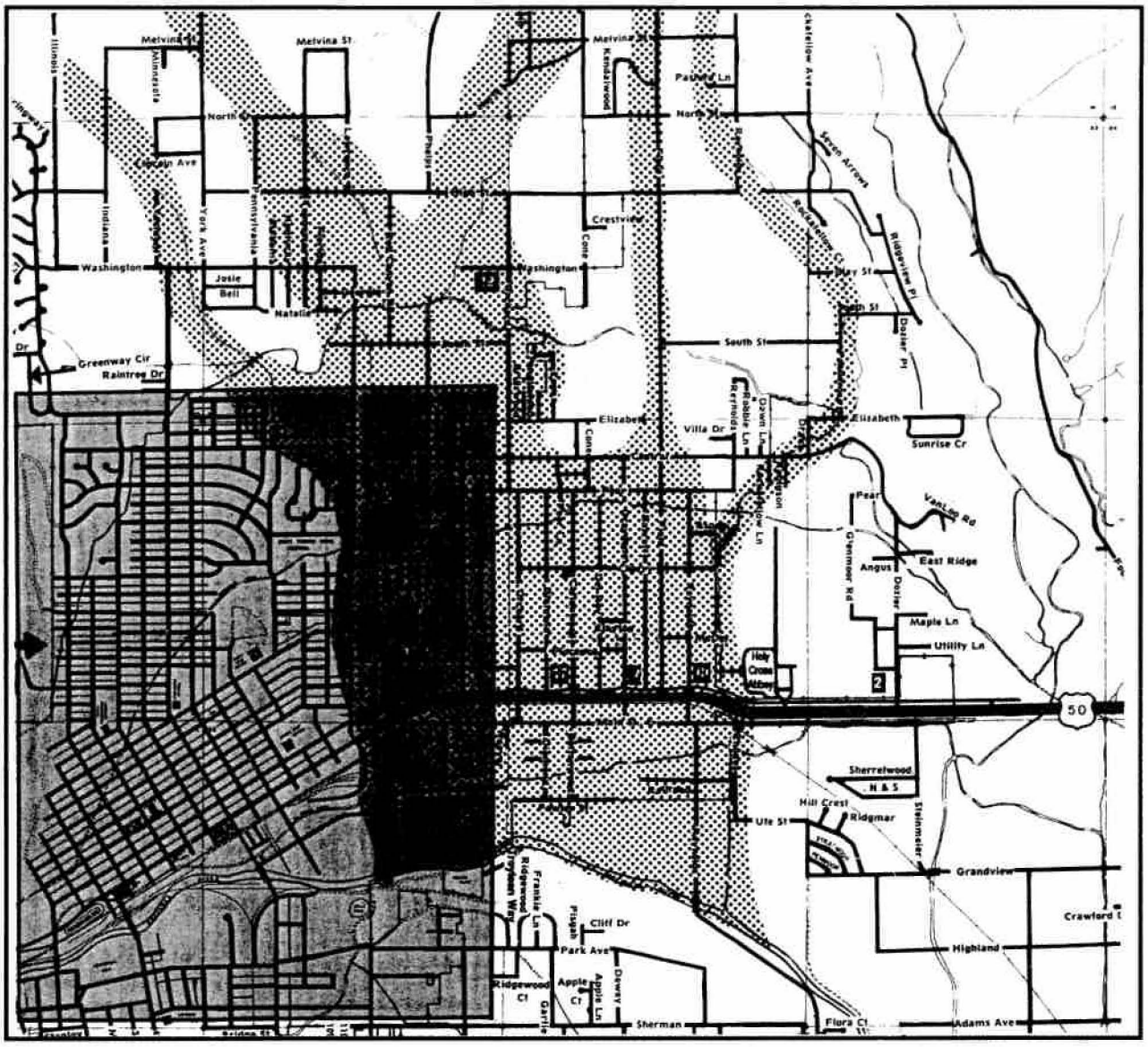


Figure 2 - Map of Flooded Area

The thunderstorm responsible for the flash flooding passed along the low foothills north of Canon City. Consequently, the brunt of the storm was concentrated in the north and east portions of the city.

Although no deaths or injuries resulted from the flooding, property damage was extensive. The dominantly residential area of northeast Canon City received the most damage from flooding. Nearly all the streets between 15th and Raynolds were flooded, damaging an estimated 135 homes. Many homes lining high-crowned roads such as Orchard, Diamond, and Barrett avenues reported flooding. Several homes along Central Avenue were hit hard from water overflowing irrigation ditches in the area. Many homeowners found several feet of water on their lawns, some of which leaked into basements by windows or doorways, but there were some incidents of entry through walls (22 basements were pumped after the storm).The flooding de-

The City of Cañon City

Box 1460

Cañon City, Colorado 81215-1460

NOTE: This questionnaire should be completed by all property owners (whether inside or outside Cañon City limits) who incurred property damage during the August 12 flood.

1. NAME:_____

1a. Owner: _____ Renter: _____ Other: _____
1b. Telephone (home)_____(work)_____

2. STREET ADDRESS OF PROPERTY DAMAGED:_____
Inside Cañon City limits:_____ Outside Cañon City limits:_____

3. NAME & ADDRESS OF PROPERTY OWNER (if different):_____

4. WHERE DID THE WATER COME FROM (How did it get into your home?) Check all that apply.

Finished Basement ____ Unfinished Basement ____ Windows ____
Walls ____ Sewer drain ____ Other (fill in)_____

5. DO YOU HAVE FLOOD INSURANCE? YES ____ NO ____ If no, go to question 8
5a. Insurance Company:_____ Policy #_____

6. PLEASE DESCRIBE THE TYPE OF DAMAGE AND VALUE:

	DESCRIPTION	VALUE
a.		
b.		
c.		
d.		

7. HAVE YOU BEEN CONTACTED BY THE RED CROSS? YES ____ NO ____

8. WOULD YOU BE INTERESTED IN RECEIVING ADDITIONAL INFORMATION ON HOW YOU CAN PREVENT DAMAGE IN THE FUTURE? YES ___ NO ____

I HEREBY AUTHORIZE THE RELEASE OF INFORMATION TO THE CITY OF CAÑON CITY, FREMONT COUNTY OFFICE OF EMERGENCY MANAGEMENT, COLORADO DIVISION OF EMERGENCY SERVICES, DISASTER PREPAREDNESS AND PLANNING AGENCIES OR THE RED CROSS, AS WELL AS INFORMATION GIVEN TO THE RED CROSS; FOR THE PURPOSE OF DISASTER PLANNING AND DAMAGE ASSESSMENT ONLY.

SIGNED:_____ DATE:_____ File No._____

Please immediately mail or bring in the completed questionnaire to the City Administrator's Office, 612 Royal Gorge Blvd., P. O. Box 1460, Cañon City, Co. 81215-1460.

