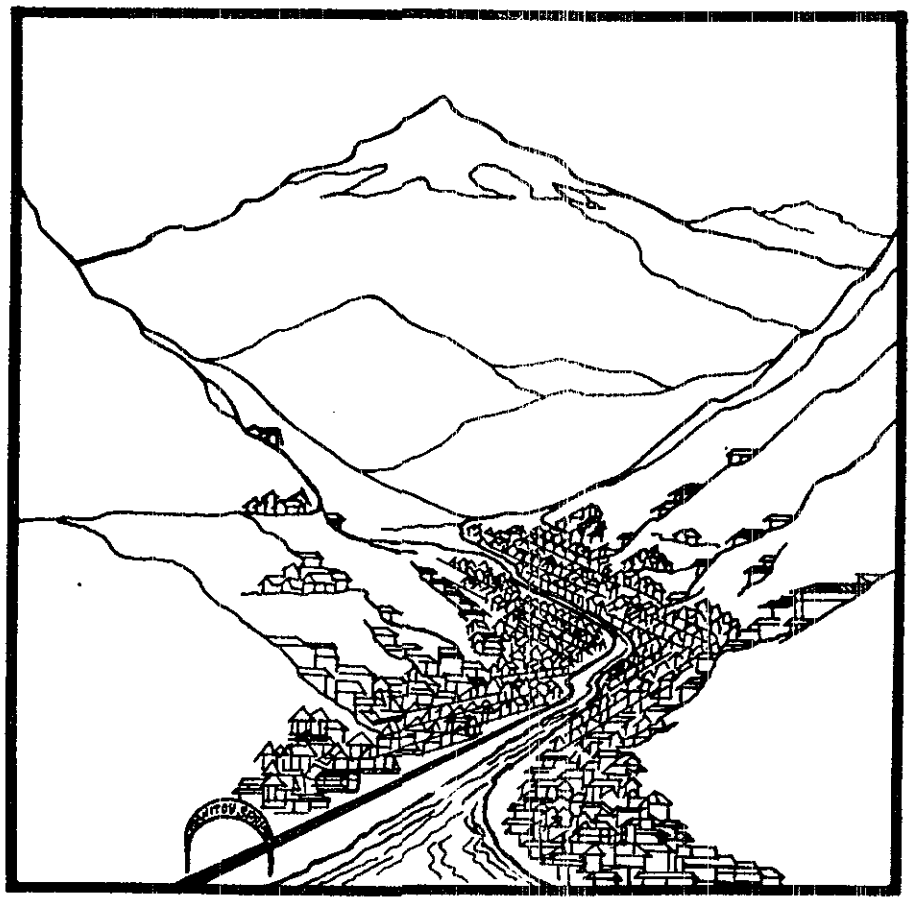
MANITOU SPRINGS FLOOD HAZARD MITIGATION PLAN

Eve C. Gruntfest

with

Pamala Weaver Rivers and Robert F. Jones



Summer 1985

Center for Community Development & Design

University of Colorado
Colorado Springs

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Project Director:

Eve C. Gruntfest, Ph.D., Assistant Professor of Geography and Environmental Studies, University of Colorado, Colorado Springs, Colorado

Project Coordinator:

Bill Leon, Ph.D., Director, Center for Community Development and Design, University of Colorado, Colorado Springs, Colorado

Research Team:

Robert F. Jones, Research Assistant, Writer, Cartographer

Pamala Weaver Rivers, Research Assistant, Writer, Editor

Carol Phelan and M. Kelly Todd, Media Assistants

Sponsored by
The Federal Emergency Management Agency
in cooperation with
The Colorado Department of Public Safety
Division of Disaster Emergency Services
and the
City of Manitou Springs

Summer 1985

Center for Community Development and Design

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ACKNOWLEDGEMENTS

Many people have been instrumental in the completion of this project. A complete list of interviews conducted is found as Appendix D of this report. These individuals willingly and generously shared their expertise, perspectives, inspiration, methodological suggestions, insights, and provided feedback on our progress through the course of the research effort. We wish to especially thank the following people.

Members of the Technical Advisory Committee actively assisted with ideas and suggestions. In particular, Jack Truby from the Colorado Division of Disaster Emergency Services, and Clancy Philipsborn, Nancy Stone, Bob Ives, Tim Maywalt, Connie Murphy, Randy Hamilton, and John Swanson from the Federal Emergency Management Agency deserve special mention for their time and attention. We also thank Brian Hyde and Bill Stanton, Colorado Water Conservation Board; Ron Cattany, Colorado Department of Natural Resources; Bob McWilliams, El Paso County Disaster Emergency Services; Alan Goins, Pikes Peak Area Council of Governments; Gary Haynes, City of Colorado Springs; and Tony Apodaca, U.S. Army Corps of Engineers. Other people who contributed valuable comments include Pat Byrne, Irwin Glassman and Pat Hagan from the Colorado Division of Disaster Emergency Services and Jerry Olson of the Federal Emergency Management Agency.

The Manitou Springs Chamber of Commerce, City Council, and public officials were always willing to answer our questions and work constructively with us. In particular we thank Paul Intemann, City Planner; Hugh King, City Manager; Harry Greenman, Police Chief; and Chris Daly, City Council member. We have also relied on the expertise and local wisdom of some of Manitou's fine citizens. Special thanks to Joanne Garrison of the Economic Development Committee for organizing community interest and for her commitment to the high quality of life in Manitou Springs.

Funding for this research was provided by the Colorado Department of Public Safety, Division of Disaster Emergency Services through a grant from the Federal Emergency Management Agency.

Mary McCutchen provided cheerful and careful word processing. Her editing and proofreading skills eased the load. Leslie O'Hara also helped with word processing duties. Carol Weissler, a student in the UCCS Natural Hazards and Public Policy class, is responsible for the partial survey of buildable lots, an introduction to which may be found as Appendix F. Thanks also for support and suggestions to Thomas Huber, Carole Huber, Joan Hassel, Betty Jones, Marc Hallahan, James Phelan, Dave Kenyon, Jeannine Phillips and Werner Jenkins.

Many others, including community members and officials, have worked closely with us. We gratefully acknowledge their assistance.

PREFACE

This research effort represents a dramatic and promising direction in floodplain management in the United States. In recent years flood losses have continued to rise despite massive funding for flood control. Federal policy has recognized this expensive discrepancy, and legislation aimed at long-term flood hazard reduction has been passed by Congress. The key change revolves around the term "mitigation". According to the Federal Emergency Management Agency, approximately 20,000 communities in the United States face flood hazards. While hundreds of these communities have developed flood hazard management plans, Manitou Springs is one of few communities which now has post-flood contingency planning possibilities to consider prior to a devastating flood.

This report makes three distinct contributions. First, it assists the community of Manitou Springs, Colorado by suggesting flood hazard mitigation strategies based on the experience of communities elsewhere in the United States. It provides an in-depth description of the city's flood history and local economic base and develops a detailed scenario of present vulnerability to the flood threat. An extensive literature review reveals how other communities with similar conditions have successfully reduced flood loss potential through warning systems, land acquisition schemes, structural flood control measures, and increased public awareness. Three characteristics which distinguish Manitou Springs from other communities are a heavy reliance on tourism as an economic base, a lack of buildable lots which are not in the floodplain or on steep hillsides, and a large percentage of historic buildings. Also, topography makes some structural projects difficult or impossible.

Second, this report provides guidelines for post-flood contingency planning for Manitou Springs, prior to a flood occurrence. Consequently, when there is a flood, local officials will have a lead on wise recovery and reconstruction planning which will reduce future potential losses.

Finally, this report suggests a methodology for post-flood planning in anticipation of floods. Research shows that post-disaster decisions must be made quickly. In addition, current legislation stipulates that disaster aid is contingent on adequate mitigation planning for reducing the threat from future events. Therefore, if local planners have a vision for community improvement, there is greater likelihood of reducing vulnerability to subsequent floods. We anticipate this methodology has applicability in other communities as well.

The strategy presented takes the local political, economic and physical realities into account, acknowledging factors which restrict such adjustments as changing the floodplain into a greenbelt or channelizing a stream. It also recognizes the opportunity a flood disaster presents for long term hazard reduction. In effect, this pre-flood/post-flood planning and implementation of steps to mitigate the hazard assures that Manitou Springs will be much less vulnerable in terms of lives lost and property damaged from a second flood.

PROJECT GOALS

A. To minimize loss of life in the event of a flash flood.

B. To minimize damage to existing development.

C. To minimize damage to FUTURE development.

D. To minimize damage to public facilities and structures and to historic buildings.

E. To minimize the public expenses for local emergency recovery and reconstruction operations.

In order to facilitate the attainment of the above mentioned goals, the following, more specific, goals must also be attained:

F. Develop and implement a specific hazard mitigation plan for Manitou Springs:

1. Organize a committee to oversee implementation and to work with technical advisors.

2. Assess the vulnerability of Manitou Springs to the flood hazard -- make a thorough survey of all structures, bridges and open spaces.

3. Select a range of mitigation strategies which have applicability to Manitou Springs; develop pre-flood AND post-flood mitigation strategies before a flood occurs.

4. Implement the pre-flood mitigation strategies as soon as possible.

5. Implement the post-flood mitigation strategies upon occurrence of flash flooding.

6. Monitor, upgrade, and streamline the mitigation plan on an ongoing basis to insure that Goals A, B, C, D, and E will always be attained.

EXECUTIVE SUMMARY

The Manitou Springs Flood Hazard Mitigation Project was funded by the Federal Emergency Management Agency. This summary provides background on the project, discusses four of the most interesting issues raised during the course of the project, presents the report recommendations, and, perhaps most importantly, sets the stage for implementation of the recommendations in Manitou Springs.

Manitou Springs is located at the base of Pikes Peak, immediately west of Colorado Springs. The year-round population is approximately 4500 people. During the summer thousands of tourists come and stay in Manitou Springs to enjoy its amenities and proximity to Pikes Peak and other attractions of the Rocky Mountain region.

Land use in Manitou Springs is constrained by the geography. The town is located along the channels of Fountain, Ruxton, Waldo, Beckers Lane, Williams, and Sutherland Creeks. Much of the remainder of the town sits on steep slopes above the floodplain. There is very little land available for development that does not face one of these hazards. Consequently, downtown Manitou Springs is built along the creeks and the floodplain is nearly fully developed. Shops, hotels, homes, and restaurants sit astride or are built partially in the floodway.

The community has had limited experience with flooding in recent memory although serious floods have occurred in the past 75 years. Manitou Springs has a floodplain ordinance and is a member of the regular phase of the National Flood Insurance program but only 32 policies are maintained.

A large portion of Manitou Springs is recognized as a national historic district. There are 850 buildings located in the main historic district and, over 150 of these are in the floodplain.

This research effort represents a joint process developed between the Federal Emergency Management Agency, Manitou Springs local government, the Colorado Division of Disaster Emergency Services, the Center for Community Development and Design, and the Department of Geography and Environmental Studies research team. Manitou Springs officials recognize the need to effectively enforce floodplain regulations and develop a plan to reduce flood hazard vulnerability. State and federal agencies are and have been aware of the constraints facing Manitou Springs including topography, low level of public awareness, economic dependence on tourism, historic nature of the town, and the need for economic development.

A proposal was prepared in late 1984. The Federal Emergency Management Agency funded the effort based on three particular goals:

1) to develop contingency planning for Manitou Springs which can be implemented now, before a flood;
2) to establish guidelines for Manitou Springs to have on hand for planning following a flood to insure that future damage potential is reduced; and,
3) to design a methodology for possible application elsewhere in the United States for pre and pre/post flood hazard mitigation.

The Federal Emergency Management Agency and Manitou Springs are aware that a new emphasis on flood hazard mitigation and preparedness planning saves lives and reduces propoerty losses. Manitou Springs recognized the value of being prepared for a flash flood but did not have the resources to design and implement a plan. In early 1985, the University of Colorado Springs Department of Geography and Environmental Studies and the Center for Community Development and Design put together a research team, a technical advisory committee, and a community group aimed at reaching these goals.

Basically, the methodology consisted of bringing the most effective and innovative plans from around the United States to the attention of Manitou Springs. These flood hazard mitigation strategies and funding prospects for each option were reviewed and recommendations for adoption and implementation in Manitou Springs were studied. In light of the fact that public awareness is essential to the implementation process, a slide/tape presentation of the likely effects of a 100 year flash flood in Manitou Springs was prepared for ongoing public education.

Four key issues which emerged are conflicts between historic preservation and wise floodplain management; reliance on tourism and the large number of visitors during flash flood season; interaction among the various actors involved in wise flood hazard mitigation including local residents, local commercial interests, the state officials and federal agencies and, the essential role of public awareness. Each of these is discussed individually below.

Historic Preservation

Federal and State historic preservation policy limits the type and extent of changes that can be made to historic structures and their sites without endangering their status on historic registries. Flood damage can endanger this status. However, taking steps to reduce an historic structure's vulnerability to flood damages can also endanger its status, e.g., relocation to a flood-free site, structural flood-proofing, installation of flood barriers, etc. Close coordination is needed between historic registry staff and local officials in reducing the flood loss susceptibility of historic structures.

Tourism

Manitou Springs depends on tourism for its economic base. One concern consistently raised by community members was the fear that preparedness planning might discourage tourism. Our findings indicate this fear is unfounded. As an example, Estes Park suffered the equivalent of a 500 year flood in 1982 due to a dam break. Within a week the town's tourism exceeded preflood levels. In fact, Estes Park is the only Colorado community in 1982 to post an increase in tourist dollars during that summer month. A well-prepared community is more attractive than one that is ill-prepared.

Multi-agency Task Force

We worked with a dedicated team of individuals who devoted many hours responding to our questions and providing valuable technical advice in all phases of the project. This integrated mission of flood hazard mitigation will carry on beyond the completion of this particular research effort. The fact that Manitou Springs is closely linked with various agencies involved in flood hazard mitigation in the region, state and nation should improve chances for obtaining funds to speed implementation of the recommendations.

Public Awareness

A scenario with an accompanying slide/tape presentation has been developed in two parts: with present level of preparedness and with a better prepared response and warning capability. Remarkable reductions in loss of life and property damage are found in the second scenario. Clearly, the public awareness message is that awareness saves lives. No funding is required to have a much better prepared community. Residents, business owners, motel owners, and tourists can be informed of the potential benefits of being aware and can be knowledgeable of appropriate actions in the event of a flash flood or flash flood warning.

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A. Situation

Manitou Springs is located in El Paso County at the foot of the Front Range of the Rocky Mountains in east-central Colorado. The city is immediately west of Colorado Springs and has a population of 4,475 (U.S. Department of Commerce, 1980 Census). Situated along Fountain Creek at an altitude of 6,606 feet, the city is at the mouth of Ute Pass and the base of Pikes Peak.

Manitou Springs is renowned for its many mineral springs located throughout the city and for other attractions such as the Garden of Gods, Cave of the Winds, Pikes Peak Cog Railroad, Cliff Dwellings and the Manitou Incline.

B. History

The history of the Manitou Springs area surrounds its 26 springs and reflects the tourism-oriented economy which is evident there today. The Indians were first to discover the natural springs of Manitou Springs, and the valley was considered sacred territory by many tribes. In the 1830's, pioneers began to recognize the natural beauty of the area as they arrived seeking the professed healing powers of the waters. In 1847, Lt. George Ruxton established permanent camps at the mouth of Ute Pass. In the 1860's, gold was discovered in South Park, just over the pass. An influx of people to the area resulted from this discovery (Phelps, 1985). The town was surveyed and laid out in 1871 as the first tourist resort in Colorado (U.S. Army Corps of Engineers, 1974). It was seen as a retreat by both tourists and settlers, promoted by the famous medicinal mineral waters. On July 8, 1876, Manitou was incorporated. A building boom in the 1890's was responsible for most of the buildings which front the main street, Manitou Avenue (Phelps, 1985). The backs of of these buildings face Fountain Creek where their walls form the creek's southern channel. Even into the 1950's, Manitou Springs was one of the two major tourist destinations in Colorado (Stumpp, 1985). Today, visitors to the area are attracted by its historic nature and small-town atmosphere.

Figure 1. Briarhurst Inn constructed in 1874 by Dr. William Bell is located between El Paso Boulevard and Fountain Creek.

C. Environment

1. Climatology

Manitou Springs is located in the east-central portion of the state of Colorado at the foot of the Rocky Mountain Front Range. The upper Fountain Creek watershed lies in portions of two Colorado counties, El Paso and Teller.

The climatology of the region surrounding Manitou Springs is derived from recorded data at Colorado Springs and Lake Moraine. Additional data has been obtained from stations with limited recording periods located at Pikes Peak, Ruxton Park, Woodland Park and Manitou Springs.

Precipitation in the region is approximately 17 to 20 inches per year. The average annual snowfall is 78 inches per year with the heaviest snows occurring in March and possible trace accumulations falling as late as June.

Thunderstorms occur in the region approximately 50 days a year. They are generally accompanied by heavy showers, severe gusty winds, and occasional hail. Precipitation during the period from April to October may make up from 75 to 80 percent of the annual precipitation total. June tends to be dryer than the other warm season months. Rains during April and May are frequently of several days duration with a relatively low hourly rate (McAnelly, 1974). July and August are characterized by heavy afternoon

thunderstorms which, due to the intense localized rain, lead to high runoff rates and localized flooding. The large triangular area between Castle Rock, Colorado Springs and the forks of the Bijou Creek south of Byers, has a history of repeated cloudbursts unequaled along the Front Range. The localization of cloudbursts in this area is influenced by the orographic effects of the Palmer Divide. Precipitation from these storms has reached levels greater than that produced by tropical cyclones (Hansen, 1973).

The probable maximum precipitation for the Manitou Springs area is delineated in Table 1. Figure 2 maps data on probable maximum precipitation for the Pikes Peak Region. Rainstorms of 35 or even 17 inches are rare; however, they have occurred. There have been several storms in the Pikes Peak region that have led to extensive flooding (see Table 2). Storms between the continental divide and the plains are caused by one of the following situations: cold front, tropical cyclone, complex convective storm, or simple convective storm. Figure 3 shows the maximum recorded precipitation for El Paso and surrounding counties. Note that Manitou Springs has received seven inches in one storm. Other storms in the region have dropped as much as 24 inches in a single storm, as recorded in Elbert County.

TABLE 1

PROBABLE MAXIMUM PRECIPITATION FOR 10 SQUARE MILES

Area	6 hours	24 hours	72 hours
Manitou Springs	24-26 inches	32-34 inches	38-40 inches
Teller/El Paso	18-20	26-27	28-30

Additional climatology data may be found in Appendix A of this report.

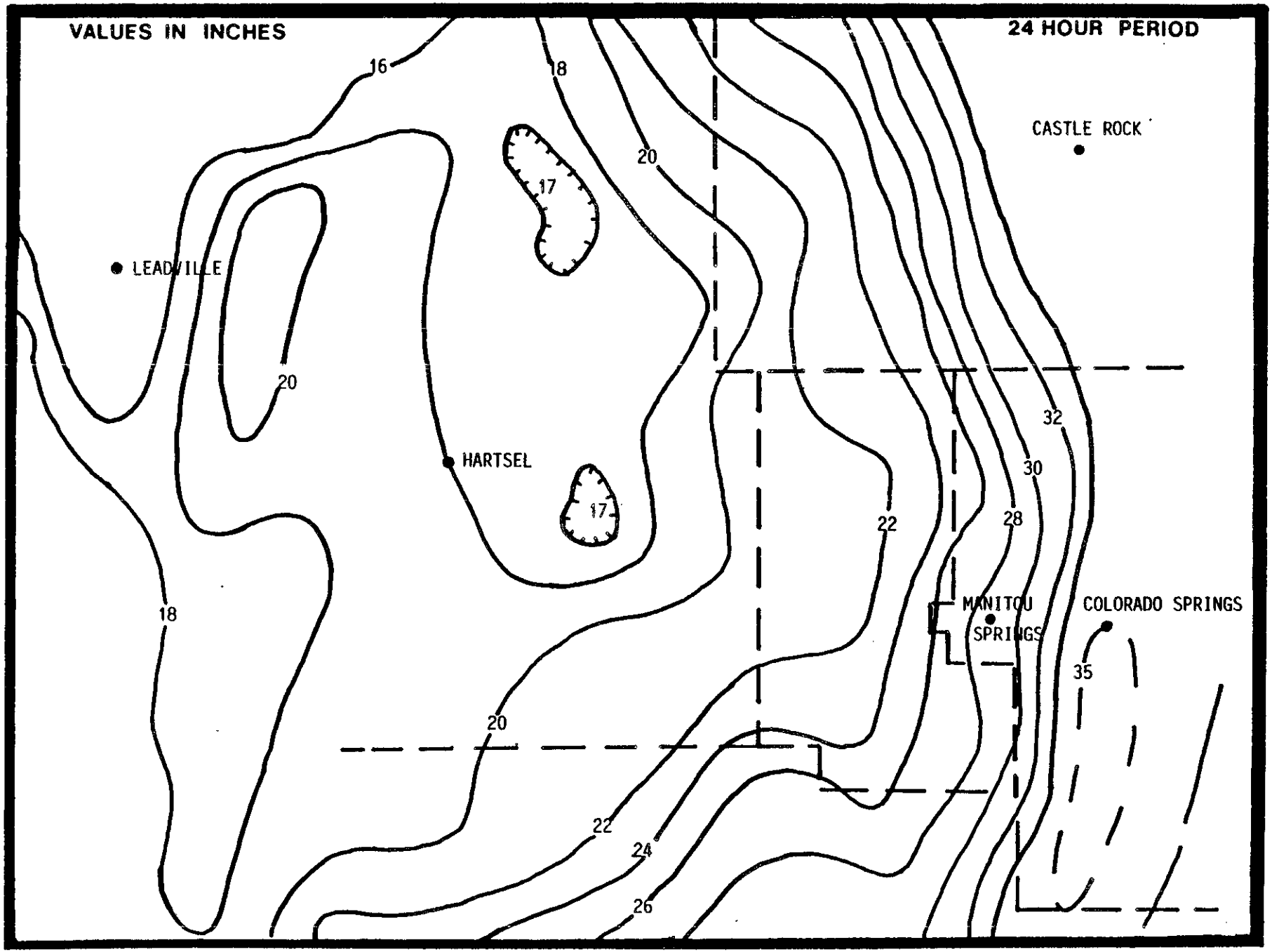


Figure 2. **PROBABLE MAXIMUM PRECIPITATION**

Figure 3. **MAXIMUM RECORDED PRECIPITATION**

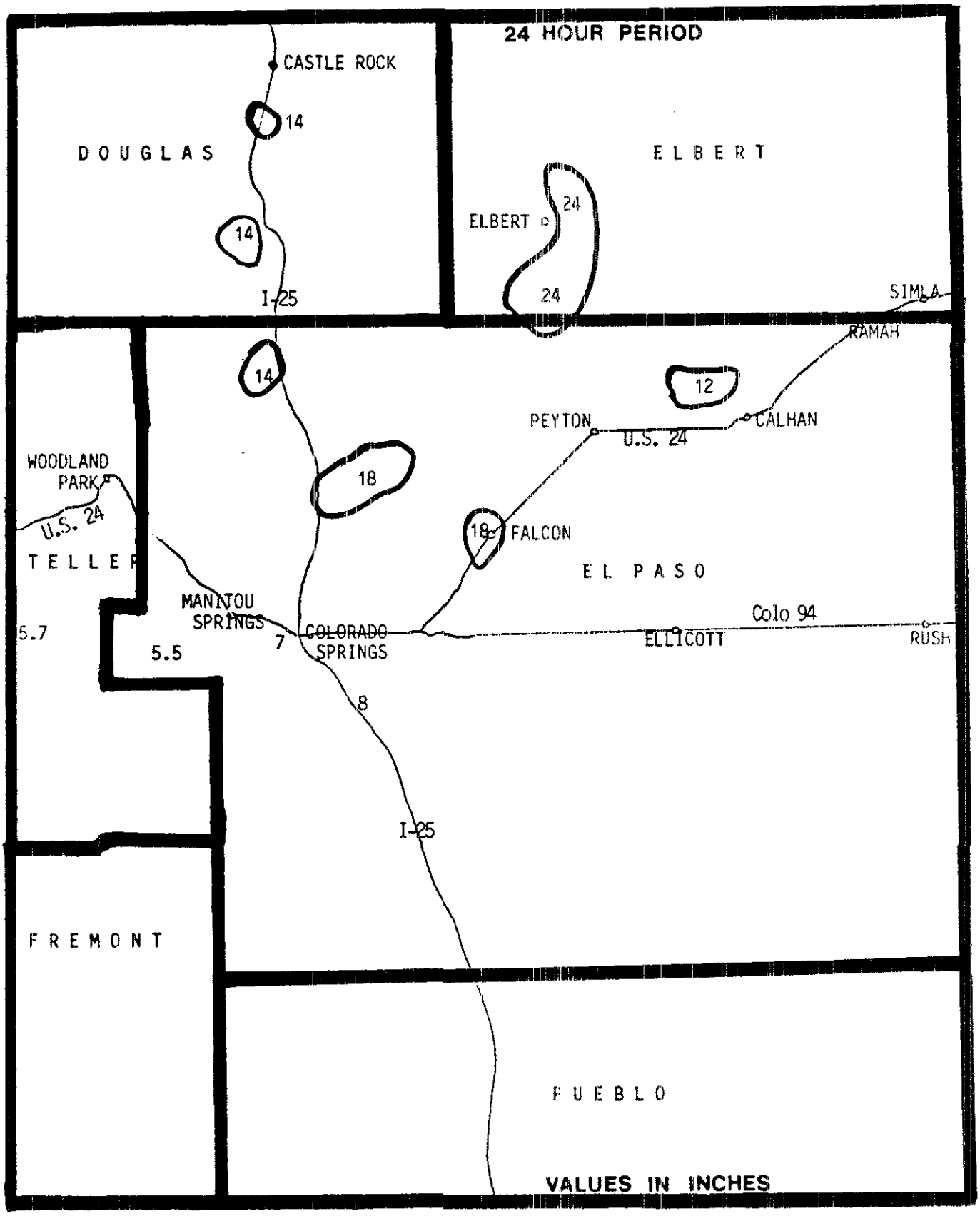


TABLE 2

STORM EVENTS FOR THE PIKES PEAK REGION

AREA	DATE	TYPE STORM	RAINFALL
Penrose	June 2-6, 1921	Complex convective (orographic)	12" in 18 hours
Cheesman	July 19-24, 1929	Complex convective (orographic)	
Kassler	Sept. 9-11, 1933	Complex convective (least orographic)	
Monument/ Cherry Creeks	May 30-31, 1935	Complex convective (least orographic)	26" in 24 hours
Leadville	July 27, 1937	Simple convective (orographic)	
Plum Creek	June 13-20, 1965	Complex convective (least orographic)	18" in 24 hours

Source: U.S. Department of Commerce, NOAA Hydrometeorological Study No.55: 1984b.