Figure 3 - Flood Damage Questionnaire

stroyed fences in some areas, eroding lawns and gardens in the process. Everyone who was affected had to contend with large volumes of mud, water, and debris.

Several ditches next to Highway 50 overflowed, pouring water onto the highway over several blocks. Upper roads in the Beaver Creek area were washed out and Penrose, Colorado received considerable flooding. Some businesses along Fremont Drive, U.S. 50, and East Main Street also were flooded.

Floodwater erosion damaged roads, sewer lines, culverts, street shoulders, and drainage ditches. Some streets were stripped of pavement, including a 15 by 50 foot wide section of asphalt on South Street between 15th and Orchard. Central Avenue had to be closed for repair following the flood.

Damage Assessment

One day after the storm, the Division of Disaster Emergency Services (now Office of Emergency Management) (OEM) and Colorado Natural Hazards Mitigation Council's Flood Mitigation Subcommittee called up building officials, engineers, and others from state and local government entities to complete damage assessment in as short amount of time as possible.

Seven teams were formed (two men per team) to investigate flood damage to private homes and businesses, roads and bridges, public buildings and equipment, and utilities. A debris inventory and possibilities for emergency protective measures were also undertaken. Included in the assessment were cleanup and repair costs and any overtime hours worked by city and county officials during the emergency. The Red Cross distributed a damage questionnaire door to door, handed out cleanup kits, and developed case files for homeowners with damaged furnaces and water heaters. The questionnaire (figure 3) asked for an estimate of damage, whether the homeowner had flood insurance, and if they might be interested in receiving additional information on preventing future damage. This questionnaire was also circulated in the local

Figure 4 - Flood Damage Assessment Team

newspaper and over 153 were returned. The questionnaire database was used to guide state, city, and county officials in assisting homeowners with flood mitigation actions.

The damage assessment results shown in figure 5 indicate that private homes and businesses suffered the greatest losses from the flood. With the exception of road and culvert damage, the city and county damages were relatively minor.

DAMAGE ASSESSMENT RESULTS	
City of Canon City	$54,160
Fremont County	38,924
Fremont Sanitation District	29,680
Hydraulic Ditch	6,438
Sub Total	$129,202
An estimated 135 homes	250,000
An estimated 11 businesses	175,000
Total estimated flood damage	$554,202

Figure 5 - Damage Assessment Results

Local Disaster Declaration

The Colorado Department of Local Affairs (DOLA), Division of Local Government's (DLG) analysis of the city and county financial situation determined that Canon City, Fremont County, and the Fremont County Sanitation District could handle expenses associated with road and bridge repair and street and drainage cleanup. Thus a state disaster declaration was not necessary.

On August 28, 1991, Governor Romer during his ***"Dome on the Range"*** visit to Fremont County announced several initiatives available for residents of Canon City and Fremont County by various state, federal, and private agencies. Assistance was provided by the Office of Emergency Management (OEM), Colorado Natural Hazards Mitigation Council, and federally supported Community Development Block Grant funds for flood clean-up and protection measures for residences and businesses.

Flood Recovery Assistance

Canon City Government Activities

During the flooding event, city crews were on the streets assisting home and business owners in response activities. They assisted in the pumping of basements and crawl spaces. The City of Colorado Springs provided pumps and other equipment. The U.S. Bureau of Land Management provided crews to assist in response and recovery efforts of home and business owners. The city picked up debris for two weeks. A local gas company inspected furnaces and water heaters. City staff provided handouts at City Hall concerning cleanup, repair and mitigation for home and business owners. The local newspaper reported types of assistance available, phone numbers, con artist warning, and buried utilities warning.

Red Cross Activities

In addition to participating in damage assessment the Red Cross provided clean-up kits and other needed items for victims. The Red Cross worked directly with several homeowners in the flood inundation area. Many homes suffered damage to furnaces and water heaters located in crawl spaces. These homes were constructed in the flood plain with no basements, however, the crawl spaces beneath the homes filled with mud and water during the event. It became urgent that the furnaces and water heaters become usable due to chilly fall evenings. The local gas services company and Red Cross in a partnership quickly provided service and funding for necessary repairs and

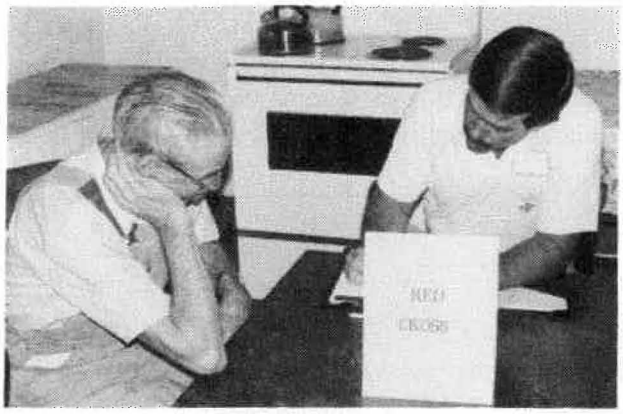


Figure 6 - Red Cross Issued Furnace Repair Funds

or replacement. The Red Cross was able to issue up to $1,500 for assistance to each family for flood expenses (including water heaters and furnaces) regardless of income levels.

Upper Arkansas Valley Council of Governments

The Upper Arkansas Valley Council of Governments administers the Community Development Block Grant Program (CDBG). This program provides grants to units of local government such as Fremont County through Chaffee County as the lead agency. Eligible activities include housing rehabilitation. Persons receiving the assistance must be low-income. Under this program up to $5,000 grants could be issued to low-income households. A dollar match on the part of the city/county would be required, however, it was decided that funds already used in flood recovery could qualify as match money.

Canon City Flood Recovery & Mitigation Workshops

The first workshop was conducted during the morning of September 5, 1991 at the Canon City Hall. Attendees included city and county officials, building officials, planning and zoning, engineers and architects. The morning workshop was restricted to public officials and topics of discussion were:

- Canon City Disaster Statistics
- Flood plain Management
- Building Permits in Flood plain
- National Flood Insurance Program
- Studies/Projects Identification & Development
- Project Funding
- Flood Hazard Mitigation Planning

The meeting organized and encouraged city, county, and state officials to pool together resources to offer assistance to the community.

On the evening of September 5, 1991, a flood mitigation workshop was conducted at the Canon City Hall. Governor Romer's Colorado Natural Hazards Mitigation Council Flood Mitigation Subcommittee and the Colorado Association of Storm water and Flood plain Managers provided qualified engineers and architects (no charge) to homeowners for flood mitigation assistance. Several tables were manned by the professionals who aced as counselors for concerned citizens. Victims were encouraged to bring photos of their homes and problem areas for the professional

Figure 7 - Flood Protection & Planning Workshop

Figure 8 - CWCB Officials Advise Homeowners

engineer/architect to advise certain mitigation techniques (corrective measures) to lessen the effects of future flooding. The professionals were instructed to not ***"dictate"*** the one best mitigation solution. One of the objectives of the flood mitigation table was to ***"build an attitude"*** so the client becomes interested in mitigation. Research has shown that advisory programs are more effective if they make the client start thinking and make his/her own decisions. Professionals were instructed to use terms like, ***"this has worked for others in your situation"*** or ***"your neighbor did this and it worked."*** They were also instructed to recommend that the client/victim seek a professional expert if he or she is considering dry flood proofing a basement and to use professionals for projects like raising a house or reworking the electrical

Figure 9 - Attendees Discuss Flood Problems

system. Personal contact is very important when advising people about mitigation. All entrants to the session were given a manual entitled "**Following A Flood**" to help with

Figure 10 - Homeowners Receive Assistance from Engineers

questions concerning flooding. Additionally, a questionnaire was given to home and business owners who had sustained damage to their property. The questionnaire focused on the extent of their property damage and if they had flood insurance.

Lessons Learned

Some valuable lessons were learned from this event, including:

- ☐ Upstream jurisdictions and property owners don't automatically look out for downstream interests;
- ☐ Keeping officials and citizens focused on the flood problem is difficult as inertia is lost with passing time;
- ☐ Sustained mitigation efforts are victimized by turnover in elected officials; an organization (i.e. committee, board, task force) that will survive a turnover is needed.

Canon City Flood History

Canon City has experienced numerous floods over the past 100 years, the impact of which has increased in recent years due to continued development in flood plains. Flooding in Canon City is of two types: intermittent streams/arroyos and riverine flooding. The general location of flood hazard areas are illustrated in figure 11 based on information from the Federal Insurance Administration (source: Canon City Comprehensive Plan).

Intermittent Stream/Arroyo Flooding

Canon City 's semi-arid climate, sparse vegetation, and potential for intense cloudbursts make it most vulnerable to flash flooding. Nearby slopes have sparse foliage cover and are not able to absorb much moisture following intense thundershowers. When intense thunderstorms occur, many creeks/arroyos

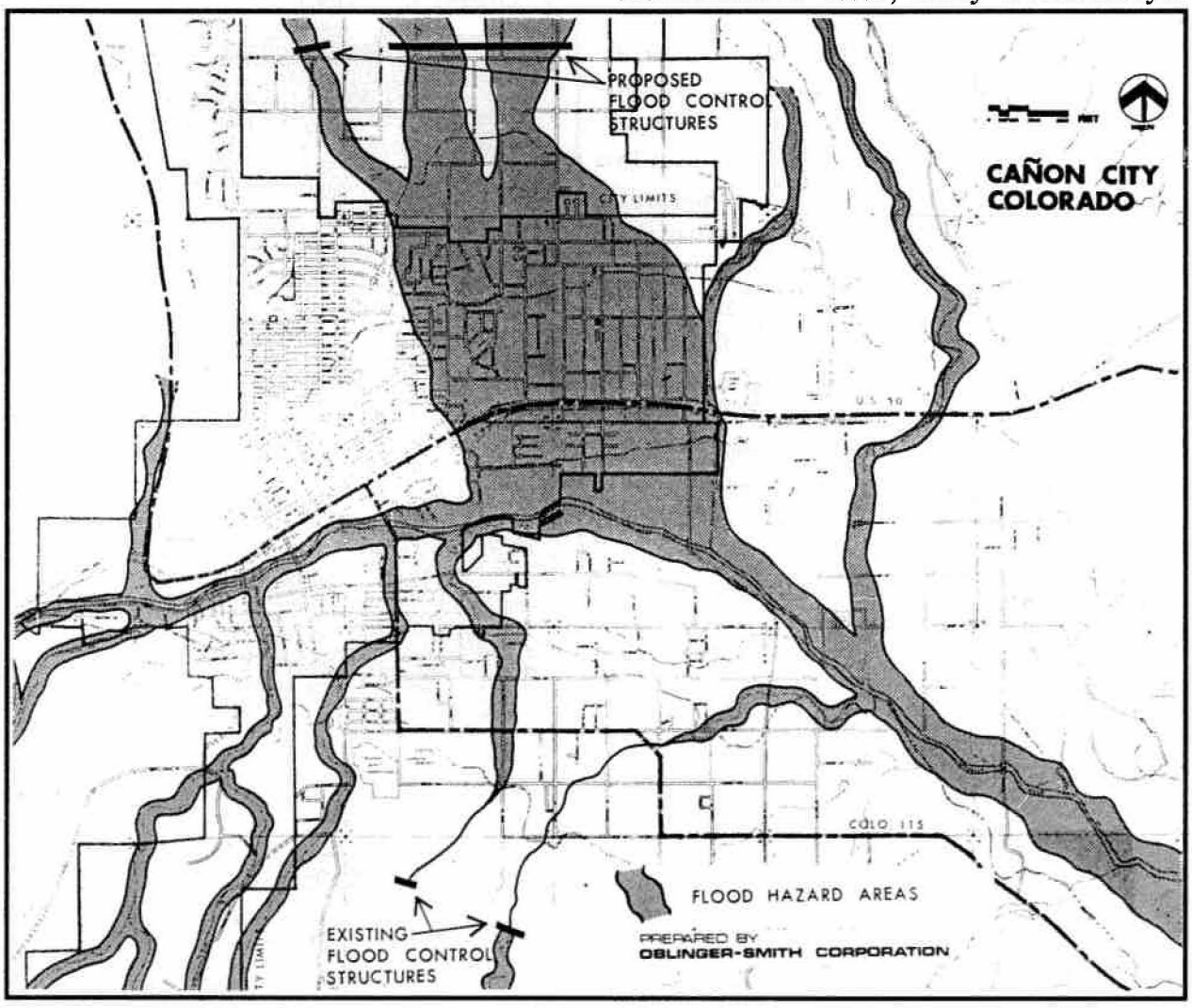


Figure 11 - Flood Hazard Areas (Canon City Comp Plan 1980)

flow into the city, much of which lies in the 100 year flood plain in the base of a watershed (see figure 11). These torrents are easily dispersed over large areas of land when they converge on the relatively flat to gently sloping terrain of the urbanized area of Canon City.

Information from local residents, newspaper files, and the Weather Bureau shows that flash flooding has occurred in 1906, 1921, 1929, 1930, 1934, 1935, 1947, 1948, 1954, 1956, 1957, 1961, 1965, 1966 and 1974. The 1974 flood caused $380,000 in damages. In 1969 a watershed flood control plan was authorized to reduce damage to agricultural land and structures. Between 1969 and 1972 two flood control structures were built south of the Lincoln Park area to slow down the floodwaters and reduce the flood plain size (see figure 12). Plans for similar structures north of Canon City were changed because the land rights could not be obtained. However, due to considerable damage to the north Canon City area during the 1974 flood the Canon City Watershed Project/diversion dam option was again considered, but met with opposition from the local community. That project may no longer be feasible due to development of the proposed detention structure area.