Penrose Storm - This was a very extensive storm system occurring in parts of 5 states over 114 hours. It was caused by warm, moist air from the Gulf of Mexico being pushed into the area by low pressure systems over New Mexico. Penrose was the largest center with 12 inches of rain falling in 18 hours (87 percent fell in 6 hours). This rainfall, combined with other centers along the Front Range and Arkansas River basin, led to extremely high flood levels from Pueblo, Colorado downstream into Kansas. Manitou Springs had a smaller storm center which dropped 4 to 5 inches of rain south and west of the city over the Ruxton Creek drainage area.

Monument/Cherry Creek - Warm, moist air form the Gulf of Mexico was pushed into the area by low pressure over northern New Mexico while a strong high pressure system was centered over the northern U.S. The 26 inches in 24 hours which fell near Elbert, Colorado is the highest rainfall amount recorded in the state. The resulting flood along Monument Creek and Fountain Creek caused heavy damage to Colorado Springs and El Paso County.

Plum Creek - Warm, unstable, moist air moved into the area from the Gulf of Mexico and heavy rains fell over a relatively long period. The most intense storms hit on June 16 and 17 with 18 inches falling over the upper Jimmy Camp Creek basin near Falcon. This led to the highest flood flow to drainage area ratio ever recorded in Colorado. Six inches fell west and southwest of Manitou Springs, but no flooding occurred.

Manitou Springs and the upper Fountain Creek watershed occupy the zone subject to orographic type storms of the same type as the Penrose, Monument/Cherry Creek and Plum Creek storms.

2. Hydrology

Fountain Creek rises in the Rampart Range near Woodland Park approximately seven miles northwest of Pikes Peak, draining the northeast slope of the mountain (see Figure 4). Flowing southeasterly through Ute Pass it drains an area of 71 square miles above Manitou Springs and is characterized by steep slopes, rugged terrain, and forest. As Fountain Creek passes through Manitou Springs, the floodplain is heavily developed in many places with city parks occupying the remainder of the space. Other drainages impacting on Manitou Springs before they enter Fountain Creek are Ruxton Creek, Williams Canon, Sutherland Creek and Beckers Lane Tributary.

Ruxton Creek has a drainage area of 17.6 square miles above its confluence with Fountain Creek and drains the eastern face of Pikes Peak. The basin above Manitou Springs is characterized by steep slopes, rugged terrain and forest, while within the city, the floodplain is heavily developed along and even over the channel.

Williams Canon has a drainage area of 2.68 square miles and drains the area north of U.S. Highway 24 near the Cave of the Winds. The basin above U.S. Highway 24 is a steep-walled canyon, while below the channel flows through residential neighborhoods. The channel is contained in a concrete culvert for its last 1100 feet along Canon Avenue before entering Fountain Creek.

Sutherland Creek has a drainage area of 5.37 square miles and drains the area south of the city. The upper basin is forested while the lower basin consists of moderately developed residential neighborhoods.

Beckers Lane Tributary has a drainage area of .88 square miles and drains the area near Beckers Lane along the northeast side of the city. The area consists of moderately developed residential neighborhoods and campgrounds.

A description of the drainage areas for Fountain Creek above Manitou Springs is contained in Table 3. Additional hydrologic data may be found in Appendix A of this report.

Figure 4. **DRAINAGE BASIN**

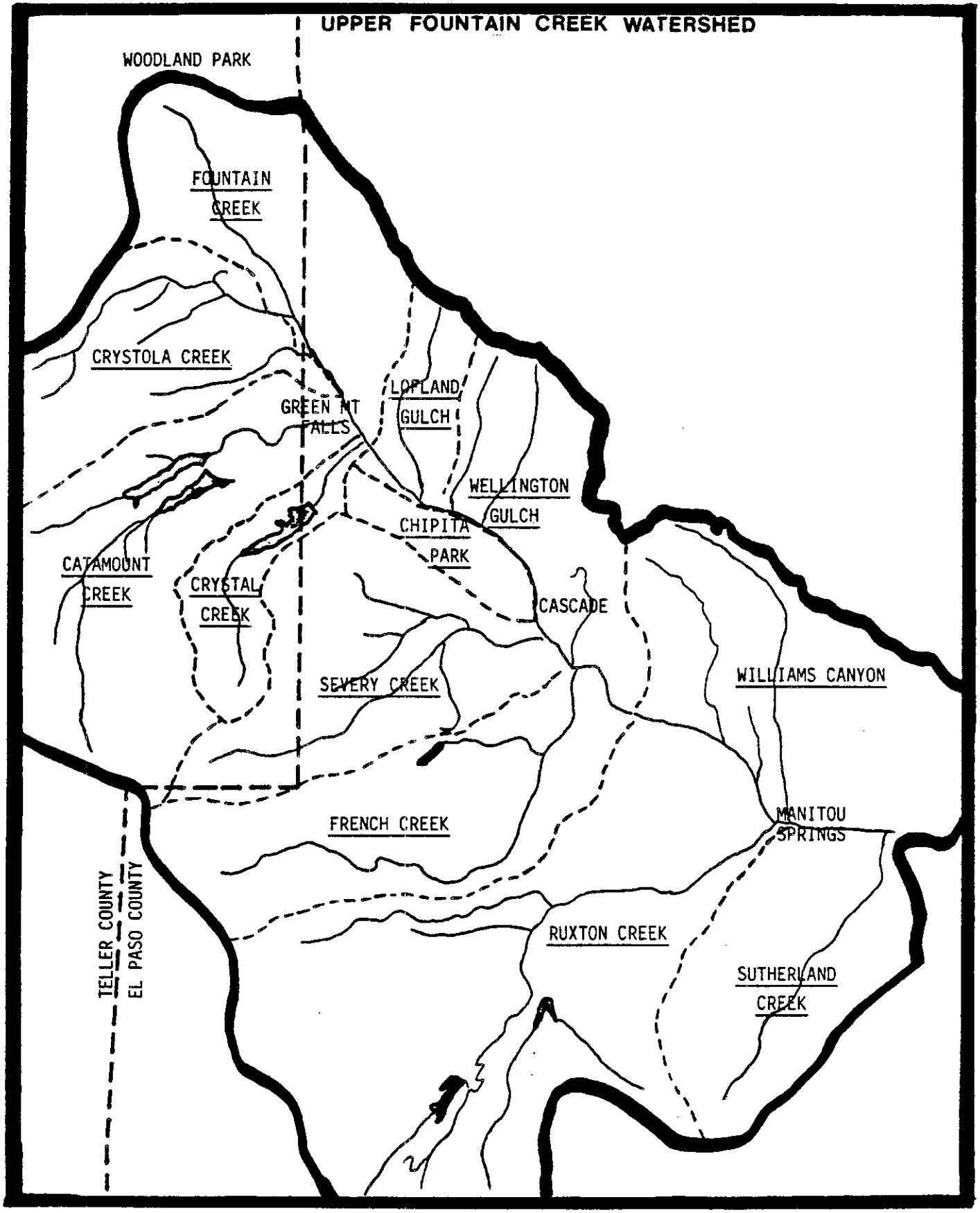


TABLE 3

DRAINAGE AREAS IN FOUNTAIN CREEK WATERSHED ABOVE MANITOU SPRINGS

Location	Drainage Area (sq. mi)
Crystola	13.7
Green Mountain Falls	19.0
Chipita Park	40.6
Cascade	55.4
Above Ruxton Creek	70.5
Below Mouth of Ruxton Creek	89
Below Mouth of Williams Canon	91
Below Mouth of Sutherland Creek	98
Below Mouth of Black Canyon	101

Source: U.S. Corps of Engineers: Floodplain Information, Fountain Creek: 1974.

3. Economy

Throughout its history, the economy of Manitou Springs has been based almost exclusively on tourism. Manitou Springs' dependence on a summer tourist economy relates to the issue of floodplain management in three important ways.

First, the flood hazard and tourism both peak at the same time of year. "Flash floods are most likely to occur in the late afternoon or early evening from late spring to early fall; at those times more tourists and visitors are in the floodplain" (Downing, 1977a). Provisions must be made in contingency plans which allow for this increase in population.

Second, although residents may be aware of the flood threat, it should be assumed that visitors to the area are unaware of the potential hazard.

And, third, when a flood does occur, the overall economy of the city will be affected. Manitou's almost exclusive reliance on the tourist trade suggests that the large scale disruption resulting from a major flood would be especially evident, as "dependence on one major source of revenue leaves the town vulnerable to fluctuations in the industry" (Community Renewal Associates, 1977). The very attractions that lead tourists to Manitou Springs are predominantly in the most hazardous floodplain areas.

4. Development Pattern

Fountain Creek and its tributaries have been extensively developed along the floodplain with residential, commercial and industrial buildings built next to, and in many cases, over the channel. This is especially true in the main business district of Manitou Springs where many businesses are established along or over Fountain Creek. It is also apparent along Ruxton Creek where residential and commercial buildings are built along or over the narrow channel. The flow from Williams Canon has been channelized to flow in a culvert along Canon Avenue with residential buildings occupying the floodplain. The culvert is designed to only carry minimal flow so the channelization is ineffective. The municipal building and fire station are situated along Fountain Creek with building supports extending into the creek. Figure 5 illustrates the 500-year floodplain inundation zone. It is similar to the 100 year floodplain. For more detailed boundaries refer to the Federal Emergency Management Agency Flood Insurance Rate Map enclosed in a packet at the back of the report.

One of the major problems in passing floodflows is the presence of natural and man-made obstructions within the floodways. These obstructions lead to the formation of dams which, in turn, cause higher backwater depths, increased overbank flooding, and, when they fail, surges in floodflows and increased debris battering.

Natural obstructions to floodflow within the Manitou Springs area occur when trees, brush and other vegetation clog the channel. Although there have been efforts in previous years to clear the channels within Manitou Springs, they are currently extensively vegetated.

There are a variety of obstructions built within the Manitou Springs area with stone arch bridges, utility pipelines, wooden footbridges and even buildings spanning the creek channels in numerous locations. Much of this material, especially the small wooden foot bridges, can be expected to be washed away to form debris dams farther downstream. Other restrictions to floodflows are the many building foundations and supports which extend into and over the channel.

D. Flood Experience

The history of floods in the Manitou Springs area is primarily based on accounts published in newspaper articles, local histories, and the memories of long-term residents (see Table 4). Although there have been many gaging stations in operation along the smaller tributaries of Fountain Creek, only one station has a substantial period of record for Fountain Creek itself. This station, located just east of the Manitou Springs city limits, has been operating since April, 1958 and measures the flow from a drainage area of 102 square miles. Many flood hazard studies have examined aspects of Manitou Springs' vulnerability. These are listed in Table 5.

TABLE 4

HISTORIC FLOODS AT MANITOU SPRINGS

DATE	CHANNEL
July 1, 1882	Williams Canon, Fountain Creek
May 31, 1894	Fountain Creek, Ruxton Creek, Williams Canon
August 5, 1902	Fountain Creek
June 5, 1921	Ruxton Creek, Fountain Creek
September 9, 1940	Fountain Creek
May 10, 1947	Williams Canon, Fountain Creek
August 4, 1964	Fountain Creek

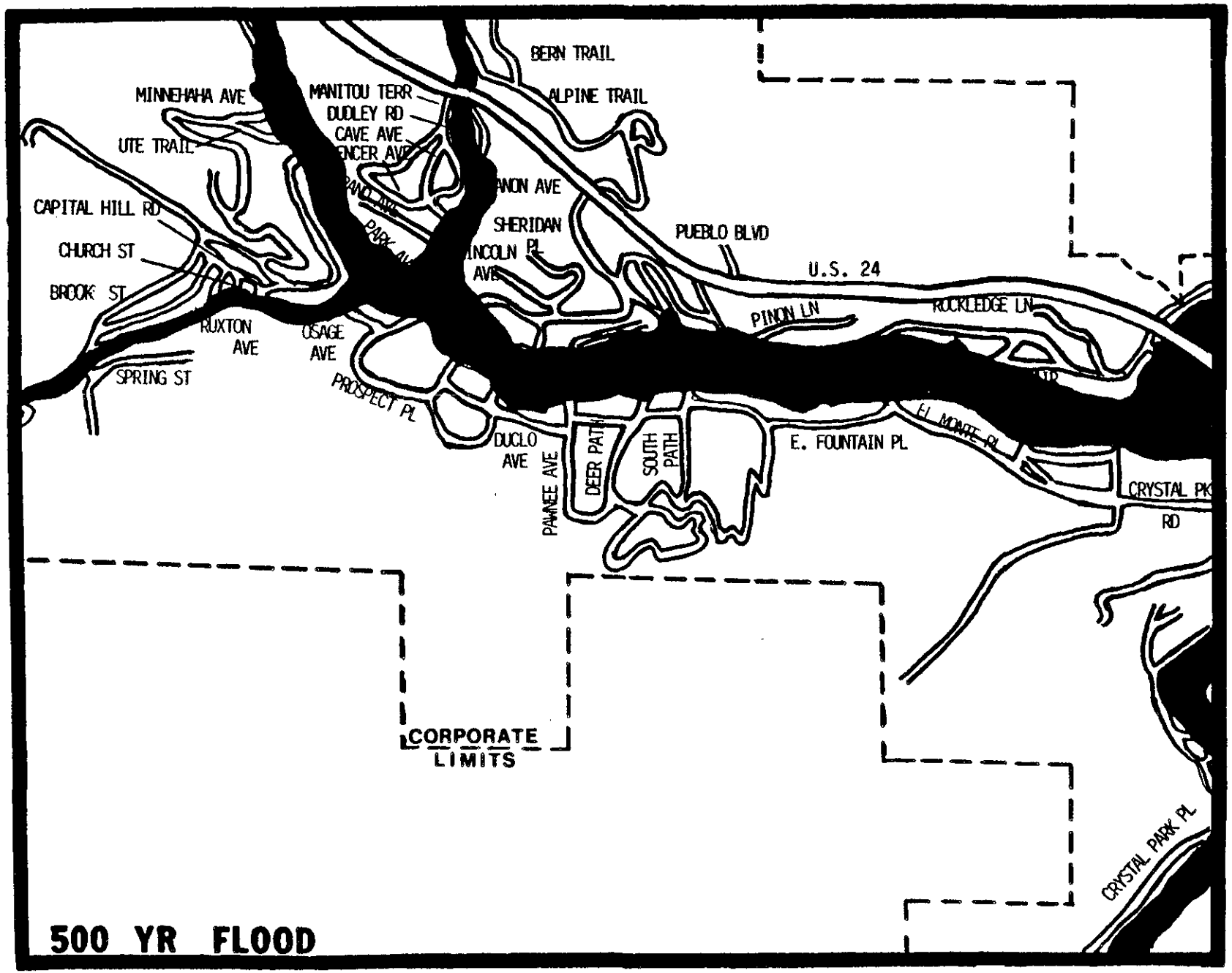


Figure 5. **FLOOD INUNDATION ZONE**

TABLE 5

FLOOD HAZARD STUDIES FOR THE MANITOU SPRINGS AREA

Date	Agent	Remarks
1968	U.S. Army Corps of Engineers	Investigated the possiblity of placing a dam west of Manitou Springs - determined to be not feasible.
1974	U.S. Army Corps of Engineers	Mapped flooded areas and provided information on hazards.
1975	Leigh Whitehead and Associates	Analysis of Sutherland Creek and Crystal Hills
1975	U.S. Department of Housing and Urban Development	Flood Hazard Boundary Map for Manitou Springs
1975	U.S. Department of Housing and Urban Development	Flood Hazard Boundary Map for Green Mountain Falls.
1976	U.S. Army Corps of Engineers	Investigated hydrology for flood insurance study.
1977	U.S. Department of Housing and Urban Development	Flood Hazard Boundary Map for El Paso County, Unincorporated Areas.
1977	U.S. Department of Housing and Urban Development	Flood Hazard Boundary Map for Teller County.
1978	Nelson, Haley, Patterson and Quirk	Comprehensive drainage plan for the Pikes Peak region.
1980	U.S. Soil Conservation Service	Soil Survey for El Paso County analyzes runoff characteristics for Manitou Springs area.
1981	Gilbert, Meyer and Sams	Master Drainage Plan for Manitou Springs
1983a	Federal Emergency Management Agency	Flood Insurance Study, City of Manitou Springs.
1984a	Federal Emergency Management Agency	Flood Insurance Study, City of Colorado Springs.
1984b	Federal Emergency Management Agency	Flood Insurance Study, El Paso County Unincorporated Areas.
1985	U.S. Army Corps of Engineers	Reconnaissance Study Final Report; analysis of structural alternatives; recommends study of warning system.

Newspaper accounts of Manitou Springs flood events provide valuable information on flooding effects, but specific information on intensity, duration, and magnitude of storms and resulting floods is largely lacking. Following are several articles describing effects of various floods at the time of their occurrence.

Flood of July 1, 1882

This flood was caused by heavy rainfall from afternoon thunderstorms that were centered over the Williams Canon drainage basin. A particularly intense cell unleashed a cloudburst around 4:30 P.M., which directed a wall of water down the narrow canyon through Manitou Springs and into Fountain Creek.

The Manitou Springs Item of July 8, 1882 described the event as follows: "Various hotels are the heaviest losers...Manitou Bath House flooded with 2 feet or more of water and it is thought that the heavy sediment on the floor is the reason the building did not float away...road to the Cave of the Winds completely washed away...railroad tracks and bridges washed away...hail as large as hen eggs seen in town with much larger seen up the canon...The city council doubtless will take action looking to the construction of the proper water courses through the town. These should be lined with masonry and always kept open."

The Colorado Springs Weekly Gazette of July 8, 1882 contained the following description: "...so far as could be learned the life of but one person had been sacrificed...two boys had gone up Williams Canon and were caught by the storm...the surviving boy said that he and his brother had gone but a short distance when they heard a terrible roaring behind them and saw a wall of water rushing down upon them...they clambered up the side of the canyon seeking refuge on the top of the old lime kiln, which is about 20 feet high, when a monstrous wave struck the kiln taking the younger boy with it...proprietor of the Ruxton Livery Stable, a short distance up Ruxton Creek saw the waterspout as it broke up Williams Canon and a few seconds afterward heard distinctly the roaring of the water as it made its way through the near (Ruxton) canyon and broke through the back door of his barn, taking with it horses and wagons...Hail, which accompanied the storm crashed through windows and threatened death to anyone who ventured outside. In some parts of town hailstones as large as oranges fell and one measured 11 inches in circumference. In places these hailstones lay in banks several feet in depth."

If the eyewitness reports contained in the newspaper accounts are accurate, the 20 foot wall of water would equal the expected 500 year flood (Federal Emergency Management Agency, 1983).

Flood of May 31, 1894

The flood of May 31, 1894 was caused by heavy general rains occurring over much of the Front Range. This is also the date on which heavy rainfall in the Ward, Colorado area led to flooding along Boulder Creek. The Rocky Mountain News of June 1, 1894 described the situation in the following manner: "Rain has been falling steadily all day making a continuous fall of 50 hours, an unheard of thing for Manitou. Ruxton Creek is still a raging

torrent and the Fountain has been tearing away stone walls and foundations and bridges. Canon Avenue, the road leading to Williams Canon is a mountain torrent down which hundreds of tons of rock have been washed."

The Colorado Springs Weekly Gazette of June 1, 1894 states that "Lake Moraine rose 6 feet in 24 hours...Midland Railroad blocked by slides in Ute Pass...water overflowed Fountain Creek and flooded Colorado City (present day west Colorado Springs)...Ruxton Creek higher than ever before...Williams Canon flooded...City Council employed 15 men to watch the creek and give people warning if necessary...Rainfall of 2 inches or more in previous days in upper Fountain Creek had prepared the soil for rapid runoff."

Flood of August 5, 1902

This flood was caused by a localized heavy thunderstorm in the vicinity of Woodland Park that dropped large amounts of rain on the upper Fountain Creek basin above Manitou Springs.

The Colorado Springs Daily Gazette of August 6, 1902 contains the following description: "...cloudburst did more damage to Manitou and the pass than has been done before by a single storm...No wagon bridges are left in Ute Pass below Cascade with the carriage road being washed out completely...Soda Springs Park is a mass of wreckage, consisting of household goods, timbers, tree trunks, and railroad ties 20-30 feet high...100 light dwellings have been moved from their former foundations...Midland Railroad is totally out of business in Ute Pass being washed out for dozens of roads in many places and the wreckage of the line being scattered along the banks of the creek for 20 miles below the scene of the cloudburst...Warning had been received through Western Union that Green Mountain Falls had been visited by a cloudburst at 2 P.M....Men on horseback went up the pass to give warning...At 3 P.M. a wall of water 15 feet high came down the creek."

The Colorado Springs Weekly Gazette of August 8, 1902 stated that "a wall of water 20 feet high chased a horseback rider down Ute Pass to Manitou . . .Summer cottages, tents, bridges, outhouses, cattle and horses strewn along Fountain Creek ... All county roads west of Manitou Springs impassable ... Bridge at Soda Springs carried away bodily...2 cottages at 364 Manitou Avenue carried 50 feet from their former locations."

The report of a wall of water 15 feet high crashing into Manitou would approximate the 100 year flood for Fountain Creek, as specified by the Federal Emergency Management Agency (1983a).

Flood of June 5, 1921

This flood was part of the large system that dropped extremely heavy amounts of rainfall along parts of the Front Range and along the Arkansas River valley. The rain fell mainly over the Ruxton Creek drainage basin and occurred the day after heavy showers dropped over 12 inches of rain at Penrose, Colorado. With the Manitou Springs flood occurring the day after the devastating Pueblo flood in which more than a hundred lives were lost, newspaper coverage of the Manitou Springs event was somewhat limited.

The Colorado Springs Evening Telegraph of June 6, 1921 describes how the Manitou and Pikes Peak Trolley line was destroyed along with parts of Ruxton Avenue in many places "...lower part of Ruxton Avenue was turned into a raging river doing much damage to homes and businesses...structures along Ruxton and Fountain Creeks had their foundations undermined and tumbled into the waters...Williams flowed all night and debris blocked culverts and flooded streets...Downtown Manitou threatened until temporary dam was constructed which diverted water from Williams Canon to enter Fountain Creek farther down the creek...Fountain Creek swelled out of its banks along Manitou Avenue."

The El Paso County Democrat of June 10, 1921 described how many structures were completely destroyed and the Mayor called for volunteers to watch the creek during the night.

Flood of September 9, 1940

This flood was the result of a heavy localized thunderstorm that occurred over the southern part of Manitou Springs with the heaviest damage taking place in the Plainview section. The cloudburst struck about 2 p.m. and lasted for only about an hour.

The Colorado Springs Daily Gazette of September 10, 1940 described how Pawnee Avenue was the hardest hit with the street containing the flow of water up to 3 feet in depth "...debris left behind reached the floorboards of cars...runoff from Pawnee and El Paso poured through Manitou Avenue just east of the business section...2.2 inches fell in 45 minutes; reported by Plainview resident and 1.98 inches fell during the afternoon; as reported from Ruxton Park."

Flood of May 10, 1947

This flood was caused by a heavy thunderstorm which was centered over the Williams and Waldo Canons north and west of Manitou Springs. Thundershowers were occurring throughout the Manitou Springs' area during the afternoon when extremely heavy downpours struck around 6 p.m. Table 6 summarizes the flood damages which received extensive newspaper coverage.