Arkansas River Flooding

Although the Arkansas River is the largest water body in the city it does not represent as severe a threat as do intermittent streams/arroyos. This is due to the predominant forest vegetation of the Upper Arkansas River Basin which absorbs much of the runoff, and the mountains which act as a flood barrier. However, the Arkansas River has flooded parts of Canon City before from spring snow melt, --often augmented by rain-- or summer thundershowers.

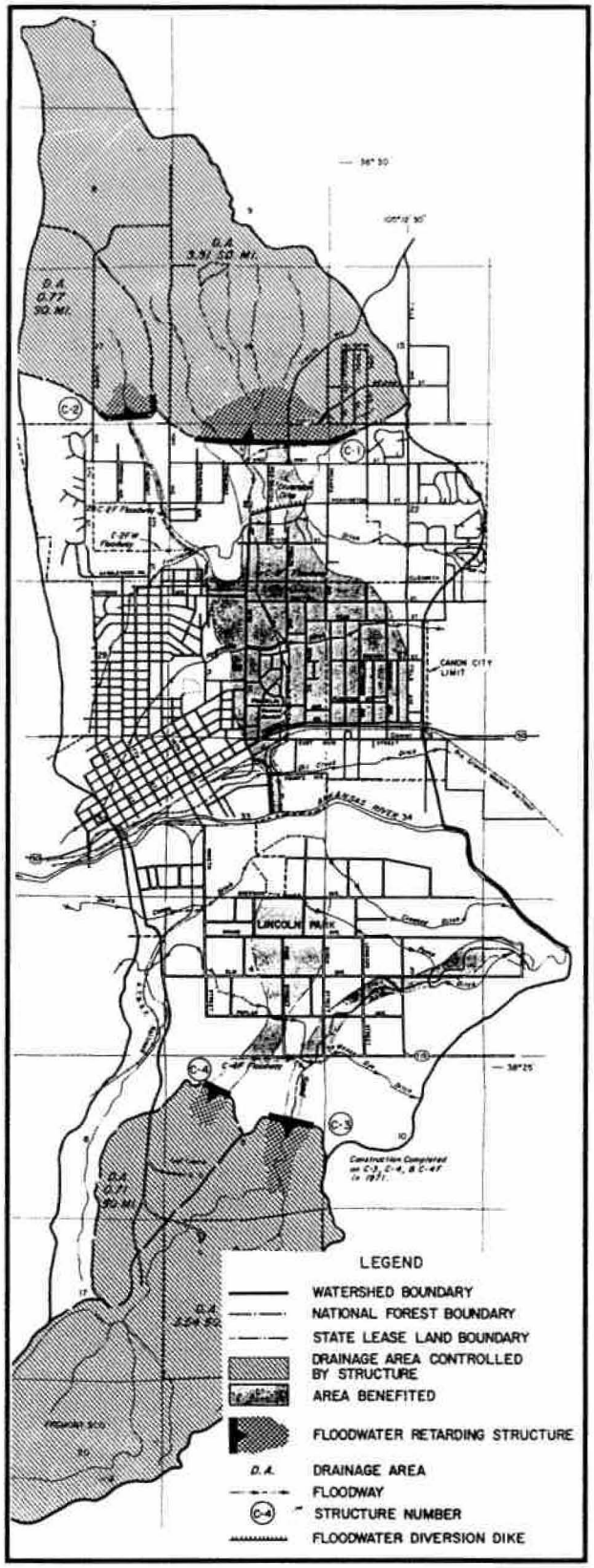
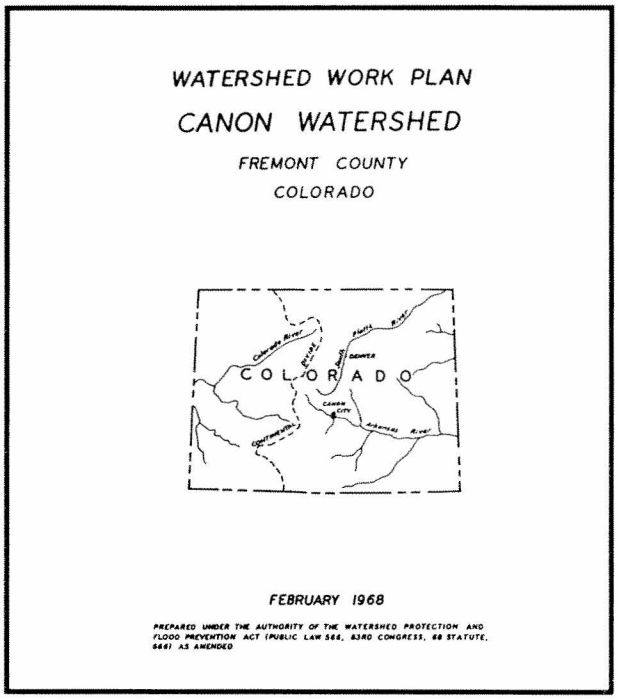


Figure 12 - Canon City Watershed and Proposed Improvements


WATERSHED WORK PLAN

CANON WATERSHED

FREMONT COUNTY

COLORADO

COLORADO

FEBRUARY 1968

PREPARED UNDER THE AUTHORITY OF THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT (PUBLIC LAW 566, 83RD CONGRESS, 68 STATUTE, 666) AS AMENDED

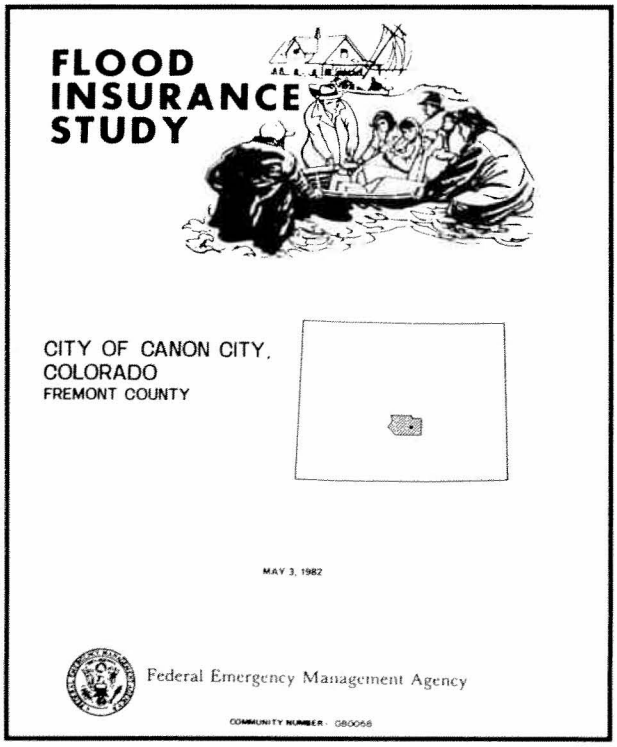
The Arkansas River has flooded in 1909, 1921 1933, 1941, 1957, 1965 and 1974. Peak discharges for these events never exceeded the ten year flood peak discharge. However, these floods have disrupted highway and railroad traffic, disturbed communications, drowned livestock, destroyed agricultural land, roads, bridges and buildings. Several lives have been lost and numerous others injured.

The 1921 flood caused the most damage as it reached a discharge of 19,000 cubic feet per second. The event flooded many streets and washed away several bridges. The floods of 1909, 1933, 1941, 1947, and 1965 washed out many bridges, including the railroad through Royal Gorge, and inundated as much as 200 acres of land between Canon City and Florence.

Canon City Flood plain Designation

In 1968, the Soil Conservation Service mapped the 100 year flood plain. The flood plain included the area from the northern border of the city reaching south to the Arkansas River; and from Yale Place on the western border to Raynolds Avenue to the east. This area includes two (2) drainage basins: (1) the Northeast Canon Basin, and (2) the Orchard Avenue Basin. The study also designated areas adjacent to the Arkansas river as well as the adjacent areas of streams that flow into the river from the South.

In 1982, a Flood Insurance Study was performed for FEMA, including a flood map update. However, only the Northeast Canon Basin was re-mapped. The 100 year flood plain was reduced in this basin. The Orchard Avenue Basin was not updated and, therefore, presently has no FEMA designated floodplain within the City limits. The most recent flood has proven current mapping to be incomplete, since many areas outside the FEMA designated flood plain were flooded in 1991 (i.e., in the Orchard Avenue Basin).


FLOOD INSURANCE STUDY

CITY OF CANON CITY, COLORADO
FREMONT COUNTY

MAY 3, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 080056

Flood Hazard Mitigation Activities

Canon City Mitigation Efforts

To reduce social and economic costs from flooding, Canon City has enacted many measures to protect life and property from flood losses. These measures were enacted by the city prior to the most recent floods, some over 20 years ago. This section highlights the past, current, and future opportunities for flood hazard mitigation in Canon City.

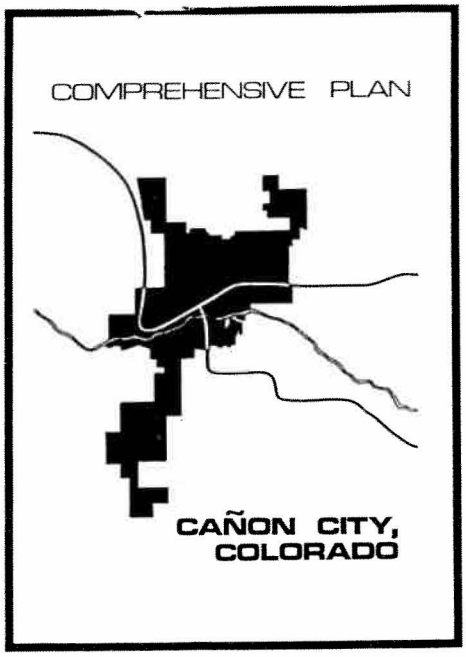
Canon City flood hazard mitigation essentially began with the authorization of The Canon City Watershed Project in 1969, which identified flood prone areas and appropriate flood control structures and development regulations. This plan resulted in the reduced risk to flooding in the Lincoln Park area due to flood control structures.

In 1974 Canon City entered the emergency phase of the National Flood Insurance Program and enacted subsequent flood plain regulations. In 1980 the city updated flood plain regulations with participation in the regular phase of the National Flood Insurance Program following in 1982. Today there are 29 flood insurance policies in Canon City.

In 1980, the Canon City Comprehensive Plan was written including a section on flood hazards.

1991 - 92 Activities

The City of Canon City continues to aggressively pursue steps towards reducing the flood



hazard. A flood mitigation work plan including an emergency response plan and maintenance of existing drainage systems has been prepared. Development in the flood plain is rigidly enforced to the flood plain management standards as adopted by the city. City staff are taking a strong position on drainage evaluation for new development and have encouraged County Officials to do the same.

The City has undertaken a maintenance program of cleaning drainage ways using inmates and city/county cooperation. The National Flood Insurance Program (NFIP) Community Rating System (CRS) provides lower flood insurance premiums for jurisdictions who ***"go the extra mile"*** in flood plain management. Persons purchasing flood insurance within the city are enjoying lower premiums, thanks

to recent efforts of Canon City Staff to qualify for the CRS discounts. City officials have also requested assistance from the U.S. Army Corps of Engineers to study problems in one basin of the city, and recently hired an engineering firm to prepare a drainage master plan and design initial improvements in another basin.

Canon City - 1993 Flood Preparedness Activities

During May of 1993, the Colorado Office of Emergency Management conducted a flood preparedness meeting with Canon City officials and homeowners. Earlier snowpack conditions in the Arkansas River Basin indicated a potential for flooding in Canon City. The meeting was similar to others that had been held around the state in preparation for spring floods expected as a result of the higher than average snowpack in the mountains.

The Office of Emergency Management was accompanied by the Federal Emergency Management Agency (FEMA) and the American Red Cross representing the volunteer agencies in Colorado. Over 50 residents of Canon City attended the evening meeting in council chambers. Officials and residents were informed of inexpensive ways to reduce damages to property. Building brick walls around window wells and entrances to basements is one way to protect against flooding. Several persons inquired about sewer back-up and other problems related to the flood of 1991. Many questions regarding flood insurance were also answered.

Action Items for Canon City

There are many ways to reduce flood hazards. These include wise land use planning, drainage improvements, structural improvements, emergency preparedness, and public awareness and education. Most community flood hazard planning should contain all these elements. However, this report, compiled over a year after the August 1991 flood, has identified that Canon City is still very much at risk. Only a few residents have implemented the suggested mitigation measures to protect their homes and property. More public assistance may be necessary for structural mitigation actions to occur. The Colorado Office of Emergency Management has prepared a list of suggestions that Canon City can take to mitigate flood hazards.