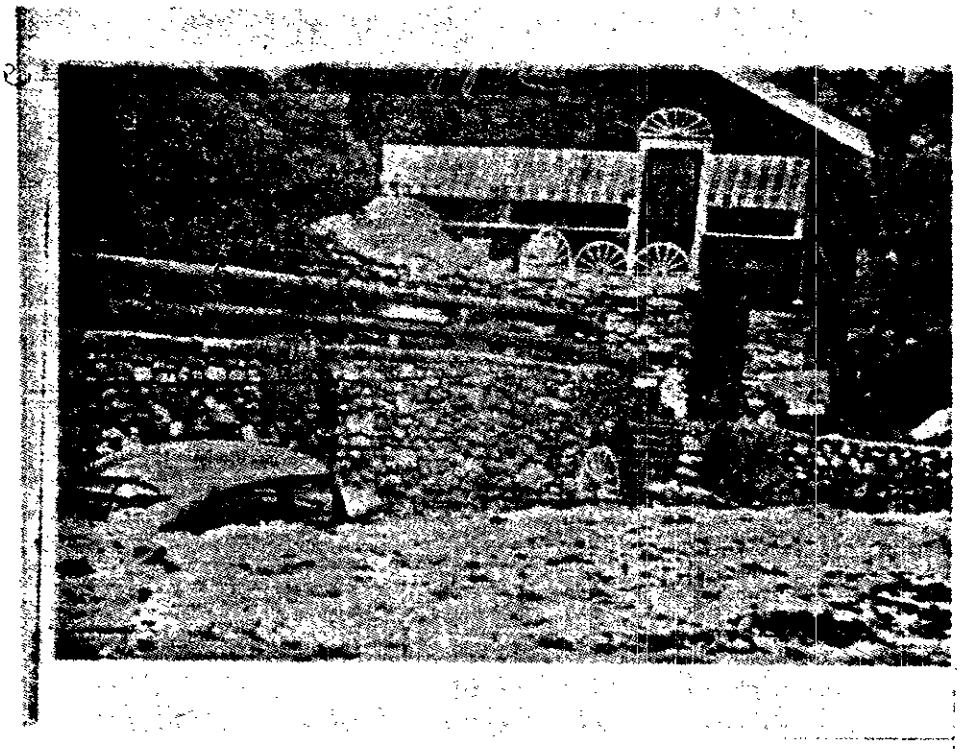


Figure 6. Debris deposits left along Canon Avenue in the aftermath of the torrent of water exiting Williams Canon.

TABLE 6

FLOOD DAMAGES WITH EXTENSIVE NEWSPAPER COVERAGE- MANITOU SPRINGS

Flood	Damages	Source
July 1882	"difficult to estimate, but it is more than our readers have any idea..."	Colorado Springs Weekly Gazette, July 8, 1882
May 1894	"in the thousands"	Colorado Springs Weekly Gazette June 1, 1894
August 1902	"probably as high as $25,000" Midland Railroad damages put at $12,000	El Paso County Democrat August 9, 1902
June 1921	$100,000 municipal and private property damages; $100,000 in damages to Pikes Peak Cog R.R.	Colorado Springs Evening Telegraph June 6, 1921
May 1947	$100,000 for streets, bridges and roads; $50,000 Red Cross Aid; $1,000 damages to Manitou Electric Company	Colorado Springs Gazette-Telegraph May 12, 1947

The Colorado Springs Gazette-Telegraph of May 11, 1947 describes the flood as follows: "Water from Waldo Canon cut U.S. Highway 24 when the culvert could not carry the flood flow and overtopped the road...a wave of water descended from Ute Pass carrying away a number of small wooden bridges...water overflowed Fountain Creek and was flowing curb high along Manitou Avenue...cottage camps on low ground along Fountain Creek in east Manitou Springs and west Colorado Springs were flooded...the small bridges washed out in Manitou Springs were carried downstream where they piled up before a bridge forming a dam...the dam of bridges broke away sending the debris downstream to the next obstruction...bridges on 21st and 30th Streets washed out and the 8th Street Bridge in a precarious condition...many motorists evacuated...gas mains broke...water and electrical services interrupted."

The Colorado Springs Free Press of May 12, 1947 stated that "Mayfair Bridge was destroyed...Cottonwood Camp and Greenwich Village Court as well as other campgrounds bordering the stream received damage to grounds and surroundings...One person drowned when she stepped into an uncovered manhole along Canon Avenue near the Cliff House and was carried away...the amount of water flowing down the street made it impossible to see where the water pressure had lifted the cover off...Flow from Williams Canon continued to flow down Canon Avenue until late on May 11."

Flood of August 4, 1964

This flood was caused by a localized thunderstorm which was centered over the downtown Manitou Springs area. The storm started about 3 P.M. and lasted about 3 hours.

The Colorado Springs Gazette-Telegraph described how shops in the Arcade and downtown Manitou Springs were flooded...Iron Springs Chateau flooded as water rushed down Ruxton Creek.

The Colorado Springs Free Press reported that "tourists and children that had taken shelter in the Arcade from heavy rain and hail were forced to stand on the platform along the outside of the structure as gutters overflowed sending water inside...the bar at the Cliff House has from 3 to 4 feet of water...car seen floating down Canon Avenue...Campers at Pikes Peak Trailer Court were taken by surprise and had to swim for their lives."

The flow rate measured at the gaging station east of Manitou Springs indicated that this flood was approximately an 8 year flood as outlined in the Flood Insurance Study (Federal Emergency Management Agency, 1983a).

Figure 7. Flood elevations along Fountain Creek adjacent to Lover's Lane Bridge.

Figure 8. Flood elevations along Ruxton Creek just below the Iron Springs Chateau.

II. MANITOU SPRINGS - CURRENT STATUS

A. The Flash Flood Threat

Land use in Manitou Springs is constrained by geography. The town is located along the channels of Fountain, Ruxton, Waldo, Beckers Lane, Williams, and Sutherland Creeks. Much of the remainder of the town is located on steep slopes above the floodplain. There is very little land available for development that does not face flood or slope stability hazards. Consequently, downtown Manitou Springs is built along the creeks, and the floodplain is nearly fully developed. Shops, hotels, homes, and restaurants sit astride or are built partially in the floodway.

B. Floodplain Management

In August 1983, the City of Manitou Springs adopted a floodplain management ordinance, number 0184, in compliance with National Flood Insurance Program regulations. This ordinance establishes a two-district (flood-way and flood fringe) approach. New construction and substantial improvements to existing structures are severely restricted in the floodway but may be allowed in the flood fringe, provided the construction takes place so as to limit damages from the base flood. (A copy of the ordinance is attached as Appendix E.)

1. National Flood Insurance Program

Manitou Springs entered the emergency phase of the National Flood Insurance Program in 1975. The Federal Emergency Management Agency released its report entitled Flood Insurance Study: Manitou Springs in 1983 and Manitou Springs entered the regular phase of the program in 1984. As of May, 1985, there are 32 flood insurance policies in force in Manitou Springs.

2. Warning System

The current flash flood warning system along Fountain Creek was installed in April 1975. The equipment from the National Weather Service is located at Cascade, Colorado and consists of a stream level monitoring device, transmission equipment and receiving devices located within the Manitou Springs Police Department. An alarm is sounded in the station whenever the level of the stream rises above a designated height. It is estimated that 15 minutes of warning time would be provided before the high level of water reached Manitou Springs.

The National Oceanic and Atmospheric Administration of the U.S. Department of Commerce keeps a round-the-clock surveillance on the nation's rivers and issues warnings when there is a threat of flooding. The National Weather Service Forecast Centers provide flood forecasts for the major river systems and flash flood guidance for the smaller streams and headwater regions. Flash flood watches are issued by these Centers and flash flood warnings are issued by National Weather Service Offices that have local and county warning responsibility.

Upon issuance of flash flood watches and warnings, the director of the El Paso County office of Disaster Emergency Services can direct designated individuals to take up positions along Fountain Creek and use staff gages to measure stream levels. The positions for the staff gages are along Ruxton Creek and Fountain Creek within the immediate Manitou Springs area (see Table 7 and Figure 9).

TABLE 7

STREAM GAGING STATIONS IN THE MANITOU SPRINGS AREA

Stream Site	Altitude	Drainage Area	Period of Record	Maximum Discharge
N. Cascade Creek at Cascade	8400 ft	4.28 sq mi	1949-1972	11.5 cfs
S. Cascade Creek at Cascade	8400	3.41	1935-1950	28.2
French Creek near Cascade	7320	9.93	1950-1973	50.5
Ruxton Creek near Halfway	9250	3.96	1949-1972	5.97
Lion Creek near Halfway	9250	2.00	1908-1950	11.6
Sheep Creek near Halfway	9100	.73	1908-1950	12.8
S. Ruxton Creek near Halfway	9390	3.95	1907-1930	
Sutherland Creek at Manitou Springs	6620	4.40	1919-1930	11.5
Fountain Creek near Colorado Springs	6110	102	1958-1985	2630

Source: U.S. Geological Survey, Water Resource Records: 1955, 1964, 1969, 1971-1984.

Figure 9. **CURRENT WARNING SYSTEM**

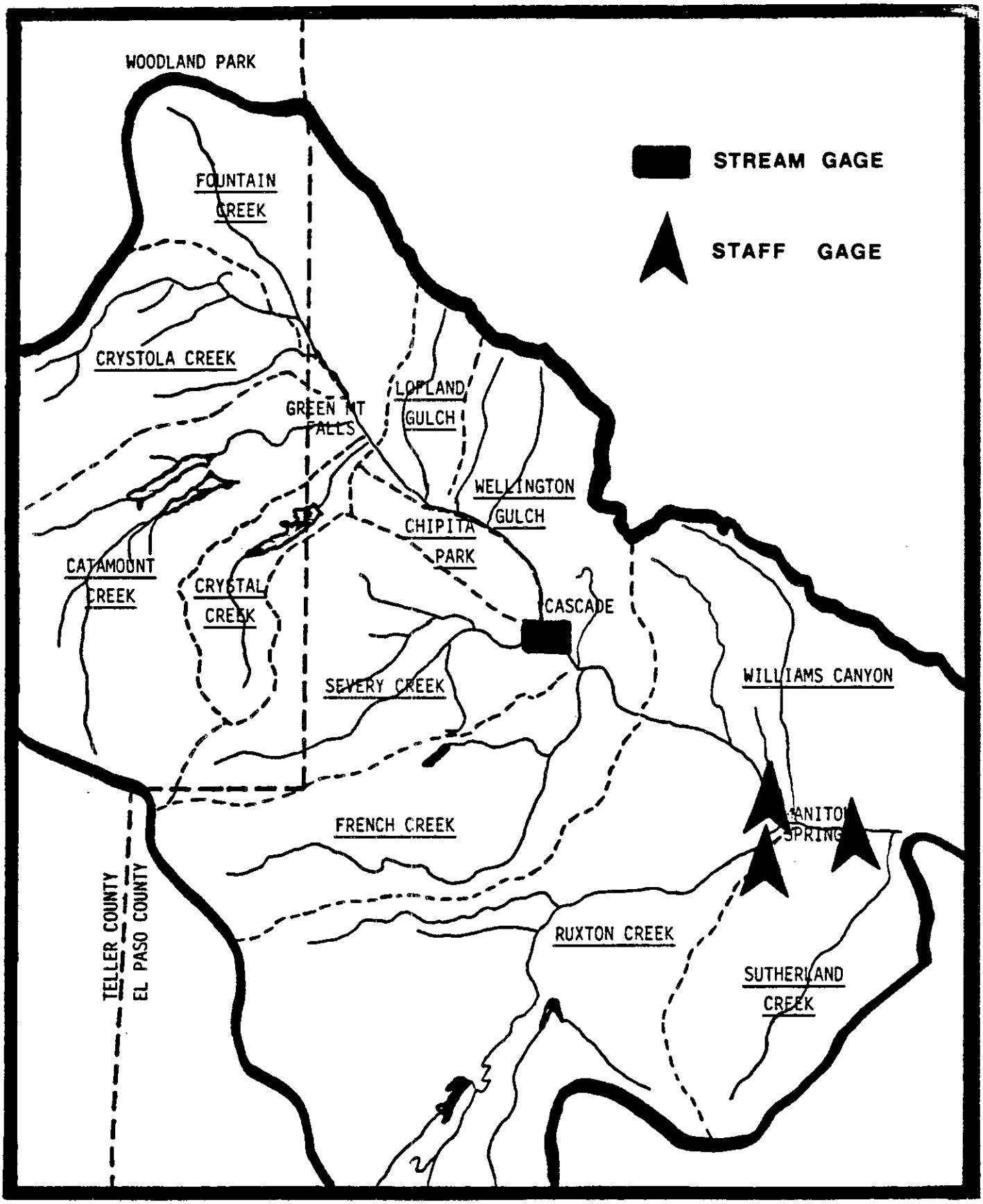


TABLE 8

HIGH HAZARD DAMS ABOVE MANITOU SPRINGS

Dam	State of Repair	Flow At Manitou Springs	Type of Dam	Travel Time To Manitou Springs
North Catamount	Excellent	76460 cfs	Earthfill	34 minutes
South Catamount	Excellent	34000	Earthfill w/steel facing	42
Crystal Creek	Good	17000	Earthfill w/steel facing	44
Big Tooth*	Poor	8920	Earthfill	22
Lake Moraine*	Good	6240	Earth and Rockfill	33
Manitou	Good	10270	Earthfill	30

* Currently undergoing repair with reservoir drained

Source: Colorado State Engineer Dam Inspection Reports: 1983.

The high hazard dams located above Manitou Springs (Table 8) are the responsibility of the owners. Colorado Springs owns five of the dams above Manitou Springs and Manitou Springs owns one. Caretakers trained by the State Engineer's office watch for unusual erosion or seepage problems that could indicate weakening of the dam's structure. The reservoirs serve as water storage for the cities of Colorado Springs and Manitou Springs and normally are filled to capacity by the end of the summer. Effects of flooding can be offset only if the reservoirs are large enough to contain the runoff. The caretakers follow an established set of procedures based on conditions listed below:

Condition A - Severe upstream flooding results from an isolated thunderstorm, rain or snow. One or more of the dams in the drainage below will be threatened by the flood.

1. Make immediate inspection and establish communications.
2. Notify appropriate personnel (water systems operations).
3. Open gated spillways and outlet pipes.
4. Move in and use equipment to lower reservoir level or raise damcrest if required.
5 Maintain on site observation and communication until danger passes or situation becomes Condition C or D.

Condition B - Dam is partially or totally failing when condition is discovered; failure of dam cannot be prevented. (Overtopping, sudden increase in seepage, serious earthquake damage, large downstream slope slides, serious piping).

1. Make immediate inspection and establish communication.
2. Notify authorities: Disaster Emergency Services
   El Paso County Sheriff
   Colorado State Highway Patrol
   Green Mountain Police Department
   Manitou Springs Police Department
   Colorado Springs Police Department
3. Advise radio, television and press media.
4. Warn downstream residents.
5. Evacuate and rescue.
6. Take action on upstream and downstream dams and control structures.
7. Advise regional office (Colorado State Engineer-Denver, Colorado Water Division Engineer-Pueblo).

Condition C - Dam shows signs of rapidly developing failure such as piping, seepage with turbidity, very much reduced freeboard, serious erosion downstream, and slope slides. Time may be available for action to save the dam, such as reducing the reservoir level by opening outlets and gated spillways, lowering spillway crest, using pumps or siphons, sandbagging crest, and blanketing seepage areas.

1. Make immediate inspection and establish communications.
2. Notify authorities: Disaster Emergency Services
   El Paso County Sheriff
   Colorado State Highway Patrol
   Green Mountain Police Department
   Manitou Springs Police Department
   Colorado Springs Police Department
3. Advise radio, television and press media.
4. Warn downstream residents.
5. Evacuate and rescue.
6. Take action on upstream and downstream dams and control structures.
7. Advise regional office. (Colorado State Engineer-Denver, Colorado Water Division Engineer-Pueblo)

Condition D - Dam shows evidence of a slowly developing failure (slow increase in volume of seepage and turbidity, appearance of sand boils, slope cracking, transverse cracks in embankment crest). Time should be available to lower reservoir level and get equipment to site for further action.

1. Make immediate inspection and establish communications.
2. Advise regional office. (Colorado State Engineer-Denver, Colorado Water Division Engineer-Pueblo)
3. Take action on dam and upstream and downstream control structures.
4. Advise authorities, media and others as situation warrants.

3. Floodproofing

Currently, the most effective type of floodproofing evident in Manitou Springs is that of elevation out of the floodplain. The elevation and setback measures were incorporated into the design of historic structures

due to their popularity around the turn of the century, when most of the structures were built. Also, these structures are on hillslopes and retaining walls are required to stabilize the slope and provide a level area on which to build. Many more recent developments have adopted these measures in order to blend favorably with existing architectural styles. Most of these buildings are residential, although several motels and businesses have been constructed in the same manner.

Additionally, there are efforts to floodproof buildings which currently exist in the floodplain. Two particular examples are mentioned here. Renovation and remodeling efforts were completed in April, 1985 at the Promenade, a shopping mall located at 735 Manitou Avenue. The front 25% of the mall is located in the floodfringe, with a 100 year flood level of three feet. Aluminum flood shields are stored on the property to be positioned over doors and tempered glass display windows in the event of a flash flood warning. Also, an effort was made to seal the existing stucco walls as well as the space between the walls and sidewalk (Garrison, 1985).

Restoration is underway at the Loop, an historic building at the intersection of Manitou Avenue and Ruxton Avenue. The 100 year flood level at this location is eight feet. In keeping with the building's original character, stucco bulkheads with concrete footings that have been wrapped in plastic below ground level have been installed where patio doors formerly existed. These new bulkheads were engineered to withstand the force of eight feet of water. Doors and windows in the northwest wall of the structure have been sealed, and construction of a new wall in the interior of the building to supplement that which currently exists is in progress. The city of Manitou Springs has additionally required flood shields for windows and doors in conjunction with new, solidly built door jams and bar latches. As of early May, 1985, $20,000 of the rehabilitation costs were attributed to floodproofing measures (Garrison, 1985).

4. Public Education

At the present time there are no special public education or community awareness programs being offered in Manitou. The local newspaper runs occasional articles on the flood hazards facing the city. In 1985 a series reporting on this Flood Hazard Contingency Planning project received a good deal of positive attention and the prospects for implementation are promising. A chronology of the project and local newspaper articles pertaining to the effort can be found as Appendix H of this report.

5. Structural Control

The following structural control measures were presented by the U.S. Army Corps of Engineers as possible flood hazard adjustments for the Manitou Springs area, but are not cost effective.

a. Diversion Tunnel. A concrete-lined tunnel to divert flows from the Fountain Creek watershed above Manitou Springs around the community and discharge them back into Fountain Creek near Black Canyon has been proposed. This diversion tunnel would be fifteen feet in diameter and have a length of approximately 8700 feet. It would tunnel through the mountain sides just north of the community. A small embankment would divert all

flows exceeding the 1300 cfs capacity of the Fountain Creek channel into the diversion tunnel. This water would then be released into a stilling basin in order to dissipate energy before reentering the Fountain Creek channel. Capacity of the diversion tunnel would be 7800 cfs, which is equivalent to a fifty year flow. Total costs for this solution are estimated at over $17,000,000. A larger diversion tunnel capable of carrying a higher frequency flood would naturally have a higher cost associated with it. Any further consideration of this alternative would require a detailed floodplain analysis to determine the impact of this solution on residents along Black Canyon.

b. Large Detention Structure. The valley through which Fountain Creek flows just above Manitou Springs is very steep and narrow, making it difficult to obtain much storage for any possible detention structure. Any structure over 30 to 40 feet high would require the relocation of U.S. Highway 24. This would also be difficult due to the narrow valley and the large road cuts that would be necessary. For this reason, possible locations of detention structures were investigated farther upstream. One possible site is about one mile upstream of the community of Crystola. Contributing drainage area above this location is 4.2 square miles. The maximum possible height of any structure without affecting U.S. Highway 24 at this location is approximately forty feet. This would result in a storage capacity of 250 acre-feet, less than a ten year volume. There is also a second possible site about 3,000 feet below Crystola with a contributing drainage area of 5.2 square miles. This location would allow a maximum height of 80 feet before affecting U.S. Highway 24. Capacity would be 500 acre-feet which is about the 25 year volume. Even if both detention dams could be built, they would not provide adequate protection for Manitou Springs. No other adequate sites were found for a large detention structure which did not require major relocations.

A Corps of Engineers report entitled "Arkansas River Above John Martin Dam Survey Report" written in 1968 had previously examined the feasibility of constructing a dam on Fountain Creek two miles west of Manitou Springs. This report also found that the costs associated with relocating U.S. Highway 24 made such a project too costly.

c. Channelization Project. Channelizing Fountain Creek through Manitou Springs was considered. Construction costs would be high because a concrete-lined, high velocity channel would be required to handle the design flow of 40,000 cfs (SPF). Channel projects allowing for protection from the 56 year flow (10,000 cfs) and the 17 year flow (5000 cfs) were also studied. Problems with these alternatives are mainly associated with obtaining rights-of-way through the heavily developed downtown area of Manitou Springs. Alterations to buildings and relocating bridges were other areas of concern. The estimated cost of the SPF project was $32,000,000 (1967 cost) while the 56 year and 17 year projects have an estimated cost of $10,500,000 and $9,000,000 (October 1984 cost), respectively.

d. Small Dams. Small dams were examined as possible methods of controlling the flood flows from Ruxton and Sutherland Creeks as well as Williams and Waldo Canons. The investigation showed that because of the steep slopes of the terrain the number of dams needed would be extremely high in order to store the necessary volume of water (100 year flow). This would cause the construction costs to be high as well.

Investigations into utilizing a multi-dam approach showed that it would take more than 115 small dams (20 feet high) with an estimated cost of $50,000 each to protect Manitou Springs from the total amount of 100 year rainfall. This alternative would not protect Manitou Springs from the flow from the upper Fountain Creek Watershed.

Information on structural alternatives investigated by the Corps of Engineers is from the Status Report on the Upper Fountain Creek Watershed Reconaissance Study and excerpts from the unpublished final report on the Reconaissance Study.

C. Historic Preservation and the Floodplain

The historic nature of Manitou Springs contributes a great deal to the unique character of the area. The historic district, which encompasses approximately three-fourths of the city, attracts tourists interested in tradition and history and exhibits characteristics which generate Manitou Springs' charming character and perpetuates a spirit of community.

Manitou Springs' multiple resource district is composed of three areas: Crystal Valley Cemetery, the Keithley log cabin district, and the main district. The main district is composed of 1,001 buildings, 85% of which contribute to its historic nature (Miller, 1985). Of these approximately 850 contributing buildings, over 150 are located in the floodplain. (A map of the Manitou Springs multiple resource area is available at the city planning office in City Hall for public inspection.)

Generally, there are three pre-flood options for dealing with structures which currently exist in the floodplain. The first of these, relocation, is not recommended when dealing with historic buildings. U.S. Department of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings states, "Removing or relocating historic buildings or landscape features, thus destroying the historic relationship between buildings, landscape features, and open space" is not recommended. Additionally, the "relationship between historic building(s) and landscape features -- or the building site -- helps to define the historic character and should be considered an integral part of overall planning and rehabilitation work" (U.S. Department of the Interior, 1983).

The second option is to leave the building alone, relying on such non-structural measures as flood insurance. However, this is only a short term solution since flooding will occur sometime in the future, and its occurrence can result in damages that can jeopardize an historic property's designation. If the damage is significant enough, the property can lose its designation as an historic structure. Therefore, it may be preferable to choose the third option.

The third option is structural floodproofing. Here again, an historic structure's designation may be jeopardized if visible changes made to resist flooding are too significant. Therefore, any proposed floodproofing design needs to be coordinated with representatives of the national and state historic registries to protect the property's historic designation.

Provisions have been made in the National Flood Insurance Program which recognize the historic character of an area and allow for variances to be issued by a community for the "reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or a State Inventory of Historic Places, without regard to the procedures set forth..." (Federal Emergency Management Agency, 1984b). This provides that a building listed on the National Register or State Inventory which is damaged in a flood may be rebuilt in the same location regardless of the degree of damage and whether or not the property is located in either the floodway or floodfringe. Whether listed individually or as contributing to an historic district, buildings on the National Register of Historic Places have the same status (Abele, 1985) and would all be subject to the variance discussed above. However, if a structure receives damage to an extent greater than 50% and is consequently rebuilt, its historic character may be questioned. The Advisory Council on Historic Preservation would then have to determine on an individual basis whether the property and structure should be retained on the National Register.

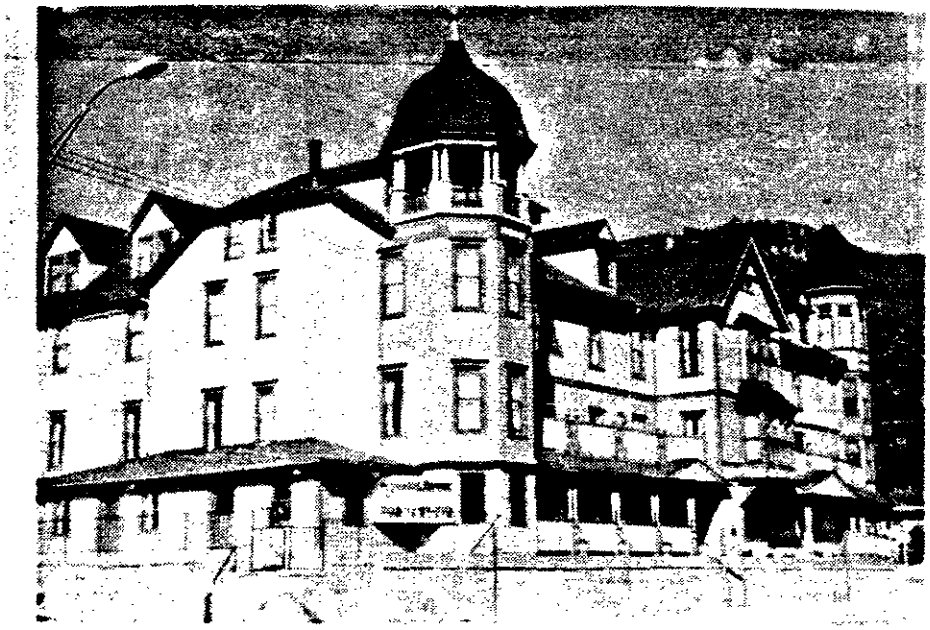


Figure 10. Barker House (formerly the Navajo Hotel) along Manitou Avenue showing the Elevated Entries and Protective Floodwall.

D. Damage Estimates

Determining damages for a given magnitude of flooding involves examining damages from historic floods, use of depth-damage curves, inventories of capital investment, and property value appraisals. The U.S. Army Corps of Engineers conducted field surveys during October, 1983, as part of its Reconaissance Study for the Upper Fountain Creek Watershed north of Pueblo. Information from this survey is contained in Tables 9, 10, and 11. Total annual average damages for the Manitou Springs area are currently estimated at $1,615,700.

TABLE 9

NUMBER OF DAMAGEABLE BUILDINGS

Right Bank	500 year	100 year	50 year	25 year
Residential	8	8	8	6
Commercial	78	71	47	44
Public	7	7	5	5
TOTAL	93	85	60	55
Left Bank				
Residential	42	36	22	10
Commercial	43	41	40	33
Public	2	2	2	2
TOTAL	87	79	64	45
Both Banks				
Residential	50	44	30	16
Commercial	121	112	87	77
Public	9	9	7	7
	180	164	124	100

Source: Unpublished Preliminary Report on Fountain Creek Watershed North of Pueblo, Colorado, Reconaissance Study by U.S. Army Corps of Engineers, Albuquerque District, April, 1985.

TABLE 10

VALUE OF DAMAGEABLE PROPERTY IN THE 500 YEAR FLOODPLAIN
(Figures in Thousands of Dollars)

	Right Bank	Left Bank	Both Banks
Residential	$ 690	$ 5,707	$ 6,397
Commercial	24,910	30,980	55,890
Public	3,400	2,850	6,250
Streets and Utilities	4,320	2,580	6,900
TOTAL	$ 33,320	$ 42,117	$ 75,437

Source: U.S. Army Corps of Engineers: Reconaissance Study Preliminary Report: 1985. Uses October 1984 prices at 8 and 3/8% interest.

TABLE 11

SINGLE OCCURRENCE DAMAGES
(Figures in Thousands of Dollars)

	500 year	100 year	50 year	25 year
Residential	$ 4,465	$ 3,323	$ 697	$ 339
Commercial	39,670	25,596	17,781	9,292
Public	4,817	3,591	2,918	2,069
Streets and Utilities	2,760	2,070	1,380	1,035
TOTAL	$ 51,712	$ 34,580	$ 22,776	$ 12,735

Source: U.S. Army Corps of Engineers: Reconaissance Study Preliminary Report, April, 1985.

TABLE 12

AVERAGE ANNUAL DAMAGES
(Figures in Thousands of Dollars)

	Right Bank	Left Bank	Both Banks
Residential	$ 18.3	$ 66.8	$ 85.1
Commercial	625.0	629.8	1254.8
Public	126.3	108.5	234.8
Streets and Utilities	25.7	15.3	41.0
TOTAL	$ 795.3	$ 820.4	$ 1615.7

Source: U.S. Army Corps of Engineers: Reconnaissance Study Preliminary Report, April, 1985.

The population-at-risk is broken down into resident, visitor and worker categories in Table 13. Note the fluctuation in number of people during the course of the day.

TABLE 13

RESIDENT, VISITOR AND WORKER ESTIMATES

Location	Visitors			Workers		
	2:00 PM	5:00 PM	11:00 PM	2:00 PM	5:00 PM	11:00 PM
Motels	120	240	420	30	20	10
Campgrounds	360	600	1200	15	15	10
Retail	500	200	0	200	200	0
Services	50	30	0	75	75	0
Parks	50	35	10	4	4	0
Driving Through	200	150	50	2	1	1
Municipal Bldg	10	5	0	20	8	4
Restaurants	200	400	100	50	75	25
Residents	80	350	400	0	0	0
TOTAL	1570	1970	2280	396	391	50

Source: 1980 census figures, visual surveys and estimated vacancy totals.

E. SCENARIO - THE ONE HUNDRED YEAR FLOOD

Scenarios are effective devices for increasing awareness and educating decision-makers of the possible consequences of a disaster. They should not be viewed as forecasts of the future. This scenario will assist decision-makers in developing a flood mitigation plan for Manitou Springs.

Public awareness and public education are needed in order for the residents of Manitou Springs to have a realistic perception of the hazards which face them. Local authorities should implement a modest education program concerning the flash flood potential.

The scenario has three interrelated objectives: first, to simulate the magnitude, characteristics, and distribution of human casualties, structural damage, and disruption of social systems likely to occur in Manitou Springs during a 100-year flash flood at its current level of preparedness; second, to show the capacity of existing emergency procedures for reducing the flood's impact; and third, to give examples of possible flood mitigation techniques that would heighten awareness, reduce stress, and reduce damage potential (Erickson: 1975, p.75).

The loss of life and property from floods has become the number one natural hazard nationwide in recent years. In Colorado alone 275 communities are subject to flooding. This represents approximately 150,000 people now living in Colorado's floodplains.

It has been nearly twenty years since a devastating flood has been witnessed in the Pikes Peak Region. We can not predict whether the next flash flood will strike today, this year, or years from now - we only know that it will, in fact, occur.

The day of the scenario is typical for the Colorado Front Range. The weather forecast calls for a chance of afternoon thunderstorms. An accumulation of thunderheads over Manitou Springs and the entire Pikes Peak Region is not sufficient cause for alarm to the residents and tourists of Manitou Springs on this warm, summer afternoon.

At 3:30 p.m., the sky has blackened and rain is beginning to fall in the mountains.

By 4:30 p.m., the storm has unleashed its full fury over the Fountain and Ruxton Creek drainage basins. The heavy rain causes many picnickers and campers in higher elevations to seek shelter or head for home.

Only light rain is falling in the lower elevations causing little concern.

By 4:45 p.m., the National Weather Service issues a general flash flood watch for El Paso County. The watch is transmitted by local radio and television stations about fifteen minutes later:

"The National Weather Service has issued a flash flood watch for valleys and low-lying areas of El Paso County until 7:00 pm."

Motorists travelling on Ute Pass are having difficulty keeping control of their vehicles during the steady downpour. One car is washed off the highway.

By 5:00 pm, the thunderstorm has intensified and shows no sign of moving out of the area. The town of Cascade reports three inches of rain in the last half-hour. Flooding is beginning to occur on the east side of Manitou Springs.

At 5:25 p.m., the National Weather Service sends out a flash flood warning:

> "The National Weather Service has issued a flash flood warning effective until 10:00 p.m. for persons in Teller, El Paso, and Freemont Counties in Colorado. Heavy rain was indicated by radar to be moving into these counties at 5:10 p.m. Woodland Park in Teller County reported two inches in thirty minutes."

The police department sends two patrol cars out to warn people to the south of Fountain Creek of the threatening flood. No officers are sent to the opposite side of the creek because of the life threatening situation that prevails (H. Greenman, 1985).

The sky over Manitou Springs has become incredibly black, interrupted only by sudden flashes of lightening. The intense rainfall is causing numerous rock and mud slides along the canyon walls and highway, trapping those people trying to escape by car. Flooding has already cut off the upper junction of Highway 24 and Manitou Avenue. Several cars are floating along the roads in low-lying areas.

Many residents and business owners, however, discount the warning, feeling secure within their own walls, and instill this false sense of security to their guests and customers.

One resident of the Fountain Creek Adult Apartments--which borders the north bank of Fountain Creek--seems unconcerned:

> "I've lived in this apartment for four years and have never seen that water rise more than two feet. It's (the creek) not a threat to my property."

By 5:45 p.m., all residents of the Fountain Creek Apartments must be evacuated to the Manitou Springs High School.

The first crashing wave of flood water hit Manitou Springs at the upper reach of Ruxton Creek. Because the channel is lined with concrete in its upper stretch, its flow is restricted and its velocity is increased.

The portion of the channel that flows beneath the Iron Springs Chateau Melodrama is unable to retain the flow, sending a six foot surge of water through the main dining room.

> "We could hear the rushing water but were advised to not drive out. All of a sudden the wall gave way and the river went right through the dining room; people and tables were thrown into a heap on the other side; There was nothing we could do to help them."

Seventeen lives are lost.

Power shortages become numerous as lines are torn down.

Numerous bridges cause damming with sudden surges of water as they eventually give way. Cars, animals and other debris fill the advancing waters.

A crashing wall of water hits the western reach of Fountain Creek just upstream from town. Three motels are inundated as Fountain Creek rushes beneath and through their structures. Some tenants escape by climbing the hill behind the motels. Nineteen others are swept to their deaths.

By 6:00 p.m., an official evacuation program has begun. Because the city has no pre-planned routes to safety the project is chaotic and inefficient. Colorado Springs' officials are having difficulty entering Manitou Springs due to the severe flooding. Flood water in the overbanks is exceeding ten feet in depth and flow velocities are now exceeding fifteen feet per second.

Confusion over warnings and evacuation procedures are overloading the few telephone lines not down. Some people are still unaware of the flood's speed and strength, spending a fatal length of time collecting valuables and pets.

> "I was taking pictues for the local paper when I noticed a woman with one arm wrapped around a post and the other around her dog. She was lucky she was so near the bank or I could never have pulled her out. The strength of the stream was overwhelming."

A mother and her three children try to escape from their drifting car when a giant wave sweeps the car and the three children away. All three children are killed. (Gazette Telegraph, 7/25/65).

In most areas the creek is cresting at least nine feet above the stream bank (U.S. Army Corps of Engineers, 1984a). Side canyons and tributaries are flooding--the powerful water is destroying cars, bridges, homes and any other obstacle that gets in its path.

Older structures located along and over Fountain Creek suffer the most damage as the flood reaches its peak. The numerous businesses and tourist shops that lie parallel to the creek and to Manitou Avenue are demolished as the creek roars past engulfing them. Video and pinball machines from Arcade Amusements are left in a chaotic mass of debris, leaving the proposed Manitou Mall area devastated.

The historic Episcopal church is inundated and all its contents virtually destroyed beyond repair.

The Manitou Springs fire and police departments face further difficulties as a crushing force of water knocks down the support beams for City Hall, causing the back half of the building to collapse into Fountain Creek. Luckily, the building had been evacuated because of its location on the creek.

Another victim is claimed on Ruxton Avenue as he and his sister try to escape their home.

> "We heard the water and eventually rocks and boulders hitting the side of the house. We saw that the creek and road were now one huge river and tried to get out and climb the bluff behind us. My brother was trapped between the outside wall and a giant wave of water...and then . . . I couldn't even see him anymore" (Gazettte Telegraph, 6/20/65).

Gas and electric lines are destroyed causing power outages and small explosions. Sanitary sewage lines fill with pressure, blowing manhole covers and spewing raw sewage into the floodwaters. The hazard of disease now adds its threat to the city.

Cottages and motels once found along the lowland floodplain are washed out, many dislocated.

The next few days are spent recovering bodies and providing shelter and food to the homeless. Victims are difficult to identify as their bodies were badly mutilated by the river and identification and clothing were stripped off by the powerful flow. Cars were destroyed and washed miles downstream. Mud and debris fill the entire Manitou Springs area.

Ninety-seven people were known to die in Manitou Springs and many others are still missing. Few are injured; there are only survivors or non-survivors. No one drowns in such a disaster but, rather, is killed by the powerful blows of water and debris. Structural damages within the city are in the multi-millions and clean-up costs will further escalate the total (U.S. Army Corps of Engineers, 1985).

III. FLOOD MITIGATION STRATEGIES: LESSONS FROM OTHER CONTEXTS

A. Floodplain Management

Humans have historically settled along waterways in recognition of their many benefits. In constructing these settlements, however, we have often failed to realize that flooding is a natural and inevitable process. In those areas where humans utilize and inhabit land areas that are subject to flooding, a potential conflict arises. Floodplain management is a comprehensive approach towards resolution of this conflict which may include both structural and nonstructural measures and addresses both preventive and corrective actions.

1. The Federal Context

Floods affect thousands of communities in the United States. More than 300,000 people are evacuated annually due to flood threats. Since 1975 an average of 200 people have died in floods each year in the United States, and annual flood damages now average nearly $5 billion (U.S. Department of Commerce, 1985: p. i). Figures 11 and 12 dramatically show the nation's vulnerability to floods. Flash floods are particularly disastrous in terms of loss of lives.

Structural and nonstructural measures have been adopted to limit flood damages. Structural measures include channel enlargement and the construction of levees, reservoirs and bypasses. Structural measures can greatly reduce flood threat and consequent loss but they can also create a false sense of security and encourage development in partially protected areas. Thus, when a rare flood occurs, even greater flood losses may be sustained. This may account, in part, for the trend toward increased flood losses as shown in Figure 12 (U.S. Department of Commerce, 1985: p. 3).

2. The State Context - Relation to the 406 Plan

A Flood Hazard Mitigation Plan was prepared by the Colorado Water Conservation Board to address critical issues relative to floodplain management at the state level (Colorado Water Conservation Board, 1985). The plan identifies areas which are vulnerable to flooding, documents existing federal, state, and local programs relevant to flood hazard mitigation, and provides guidance to local governments regarding reasonable actions to take to reduce flood damages. The Plan is a resource to help state and local agencies develop, in light of limited budgets, policies and programs which will mitigate flood losses in Colorado.

Manitou Springs is one of more than 200 Colorado communities which faces a flash flood threat. Flood hazards exist in all 63 of Colorado's counties. Approximately 150,000 people permanently reside in Colorado's floodplains. At least 350 people have died in Colorado as a result of flooding in the past 100 years. Cumulative flood losses in Colorado's history are estimated to exceed $1.6 billion dollars in present value (Colorado Water Conservation Board, 1985: pp. vii-viii).

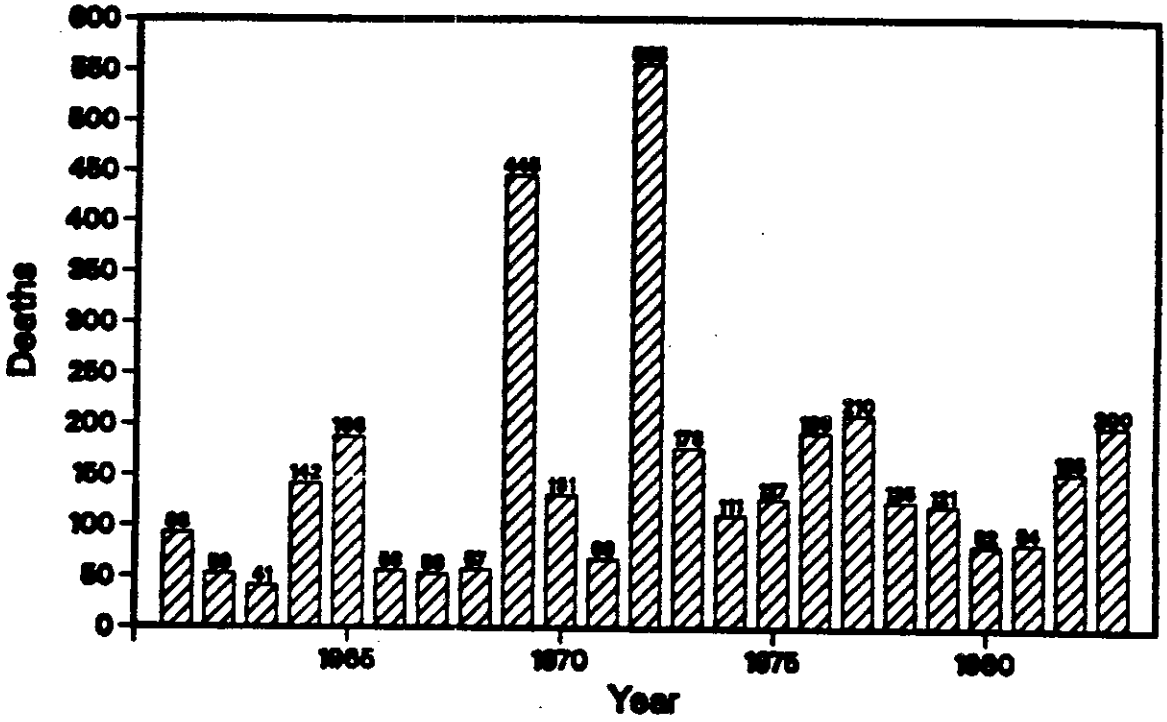


Figure 11. Annual Flood Deaths
Source: U.S. Department of Commerce, 1985:iv

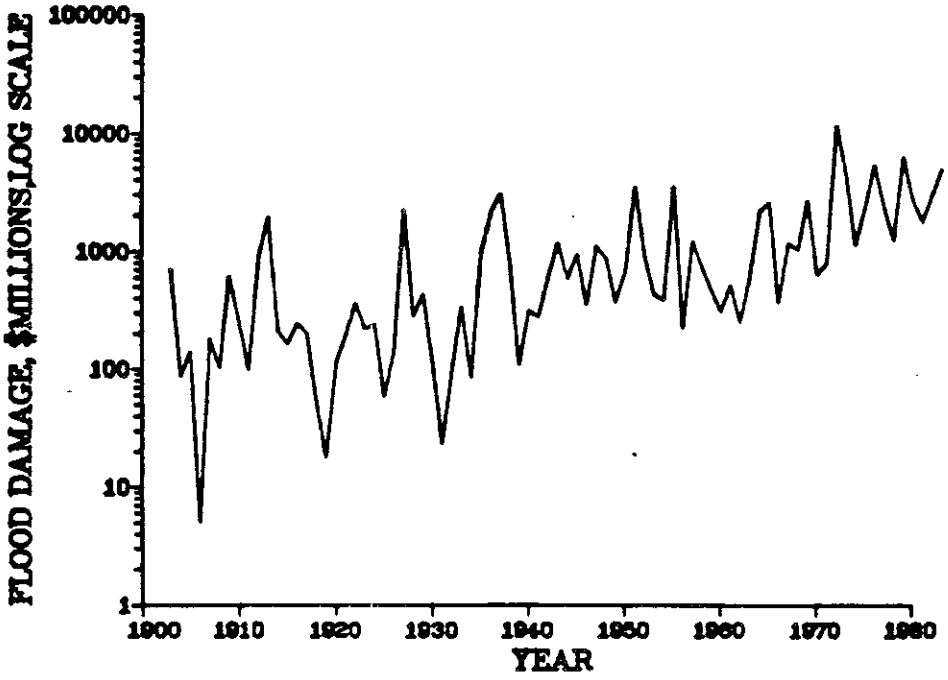


Figure 12. Annual Flood Damages

Source: U.S. Department of Commerce, 1985:iv

Across the state, only about 9 percent of all floodplain structures are insured and most are underinsured. In the state there are over 2000 dams. Six of these dams pose some threat to Manitou Springs.

This flood hazard contingency planning effort for Manitou Springs tailors many of the 37 recommendations made in the state mitigation plan. In particular, efforts made to increase public awareness, investigate the efficacy of different types of warning systems, organize an effective emergency operations plan, and improve basin-wide management of flood mitigation projects can reduce Manitou Springs' vulnerability to a disastrous flash flood. Manitou Springs is to be commended for taking initiative aimed at reducing potential flood losses.

B. Flood Hazard Adjustments

1. Warning Systems

Boulder County, Colorado

The Boulder County flash flood warning system takes a sophisticated approach to collection and evaluation of real-time data. It relies on an automatic system of telemetry stream and rain gages, an extensive system of volunteer weather observers and weather radar.

The system includes 36 rain gages and 12 stream gages with telemetry communications to the Boulder County Communications Center. Data supplied is processed through a micro-computer using modified software which determines projected peak flows. The system of ground observers provides ground confirmation of radar information supplied by the National Weather Service radars located at Limon, Colorado and Cheyenne, Wyoming.

The total cost of the system is approximately $44,700 which is broken down in Table 14.

TABLE 14

COMPONENTS AND COST OF BOULDER WARNING SYSTEM

Each telemetry rain gage	$3000
Each telemetry rain gage site right of way	100
Each telemetry stream gage	5000
Each telemetry stream gage right of way	200
Each recording rain gauge	900
Each micro-computer	9000
Each centralized data display map	7000
Each radar reception unit	14500
Miscellaneous repair parts (annually)	5000

Source: Boulder County Flood Warning System, 1982.

Two full time employees are responsible for the operation and maintenance of the system. Part time assistance from police, sheriff and civil defense personnel is provided throughout the year.

Lena Gulch, Colorado

The warning system at Lena Gulch, located near Golden, Colorado, was installed in 1984. The project was funded by the Urban Drainage and Flood Control District and includes six rain gages and three stream gages with radio telemetry capabilities. The collected data is processed through a micro-computer using software provided through the National Weather Service's ALERT system. The cost of the system totals approximately $100,000 which is broken down in Table 15.

TABLE 15

COMPONENTS AND COST OF LENA GULCH WARNING SYSTEM

Micro-computer	2 @ $5000 each	$10000
Repeater Station		3000
Antenna		400
Antenna Duplexer		1200
Stream gages		1450
Rain gages		13175
VHF Transmitter		2500
Electronics		1300
Decoders		23400
Receivers		18000

Source: K. Stewart, 1985.

The drainage area covered by this warning system is slightly more than 11 square miles. The Urban Drainage and Flood Control District also employs the services of a private weather forecastor from mid-May to mid-September at a cost of $37,500.

Harris County, Texas

The Harris County automated flood warning system is a real-time, self-powered system that serves the Houston, Texas area by collecting rainfall and water level data at thirty-eight locations. The information is transmitted by radio signal to a computerized base station for processing and display. The previous method of flood warning relied on individuals/crews to provide data from staff gages. The lack of complete coverage and less than real-time processing limited the effectiveness of such a system so the county authorized funding for an automated system. The total cost of the system was $250,000. Costs were limited by utilizing in-place U.S.G.S. gaging stations.

System Overview:

- IBM XT computer with 10 megabyte hard disk
- Modem access by U.S.G.S., C.O.E., and N.W.S.
- Quantum software utilizing ALERT programs
- Display map (computerized)
- Radio transmitters utilizing N.W.S. frequencies
- Precipitation sensors
- Stream level sensors

Gatlinburg, Tennessee

Many towns which have potential flash flood problems but have not experienced flooding in many years are currently developing flood warning systems.

Gatlinburg, Tennessee, population 3200, is bisected by the Pigeon and West Prong Rivers with motels, hotels and restaurants located in the flash flood area. A storm twenty miles away could send ten feet of water into the town only 15 minutes after the first warning. In cooperation with the National Weather Service, a system involving automatic rain and river gages, a computer model of the watershed, automatic data processing and automatic alarms have been set up.

Gatlinburg has adopted strict regulations for future floodplain use plus the warning system and evacuation plan approach for the time being. Funding was supplied by the Tennessee Valley Authority and Gatlinburg (Kusler, 1982).

2. Land Acquisition and Relocation

Soldiers Grove, Wisconsin

Soldiers Grove, Wisconsin, home to some 600 people, relocated its Central Business District after repeated flooding, culminated by a severe flood in 1978. Stipulating that energy conservation in new building was a number one priority, Soldiers Grove now gets 50% of its energy from the sun. Federal and state backing was obtained through a clear demonstration of community support, detailed planning, quick concerted action in time of crisis and persistant political pressure.

The U.S. Dept of Housing & Urban Development, the HUD Community Block Grant for Small Cities, the Land & Water Conservation Fund, the Economic Development Administration and the Community Services Administration all contributed monies (David & Mayer, 1984).

Rapid City, South Dakota

Rapid City, South Dakota, experienced a 100 year flood in 1907. No one was killed and only minimal damage done. After much city expansion, 9000 people had located in the floodplain by 1970. A flood similar to the 1907 flood was again experienced in 1972. This time 238 people died and damage was estimated at $128 million.

The city immediately embarked on a flood management program. The floodway was marked and all homes, motels and most commercial establishments were removed from this area. The floodway now serves as a golf course, picnic area, and natural area, it has several ponds, skating rinks, and a bike path. Funds were provided by the Federal Disaster Assistance Administration and The Small Business Administration (Rahn, 1984). This type of funding is no longer available in this form.

Additional Case Studies

A comparison of various case study experiences can be found in Table 16. Detailed discussions of these are included here.

Baltimore County, Maryland, decided that the only long term solution to its flooding problem was to relocate 221 houses. Financed entirely by county funds, citizen approval was obtained once it was shown that allocation and relocation of these homes would actually save tax dollars (Ralph M. Field and Associates, 1979).

Beatrice, Nebraska, is a city of roughly 12,500 people. One out of every six residents lives in the floodplain. The levee and channel improvements that the city had done were of no help in a 1973 flood. Community Development Block Grant and Municipal funds were used to relocate people out of the floodplain (Ralph M. Field & Associates, 1979).

A flood in 1964 totally devastated the small town of Klamath, California. A relocation site was chosen 1000 yards from the old town. Regulations prevented owners from rebuilding but the city did not buy the property. The new town site was not ready until 1969, five years after the flood. The Corps of Engineers and the State of California financed the project, but because of the lack of financial assistance in the form of acquisition payments and the time involved to prepare the relocation site, the project failed to receive public support.

Prairie du Chien, Wisconsin, is an historic community with a population of 6000. After a 1965 flood inundated the city for 22 days, a flood protection study was requested. Results of this study in 1970 led to the evacuation of the 10 year floodplain, floodproofing buildings in the 50 and 100 year floodplain and continued flood insurance. These projects were funded 80% by the Corps of Engineers and 20% by the city with the help of HUD Block Grants.

3. Floodproofing

The Colorado Water Conservation Board's Colorado Floodproofing Manual (1983) lists three major categories of floodproofing. The first of these is permanent, where different types of floodproofing such as elevation of a structure and flood walls are incorporated into the design of a building. The second category, contingent floodproofing, is usually initiated at the time a warning is issued. Removable flood shields and movable flood walls are two examples. They might require minor remodeling of the existing structure and could remain in place throughout the flood season. Emergency floodproofing, the final category, consists of such methods as sandbags and is initiated at the time of flooding. However, there is usually too little time available for emergency floodproofing in a flash flood situation.