ACTION ITEM	AGENCY RESPONSIBLE	TIME FRAME	STATUS
Inspection and maintenance program for drainage ways (mapped and inventoried).	City Public Works Dept.		Ongoing
Cleaning city and county drainage-ways	City/County		Ongoing
Require storm drainage facilities for new development	City Engineering Dept.		Ongoing
Building Code upgrade that requires new structures' floor level to be 12" and 2% above nearest drainage	City Engineering Dept.		Ongoing
City and county flood committee to develop long term, cooperative solutions	City/County	Summer/Fall 1993	
Develop Mutual Aid Program	City/County		Ongoing
Physical drainage improvements needed	City/County	1993-1997	
Develop Flood Emergency Plan	City		Completed
Fourmile Creek Flood Study	Soil Conservation Service	Fall 1993	Underway
Assistance from Army Corps of Engineers	Colorado OEM/ACOE	Initial study began Summer 1993	
Master plan and initial improvements in NE Canon Basin	City	1993	Underway
FEMA flood mapping for Orchard Avenue Basin	FEMA		City evaluating need for mapping
GIS implementation with CAD system	City Engineering Dept		Under Consideration
Discouraging furnace and water heaters in basements	City Engineering Dept		Ongoing
Construct detention ponds on upper WPA drainage-way	City/SCS	Summer 1993	
City and County storm water utility	City/County	Spring 1994	Under Consideration
Join CRS community rating system	City Engineering Dept.	Initial discounts achieved. Working towards further discounts.	
Develop camera ready flood information for local newspaper	City	Summer 1993	
Flood brochure - what to do before, during, after a flood	City	Spring 1993	
Advise to property owners re: mitigation Measures	City Engineering Dept.		Ongoing

Figure 13 - Flood Hazard Mitigation Activities

Flood Insurance

In 1968 the U.S. congress established the National Flood Insurance Program (NFIP). The NFIP is designed to benefit both individuals and the communities in which they live. It enables all property owners to purchase flood insurance at reasonable rates, and it requires communities to adopt and administer local flood plain management measures aimed at protecting lives and new construction from future flooding. Through this mechanism, the Federal Emergency Management Agency (FEMA) and participating communities are able to reduce future flood losses. The adoption and enforcement of flood plain regulations, however, is not only a prerequisite for entering the program, it is also a condition for staying in the NFIP. Communities have been suspended from the regular program in the State of Colorado for not enforcing adopted flood plain ordinances.

Canon City has only 29 flood insurance policies, yet many more buildings are located in the designated 100 year flood plain. Also, many homes that had flood damage in the recent event were not located in the FEMA-specified 100 year flood plain. It is not likely that the area will be re-mapped by FEMA any time soon, therefore, any new flood protection measures must be taken by the community and the individual citizens.

Recommendations for Increasing Participation in the National Flood Insurance Program for Canon City

- Determine which buildings are located in the FEMA-specified 100 year flood plain.
- Contact building owners in the FEMA-specified 100 year flood plain through the mail, personal visits or telephone calls. Educate citizens on the benefits of flood insurance. Encourage them to buy flood insurance within six months. Inform them that a follow up check will be made in six months.
- After six months, inform all lending institutions of non-flood insured buildings located in the 100 year flood plain.
- Map the boundaries of the recent flood and enact Canon City regulations requiring flood insurance within that area.
- Implement a mass flood awareness campaign aimed at all Canon City residents on the benefits of flood insurance.

Flood plain management

Wise land-use and public acquisition of flood hazard property are often the most cost-effective means of flood hazard mitigation. Effective land use, for example, can provide very high net benefits and can significantly lower future catastrophic flood loss potential. When carefully planned and implemented, land use decisions can generate enormous savings in life and property over relatively few years.

Continued participation in the NFIP by Canon City mandates the regulation of the construction of new structures, significant improvement to homes, and the reconstruction of damaged structures in the 100-yr flood plain.

If a structure already located in the 100-year flood plain is damaged for <u>any</u> reason (fire or flood) and requires repairs valuing more than 50% of market value, it will have to be proven conclusively that there will be <u>no</u> increase in flood levels due to the improvement. Without such proof, repairs to the property are prohibited and alternative solutions will have to be sought.

Emergency Preparedness and Flood Warning

Spotter network for Canon City

One of the most exciting opportunities for flood hazard mitigation in is the development of a local spotter network. A network of selected volunteer observers in the vicinity could be designated to monitor rainfall amounts and stream levels in the Canon City watersheds. This network of manned rainfall observation stations would monitor local rainfall with standardized Rain Gauges so all records could be correlated and compiled into evidence for informed decision-making.

In this proposed system, records would be kept of daily rainfall but only heavy rainfall accumulations would be relayed to a designated coordinator who could then effectively calculate the potential for flood hazard. Rainfall information would be supplemented by stream gauges placed at strategic points along the major tributary streams.

Floodproofing for Business and Homeowners

Many of the floodproofing techniques that keep water away from a residence, such as flood walls, levees, and structural sealing, may require special treatment for openings such as doors, windows, driveways, etc. These closures act as shields to cover the gap and prevent water from entering, and can be of a variety of shapes, sizes, and materials.

In some cases closures are permanently attached using hinges so that they can remain open when there is no flood threat. They may be portable, normally stored in a convenient location and slipped into place when a flood threatens. In certain situations, when flooding is of very low level, usually less than one foot, some method of enclosing low entrances such as basement doors or window wells might be a satisfactory option. In any case, there are a number of elements involved in designing and using a closure system.

In areas of shallow, low velocity flooding, closures can be used on doors, windows, vents, and other building openings. However, the first step with the use of closures placed directly on buildings is to be certain that both the closure and the wall systems are strong enough and sufficiently watertight to withstand flood pressures. The use of closures directly on a structure is considered to be part of the sealing process.

Closures can be considered as an option only if a flooding situation provides sufficient time to install the closures. The need for both warning time and "human intervention" is critical, since all closure system require personnel to install them and make certain they are properly sealed.

Closures that are stored between floods must be readily accessible. The effectiveness of an entire closure system will be compromised if the closures are stored such that flooding renders them inaccessible, or if even one closure is improperly installed.

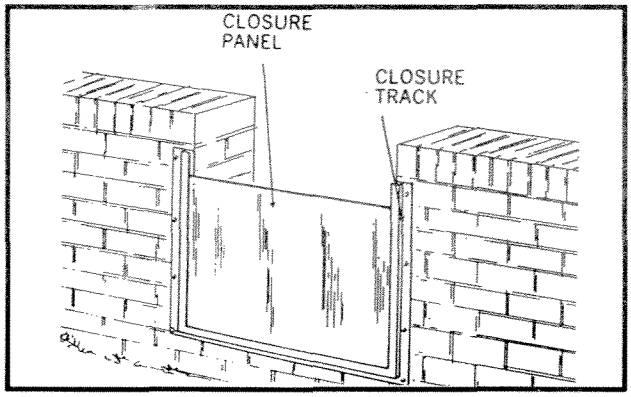


Figure 14 - Example of a 'drop-in' closure

Sandbagging Steps

1. Strip the ground of sod. Grass gets slippery when wet and your wall could be pushed along the ground by the weight of the floodwater.

2. Dig a bonding trench and lay a plastic sheet in the trench and on the flood side.

3. Fill bags 1/2-3/4 full. Don't tie them.

4. Starting in the bonding trench, lay the bags on top of the plastic sheet. Place each bag on top of the previous one's flap.

5. Lay each layer's bag at right angles to the layer below it and tamp tightly in place.

6. When you reach your flood protection level, pull the plastic sheet up in front of the wall and hold it down with more bags.