TABLE 16

ACQUISITION AND RELOCATION CASE STUDIES

City	Population	Plan	Funding
Baltimore County, Maryland	315,000	Acquisition Relocation	100% Local
Beatrice, Nebraska	12,500	Acquisition Relocation	Municipal Funds HUD Comm. Block Grants
Clinchport, Virginia	150	Acquisition Relocation	Tenn. Valley Authority
Gatlinburg, Tennessee	3200	Warning system Evacuation plan (with the NWS)	Tenn. Valley Authority Local
Klamath, California		Relocation	State Loans Corps of Engineers
Prairie du Chien, Wisconsin	6000	Evacuation of 10 yr floodplain Flood proofing in 50 & 100 yr floodplain	80% Corps of Engrs 20% City with HUD Block Grants
Rapid City, South Dakota	9000	Acquisition	FEMA & Small Busns. Administration
Soldiers Grove,	600	Acquisition	HUD Comm. Dev. Block Grants for Small Cities, Land & Water Consv. Fund, Economic Development Administration, Community Services Administration

Sources: David and Mayer, 1984; Ralph M. Field and Associates, 1979; Rahn, 1984.

Effectiveness depends on matching the particular type of floodproofing to building design, location, and amount of available warning time. Many specific examples are examined in the Colorado Floodproofing Manual and officials at the Colorado Water Conservation Board are available for consultation on individual cases.

Floodproofing costs fluctuate with such variables as the type of structure, building design, method of floodproofing, location, and material and labor costs. Benefits include saving lives, protecting the building and its contents, and reducing flood insurance premiums (Colorado Water Conservation Board, 1985).

4. Contingency Planning

A Local Emergency Operations Plan (LEOP) is a plan developed by a municipality in order to increase efficiency and decrease confusion in the event a disaster should occur. It should contain several basic elements, including a brief discussion of the general situation with regard to a particular threat, a list of departments and organizations which will be involved should this event occur, and definition of the key organizations' responsibilities. Particular issues to be addressed include warning and communication procedures, control and coordination, evacuation and sheltering, public information, and damage assessment (I. Glassman, 1985).

5. Flood Insurance

The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency, is designed to help communities develop information regarding flood hazard areas and to prevent flood disasters at the local level. The NFIP provides federally subsidized insurance for buildings and their contents in flood-prone areas.

A community may enter the emergency phase of the NFIP by submitting an application and adopting preliminary floodplain management policies, including requiring permits for any proposed construction or development so as to minimize flood damage potential (Colorado Water Conservation Board, 1983). During this phase, the federal government provides a limited amount of subsidized flood insurance for structures, regardless of their flood risk. Also during the emergency phase, the Federal Emergency Management Agency generally prepares Flood Hazard Boundary Maps and more detailed Flood Insurance Rate Maps for the community.

Conversion to the regular phase is based on completion of a flood insurance study and adoption of more stringent floodplain management regulations than those applicable in the emergency phase. Increased flood insurance then becomes available.

6. Public Education

Community flash flood awareness can be achieved by installing signs identifying historic high water marks, identifying one-hundred year flood elevations on street corners, and placing "climb to safety" signs in hazard areas.

Once the community is aware of the hazard, public education can be used to transform concern into action. Evacuation plans should be posted and practiced. When the warning sounds, people will know why and what action to take. Public education is the key to saving lives in a flash flood situation as the short lead time requires quick, positive action.

7. Historic Preservation: St. Marys, Ontario, Canada

The town of St. Marys is located in southwestern Ontario at the junction of the North Thames River and Trout Creek. Incorporated in 1855, it is in many ways similar to Manitou Springs. It contains significant historical architecture, and the majority of the downtown business district is located in the floodplain. St. Marys' 1984 population was approximately 4700, and tourism is the staple of the town's economy (Mitchell, 1984).

The agency which is responsible for flood control in St. Marys is the Upper Thames River Conservation Authority (UTRCA). In many communities within its district, the Authority advocates acquisition of riverfront land, and consequent demolition of any buildings on that land, to provide a greenway. However, in St. Marys, the UTRCA has responded to the historic nature of buildings in the floodplain and the town council's opposition to acquisition by adopting a different strategy utilizing floodwalls and floodproofing (Mitchell, 1984).

In 1982, the Ontario Ministry of Natural Resources and Ministry of Municipal Affairs and Housing provided that in existing commercial, retail, industrial, or residential developments located in floodplain areas, "rehabilitation, redevelopment or replacement of structures in such areas are seen as necessary to continued community viability and major relocations are not considered feasible." The Upper Thames River Conservation Authority's floodplain management strategy in St. Marys is consistent with this approach and gives historic preservation a greater priority than flood damage reduction. In doing so, "the community has accepted a higher risk of flood damages" (Mitchell, 1984).

8. Sense of Future Community Vision: Estes Park, Colorado

Estes Park is similar to Manitou Springs in that its economy is based primarily on summer tourism. Although the year-round population of Manitou Springs is greater, Estes Park receives more visitors and generates more sales tax dollars (Duea, 1982). During the summer of 1984, a quarter of a million people visited Estes Park's Chamber of Commerce/Visitor Center (Larry Stumpp, 1985), while only 20,000 cars were estimated to have visited the Manitou Springs Chamber of Commerce and Information Trailer on Highway 24 (Rayer, 1985). Nevertheless, these two cities share similar histories and were, until the 1950's, the two major tourist resort destinations in Colorado.

On July 15, 1982, Lawn Lake Dam failed, and water rushed down the Roaring and Fall Rivers and into Estes Park, inundating three-fourths of the downtown business district and causing substantial damage and destruction in many other areas. The recurrence interval of the flood has

been estimated at well over 500 years. However, the amount of water released was a mere 8,000 cfs, as compared to a modest estimate of 28,500 cfs for a 100 year flood in Manitou Springs.

According to the Intergovernmental Flood Hazard Mitigation Report for the Lawn Lake Dam Failure and the Fall River Flood, 177 businesses in Estes Park were inundated. Structural damage was minimal, but three to four feet of mud and water was left in most establishments. Clean-up efforts began immediately, and most shops were open for business within a few days.

The Estes Park Chamber of Commerce estimates the visitor count at 1250 on Wednesday, July 14, the day before the flood. On the day of the dam break, 200 visitors were in the area before the water rushed into town. The next day, Friday, the count rose to 500. It continued to rise over the weekend so that by the following Monday, July 19, the visitor count was back up to its pre-flood level of 1250 (Stumpp, 1985).

Retail sales figures for the first two weeks of July, 1982, represented an increase of 12.7% over the previous July. Figures for the last two weeks of July represented no loss or gain over those from the previous year. Therefore, July 1982 retail sales saw a net gain of 12.7% over those for the same month in 1981. According to the American Automobile Association, Estes Park was the only community in Colorado to show an increase in tourism in 1982 (Stumpp, 1985).

Like the Lawn Lake flood in Estes Park, a 100 year flood in Manitou Springs would inundate most of the downtown business district. The amount of tourist dollars that would be lost due to such an event is difficult to estimate, as several factors such as the date of the flood and duration of clean-up activities must be taken into consideration. However, much of the retail sales lost in the few days immediately after the flood might be made up as relief personnel and those seeking to satisfy their curiosity would bring dollars into the area.

C. Roles of Governmental Agencies

Flood problems are not restricted to municipal boundaries. Floodplain management efforts should therefore be coordinated between neighboring municipalities and regional, state, and federal authorities.

1. Local

It is the responsibility of the local government to enact and enforce land use regulations for their community and to inform state and federal agencies of their goals and decisions regarding floodplain management. Local government is also generally responsible for applying to regional, state, and federal agencies for planning, technological, and financial assistance in developing and implementing their floodplain management strategies (U.S. Water Resources Council, 1979).

2. Regional

PIKES PEAK AREA COUNCIL OF GOVERNMENTS (PPACG) - PPACG is a regional council of governments formed in 1967 to serve in the areas of regional planning and intergovernmental contracting. It is a voluntary organization of local governments serving the regional community of counties and cities with a governing body of elected officials from various participating local governments including Manitou Springs. The Council has been especially active in the U.S. Army Corps of Engineer's Reconaissance Study for the Upper Fountain Creek Watershed involving Manitou Springs as a liaison between the many governmental agencies.

REGIONAL BUILDING DEPARTMENT - The Regional Building Department serves the Pikes Peak region by establishing building codes and regulations and by conducting building inspections. There has been discussion regarding the establishment of a position of Floodplain Administrator for the region who would oversee construction activities within the floodplain.

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT (UDFCD) - The origins of the Urban Drainage and Flood Control District can be traced to the devastating flood along the South Platte River in June, 1965. This flood demonstrated that floodwaters do not respect development in the floodplain and disregard jurisdictional boundaries. Denver area engineers working for the various municipalities initiated an ad hoc group advocating regional solutions to drainage problems and enlisted the support of an influential state senator. Through their efforts, legislation was signed in 1969 creating the Urban Drainage and Flood Control District (UDFCD).

The first activity of the district was to inventory drainage basins, determine the extent of problems and develop a plan to attack those problems. The original 1/10 mill levy was expanded to 5/10 mill in 1974 and again expanded to 9/10 mill during 1979.

Other activities carried out by the district include a master planning program designed to develop flood control, design and construction, floodplain management program, and maintenance and preservation of all floodplains and floodways.

The district extends from north of Boulder to just south of the Douglas County line and from Golden on the west to east of Aurora. It is included in this discussion as a model for the Manitou Springs/Colorado Springs Area. See Recommendations Section for additional information.

3. State

COLORADO WATER CONSERVATION BOARD (CWCB) - The CWCB is principally responsible for the following programs: 1) floodplain management services, 2) identifying flood hazard areas, 3) planning of flood control and drainage projects, and 4) hydrologic and hydraulic investigations.

DIVISION OF WATER RESOURCES (STATE ENGINEER) - The State Engineer is responsible for the administration of all waters within the state. The Engineer's office administers the dam safety program, operates and maintains state stream gages, and maps the dam failure flood zone.

DIVISION OF DISASTER EMERGENCY SERVICES (DODES) - DODES is responsible for coordinating the activities of other state agencies in the areas of mitigation, preparedness, response, and recovery from disasters. It supervises the preparedness and emergency planning of local governments.

DEPARTMENT OF LOCAL AFFAIRS (DLA) - Within the Department, the Division of Local Government, the Division of Housing, and the Division of Commerce and Development have programs which deal with drainage, flood control, and floodplain management.

4. Federal

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) - FEMA is the chief agency involved with management of natural and technological hazards at the Federal level. Some of its numerous programs which pertain to the development of local preparedness programs include: 1) mapping flood hazard areas assisting local entities in using these maps, 2) providing assistance for evaluation of local disaster preparedness, 3) providing technical assistance for development of floodplain management practices at the local level, 4) coordinating post-disaster assistance and aid at the Federal level, 5) coordinating Federal dam safety programs, and 6) responsibility for the National Flood Insurance Program.

U.S. ARMY CORPS OF ENGINEERS (COE) - The COE is responsible for planning and constructing projects for flood control. Included in its programs are: 1) floodplain information, 2) survey investigations, 3) small flood control projects, 4) snagging and clearing of stream channels, and 5) emergency flood response.

NATIONAL WEATHER SERVICE (NWS) - The NWS is responsible for issuing weather and river forecasts and hazardous weather and flood warnings. It also assists communities in establishing local flood warning systems.

U.S. SOIL CONSERVATION SERVICE (SCS) - The SCS is involved in water and land resources planning programs including watershed projects, flood protection projects, resource conservation and development projects, and river basin studies.

U.S. GEOLOGICAL SURVEY (USGS) - The USGS carries out an extensive program to collect and interpret information on the nation's land and water resources. It operates stream flow gaging stations which measure discharge and stream height used in computing water supplies of the United States.

U.S. FOREST SERVICE (USFS) - The USFS is responsible for land use planning and management practices for large areas of publically owned forest land. They study impacts on stream flows and basin flood characteristics.

IV. RECOMMENDATIONS FOR MANITOU SPRINGS

The recommendations have been divided into six phases. They are listed below. Elaboration on each phase follows the list.

A. Overview

PHASE I: Establish a Steering Committee for Long-Term Implementation of the Plan

Schedule: Initiate Immediately
Duration: Ongoing

A. Coordinate with adjacent communities

B. Investigate funding sources

C. Form an area-wide flood control district

D. Develop a public education program

E. Coordinate with historic registry staff

F. Encourage purchase of flood insurance

G. Oversee regulation of floodplain development (Ordinance 0184)

PHASE II: Survey the Community

Schedule: Month Two
Duration: 30 Days

PHASE III: Identify Mitigation Strategies

Schedule: Month Three
Duration: 30 Days

A. Prepare a warning and evacuation plan

B. Develop a floodproofing program

C. Develop a program for improving passage of flood flows

PHASE IV: Develop Pre-Flood and Post-Flood Mitigation Plans

Schedule: Month Four
Duration: 30 Days

PHASE V: Implement Pre-Flood Mitigation Plan

Schedule: Month Five
Duration: Ongoing

PHASE VI: Implement Post-Flood Mitigation Plan

Schedule: Post-Flood
Duration: Ongoing

The next section describes the recommendations. Addresses and phone numbers of key agencies are provided in the Appendix D.

B. Elaboration of Phases

1. PHASE I: Establish a Long-Term Implementation Committee

Schedule: Immediately
Duration: Ongoing

Manitou Springs should formally establish an intergovernmental, interagency and interdisciplinary committee to assist in the continued development and implementation of its Hazard Mitigation Plan.

A community group and a technical advisory group were established in January, 1985. Community members are listed as Appendix J of this report. These groups are motivated and have already taken initiative aimed at implementing these recommendations. Meetings should be regularly scheduled and guests from the National Flood Insurance Program, the state Historic Registry staff, Urban Drainage and Flood Control District in Denver, and others with relevant expertise should be invited in an advisory capacity.

Recommendation A. Coordinate With Adjacent Communities

The Committee should further pursue the involvement of all communities in the river basin to develop a coordinated plan for mitigating anticipated flash flooding.

The County Civil Defense officer is a logical coordinator of this effort. Mr. McWilliams can provide a forum for discussion. He can invite civil defense officials from Teller County and the neighboring cities to develop a comprehensive response capability and to set the stage for integrated emergency management for floods and possibly other hazards. He can invite the State Department of Emergency Services to conduct drills and exercises to develop a comprehensive approach in the region.

The committee can also request workshops from the Colorado Water Conservation Board, the Federal Emergency Management Agency, and the Pikes Peak Area Council of Governments to foster the regional approach to planning.

Recommendation B. Investigate Funding Sources

The committee should investigate all possible sources for funding the implementation of these recommendations, including Federal and State cost-sharing, joint funding with adjacent communities and other techniques.

TABLE 17

Available Asistance for Program Development

Element	Financial Assistance	Technical Assistance	Useful Information
Problem Analysis	CDBG[4] FEMA COE[2]	ES FEMA NWS1 PHS SCS[1] COE[1] CWCB[1]	ES FEMA[1] NWS1 RC SCS1 COE1 CWCB1 USGS[1]
Warning	CDBG[4] FEMA[3] COE[1]	NWS1 SCS COE1 DODES[1]	NWS1 SCS COE DODES1
Evacuation and Rescue	CDBG[4] FEMA[3]	ES FEMA RC[1] SCS[1] COE[1] DODES	ES FEMA PHS RC1 SCS COE DODES
Damage Reduction	CDBG[4] FEMA[3] SCS[2]	ES PHS SCS COE[1] CWCB[1]	ES RC SCS COE1 CWCB1 USGS
Recovery	CDBG[4] FEMA[3] RC[1] COE[1] SCS[1]	ES FEMA1 PHS RC1 SCS COE[1]	ES FEMA1 PHS RC1 SCS COE
Public	CDBG[4] FEMA[3]	FEMA NWS1 PHS RC SCS COE[1] CWCB DODES	FEMA NWS1 PHS RC SCS COE1 CWCB DODES
Plan Implementation	CDBG[4] FEMA[3]	FEMA1 NWS1 RC SCS COE1	FEMA NWS RC SCS COE1
Plan Maintenance	CDBG[4] FEMA[3]	FEMA1 NWS1 SCS	FEMA1 NWS SCS

1 Major Involvement
2 Project Authorization or Congressional Guidance
3 Grants to states
4 Grants

CDBG - Community Development Block Grant Program, HUD
ES - Extension Service, Department of Agriculture
FEMA - Federal Emergency Management Agency
COE - Corps of Engineers
NWS - National Weather Service
PHS - Public Health Service
RC - Red Cross
SCS - Soil Conservation Service
CWCB - Colorado Water Conservation Board
DODES- Division of Disaster Emergency Services

Source: Adopted from the New York State Warning System Study, 1984.

Table 17 shows potential funding sources based upon experiences elsewhere in the United States. The committee can explore each possibility by contacting each agency directly. Manitou Springs will be more effective in the funding quest if the community acts in conjunction with others in the region.

Settle (1985) developed a matrix showing the types of funding sources and programs which are available for emergency management (see Table 18). While not all of the programs shown there may have direct application in Manitou Springs, it is heartening to note the vast array of funding alternatives which have been adopted elsewhere.

TABLE 18

Matrix for Emergency Management Funding

Funding and Financing Alternatives for Local Governments	Mitigation (long-term) Reduce/ Eliminate Disaster	Preparedness (to respond) When Mitigation Cannot Help	Response (to emergency)	Recovery (short- and long-term)
Budget Transfers (temporary loan)	X	X	X	X
Mutual Aid Agreements (state and local)			X	X short-term
Joint Powers Agreements (JPA/JPIA)			X	X
Tax Anticipation Notes (short-term loans)	X	X	X	X
Bonds (municipal, industrial development)	X			X
Insurance Funding and Programs (federal, state, and local)				X
Assessment District	X	X		X
Grant-in-Aid (block and categorical)	X	X		X
Property or Sales Tax Increases	X	X		X
Lease Purchase Agreements	X			X
Tax Increment Financing (redevelopment)	X			X
State or Federal Highway/Gas Tax Funds (depends on state)**	X**	X**		X

(Federal and state disaster aid covered under response and recovery)

Source: Settle, 1985.

Recommendation C. Form a Flood Control District

The committee should encourage adjacent communities to join with Manitou Springs to form an area-wide flood control district. Such a district would promote cost-sharing. Presently, Manitou Springs and neighboring communities are attempting to manage flood problems that have basin-wide origins and impacts needing basin-wide management. A very good example of such a program is the Denver areas' Urban Drainage and Flood Control District (UDFCD) which was created in 1969 by an Act of the Colorado State Legislature. The UDFCD includes all of Denver county and parts of Adams, Arapahoe, Jefferson, Boulder and Douglas Counties, and it acts as a coordinating agency for the collection and dissemination of drainage information, floodplain definition and assistance in qualifying for flood insurance programs.

The District has the power to plan, design, construct, acquire, equip, relocate, maintain and operate drainage facilities and can enact floodplain regulation. It can also make planning and design information available, including maps of the Drainage District that delineate drainage basins and provide physical and hydrological parameters, design rainfall information for runoff analysis, statistical analysis of long-term records and provide other information that becomes available from time to time.

The Colorado Division of Disaster Emergency Services is now coordinating the development of similar drainage and flood control districts on the western slope of Colorado, centered in Grand Junction and in the San Luis Valley. The committee should learn from the experiences elsewhere with successful regional drainage districts.

An Urban Drainage and Flood Control District would also be instrumental in the development of a more sophisticated warning system. The current warning plan for Manitou Springs includes one alarm in place for the Upper Fountain Creek watershed that interfaces with the Manitou Springs Police Department. The City of Colorado Springs is planning to install dam measuring devices that will monitor the condition of the six dams above Manitou Springs and report that information directly to the Water Control Center on Mesa Road. One umbrella organization to receive all data on flood conditions would facilitate more effective decision-making, and an area-wide flood control district would fill this need perfectly. Each community in the District would benefit, and costs could be shared. The development of a formal relationship between Manitou Springs, El Paso County, Teller County, Colorado Springs and the upstream communities of Green Mountain Falls, Chipita Park, Woodland Park and Divide would be extremely beneficial for flood warning, drainage issues and post-flood preparation.

There has been discussion regarding the establishment of a position of floodplain administrator who would oversee construction activities within the floodplain. Such a role would be ideally situated in the proposed district. For further information on the Denver UDFCD contact L. Scott Tucker, Executive Director, or Jack Truby, Colorado Division of Disaster Emergency Services (addresses and phone numbers found in Appendix D).

Recommendation D. Develop a Public Education Program

The committee should work with the local media and public and private groups to heighten awareness of the hazard and actions that can be taken to mitigate its effects.

Community awareness through public education is vital to reduce the flood threat. Public education is a key to saving lives in a flash flood as the short lead time requires quick, positive action. Many tools may be used to increase the level of awareness including the following options: showing the Manitou Springs flash flood scenario (the slide show is available at the public library, the commentary can be found as Appendix I of this report) Signs can be installed identifying the flood threat; evacuation routes can be marked with 100 year flood elevations, and historical high water marks; pamphlets can be prepared and sent to residents and business owners; and, workshops can be held to maintain a high level of preparedness.

Recommendation E. Coordinate with Historic Registry Staff

The committee should contact representatives of both the National and State historic registries in order to identify ways to maintain the historic designations of places within the city while achieving hazard mitigation goals.

Certain questions must be answered before a flood so that post-flood operations run smoothly. These include (1) what types of design alterations are or are not acceptable for protecting buildings and other historic structures from flooding; and, (2) how is the threshold established for determining when damage from fire, flood or other hazard would endanger a structure's historic designation.

The City of Manitou Springs can initiate negotiations with the local business owners, the Colorado Water Conservation Board and the Federal Emergency Management Agency to develop a "Memo of Understanding" which would establish the procedures for reconstruction of historically contributing buildings in the floodway and floodfringe. This document can stipulate post-flood activities for the buildings based on their location and degree of damage and would serve to minimize confusion in the aftermath of a flood and speed the recovery period.

Recommendation F. Encourage Local Property Owners to Purchase Flood Insurance

The Committee should work with the local insurance agents and the Federal Emergency Management Agency staff to encourage the purchase of flood insurance by local property owners.

With Manitou Springs' topography and development pattern, flood damages are inevitable. Flood insurance is one of the most effective means to mitigate these anticipated losses. Yet, only a very small percentage of the city's floodprone properties are currently covered by flood insurance (only 32 policies are in effect as of May, 1985) Flood

insurance under the NFIP is heavily subsidized and therefore available at low rates, e.g., $.50 per $100 of coverage, to a limit of $300,000. Contents coverage is available at $1.00 per $100, to a limit of $200,000. Residential coverage is available at somewhat lower rates and limits.

A flood insurance promotional campaign should be held every Spring with the cooperation of the Federal Emergency Management Agency and local insurance agents. This campaign should be made a part of the city's flash flood education program. The Federal Emergency Management Agency has available brochures, maps and other information that can be used to promote the purchase of flood insurance. In addition, its staff can assist by providing workshops and other presentations to provide insurance agent training and to answer questions on its programs.

Recommendation G. Assist in Regulating Floodplain Development

The Committee should assist the city's floodplain development permit official in the process of implementing Ordinance #0184, Manitou Springs Floodplain Ordinance. A copy of the Ordinance is attached as Appendix E of this report.

The city planning department, economic development group, and city council should take the lead. These groups should take full advantage of the technical assistance available from the Colorado Water Conservation Board and Federal Emergency Management staff. The distinctions between the floodplain and the floodway as specified in the ordinance should be understood and be reflected in policy and permit procedures.

According to the Federal Emergency Management Agency (1983:p. 17), "The floodway includes the channel of a river and the adjacent floodplain that must be reserved in order to discharge the base flood. The Federal Emergency Management Agency requires the community to designate a part of the floodplain as a 'regulatory floodway' to avoid the possibility of significantly increasing upstream flood elevations. This 'regulatory floodway' cannot cause a cumulative increase in the water surface elevation of the base flood of more than one foot at any point. Some state standards specify smaller allowable increases. Within the designated floodway a community must prohibit development that would cause any additional rise in base flood elevations."

In the same Federal Emergency Management Agency publication (p. 13), the flood insurance rate structure is explained. Since Manitou Springs is a 'regular' member of the National Flood Insurance Program, Flood Insurance Rate Maps are available. This regular status enables Manitou Springs residents to purchase increased amounts of flood insurance while new and substantially improved structures in the floodplain are charged actuarial rates--at much higher cost than the subsidized rates.

Committee members are referred to the 1983 FEMA publication Questions and Answers on the National Flood Insurance Program for more specific information.

2. Phase II: Survey Community

Schedule: Month Two
Duration: 30 Days

The committee, with the assistance of Federal and State technical agencies, should perform a survey of the community to provide information necessary to identify mitigation needs and strategies.

Where to Survey:

--Stream channel--Identify channel maintenance needs, points where widening or the alteration would reduce damages, and points where flow breaks out of the channels. The survey should provide the basis for immediate and long-term channel improvements and maintenance.

--Floodplain (especially the floodway)-- Survey the following items:

(a) buildings, residential, nonresidential, and especially historic;

(b) streets, bridges, culverts, water, sewer and other utility lines and facilities; and,

(c) critical facilities, especially public buildings, water and power plants, emergency and health facilities, hazardous materials sites, and gas stations.

--Floodplain and adjacent areas -- This serves to identify the anticipated path of flood waters. Also the survey helps planners by identifying building types, uses, contents, occupancy patterns, extent of potential flood damages, effects on flood flows, and mitigation opportunities including floodproofing and relocation.

--Entire community-- This can serve as the basis for identifying potential locations for siting or relocating pre-and post-flood development, especially critical facilities and for preparing warning and evacuation plans and procedures. Perhaps most importantly, this survey will identify all undeveloped areas to which proposed development can be directed or to which post-disaster reconstruction can be re-sited. The city should emphasize the placement of critical facilities such as public offices and emergency service facilities to these open areas.

Identify the following items:

(a) vacant lots and other potential development sites. One-half of this survey has been completed. It is attached as Appendix F;

(b) population concentrations at various times of day;

(c) evacuation routes and impediments to rapid egress; and

(d) residences and work places of elderly and handicapped.

In connection with the community survey, Manitou Springs should do the following:

(a) develop site-specific mitigation designs for selected floodplain properties e.g., those with high loss potential or which increase the hazard;

(b) determine the economic feasibility of pre-flood implementation of these designs;

(c) coordinate designs for historic structures with representatives of the national and state historic registries;

(d) implement those designs that are feasible in the pre-flood period; and,

(e) for structures or areas where floodproofing proves economically infeasible or unrealistic, develop a plan to:

1. direct the post-flood reconstruction of destroyed or severely damaged structures to flood-free areas; and

2. design the post-flood reconstruction of remaining structures to protect them from future flooding.

3. PHASE III: Identify Mitigation Strategies

Schedule: Month Three
Duration: 30 Days

Based on the Phase II survey results, and with the assistance of the Federal and State technical agencies, the committee should identify mitigation strategies for the protection of lives and property.

Recommendation A: Prepare a Warning and Evacuation Plan

The committee, with the assistance of Federal and State technical agencies, should prepare a warning and evacuation plan for the city. The following six major issues in warning and evacuation planning should be covered:

(a) operational aspects -- set up an EOC in a safe location, upgrade the existing warning system, and address warning dissemination, evacuation routing and traffic control;

(b) staffing -- identify full-time, part-time and volunteer staff and their responsibilities, and assign back-ups;

(c) maintenance -- procedures to keep the plans, facilities and equipment operating;

(d) funding -- initial and incremental funding, including upgrading on a yearly basis and cost-sharing;

(e) training -- program to train staff, and exercises involving the public; and,

(f) coordination with adjacent communities -- integration of the city's warning and evacuation procedures into those of adjacent communities.

Given the large number of people exposed to the threat of flooding in Manitou Springs (see Table 13) and the limited amount of lead time, it is apparent that a warning system with the capability to evaluate real-time data and rapidly disseminate warning instructions is needed in order to mitigate the impact from a flash flood.

Types of warning systems range greatly, from a very inexpensive cooperative effort of volunteers who watch the weather and height of water in the stream channel to multi-million dollar satellite packages. Recommended for immediate implementation in Manitou Springs are the organization of a network of volunteers in the Ute Pass area to keep statistics on weather patterns and stream flows and a modest upgrading of the existing system of stream gages.

The following discussion of warning systems explains the methodology of how they work, and leads to a better understanding of why these systems can be of great benefit to a community. Elaborate warning systems are recommended as a long term flood hazard mitigation strategy for Manitou Springs as its capability to fund them expands.

Design of an effective flash flood warning system includes the collection of real-time data, evaluation of real-time data and dissemination of the warning.

Collection of Real-Time Data

The design of a collection system for real-time data could include the following:

(a) automatic system of telemetry stream and rain gages;
(b) volunteer weather observers to provide ground truthing;
(c) weather radar; and,
(d) automatic reservoir monitoring devices.

Stream and rain gages - stream gages that transmit stream level changes and tipping rain gages that transmit each tip automatically to the evaluation center are essential for real-time data collection. A location map of proposed stream and rain gaging sites is shown in Figure 13.

Observers - To provide ground confirmation of weather and stream conditions, it is necessary to recruit volunteer observers throughout the drainage area. Stream observers would report flow depths from staff gages placed in various locations and any unusual erosion or debris buildup. Rain observers would be provided with plastic rain gages and would report rainfall data to the evaluation center. Certain individuals could be provided with radio equipment to provide a backup communication link in case of telephone line disruption.

Weather Radar - Information from radar is provided by the National Weather Service operating from Limon, Colorado. This input would be received at the evaluation center where severe thunderstorm activity can be tracked continuously. When it becomes available, the evaluation center could augment its radar interpretation equipment with the Program for Regional Observing and Forecasting Services (PROFS) to insure the most capable method of following storms which may lead to flooding. The city, along with other local government entities, could lobby for locating the new PROFS system in Colorado Springs. See Appendix K for further description of the PROFS program. Current plans are for Denver and Pueblo to receive the system, but not Colorado Springs.

Automatic Reservoir Monitoring Devices - The high hazard dams above Manitou Springs pose a special problem and must be closely monitored to insure safety. The City of Colorado Springs is currently planning on installing automatic reservoir level and flow measuring devices for all city-owned dams. The system will be capable of satellite transmission to the Department of Utilities' Water Division Control Center for real-time data collection. This information could also be directed to the evaluation center when established.

Evaluation of Real-Time Data

The data collected must be analyzed quickly in order for an effective warning to be issued. To accomplish this task a micro-computer coupled with an established decision procedure must be available.

Micro-computer - Provides for the automatic collection, verification, storage and display of all iincoming telemetry data. Accompanying software will allow rainfall data to be interpreted and provide method of forecasting peak flows for the basin.

Decision Procedure - Allows personnel other than qualified hydrologists to be able to interpret real-time data and make necessary decisions. Manuals could relate stream levels or rainfall data to flood forecast and include necessary actions to follow when these conditions are met.

Current analysis of weather radar is provided by the National Weather Service offices in Colorado Springs and Denver. The evaluation center could also include the services of a private meteorologist who could concentrate the analysis of radar information for the impacted area instead of interpreting data for a large area (Front Range to Eastern Plains).

Dissemination of the Warning

The dissemination of flood warnings to the public is the responsibility of local police and disaster emergency services personnel. Warnings and evacuation orders can be disseminated by police and fire vehicles using public address systems, NOAA weather radio, emergency broadcast system and emergency sirens. Upgrading emergency siren capability to include voice transmission would allow for a more effective means of disseminating flood warnings, especially to tourists who would be unfamiliar with safety actions.

The warning system for Fountain Creek could have a capability for automatic sensing of rain and stream information and real-time processing of the data for timely response. The system could include six dam reservoir level and flow monitors, twelve automatic rain reporting devices and eight stream level reporting devices. The dam monitors would utilize satellite transmission while the rain and stream units would transmit by radio. Locations for the monitoring devices are shown in Figure 13. The costs for the warning system components are shown in Table 19.

TABLE 19

COSTS OF RECOMMENDED WARNING SYSTEM

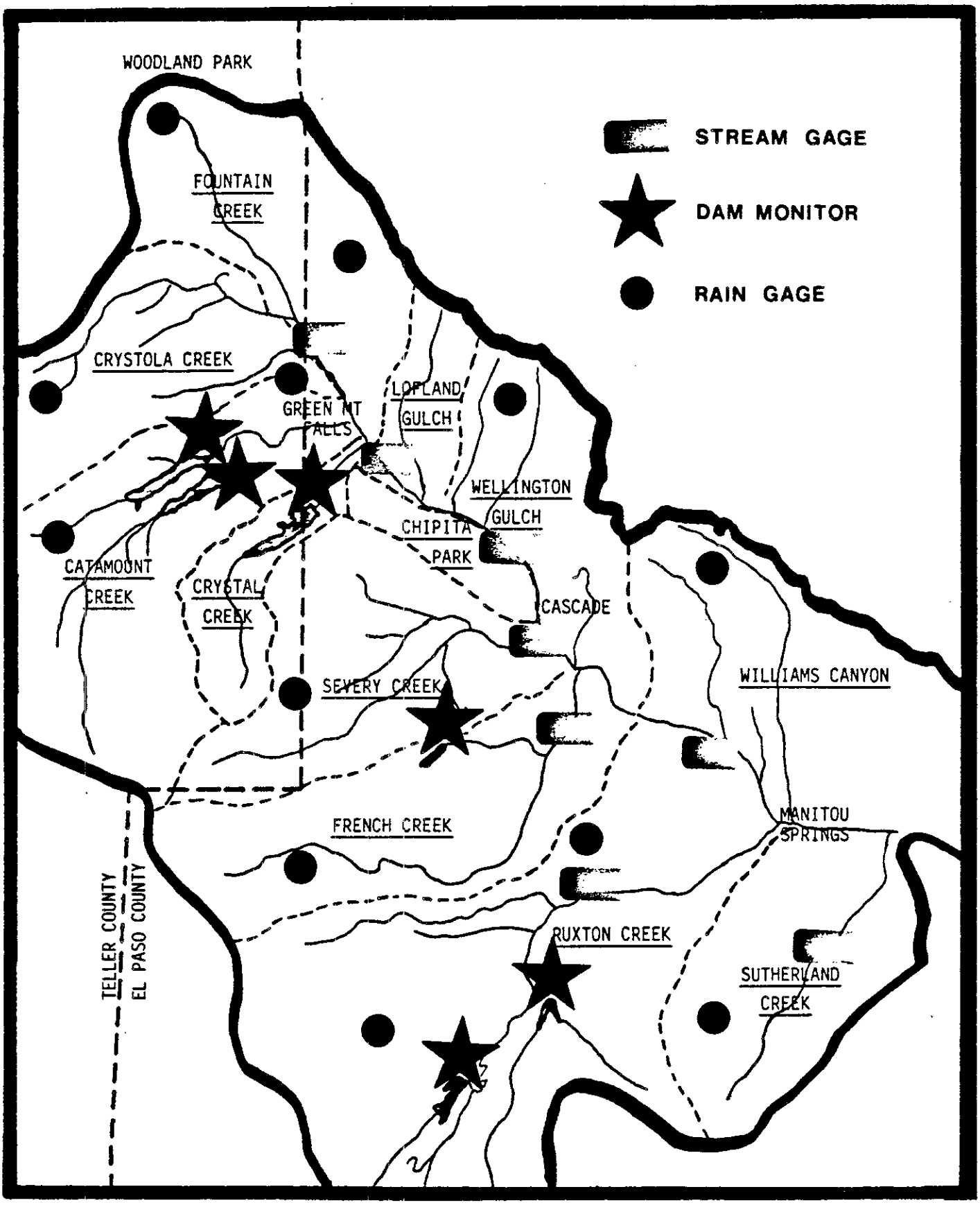
Rain gages	12 @ $ 5,000 ea	$ 60,000
Stream gages	8 @ 2,000 ea	16,000
Dam monitors	6 @ 10,000 ea	60,000
Micro Computer	2 @ 5,000 ea	10,000
Repeator Station	2 @ 3,000 ea	6,000
Electronics		18,000
Transmitters/ Receivers		60,000
Installation		200,000
TOTAL		$537,000

Local Emergency Operations Plan (LEOP)

The City of Manitou Springs could develop a Local Emergency Operations Plan in order to minimize confusion, injury, and loss of life in the event of a disaster. Although it is recommended that the plan be focused to deal specifically with the threat of flash flooding, the procedures which are developed could be followed in any emergency situation.

Although adoption of the plan rests with local decision-makers, it could be drafted and coordinated by an appointed planning committee and presented to the city council for approval. Assistance may be provided by the Colorado Department of Public Safety, Division of Disaster Emergency Services (DODES) and the El Paso County Disaster Emergency Services coordinator, Bob McWilliams, in the form of sample plans, explanation of procedures, and additional direction.

Figure 13. **RECOMMENDED WARNING SYSTEM**



The LEOP should address the general situation in Manitou Springs with respect to the flood threat and contain a list of the departments and organizations that would respond to a flood (e.g. city council, police and fire departments, social services, and public information office) and define their responsibilities. It should include such key elements as warning and communication procedures, evacuation measures, sheltering considerations, coordination and control, public information, damage assessment, and disaster declaration (Glassman, 1985). After a plan is developed, it is critical that it be tested. This process will reveal any deficiencies, which are found even in the best of plans, increase efficiency, and heighten public awareness (Glassman, 1985).

The following ideas are intended to stimulate discussion among the planning committee.

1. Plans should be made for an emergency operations center when City Hall is incapacitated. Any important documentation should be stored outside of the floodplain.

2. Evacuation considerations include the following questions. Who can authorize an evacuation? What modes of evacuation will be used? Who is in control of the evacuation? (Glassman, 1985). Lists should be made and maintained of all elderly and handicapped persons working or residing in the floodplain to expedite evacuation efforts. The plan should also consider tourists who are unfamiliar with the situation and terrain.

3. The LEOP should designate shelters located outside of the floodplain, who can authorize opening the shelters, and who will manage them. (Glassman, 1985).

4. The City of Manitou Springs may wish to consider mutual aid agreements with the City of Colorado Springs and/or El Paso County (Glassman, 1985).

Recommendation B: Develop a Floodproofing Program

The committee, with the assistance of the Federal and State technical agencies, should prepare a floodproofing program for the city.

Where economically feasible, building owners should be encouraged to floodproof their structures in a manner compatible with the building's architecture and historic character. For example, exterior walls could be reinforced with concrete on the inside of the building so as not to alter its outer appearance. Display windows could be protected by various types of flood shields. The Colorado Water Conservation Board's Colorado Flood-Proofing Manual provides specific examples of various types of floodproofing as well as cost/benefit analyses.

Effectiveness depends on matching the particular type of floodproofing with the building design and location and the amount of available warning time. Floodproofing costs fluctuate with such variables as the type of structure, building design, method of floodproofing, location, and material and labor costs. Benefits include saving lives, protection of the building and its contents, and reduced flood insurance premiums.

Recommendation C. Develop a Program for Improving the Passage of Flood Waters

The committee, with the assistance of the Federal and State technical agencies, should develop a program for removing impediments to flow, increasing channel efficiency and maintaining improved conditions over the long-term.

4. PHASE IV: Develop Pre-Flood and Post-Flood Hazard Mitigation Plans

Schedule: Month Four
Duration: 30 Days

The committee, with the assistance of the Federal and State technical agencies, should organize the mitigation strategies identified in Phase III into pre-and post-flood implementation plans.

Certain activities can begin now, prior to a major flood. These include the measures Risted above. Other mitigations measures are likely to be more politically and economically feasible following a major flood. This process can be incorporated into the community's current effort to update its Master Plan. Post-flood planning assures that Manitou Springs will face reduced vulnerability in the long term future. Pre-flood planning for post-flood circumstances is essential. After a flood many crucial decisions must be made quickly. A list of do's and don't for community leaders who are faced with post-disaster recovery based on a major disaster recovery research effort is given below.

1. DON'T wait until restoration is over before examining long-term reconstruction issues.

2. DO immediately consider whether new decision-making mechanisms are needed.

3. DO examine who the local specialists are.

4. DON'T assume the private sector will hold off until public decisions are made.

5. If significant relocation of families and businesses is to occur DO consider the full range of services and consequences.

6. DO recognize that fundamental city change is unlikely.

7. DON'T assume temporary housing will be temporary.

8. DON'T confuse physical recovery with actual city economic recovery.

9. DO use every opportunity to make the city safer, but DON'T try to make the city invulnerable.

10. Perhaps most importantly, when tempted to delay a decision, DON'T. (Haas, et. al., 1977).

If Manitou Springs has a vision of itself for the future, plans can be made now to implement far-reaching goals to improve the long term quality of life. In particular, plans for possible acquisition and relocation of housing, commercial areas, and public facilities can be discussed prior to the major flood. Major community-wide floodproofing projects envisioned now can serve as the basis of the post-flood Manitou Springs. If plans are accessible and well-designed prior to the occurrence of a major flood, community leaders can simply take the report from the shelf and begin implementation. Estes Park community leaders benefited greatly from looking toward the future in a constructive way. After the flood occurred, the community was prepared to execute dramatic changes toward beautifying the town, improving traffic flows, and reducing long term flood vulnerability. Refer to Section III for more details on acquisition, relocation, and pre-flood/post-flood planning in other communities.

5. PHASE V: Implement Pre-Flood Mitigation Plan

Schedule: Month Five
Duration: Ongoing

The Committee should implement the pre-flood mitigation plan immediately upon its completion. Refer to the discussion following the recommendations in Phase III.

6. PHASE VI: Implement Post-Flood Mitigation Plan

Schedule: Post-Flood
Duration: Ongoing

The committee should implement the post-flood mitigation plan immediately following anticipated flash flooding.

The hazard mitigation plan will play the major role in determining the effectiveness and speed of Manitou Springs recovery from a flash flood disaster. As stated above, with the plan already in place, all that the city will have to do is pull the plan off the shelf and begin implementation.

C. Post-Mitigation Scenario

It is a typical summer afternoon on the front range. Manitou Springs is experiencing the characteristic afternoon showers that showed no hint of escalating into a torrential flash flood.

By 4:00 p.m., the recently implemented satellite warning system notifies city officials that a massive thunderhead is nearing Manitou Springs.

At 5:15 p.m., the alarms sound, notifying the residents and tourists of Manitou Springs that a flash flood would, in fact, hit the city in approximately seventeen minutes.

The workshops attended by business owners, city officials, and residents prior to flood season prove beneficial in educating these people to take prompt, positive action to the flood event. Evacuation routes were pre-planned and practiced so few residents hesitate in moving to higher ground.

There is little chaos except for the excitement of the flood itself.

Monthly debris clean-up of the channels cut back on back-water damming, although numerous footbridges still hamper the stream flow. Residents on both sides of Fountain Creek are notified, either by the flood alarms themselves or by radio, to evacuate. Most respond to the reliable warning system--knowing it is only sounded in the event of a severe flash flood. The heightened awareness of the community makes all citizens more confident about their ability to respond to the warning.

Although saving lives is the primary benefit from the flash flood warning system, some property damage is prevented through emergency flood-proofing.

City Hall, the Fire Department, and the Police Department had been relocated out of the floodplain as part of the Manitou Springs Flood Hazard Mitigation Plan. These buildings now serve as the central network for all communication and emergency activities.

Personnel at the utilities and water departments are notified so that power and gas lines can be shut off. They are also informed of possible pressure increases in the sewage lines. Thus, any major damage of utility lines does not cause a threat to the community.

The partial greenbelt running alongside Fountain Creek provides an open area for swelling streams to flow. Although the greenbelt also serves to beautify the Manitou Springs area, its most beneficial purpose is served today.

Signs indicating evacuation routes are located throughout the city, directing people to head for safety by foot rather than car - a far safer alternative.

Prior to the flood season, Manitou Springs Police Department developed a list noting the addresses of all elderly and handicapped persons living in the city so that they can be aided during the evacuation.

Manitou's effective pre-hazard policies for flash flood situations saves this city and its citizens.

APPENDIX A

TABLE A-1
MANITOU SPRINGS POPULATION

1980 - 4475
1979 - 4206
1978 - 4447
1977 - 4225
1976 - 4202
1975 - 4206
1974 - 4290
1973 - 4375
1972 - 4345
1971 - 4315
1970 - 4278
1960 - 3626
1950 - 2580
1940 - 1462
1930 - 1205
1920 - 1129
1910 - 1357
1900 - 1412
1885 - 698
1880 - 500

TABLE A-2
CLIMATOLOGY DATA

	Manitou Springs	Colorado Springs	Lake Moraine	Pikes Peak
January Mean Temp.	26	28.8		20.4
January Mean Low Temp.	12.8	15.6		9.6
Lowest Recorded Temp.	-35	-27		-37
Mean Date Last Spring Frost	May 29	May 7	June 5	June 16
Latest Occurrence Spring Frost	June 16	June 3	June 17	June 22
Mean Date Last Fall Frost	Sept. 23	Oct. 11	Sept. 15	August 11
Earliest Occurrence Fall Frost	Sept. 1	Sept. 11		
July Mean Temp.	65	70.4		53.3
July Mean High	77	84.6		
Highest Recorded Temp.		100		
Humidity-Mean Annual	57	54		
Cloudy Days in %	21	16		24
Clear Days in %	50	54		47
Mean Annual Precip.	17	13.9	24.3	29.3
Maximum Precip. in 24 hrs		7	5.5	5.5
Mean Precip. Apr-Sep	12.9	11.9		18.6
Minimum Annual Precip	9	6.1	15.7	9.28
Mean Annual Snowfall	78	37.8		149.7

Source: Hansen, W., Climatography of the Front Range, Colorado: 1979.

TABLE A-3
FLOOD CHARACTERISTICS OF FOUNTAIN CREEK

Location	Peak Discharge	Height of Rise	Rate of Rise	Duration of Flooding	Channel Velocity
Manitou Springs	500 22070	7.6 ft	2.5 ft/hr	8.3 hrs	18.8 mph
City Limits	100 13000	5.5	4.2	5.2	16.1
Below Confluence	500 23300	15.1	5.0	8.3	12.2
of Ruxton Creek	100 13750	11.6	8.9	5.2	9.8
Below Confluence	500 25570	12.4	4.0	8.3	18.6
of Williams Canon	100 15000	9.1	7.0	5.2	15.9
Below Confluence	500 27750	7.5	2.8	7.0	17.4
of Sutherland	100 16000	5.1	3.9	3.5	14.9
Creek					
Below Confluence	500 29100	9.6	3.0	8.0	15.8
of Black Canyon	100 17100	8.5	6.1	4.5	12.2

Source: U.S. Army of Corps of Engineers: Floodplain Information; 1974

TABLE A-4
COMPARISON OF MAXIMUM FLOW AND DRAINAGE AREA

Maximum Flow (cfs)	Drainage Area (sq miles)	Location
2630	.3	Little Pinto Creek tributary, Newcastle Utah
7210	1.0	Glen Comfort, CO
45000	6.9	Hillsboro, NM
76000	22.9	Eldorado Canyon, NV
31200	150	Big Thompson, CO
50600	91	Rapid City, SD
124000	66	Jimmy Camp Creek, CO

Sources:

Maddox, Robert and Caracena, Fernando. Meteorological Aspects of the Big Thompson Flash Flood of 31 July 1976, NOAA Technical Report ERL 388-APCL 41, 1977.

Livingston, R. and Klein, John, Water Resources of El Paso County, Colorado, Colorado Water Resources Circular No. 32, Colorado Water Conservation Board, 1976.

National Oceanic and Atmospheric Administration; Hydrometeorological, Study No. 55, 1984b.

TABLE A-5
SUMMARY OF DISCHARGES

Location	Drainage Area	Peak Discharge (cfs) 10-Yr	50-Yr	100-Yr	500-Yr Flood
Fountain Creek at Teller County	12 sq mi	2200	5800	7500	14000
Fountain Creek at Manitou Springs upper city limits	71	2800	8200	12300	28500
Fountain Creek below confluence with Williams Canon	91	3200	9300	13750	31500
Fountain Creek upstream of U.S. Highway 24	98	3650	10700	16000	37500
Fountain Creek at Monument Creek	358	9200	28500	42200	98000
Sutherland Creek at Fountain Creek	5.37	2630	4620	5730	10200
Williams Canon at Fountain Creek	2.68	1930	3640	4710	8940
Ruxton Creek at Fountain	17.6	2540	4350	5330	9350

Source: Federal Emergency Management Agency: Flood Insurance Studies for Manitou Springs, Colorado Springs and Unincorporated El Paso County, 1984a, 1983a.

TABLE A-6
MAXIMUM KNOWN FLOOD DISCHARGES FOR STREAMS IN THE PIKES PEAK REGION

Stream	Location in Colorado	Contributing Drainage Area	Date	Amount	Peak Discharge per Sq. Mile
Monument Creek	Colorado Springs	238 sq mi	5/30/35	50000 cfs	210 cfs
Black Squirrel Creek	South of Ellicott	482	6/04/21	56000	116
Jimmy Camp Creek	Fountain	54	6/17/65	124000	2284
Plum Creek	Louviers	302	6/16/65	154000	510
East Plum Creek	North of Castle Rock	108	6/16/65	126000	1167
Cherry Creek	Melvin	336	6/16/65	39900	119
West Bijou Creek	Kiowa	86	6/17/65	67200	784

Source: U.S. Corps of Engineers: Floodplain Information: 1974.

TABLE A- 7
FOUNTAIN CREEK FLOW RATES

This data is obtained from the gaging station located one mile downstream from Sutherland Creek. The area of drainage is 102 square miles and the first recording was obtained in April, 1958.

YEAR	DATE	TIME	MAXIMUM FLOW (cfs)
1958	July		752
1959	June 20		584
1960	July 11		89
1961	July 1	2100	456
	July 7	1530	560
	July 8	1600	432
	July 11	1200	955
	August 2	2000	359
	August 11	1600	880
	September 19	1930	334
1962	June 3	1730	259
	June 19	1300	366
1963	August 3	1800	428
	August 6	2330	428
1964	May 29	1330	672
	August 4	1545	2630
	August 7	1415	800
1965	June 17	1700	359
	July 2	1900	310
1966	July 24	1730	295
1967	May 26	1800	544
1968	August 2	1500	301
1969	July 24	1730	295
1970	July 21	0200	616
1971	August 31		96
1972	August 16		223
1974	July 14		500
1975	July 20		492
1976	August 2		408
1977	August 2		560
1978	July 13		416
1979	August 26	1645	416
1980	May 15	2245	338
1981	June 2	2200	650
1982	June 12	1600	305
1983	May 31		286

Source: U.S. Geological Survey, Water Records: 1964, 1969, 1971-1984.