7. If strong current and debris are expected, protect your plastic sheet from ripping with another layer of sandbags.

Figure 15 - Sandbagging Steps

For most flooding situations, a homeowner should consult with a professional engineer to be certain that the closure system being planned can withstand the hydrostatic and hydrodynamic pressures that will be involved.

Low Profile Permanent Closures

For cases involving flood levels of up to two feet, a type of "mini-flood wall can be used to permanently protect various types of openings. Possible materials for this use include brick, concrete block and poured concrete. Figure 16 shows a wall around a window well. For flooding around a basement door, a low wall around the entrance may be the solution, as shown in figure 16. Though the "mini"-walls may not require the degree of reinforcing of larger flood walls, they should be supported by and securely tied onto a footing so that they will not be undercut by scouring.

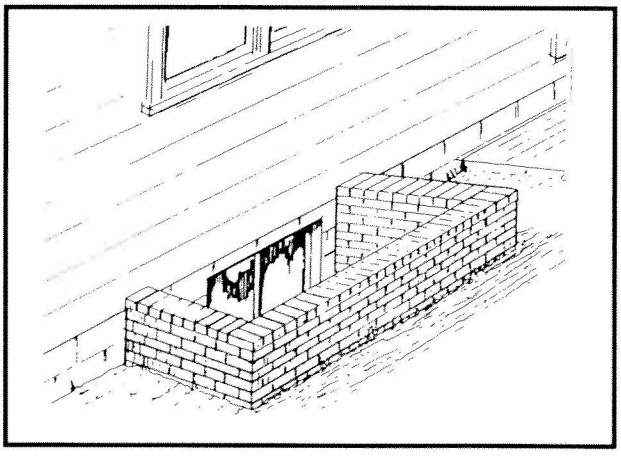


Figure - 16 - Example of a 'mini-flood wall'

Sandbagging

As a last resort or during emergencies, sandbags can keep water away from vulnerable property. However, flood proofing measures and moving contents out of the way are much more secure methods to accomplish the same

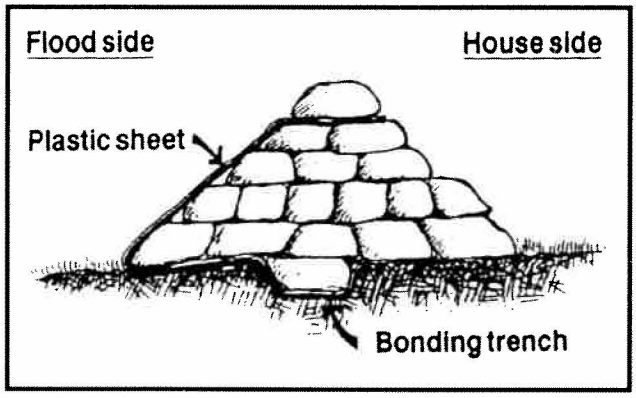


Figure 17 - Sandbag Wall Cross-Section

thing. Additionally, sandbagging can be very expensive.

A community plan for sandbagging requires buying sandbags before a flood. Get burlap or plastic sandbags. Other kinds of bags simply won't hold up. Burlap or plastic bags cost 25 to 50 cents each. Sand and plastic sheeting must also be stockpiled.

Sandbagging can also be very time consuming. It takes two people approximately one hour to fill and place 100 sandbags, giving you a wall one foot high and 20 feet long. If you skimp on the bags, you risk putting up a wall that will be knocked over.

When a flood is imminent, everyone wants to sandbag, usually because they don't know what else to do. While it does have a therapeutic effect, sandbagging should be considered only as part of an overall flood response plan, or as a last resort for individuals.

A good plan will help use your limited time and resources most efficiently. An overall flood response plan might call for sandbags to fill in any gaps in a flood wall.

State Assistance

OEM will improve the state's capability to respond to disaster response and recovery efforts by the incorporation of mitigation into disaster preparedness and recovery programs and activities. The Disaster Preparedness Improvement Grant (DPI) and Emergency Management Training (EMT) will work in unison to establish and complete training activities for emergency managers, state and local government officials, business and industry, and private citizens of Colorado.

OEM will up-date the Colorado Hazard Mitigation Plan and identify potential mitigation projects. This will be in conjunction with Colorado Natural Hazards Mitigation Council and Foundation. Projects are already being developed and funded by various state/local and private organizations.

Colorado is underway with the development of a Disaster Reservist System. OEM will prepare a Disaster Damage Assessment pocket version of the training instructions and an instructor's video training film for local governments.

References

Canon City Comprehensive Plan. Oblinger-Smith Corporation, October 1979.

City of Fort Collins Flood Hazard Mitigation Plan - "The June 24, 1992 Flood". City of Fort Collins and Colorado Office of Emergency Management, October,1992.

Daily Record, August 13, 1991.

Daily Record, August 14, 1991.

Daily Record, August 15, 1991.

Daily Record, August 17-18, 1991.

Daily Record, August 19, 1991.

Daily Record, August 20, 1991.

Daily Record, August 28, 1991.

Design Guidelines for Flood Damage Reduction. Federal Emergency Management Agency, December 1981.

Final Environmental Impact Statement, Canon Watershed Project, Fremont County, Colorado, Halstead, R. G., Soil Conservation Service, U. S. Dept of Agriculture, May 1977.

Floodplain Management Handbook. U.S. Water Resources Council, prepared by Flood Loss Reduction Associates, September 1981

Flood Insurance Study, City of Canon City, Colorado Fremont County. Federal Emergency Management Agency, May 1982.

Following a Flood...Steps to Recovery. Brochure,Federal Emergency Management Agency, November 1990.

The Pueblo Cheiftan, August 15, 1991.

Watershed Work Plan, Canon Watershed, Fremont County Colorado. Fremont Soil Conservation District, February 1968.

Appendix A - In The Event of a Flood: Tips to minimize loss of life and property

The following tips are from the Federal Emergency Management Agency Federal Insurance Administration National Flood Insurance Program and should be used as suggested guidelines for action before, during, and after a flood.

STEPS TO TAKE TODAY

- ☐ Make an itemized list of personal property, including furnishings, clothing, and valuables. Photographs of your home - inside and out - are helpful. These will assist an adjuster in settling claims and will help prove uninsured losses, which are tax deductible.
- ☐ ***Learn*** the safest route from your home or place of business to high, safe ground if you should have to evacuate in a hurry.
- ☐ ***Keep*** a portable radio, emergency cooking equipment, and flashlights in working order.
- ☐ ***Persons who live in frequently flooded areas should keep on hand materials such as*** sandbags, plywood, plastic sheeting, and lumber which can be used to protect private property. (Remember, sandbags should not be stacked directly against the outer walls of a building, since, when wet, the bags may create added pressure on the foundation.)
- ☐ ***Buy flood insurance***. You should contact your property/casualty agent or broker about eligibility for flood insurance, which is offered through the National Flood Insurance Program. Generally, there is a five-day waiting period for this policy to become effective, so don't wait until the last minute to apply.
- ☐ ***Keep*** your insurance policies and a list of personal property in a safe place, such as a safety-deposit box.
- ☐ ***Know*** the name and location of the agent(s) who issued the policies.