TABLE A-8

FLOW RATES FROM GAGING STATIONS ABOVE MANITOU SPRINGS

Year	North Catamount Flow	Date	South Cascade Flow	Date	Lion Creek Flow	Date	Sheep Creek Flow	Date
1921					11.6	June 4	12.8	June 5
1935	15.0	May 25	13.5	May 26	5.28	May 25	2.53	May 31
1936	10.5	August 6	28.2	August 7	7.0	May 11	3.18	Aug 7
1937	3.5	October 1	2.9	June 6	2.38	May 4	1.23	Apr 15
1938	15.2	May 16	8.2	May 17	1.70	May 14	2.43	Sep 3
1939	4.7	May 6	3.8	June 1	3.46	May 23	1.15	Apr 30
1940	3.4	June 2	5.4	May 30	1.57	Sep 10	1.07	Sep 10
1941	23.1	May 15	20.3	May 27	4.12	May 24	3.94	May 25
1942	11.3	May 4	4.4	June 1	10.90	May 13	11.80	May 12
1943	18.3	June 2	16.1	May 1			1.11	Aug 15
1944					3.76	May 14	4.50	May 13
1945	7.5	August 8	10.9	August 12	1.84	Aug 14	1.39	Aug 14
1946	2.5	May 13	7.0	August 23			.84	Aug 23
1947	30.5	May 21	14.1	May 13	5.89	May 11	4.62	May 21
1948	7.8	May 10	8.1	May 24			1.44	May 25
1949	6.5	May 15	7.4	June 8	1.39	May 14	1.23	May 15
1950	3.3	April 22	2.3	Sep 11	.99	July 11	.58	July 11

North Catamount Creek gaging station: located 2 miles west of Green Mountain Falls, 1/4 mile upstream of confluence with S. Catamount Creek. Altitude is 9190 feet and drainage area is 5.8 square miles.

South Catamount Creek gaging station: located 1000 feet upstream from mouth and 3/4 mile west of Cascade. Altitude is 8400 feet and drainage area is 3.41 square miles.

Lion Creek gaging station: located 3 miles west of Manitou Springs, 500 feet upstream from mouth and 1/2 mile southwest of Halfway. Altitude is 9250 feet and drainage area is 2.00 square miles.

Sheep Creek gaging station: located 3 miles west of Manitou Springs, 500 feet upstream from mouth and 1/4 mile west of Halfway. Altitude is 9100 feet and drainage area is .73 square miles.

Source: U.S. Geological Survey Water Records: 1955.

APPENDIX B

GLOSSARY

BACKWATER EFFECT - The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water must flow. Also referred to as "heading up".

BASE FLOOD - A term used in the National Flood Insurance Program to indicate the minimum size flood to be used by a community as a basis for its floodplain management regulations; presently required by regulation to be that flood which has a one-percent chance of being equaled or exceeded in any given year. Also known as a 100-year flood or one-percent chance flood.

BASE FLOODPLAIN - The floodplain that would be inundated by a 100-year (one-percent chance) flood.

BASIN - The total area from which surface runoff is carried away by a drainage system. Other comparable terms are "drainage area", "catchment area", and "watershed".

C.F.S. - Cubic feet per second. Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

CHANNEL - A natural or artificial watercourse with definite bed and banks to confine and conduct flowing water.

CHANNEL CAPACITY - The maximum flow which can pass through a channel without overflowing the banks.

CHANNEL ALTERATIONS - The improvement of the water carrying capacity or flow characteristics of a natural or artificial channel by clearing, excavation, bank stabilization or other means. Also referred to as channelization.

CROSS SECTION - A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

DESIGNATED FLOODWAY - The channel of a stream and that portion of the adjoining floodplain designated by a regulatory agency to be kept free of further development to provide for unobstructed passage of flood flows.

DESIGN FLOOD - Commonly used to mean the magnitude of flood used for design and operation of flood control structures or other protective measures. It is sometimes used to denote the magnitude of flood used in floodplain regulations.

EFFECTIVE STORM DURATION - The time period within which 90% of the total precipitation occurs.

FLASH FLOOD - A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flows.

FLOOD OR FLOODING - Temporary inundation of normally dry land areas from the overflow of inland and/or tidal waters, and/or from the unusual and rapid accumulation or runoff of surface waters from any source. The rise in water may be caused by excessive rainfall, snowmelt, natural stream blockages, wind storms over a lake or ocean, tsunamis, extremely high tides, or any combination of such conditions.

FLOOD CONTROL - Keeping flood waters away from specific developments and/or populated areas by the construction of flood storage reservoirs, channel alterations, dikes and levees, bypass channels, or other engineering works.

FLOOD CREST - The maximum stage or elevation reached or expected to be reached by the waters of a specific flood at a given location.

FLOOD DURATION - The length of time a stream is above flood stage or overflowing its banks.

FLOOD FORECASTING - The process of predicting the occurrence, magnitude and duration of an imminent flood through meteorological and hydrological observations and analysis.

FLOOD FREQUENCY - A statistical expression of the average time period between floods equaling or exceeding a given magnitude. For example, a 100-year flood has a magnitude expected to be equaled or exceeded on the average of once every hundred years; such a flood has a one-percent chance of being equaled or exceeded in any given year. Often used interchangeably with "recurrence interval".

FLOOD FRINGE - The portion of the floodplain outside of the floodway or coastal high hazard area but still subject to flooding. Sometimes referred to as "floodway fringe". Also used to refer to areas subject to flooding by water with little or no velocity.

FLOOD HAZARD BOUNDARY MAP - An official map of a community issued by the Federal Insurance Administration on which the boundaries of the floodplain (i.e., subject to the 100-year flood), mudslide and/or flood-related erosion areas having special hazards have been drawn.

FLOOD INSURANCE - Insurance on structures and/or their contents for their restoration or replacement if damaged by floodwater. The term is usually applied to flood insurance under the National Flood Insurance Act of 1968, as administered by the Federal Insurance Administration.

FLOOD INSURANCE EMERGENCY PROGRAM - A phase of the National Flood Insurance Program intended primarily as an interim program to provide a limited amount of insurance at federally-subsidized rates on all existing and new construction begun prior to publication of a detailed flood insurance rate map for an area.

FLOOD INSURANCE RATE MAP - An official map of a community on which the Federal Insurance Administration has delineated the area in which the purchase of flood insurance is required under the flood insurance regular program and the actuarial rate zones applicable to such area.

FLOOD INSURANCE REGULAR PROGRAM - The phase of the National Flood Insurance Program under which actuarial rates have been determined.

FLOOD OF RECORD - The greatest flood recorded for a location. Usually referred to as the "maximum flood of record". The term is also sometimes used to mean any flood for which there is a measurement of height or other systematic or reliable record useful for technical analysis.

FLOOD PEAK - The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of flood crest.

FLOODPLAIN - The low lands adjoining the channel of a river, stream or watercourse, or ocean, lake, or other body of standing water, which have been or may be inundated by flood water. The channel of a stream or watercourse is a part of the floodplain.

FLOODPLAIN DELINEATION - The process of showing in a graphical form, usually on a map or photo mosaic, areas which have been inundated by a specific flood or which can be expected to be inundated by a predicted flood of specific magnitude.

FLOODPLAIN MANAGEMENT - The operation of a program intended to lessen the damaging effects of floods, maintain and enhance natural values, and make effective use of related water and land resources within the floodplain. It is an attempt to balance values obtainable from use of floodplains with potential losses arising from such use. Floodplain management stresses consideration of the full range of measures potentially useful in achieving its objectives.

FLOODPLAIN REGULATIONS - A general term for the full range of codes, ordinances, and other regulations relating to the use of land and construction within stream channels and floodplain areas. The term encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment line statutes, open-space regulations, and other similar methods of control affecting the use and development of these areas.

FLOOD PROBABILITY - A statistical expression of the chance (usually as a percentage) that a flood of given magnitude has of being equaled or exceeded in any one year (see flood frequency).

FLOOD PROFILE - A graph showing the relationship of water surface elevation to location (usually expressed as distance above mouth for a stream of water flowing in an open channel.) It is generally drawn to show surface elevation for a crest of a specific flood.

FLOODPROOFING - A combination of structural changes and adjustments to new or existing structures and facilities, their contents and/or their sites for the purpose of reducing or eliminating flood damages by protecting against structural failure, keeping water out, or reducing the effect of water entry.

FLOOD STAGE - The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

FLOOD WARNING - The issuance and dissemination of information about an imminent or current flood.

FLOOD WATCH - Issuance and dissemination of information about a possible flood within a designated area.

FLOODWAY - The channel of a watercourse and those portions of the adjoining floodplain required to provide for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the floodlevels above that of natural conditions. As used in the national Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (one foot in most areas).

HIGH HAZARD DAM - Where dam failure would probably cause loss of life.

INTERMEDIATE REGIONAL FLOOD - A flood having an average frequency of occurrence on the order of once in 100 years although the flood may occur in any year. Designation is used by the Corps of Engineers.

LOW HAZARD DAM - Where dam failure would cause damage to only the structure itself.

MODERATE HAZARD DAM - Where dam failure would cause extensive property damage but is not expected to cause loss of human life.

NONSTRUCTURAL MEASURES - All floodplain management measures excepting structural flood control works. Examples of nonstructural measures are flood warning/preparedness systems, relocation, floodproofing, regulation, land acquisition, and public investment policy.

ONE-HUNDRED YEAR FLOOD - A flood having a one-percent chance of occurring in any given year and which, over a very long period of time, can be expected to be equalled or exceeded on the average of once every hundred years.

PROBABLE MAXIMUM FLOOD - The most severe flood that may be expected from a combination of the most critical meteorological and hydrological conditions that are reasonably possible in the drainage basin. It is used in designing high-risk flood protection works and siting of structures and facilities that must be subject to almost no risk of flooding. The probable maximum flood is usually much larger than the 100-year flood.

PROBABLE MAXIMUM PRECIPITATION (PMP) - Theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area of a particular geographic location at a certain time of the year.

PROGRAM FOR REGIONAL OBSERVING AND FORECASTING SERVICES (PROFS) - An experimental organization within NOAA that is improving the short range operational weather services through scientific and technological advances.

RECURRENCE INTERVAL - A statistical expression of the average time between floods equalling or exceeding a given magnitude (see flood frequency).

REGULATORY FLOODPLAIN - That portion of the floodplain subject to floodplain regulations (usually the floodplain inundated by the one-percent chance flood).

REGULATORY FLOODWAY - The channel and that portion of the adjacent land area that is required through regulations to pass flood flows without increasing the water surface elevation more than a designated height.

RESERVOIR - A natural or artifically created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary.

STANDARD PROJECT FLOOD - A term used by the U.S. Army Corps of Engineers to designate a flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. The peak flow for a standard project flood is generally 40 to 60 percent of the probable maximum flood for the same location.

STREAM - A body of water flowing in a natural surface channel. Flow may be continous or only during wet periods. Streams which flow only during wet periods are termed "intermittent streams".

STRUCTURAL MEASURES - Flood control works such as dams and reservoirs, levees and floodwalls, channel alterations, seawalls, and diversion channels which are designed to keep water away from specific developments and/or populated areas or to reduce flooding in such areas.

SUBSIDENCE - Sinking of the land surface, usually due to withdrawals of underground water, oil, or coal.

SUBSTANTIAL IMPROVEMENT - A term used in connection with the National Flood Insurance Program for determining when its regulations must be applied to actions involving existing structures. It means any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either: (a) before the improvement or repair is started; or (b) if the structure has been damaged, and is being restored, before the damage occurred.

ZONING ORDINANCE - An ordinance under the State or local government's police power which divides an area into districts and, within each district, regulates the use of land and buildings, height and bulk of buildings or other structures, and the density of population.

APPENDIX C

METHODOLOGY FOR COMMUNITY DEVELOPMENT

The process of organizing the researchers, reviewers, and implementers of the recommendations was an additional challenge for the Manitou Flood Hazard Mitigation Team. Since the motivation for the research was more than academic, early efforts were made to contact and involve key people and agencies in the project. The community development process as practiced by the Center for Community Development and Design (CCDD) served as the basis for implementing this strategy of maximum involvement. The key elements were the coordination of service, education, and research activities, and clear, consistent communication.

The groundwork for the study was laid in the fall of 1984 via discussions with all parties who became the major participants in the study. The need for such work in Manitou Springs and other communities has been known for some time. Discussions by CCDD with the planner, city manager, and planning commission of Manitou Springs revealed a match between their immediate research needs and the research interests of Dr. Gruntfest and her students. Discussions with the staffs of the Colorado Water Conservation Board and the Federal Emergency Management Agency confirmed interest in similar work at the state and federal levels. Thus, when the availability of funds became known, the outline of the proposal was developed. Bill Leon, Director of CCDD on the UCCS campus, then worked with all the parties mentioned above and some additional ones, including the Colorado Division of Disaster and Emergency Services to create an integrated research proposal. Thus, from the outset, all participants' concerns and potential roles were identified.

The benefits to all participants fit into the categories of service, education, and research. The major ones are outlined below.

Service

Manitou Springs received free assistance with a major problem facing the town and its future.

The Federal Emergency Management Agency had a chance to see the value of preflood disaster planning with a community development focus.

Division of Disaster Emergency Services and The Colorado Water Conservation Board had the opportunity to help Manitou Springs prepare for a flood, thereby reducing potential flood losses. They also had an opportunity to assist in the development of some model strategies that may assist other Colorado communities.

County officials and representatives of the Pikes Peak Area Council of Governments had a chance to help strategize on ways to reduce the flood threat to Manitou Springs and to other communities along Fountain Creek.

Education

Students, faculty, disaster professionals, local planners and officials and the City of Manitou Springs learned about the flood threat, how to study it, and how to rationally and collectively consider alternatives for mitigation. We are all still learning how to creatively implement mitigation strategies in ways that preserve the economy and character of a community.

Faculty and students at the University of Colorado at Colorado Springs, learned from participating and have now established long-term contacts with the community. They now have more tools and skills for conducting similar studies elsewhere.

Research

All parties who participated in the substantive local and archival research associated with the project contributed to the development of some creative ideas. The work was both theoretical and applied. It will have applications in other mountainous communities and especially in those with historic resources and/or with economies based on tourism.

The key to success in this venture has been and will be communication. From the beginning, frank discussions of the tasks and obstacles to be overcome improved understanding and effectiveness for all participants. A clear plan of action was developed with input from the city council and planning staff. The technical advisory committee, with its broad representation from local, county, state, and federal interests was a useful vehicle for posing and answering the important questions and for helping the researchers and ultimate users of the information to evaluate the data and proposed recommendations.

Constant communication with the city through its planner, administrator, fire and police department, interested city council members and local citizens has led to improved confidence in the research results. This is not to say, however, that no debatable issues remain. In fact, they are just beginning to surface. It has not been the role of the researchers to tell Manitou Springs what to do. Instead, the goal has been to present a wide range of viable alternatives for action. It is the community's responsibility to decide how best to cope with its situation.

Rational debate on issues such as those facing Manitou Springs can be beneficial and, in fact, is necessary if a consensus for action is to develop. The issues are too important to be left to the experts. Residents from concerned citizens to local businesspeople to the administrative staff to the mayor all have voices that should be heard in the debate. In airing their opinions and in working together to create equitable, viable, and productive solutions, the community will be stronger and better able to control its own destiny.

A list of citizens who have been involved with the research project is attached as Appendix J. It is believed that their efforts will assist in implementation of this report's recommendations.

APPENDIX D

PERSONAL COMMUNICATIONS

FEBRUARY - MAY 1985

Apodaca, T.
U.S. Army Corps of Engineers, Albuquerque, NM.

Baucom, B.
Water Division, Utilities Department, City of Colorado Springs, 701 N. Circle Drive, Colorado Springs, CO 80909, 636-5611

Cattany, Ron
Colorado Department of Natural Resources, 1313 Sherman St. Denver, CO 80203-2770

Garrison, Joanne
Manitou Springs Development Company, 728 1/2 Manitou Avenue, Manitou Springs, CO 80829, 685-9456

Goins, Alan
Pikes Peak Area Council of Governments, 27 E., Vermijo, Colorado Springs, CO 80903-2291, 471-7080

Gore, Doug
National Flood Insurance Program, Federal Emergency Management Agency, Region 8, Building 710, Denver Federal Center, Box 25267, Denver, CO, 80225-0267, 235-4840

Hagan, Pat
Division of Disaster Emergency Services, Camp George West, Golden, CO 80404, 273-1771

Holm, D.
Communications and Warning Officer, Division of Disasater Emergency Services, Camp George West, Golden, CO 80404, 273-1771

Hyde, Brian
Colorado Water Conservation Board, 1313 Sherman, Denver, CO 80203-2278, 866-3441

Intemann, Paul
Land Use Planner, City of Manitou Springs, 606 Manitou Avenue, Manitou Springs, CO 80829, 685-5481

Ives, Bob
Federal Emergency Management Agency, Region 8, Building 710, Denver Federal Center, Box 25267, Denver, CO 80225-02676, 235-4894

Keating, Lynn
Colorado Historic Preservation Office, Denver, CO 866-3392

McDonald, Alexander
Director, National Oceanic and Atmospheric Administration, Environmental Research Laboratory, 325 Broadway, Boulder, CO 80303

McWilliams, Bob
El Paso County Disaster Emergency Services, 230 E. Kiowa, Colorado Springs, CO 80903, 632-1180

Mills, Gloria
Colorado Historic Preservation Office, Denver, CO 888-3392

Moore, Herb
National Weather Service, Colorado Springs Municipal Airport, Colorado Springs, CO 596-1116

Patterson, Karen
Colorado Historic Preservation Office, Denver CO 866-3392

Phelps, Bill
c/o Manitou Springs Chamber of Commerce, 354 Manitou Avenue, Manitou Springs, CO 80829, 685-5089

Philipsborn, Clancy
Federal Emergency Management Agency, Region 8, Building 710, Denver Federal Center, Box 25267, Denver, CO 80225-02676, 235-4894

Rayer, Lynn
Manitou Springs Chamber of Commerce, 354 Manitou Avenue, Manitou Springs, CO 80829, 685-5089

Rumff, R.
U.S. Army Corps of Engineers, Pueble, CO, 543-9459.

Stanton, Bill
Colorado Water Conservation Board, 1313 Sherman, Denver, CO 80203-2278, 866-3441

Stewart, Ken
Urban Drainage and Flood Control District, 2480 W. 26th Avenue, #156B, Denver, CO 80211, 221-7679

Stone, Nancy
Federal Emergency Management Agency, Region 8, Building 710, Denver Federal Center, Box 25267, Denver, CO 80225-02676, 235-4894

Stumpp, Larry
Ester Park Chamber of Commerce, Estes Park, CO

Truby, Jack
Division of Disaster Emergency Services, Camp George West, Golden, CO 804040, 273-1771

Tucker, L.Scott.
Urban Drainage and Flood Control District, 2480 W. 26th Avenue, #156B, Denver, CO 80211, 221-7679

VanWie, D
Boulder County, Disaster Emergency Services, Boulder, CO 80302, 441-3637.

White, J.
Harris County Flood Control District, Houston, TX, (713) 691-8600.

Widmer, Richard
Department of Public Works, Estes Park, CO 586-5331

APPENDIX E

MANITOU SPRINGS FLOODPLAIN ORDINANCE

COUNCIL BILL NO. 0184 ORDINANCE NO. 0184

AN ORDINANCE

AN ORDINANCE enacting floodplain management regulations in the City of Manitou Springs

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WHEREAS, the City of Manitou Springs desires to continue participating in the National Flood Insurance Program; and

WHEREAS, the City of Manitou Springs has requested that the Colorado Water Conservation Board designate the Flood Insurance Study and corresponding Flood Insurance Rate Map and Flood Boundary and Floodway Map prepared by the Federal Emergency Management Agency on August 1, 1983 as the official floodplain study for Manitou Springs; and

WHEREAS, the City of Manitou Springs desires to promote public health, safety and welfare, and to minimize public and private losses due to flood conditions in specific areas of the City;

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MANITOU SPRINGS, COLORADO, THAT:

SECTION 1: STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND OBJECTIVES

1.1 STATUTORY AUTHORIZATION

The Legislature of the State of Colorado has delegated in Section 31-23-301, Colorado Revised Statutes, the responsibility to local governmental units to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the City Council of the City of Manitou Springs, Colorado does ordain as follows:

1.2 FINDINGS OF FACT

a) The flood hazard areas of the City of Manitou Springs are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

b) These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazards which increase flood heights and velocities, and when inadequately anchored, damage uses in other areas. Uses that are inadequately floodproofed, elevated or otherwise protected from flood damage also contribute to the flood loss.

1.3 STATEMENT OF PURPOSE

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

a) To protect human life and health;
b) To minimize expenditure of public money for costly flood control projects;
c) To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
d) To minimize prolonged business interruptions;
e) To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
f) To help maintain a stable tax base by providing for the second use and development of areas of special flood hazard so as to minimize future flood blight areas;
g) To insure that potential buyers are notified that property is in an area of special flood hazard; and,
h) To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

1.4 METHODS OF REDUCING FLOOD LOSSES

In order to accomplish its purposes, this ordinance includes methods and provisions for:

a) Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
b) Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
c) Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
d) Controlling filling, grading, dredging, and other development which may increase flood damage; and,
e) Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

SECTION 2: DEFINITIONS

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application.

APPEAL means a request for a review of the City Manager's interpretation of any provision of this ordinance or a request for a variance.

AREA OF SPECIAL FLOOD HAZARD means the land in the flood plain within a community subject to a one percent (1%) or greater chance of flooding in any given year, the 100-year floodplain.

BASE FLOOD means the flood having a one percent (1%) chance of being equalled or exceeded in any given year.

DEVELOPMENT means any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations located within the area of special flood hazard.

DEVELOPMENT PERMIT means the permit issued by the City Manager before a development occurs within any area of special flood hazard.

EXISTING MOBILE HOME PARK OR MOBILE HOME SUBDIVISION means a parcel (or contiguous parcels) of land divided into two (2) or more mobile home lots for rent or sale for which the construction of facilities for servicing the lot on which the mobile home is to be affixed (including, at a minimum, the installation of utilities, either final site grading, or the pouring of concrete pads, and the construction of streets) is completed before the effective date of this ordinance.

EXPANSION TO AN EXISTING MOBILE HOME PARK OR MOBILE HOME SUBDIVISION means the preparation of additional sites by the construction of facilities for servicing the lots on

which the mobile homes are to be affixed (including the installation of utilities, either final site grading, or pouring of concrete pads, or the construction of streets).

FLOOD or FLOODING means a general and temporary condition of partial or complete inundation of normally dry land areas from:

a) The overflow of inland and/or
b) The unusual and rapid accumulation or runoff of surface waters from any source.

FLOOD INSURANCE RATE MAP (FIRM) means the official map on which the Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

FLOOD INSURANCE STUDY means the official report provided by the Federal Insurance Administration that includes flood profiles, the Flood Boundary-Floodway Map, and the water surface elevation of the base flood.

FLOODWAY means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot.

FLOODWAY FRINGE means those areas denoted on the Floodway Map that are adjacent to the floodway and within the 100-year floodplain.

FLOOD BOUNDARY-FLOODWAY MAP means the official map on which the Federal Insurance Administration has delineated both the areas of special flood hazard and the floodway.

MARKET VALUE means the value established by an MAI-certified inspector (Member, American Institute of Real Estate Appraisers), considering, but not limited to, replacement costs or comparable values of similar structures.

MOBILE HOME means a structure that is transportable in one (1) or more sections, built on a permanent chassis, and designed to be used with or without a permanent foundation when connected to the required utilities. It does not include recreational vehicles and travel trailers.

NEW CONSTRUCTION means structures for which the "start of construction" commenced on or after the effective date of this ordinance.

NEW MOBILE HOME PARK OR MOBILE HOME SUBDIVISION means a parcel (or contiguous parcels) of land divided into two (2) or more mobile home lots for rent or sale for which the construction of facilities for servicing the lot (including, at a minimum, the installation of utilities, either final site grading, or the pouring of concrete pads, and the construction of streets) is completed on or after the effective date of this ordinance.

START OF CONSTRUCTION means the first placement of permanent construction of a structure (other than a mobile home) on a site, such as the pouring of slabs or footings or any work beyond the stage of excavation. Permanent construction does not include land preparation, such as clearing, grading, and filling, nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not as part of the main structure. For a structure (other than a mobile home) without a basement or poured footings, the "start of construction" includes the first permanent framing or assembly of the structure or any part thereof on its piling or foundation. For mobile homes not within a mobile home park or mobile home subdivision, "start of construction" means the affixing of the mobile home to its permanent site. For mobile homes within mobile home parks or mobile home subdivisions, "start of construction" is the date on which the construction of facilities for servicing the site on which the mobile home is to be affixed (including, at a minimum, the construction of streets, either final site grading, or the pouring of concrete pads, and installation of utilities) is completed.

STRUCTURE means a walled and roofed building or mobile home that is principally above ground.

SUBSTANTIAL IMPROVEMENT means any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either:

a) Before the improvement or repair is started, or
b) If the structure has been damaged and is being restored, before the damage occurred. For the purposes of this definition, "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure.

The term does not, however, include either:

a) Any project for improvement of a structure to comply with existing State or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions, or
b) Any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

VARIANCE *means a grant of relief from the requirements* of this ordinance which permits construction in a manner that would otherwise be prohibited by this ordinance.

SECTION 3: GENERAL PROVISIONS

3.1 LANDS TO WHICH THIS ORDINANCE APPLIES

This ordinance shall apply to all areas of special flood hazard within the jurisdiction of the City of Manitou Springs.

3.2 BASIS FOR ESTABLISHING THE AREAS OF SPECIAL FLOOD HAZARD

The areas of special flood hazard identified by the Federal Insurance Administration in a scientific and engineering report entitled "The Flood Insurance Study for the City of Manitou Springs," dated August 1, 1983, with accompanying Flood Insurance Rate Maps, is hereby adopted by reference and declared to be a part of this ordinance. The Flood Insurance Study is on file at 606 Manitou Avenue, Manitou Springs, CO 80829.

3.3 COMPLIANCE

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this ordinance and other applicable regulations.

3.4 PENALTIES FOR NON-COMPLIANCE

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this ordinance and other applicable regulations. Violation of the provisions of this ordinance by failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Any person who violates this ordinance or fails to comply with any of its requirements shall be subject to penalty as provided in Subsections A and B of Section 1.01.100 of the Municipal Code (Ordinance 1274 Section 10, 1974, as amended).