WHEN THE FLOOD COMES

The safety of your family is the most important consideration. Since floodwaters can rise very rapidly, you should be prepared to evacuate before the water level reaches your property.

- ☐ Keep a battery-powered radio tuned to a local station, and follow all emergency instructions.
- ☐ **If you're caught in the house** by suddenly rising waters, move to the second floor and, if necessary, to the roof. Take warm clothing, a flashlight, and portable radio with you. Then wait for help...don't try to swim to safety. Rescue teams will be looking for you.
- ☐ ***When outside the house,*** **remember.... FLOODS ARE DECEPTIVE.** Try to avoid flooded areas, and don't attempt to walk through floodwaters that are more than knee deep.
- ☐ **If, and only if, time permits...**there are several precautionary steps that can be taken.
- ☐ **Turn off all utilities** at the main power switch and close the main gas valve if evacuation appears necessary. Do not touch any electrical equipment unless it is in a dry area

and you are standing on a piece of dry wood while wearing rubber gloves and rubber soled boots or shoes.

- ☐ **Move valuable papers,** furs, jewelry, clothing, and other contents to upper floors or higher elevations.
- ☐ **Fill bathtubs, sinks and jugs with clean water** in case regular supplies are contaminated. You can sanitize these items by first rinsing with bleach.
- ☐ **Board up windows** or protect them with storm shutters or tape to prevent flying glass.
- ☐ **Bring outdoor possessions inside the house** or tie them down securely. This includes lawn furniture, garbage cans, tools, signs, and other movable objects that might be swept away or hurled about.
- ☐ **If it is safe to evacuate by car,** you should consider doing the following:
- ☐ **Stock the car with non perishable foods** (like canned goods), a plastic container of water, blankets, first aid kit, flashlights, dry clothing, and any special medication needed by your family.
- ☐ **Keep the gas tank at least half full** since gasoline pumps will not be working if the electricity has been cut off.
- ☐ **Do not drive where water is over the roads.** Parts of the roads may already be washed out.
- ☐ **If your call stalls out in a flooded area,** abandon it as soon as possible. Floodwaters can rise rapidly and sweep a car (and its occupants) away. Many deaths have resulted from attempts to move stalled vehicles.

AFTER THE FLOOD

If your home, apartment or business has suffered flood damage, immediately call the agent or broker who handles your flood insurance policy. The agent will then submit a loss form to the National Flood Insurance Program. An adjuster will be assigned to inspect your property as soon as possible.

- ☐ ***Prior to entering a building***, check for structural damage. Make sure it is not in danger of collapsing. Turn off any outside gas lines at the meter or tank, and let the house air for several minutes to remove foul odors or escaping gas.
- ☐ ***Upon entering the building,*** do not use open flame as a source or light since gas may still be trapped inside; a battery-operated flashlight is ideal.
- ☐ **Watch for electrical shorts or live wires** before making certain that the main power switch is turned off. Do not turn on any lights or appliances until an electrician has checked the system for short circuits.
- ☐ **Cover broken windows** and holes in the roof or walls to prevent further weather damage.
- ☐ **Proceed with immediate cleanup measures** to prevent any heath hazards. Perishable items which pose a health problem should be listed and photographed before discarding. Throw out fresh food and previously opened medicines that have come in contact with flood waters.
- ☐ ***Water for drinking and food preparation*** should be boiled vigorously for ten minutes (until the public water system has been declared safe). Another method of disinfecting is to mix 1/2 teaspoon of liquid commercial bleach with 2-1/2 gallons of water...let stand for five minutes before using. The flat taste can be removed by pouring the water from one container to another or adding a pinch of salt. In an emergency, water may be obtained by draining a hot water tank or melting ice cubes.

- ☐ ***Refrigerators, sofas, and other hard goods*** should be hosed off and kept for the adjuster's inspection. A good deodorizer when cleaning major kitchen appliances is to add one teaspoon of baking soda to a quart of water. Any partially damaged items should be dried and aired; the adjuster will make recommendations as to their repair or disposal. Take pictures of the damage done to your building and contents.
- ☐ **Take all wooden furniture outdoors,** but keep it out of direct sunlight to prevent warping. A garage or carport is a good place for drying. Remove drawers and other moving parts as soon as possible, but do not pry open swollen drawers from the front. Instead, remove the backing and push the drawers out.
- ☐ **Shovel out mud while it is still moist** to give walls and floors a chance to dry. Once plastered walls have dried, brush off loose dirt. Wash with a mild soap solution and rinse with clean water; always start at the bottom and work up. Ceilings are done last. Special attention at this early stage should also be paid to cleaning out heating and plumbing systems.
- ☐ **Mildew can be removed from dry wood** with a solution of 4 to 6 tablespoons of tri-sodium phosphate (TSP), 1 cup liquid chlorine bleach, and 1 gallon water.
- ☐ **Clean metal at once** then wipe with a kerosene-soaked cloth. A light coat of oil will prevent iron from rusting. Scour all utensils, and, if necessary, use fine steel wool on unpolished surfaces. Aluminum may be brightened by scrubbing with a solution of vinegar, cream of tartar, and hot water.
- ☐ **Quickly separate all laundry items** to avoid running colors. Clothing or household fabrics should be allowed to dry (slowly, away from direct heat) before brushing off loose dirt. If you cannot get to a professional cleaner, rinse the items in lukewarm water to remove lodged soil. Then wash with mild detergent; rinse and dry in sunlight.
- ☐ ***Flooded basements should be drained*** and cleaned as soon as possible. However, structural damage can occur by pumping out the water too quickly. After the flood waters around your property have subsided, begin draining the basement in stages, about 1/3 of the water volume each day.

Appendix B - Sources of Assistance

The following agencies can provide advice or assistance before, during, or after a flood.

Emergency Management

City of Canon City
City Hall
612 Royal Gorge Blvd.
Canon City, CO 81212
(719) 269-9011

Canon City Fire Dept
1475 N. 15th Street
Canon City, CO 81212
(719) 275-8666

Fremont County
Emergency Services
500 Justice Center Rd.
Canon City, CO 81212
(719) 275-2000

Colorado Office of Emergency Management
Camp George West, Bldg 120
Golden, CO 80401
(303) 273-1622

Flood Mitigation/Control Information

Colorado Water Conservation Board
1313 Sherman St, Rm 720
Denver, CO 80203
(303) 866-3441

Flood Insurance

Local Insurance Agents
Your City or County
Federal Emergency Management Agency (FEMA)
Federal Insurance Administration
Washington, D.C. 20472
(202) 646-2780
(800) 638-6620

Victim Assistance

American Red Cross
Fremont County Chapter