3.5 ABROGATION AND GREATER RESTRICTIONS

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

3.7 INTERPRETATION

In the interpretation and application of this ordinance, all provisions shall be:

a) Considered as minimum requirements;
b) Liberally construed in favor of the governing body; and,
c) Deemed neither to limit nor repeal any other powers granted under State Statutes.

3.6 WARNING AND DISCLAIMER OF LIABILITY

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by manmade or natural causes. This ordinance does not imply that land outside the areas of special flood *hazards or uses permitted within such areas will be* free from flooding or flood damages. This ordinance shall not create liability on the part of the City of Manitou Springs, any officer or employee thereof, or the Federal Insurance Administration, for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

SECTION 4: ADMINISTRATION

4.1 ESTABLISHMENT OF DEVELOPMENT PERMIT

A development permit shall be obtained before construction or development begins within any area of special flood hazard established in Section 3.2. A fee of

$25.00 shall be submitted with submittal of the application for a development permit. Application for a development permit shall be made on forms furnished by the City Manager and may include, but not be limited to: plans in duplicate drawn to scale showing the nature, location, dimensions, and elevations of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required and is to be certified by a licensed professional engineer or architect.

a) Elevation in relation to mean sea level of the lowest floor (including basement) of all structures;

b) Elevation in relation to mean sea level to which any structure has been floodproofed;

c) Evidence that the floodproofing methods for any nonresidential structure meet the floodproofing criteria in Section 5.2.2; and,

d) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

4.2 DESIGNATION OF THE CITY MANAGER

The City Manager is hereby appointed to administer and implement this ordinance by granting or denying development permit applications in accordance with its provisions.

4.3 DUTIES AND RESPONSIBILITIES OF THE CITY MANAGER

Duties of the City Manager shall include, but not be limited to:

4.3.1 Permit Review

a) Review all development permits to determine that the permit requirements of this ordinance have been satisfied.

b) Review of all development permits to determine that all necessary permits have been obtained from those Federal, State, or local governmental agencies from which prior approval is required.

c) Review all development permits to determine if the proposed development is located in the floodway. If located in the floodway, assure that the encroachment provisions of Section 5.3(a) are met.

4.3.2 Use of Other Base Flood Data

The City Manager shall obtain, review, and reasonably utilize any base flood elevation data available from a Federal, State or other source in order to administer Sections 5.2.1, Specific Standards—Residential Construction, and Section 5.2.2, Specific Standards—Nonresidential Construction.

4.3.3 Information to be Obtained and Maintained

a) Obtain and record the actual elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially-improved structures.

b) For all new or substantially-improved floodproofed structures:

(i) Verify and record the actual elevation (in relation to mean sea level), and

(ii) Maintain the floodproofing certifications required in Section 4.1.c.

c) Maintain for public inspection all records pertaining to the provisions of this ordinance.

4.3.4 Alteration of Watercourses

a) Notify adjacent communities and the Colorado Water Conservation Board prior to any alteration or relocation of a watercouse, and submit evidence of such notification to the Federal Insurance Administration.

b) Require that maintenance is provided within the altered or relocated portion of said watercourse so that the flood-carrying capacity is not diminished.

4.3.5 Interpretation of FIRM Boundaries

Make interpretations where needed as to the exact location of the boundaries of the areas of special flood hazard (for example, where there appears to be a conflict between a mapped boundary and actual field conditions). The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in Section 4.4.

4.4 VARIANCE PROCEDURE

4.4.1 Appeal Board

a) The Manitou Springs Planning Commission, as established by the Manitou Springs City Council, shall hear and decide appeals from a decision of the City Manager and requests for variances from the requirements of this Ordinance.

b) The Manitou Springs Planning Commission may review any requirements, decisions, or determinations made by the City Manager in the enforcement or administration of this Ordinance.

c) An applicant may appeal the decision of the Manitou Springs Planning Commission to the Manitou Springs City Council by filing a written request for hearing with the City Clerk within fifteen (15) days of the decision of the Manitou Springs Planning Commission.

d) Manitou Springs City Council may review the Minutes of the Manitou Springs Planning Commission, as well as the positions of the applicant and the City Manager, as these positions were set forth before the Planning Commission.

e) The decision of the Manitou Springs City Council may be appealed pursuant to Rule 106 of the Colorado Rules of Civil Procedure. The cost of preparing a transcript of the record by a certified court reporter, or other qualified individual, shall be paid by the applicant at the time such transcript is requested.

f) In passing upon such applications, the Manitou Springs Planning Commission shall consider all technical evaluations, all relevant factors, standards specified in other sections of this ordinance, and:

(i) The danger that materials may be swept onto other lands to the injury of others;

(ii) The danger to life and property due to flooding or erosion damage;

(iii) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

(iv) The importance of the services provided by the proposed facility to the community;

(v) The necessity to the facility of a waterfront location, where applicable;

(vi) The availability of alternative locations for the proposed use which are not subject to flooding or erosion damage;

(vii) The compatibility of the proposed use with existing and anticipated development;

(viii) The relationship of the proposed use to the Comprehensive Plan and flood plain management program for that area;

(ix) The safety of access to the property in times of flood for ordinary and emergency vehicles;

(x) The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and,

(xi) The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water systems, and streets and bridges.

g) Generally, variances may be issued for new construction and substantial improvements to be erected on a lot of one-half (1/2) acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing items (i-xi) in Section 4.4.1.d have been fully considered.

h) Upon consideration of the factors of Section 4.4.1.d and the purposes of this ordinance, the Manitou Springs Planning Commission may attach such conditions to the granting of variances as it deems necessary to further the purposes of this ordinance.

i) The City Manager shall maintain the records of all appeal actions and report any variances to the Federal Insurance Administration upon request.

4.4.2 Conditions for Variances

a) Variances may be applied for upon application to the City Manager and submittal of a $50.00 application fee.

b) Development permits may be issued by the City Manager for the reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic

Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this section. Infill of vacant lots within the Historic Preservation District may be issued variances provided that the provisions of Section 4.4.2.e are met.

c) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

d) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

e) Variances shall only be issued upon:
(i) A showing of good and sufficient cause;
(ii) A determination that failure to grant the variance would result in exceptional hardship to the applicant; and
(iii) A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public as identified in Section 4.4.1.f, or conflict with existing local laws or ordinances.

f) Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor elevation below the base flood elevation and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation.

SECTION 5: PROVISIONS FOR FLOOD HAZARD REDUCTION

5.1 GENERAL STANDARDS

In all areas of special flood hazards, the following standards are required:

5.1.1 Anchoring

a) All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

b) All mobile homes shall be anchored to resist flotation, collapse, or lateral movement by providing over-the-top and frame ties to ground anchors. Specific requirements shall be that:

(i) Over-the-top ties be provided at each of the four (4) corners of the mobile home, with two (2) additional ties per side at intermediate locations, with mobile homes less than 50 feet long requiring one (1) additional tie per side; and
(ii) Frame ties be provided at each corner of the home with five (5) additional ties per side at intermediate points, with mobile homes less than 50 feet long requiring four (4) additional ties per side;
(iii) All components of the anchoring system be capable of carrying a force of 4,899 pounds; and
(iv) Any additions to the mobile home be similarly anchored.

5.1.2 Construction Materials and Methods

a) All new construction and substantial improvements shall be constructed with materials and utility equipment resistent to flood damage.

b) All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

5.1.3 Utilities

a) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

b) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharge from the systems into flood waters; and,

c) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

5.1.4 Subdivision Proposals

a) All subdivision proposals shall be consistent with the need to minimize flood damage;

b) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage;

c) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage; and,

d) Base flood elevation data shall be provided for subdivision proposals and other proposed developments which contain at least 50 lots or 5 acres (whichever is less).

5.1.5 Encroachments

Any proposed development shall be analyzed to determine effects on the flood-carrying capacity of the area of special flood hazard as set forth in Section 4.3.1, PERMIT REVIEW.

5.2 Specific Standards

In all areas of special flood hazard where base flood elevation data has been provided as set forth in Section 3.2 BASIS FOR ESTABLISHING THE AREAS OF SPECIAL FLOOD HAZARD, the following provisions are required:

5.2.1 Residential Construction

New construction and substantial improvement of any residential structure shall have the lowest floor, including basement, elevated to or above base flood elevation.

5.2.2 Nonresidential Construction

New construction and substantial improvement of any commercial, industrial, or other nonresidential structure shall either have the lowest floor, including basement, elevated to the level of the base flood elevation; or,

Together with attendant utility and sanitary facilities, shall:

a) Be floodproofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water;

b) Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

c) Be certified by a registered professional engineer or architect that the standards of this subsection are satisfied. Such certifications shall be provided to the official as set forth in Section 4.3.2.b.

5.2.3 Mobile Homes

a) For new mobile home parks and mobile home subdivisions; for expansions to existing mobile home parks and mobile home subdivisions; for existing mobile home parks and mobile home subdivisions where the repair, reconstruction, or improvement of the streets, utilities, and pads equals or exceeds 50 percent of the value of the streets, utilities, and pads before the repair, reconstruction, or improvement has commenced; and for mobile homes not placed in a mobile home park or mobile home subdivision, require that:
(i) Stands or lots are elevated on compacted fill or on pilings so that the lowest floor of the mobile home will be at or above the base flood level;
(ii) Adequate surface drainage and access for a hauler are provided; and
(iii) In the instance of elevation on pilings, that:
—Lots are large enough to permit steps,
—Piling foundations are placed in stable soil no more than ten (10) feet apart, and
—Reinforcement is provided for pilings more than six (6) feet above the ground level.
(iv) Mobile homes shall be anchored in accordance with Section 5.1.1.b.

b) No mobile home shall be placed in a floodway, except in an existing mobile home park or existing mobile home subdivision.

5.3 FLOODWAYS

Located within areas of special flood hazard established in Section 3.2 are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles, and erosion potential, the following provisions apply:

a) Prohibit encroachments, including fill, new construction, substantial improvements, and other development unless certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

b) If Section 5.3.a is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of Section 5.0 PROVISIONS FOR FLOOD HAZARD REDUCTION.

c) Prohibit the placement of any mobile homes except in an existing mobile home park or existing mobile home subdivision.

SECTION 6: This ordinance shall be in full force and effect from and after five (5) days of its final passage and publication as provided by law.

PASSED ON FIRST READING AND ORDERED PUBLISHED THIS 17th DAY OF JANUARY 1984.

CITY CLERK

PUBLISHED: January 17, 1984
PIKES PEAK JOURNAL

PASSED ON SECOND READING AND ADOPTED BY THE CITY COUNCIL THIS 31st DAY OF JANUARY 1984.

APPROVED: _____
MAYOR AND CITY COUNCIL

ATTEST: _____
CITY CLERK

APPROVED AS TO FORM: _____
CITY ATTORNEY

APPROVED FOR COUNCIL ACTION: _____
CITY MANAGER

PUBLISHED: February 3, 1984
PIKES PEAK JOURNAL

APPENDIX F

PARTIAL INVENTORY OF VACANT LAND IN MANITOU SPRINGS

by Carol Weissler

In disaster planning, knowing where available vacant land is located can be invaluable. A "routine information inventory" should be created to list the land tracts which are available for temporary relocation facilities and permanent expansion and relocation. This inventory can increase options and save valuable time early in the reconstruction process (Haas, et.al.,1977).

This inventory, updated regularly, could include the address and legal description of the property, current land use, zoning, and ownership. This information is available from the local tax assessor's office.

Ordinance #1882 creates a Hillside Low Density Residential Zone to be added to the Zoning Ordinance of Manitou Springs. This allows single family residences to be built on steep slopes with certain development requirements. One of the requirements is conformity to a table which requires a certain minimum size lot in proportion to the percent of slope. The greater the slope, the larger the square foot requirement of the lot.

As stated earlier, Manitou Springs has relatively little land open for development. The number of "buildable" lots is constrained by floodplain and steep slopes which constitute most of the city's land. A list which identifies land available for building that is not susceptible to these two hazards will be of great value, particularly after a flood. It can be an essential resource for planning decisions when damaged and destroyed buildings are being relocated.

The physical setting of Manitou Springs limits the expansion of the city. It is in a narrow valley with Ute Pass to the west, Colorado Springs to the east, and steep slopes to the north and south. The area of the city is 3.019 square miles, not including Crystal Hills Addition #2 annexation or the city dump and cemetery.

Though the inventory is incomplete, specific trends are evident. Most of the land on the Fountain Creek Floodway is developed, with some vacant lots scattered in low density areas such as Crystal Hills. However, the majority of vacant land is in the hillside low density areas on the north and south sides of the city.

This partial inventory, which is available at the Manitou Springs Land Use Planning Office, represents approximately one-half of the property in Manitou Springs. To update and complete this list, the researcher may begin with the next tax numbers. To update, check the addresses with the Manitou Springs Water Department (located at City Hall). If the property has been built on, there will be a water service card.

MANITOU SPRINGS
UNIMPROVED PROPERTY-TAX NUMBERS
74053-23-001 to 74094-04-003
As of Jan. 1984

74053-25-012	832 Midland Av	Lot 8, Blk 2
74053-27-003	905 Midland Av	Lot 3, Blk 5
74053-27-007	High Rd	Lots 13-15, Blk 2 Ouray Add.
74053-27-008	908/906 High Rd	Lots 16-17, Blk 2 Ouray Add.
74053-28-009	814 Shoshone Pl	Lot 11, Blk 3
74053-29-003	Midland Av	Lot 32, Blk 1
74053-29-010	815 Shoshone Pl	Lot 21, Blk 1
74053-29-011	817 Shoshone Pl	Lot 20, Blk 1
74053-29-012	11-13-15-17 Charcas Rd	Lots 16-19, Blk 1
74053-29-013	19 Charcas Rd	Lot 15, Blk 1
74053-29-014	21 Charcas Rd	Lot 14, Blk 1
74053-29-015	127 Pawnee Av	Lot 13, Part of lot 4
74053-29-017	25-27-29 Charcas Rd	Lots 11-12, Blk 1
74053-29-022	31-33 Charcas Rd	Lots 9&10, Blk 1
74053-30-006	215 Pawnee Av	Lot 7, Blk 1
74053-32-005	831-833-903 Shoshone Pl	Lots 1&2, Blk 6
74053-33-004	High Rd	Lot 18, Blk 3 Ouray Add.
74053-34-001	916 High Rd	Lot 12, Blk 7 Ouray Add.
74053-34-005	930 High Rd	Lot 5, Blk 7 Ouray Add.
74053-34-006	921-23 Utah Dr	Lots 1&2, Blk 9 Ouray Add.
74053-34-007	919 Utah Dr	Lot 3, Blk 9 Ouray Add.
74053-34-008	917 Utah Dr	Lot 4, Blk 9 Ouray Add.
74053-34-009	913-15 Utah Dr	Lots 5&6, Blk 9 Ouray Add.
74053-34-010	510-512 Winona Rd	Lots 15&16, Blk 7 Ouray Add.
74053-34-011	507 Winona Rd	Lot 7, Blk 9 Ouray Add.
74053-34-012	509 Winona Rd	Lot 8, Blk 9 Ouray Add.
74053-34-015	High Rd	Lots 13&14, Blk 7 Ouray Add.
74053-37-001	Grant Av	Lot 20, Blk 5 Busbys Sub.
74053-37-004	36 Lincoln Av	Part of Lot 5, Blk 5 Busbys Sub.
74053-37 005	Grant Av	Lot 21, Blk 5 Busbys Sub.
74053-37-006	Grant Av	Lot 22, Blk 5 Busbys Sub.
74053-37-007	Grant Av	Lot 23, Blk 5 Busbys Sub.
74053-38-005	Grant Av	Lot 12, Blk 6 Busbys Sub.
74053-38-006	Grant Av	Lot 7, Blk 6 Busbys Sub.
74053-39-005	10 Lincoln Av	Lot 11, Blk 5 Busbys Sub.
74053-39-014	18 Lincoln Av	Lot 8, Blk 5 Busbys Sub.
74053-43-022	Canon Av	Lot 2, Blk 1 El Pomar Fil.#1 Comm
74053-44-003	124 Canon Av	Lot 17, Blk C Manitou Sub. Comm
74053-44-006	Lovers Ln	Lot 5, Blk 1 Busbys Sub.
74053-45-003	Wichita Way	Lot 12, Blk 2 Busbys Sub.
74053-45-008	Wichita Way	Lot 11, Blk 2 Busbys Sub.
74053-45-010	119 Lovers Ln	Lots 8&9, Blk 2 Busbys Sub.
74053-46-001	Wichita Way	Lots 1-5, Blk 9 Mansions Pk Pl.
74053-47-014	Lovers Ln	Lot 6, Standish Sub.
74053-47-015	Lovers Ln	Part of Lot 7, Standish Sub. Comm
74053-47-020	Lovers Ln	Part of Lot 7, Standish Sub.

74054-01-004	6	Fountain Pl	Lot 3, Blk 5
74054-01-005	4	Fountain Pl	Lot 2, Blk 5
74054-01-008	107	S. Path	Lots 17&18, Blk 5
74054-02-004	511	High St	Lot 1, Blk C Hals Sub.
74054-02-005	511	High St	Lot 1, Blk C Hals Sub.
74054-02-006	103	Deer Path Av	Lot 6, Blk C Hals Sub.
74054-02-023	505	High St	Lot 1, Blk C Hals Sub.
74054-02-024	503	High St	Lot 1, Blk C Hals Sub.
74054-02-026	132	S. Path	Lot 4, Blk 9 Peakview Add.
74054-02-028		S. Path	Lot 5, Blk 4
74054-02-029		S. Path	Lot 22, Blk 4
74054-02-030	101	Deer Path	Lot 5, Blk C Hals Sub.
74054-04-016	111	Pawnee Av	Lot 6, Blk M
74054-05-018	132	S. Path	Lot 9
74054-07-001		Beaver Path	Lots 1-8, Blk 12 Peakview Add.
74054-08-003		Weasel Path	Lots 1-7, Blk 11 Peakview Add.
74054-08-003	301	Peakview Blvd	Lot 9, Blk 11 Peakview Add.
74054-09-001	301	Peakview Blvd	Lot 8, Blk 11 Peakview Add.
74054-09-002		S. Path	Lot 2, Blk 10 Peakview Add.
74054-09-003	5	Weasel Path	Lot 8, Blk 10 Peakview Add.
74054-09-006	135	Peakview Blvd	Lot 3, Blk 2 Peakview Add.
74054-10-003	110	Peakview Blvd	Lot 6, Pt Lot 4 Peakview Add.
74054-11-003	6	Cherokee Rd	Lot 3, Blk 2 Peakview Add.
74054-11-004		Oklahoma Rd	Lot 5, Blk 2 Peakview Add.
74054-11-013		Elk Path	Lot 20, Blk 2 Peakview Add.
74054-12-002		Peakview Blvd	Lots 4&5, Blk 8 Peakview Add.
74054-12-003		Peakview Blvd	Lots 6-8, Blk 8 Peakview Add.
74054-12-013		Oklahoma Rd	Lots 25&26, Blk 8 Peakview Add.
74054-12-017	319	Oklahoma Rd	Lots 27-31, Blk 8 Peakview Add.
74054-13-004		Peakview Blvd	Lots 10-16, Blk 13 Peakview Add
74054-14-001		Otter Path	Lot 7, Blk 14 Peakview Add.
74054-14-003		Beaver Path	Lot 1, Blk 14 Peakview Add.
74054-15-003	418-20	Oklahoma Rd	Lots 4&5, Blk 7 Peakview Add.
74054-15-006	435	Oklahoma Rd	Lot 13, Blk 7 Peakview Add.
74054-15-007	117	Squirrel Path	Lot 14, Blk 7 Peakview Add.
74054-15-008		Delaware Rd	Lots 15&16, Blk 7 Peakview Add.
74054-15-009		Delaware Rd	Lots 17&18, Blk 7 Peakview Add.
74054-15-012	422-24	Oklahoma Rd	Lots 6&7, Blk 7 Peakview Add.
74054-15-012	426	Oklahoma Rd	Lot 8, Blk 7 Peakview Add.
74054-15-014	428	Oklahoma Rd	Lot 9, Blk 7 Peakview Add.
74054-16-002	206	Oklahoma Rd	Lot 47, Blk 3 Peakview Add.
74054-16-003	208	Oklahoma Rd	E. 58 Ft. Lot 46, Blk 3 Pkvw Ad
74054-16-006		Cherokee Rd	Lots 2,3,36,37, Blk 3 Pkvw Add.
74054-16-008	29	Cherokee Rd	Lot 5, Blk 3 Peakview Add.
74054-16-009	21	Cherokee Rd	Lot 6, Blk 3 Peakview Add.
74054-16-013	37	Cherokee Rd	Lot 14, Blk 3 Peakview Add.
74054-16-019	46/48	Delaware Rd	Lots 30,31, Blk 3 Peakview Add.
74054-16-024	18	Delaware Rd	Lot 40, Blk 3 Peakview Add.
74054-17-005		Delaware Rd	Lots 6,7, Blk 4 Peakview Add.
74054-17-006	43	Delaware Rd	Lot 8, Blk 4 Peakview Add.
74054-17-007	45	Delaware Rd	Lot 9, Blk 4 Peakview Add.
74054-17-010	52	Delaware Rd	Lots 13,14, Blk 4 Peakview Add.
74054-17-011		S. Side Rd	Lot 15, Blk 4 Peakview Add.
74054-18-002	15	Fox Path	Lot 2, Blk 5 Peakview Add.
74054-19-002		Oklahoma Rd	Lot 9, Blk 6 Peakview Add.
74054-19-006		Delaware Rd	Lot 2,3, Blk 6, Peakview Add.
74054-19-007		Delaware Rd	Lot 1, Blk 6 Peakview Add.

74054-20-001		Peakview Blvd	Lots 1-18, Blk 15 Peakview Add.
74054-21-001	445	Oklahoma Rd	Lot 16, Blk 16 Peakview Add.
74054-21-002	443	Oklahoma Rd	Lot 15, Blk 16 Peakview Add.
74054-21-003	436	Kiowa Rd	Lot 14, Blk 16 Peakview Add.
74054-21-005		Kiowa Rd	Lot 5, Blk 16 Peakview Add.
74054-21-006		Kiowa Rd	Lots 1-4, Blk 16 Peakview Add.
74054-21-007	444/46	Oklahoma Rd	Lots 6&7, Blk 16 Peakview Add.
74054-21-008		Oklahoma Rd	Lots 8,9,10, Blk 16 Peakview Ad
74054-21-009		Oklahoma Rd	Lots 11-13, Blk 16 Peakview Add
74054-22-001		Kiowa Rd	Lots 1,2,3, Blk 17 Peakview Add
74054-22-006		Pinon Ln	Lot 5, Blk N
74054-24-001		Holtz St	Lots 5&6, Blk 4 Sunny Crest Add
74054-24-002		Tarrant St	Lots 2-4&7&8, Blk 4 Sunny Crest
74054-24-003		Baker St	Lot 9, Blk 4 Sunny Crest Add.
74054-24-009		Cedar Ln	Lot 1, Blk 3 Arterberrys Sub.
74054-24-010		Cedar Ln	Lot 2, Blk 5 Arterberrys Sub.
74054-24-011		Cedar Ln	Lot 3, Blk 3 Arterberrys Sub.
74054-24-012		Cedar Ln	Lot 4, Blk 3 Arterberrys Sub.
74054-24-018		Cedar Ln	Lot 11, Blk 2 Arterberrys Sub.
74054-24-031		Pinon Ln	Lot 2, Blk 2 Arterberrys Sub.
74054-24-035		Tarrant St	Lot 5, Blk 5 Sunny Crest Add.
74054-24-036		Baker St	Lot 6, Blk 1 Sunny Crest Add.
74054-24-037		Baker St	Blk 2, Sunny Crest Add.
74054-24-038		Cedar Ln	Lots 5&6, Blk 3 Arterberrys Sub
74054-24-040		Holtz St	Lot 1, Blk 3 Sunny Crest Add.
74054-24-041		Holtz St	Lots 10-16, Blk 3 Sunny Crest
74054-24-042		Cedar Ln	Lots 19&20, Blk 2 Arterberrys
74054-24-044		Cedar Ln	Lots 5&6, Blk 2 Arterberrys Sub
74054-24-046		Tarrant St	Lots 1-4, Blk 5 Sunny Crest Add
74054-25-006	486	El Paso Blvd	
74054-25-010		Cedar Ln	Part of Lot 2
74054-25-011		Kortz Path	Part of lot 2
74054-25-016		Cedar Ln	Part of Lot 2, Blk N
74054-25-017	103	Pinon Ln	
74054-25-018		S. View Terr	Blk G Albrechts Resub.
74054-25-019		S. View Terr	Blk F Albrechts Resub.
74054-25-020		Pinon Ln	Pt of Lot 2 Albrechts Resub.
74054-25-021			Lot 22, Blk D Albrechts Resub.
74054-25-022			Block F Albrechts Resub.
74054-26-001	487	El Paso Blvd	Lots 11-14 Smiths Resub. Comm
74054-27-001		El Paso Blvd	E 5 Ft Lot 15 Pt lots 2-5 Blk N
74054-27-021	108	Pinon Ln	Lot 4, Blk 2
74054-27-022	112-114-116	Pinon Ln	Lots 5-7, Blk 2
74054-28-004	469	El Paso Blvd	Lots 3-6, Blk 1 Comm
74054-28-007		Manitou Ave	Lots 2&3, Blk N Comm
74054-28-008		Manitou Ave	Part of Lot 4, Blk N
74054-28-004		Manitou Ave	Part of Lot 5, Blk N Comm

74054-20-001		Peakview Blvd	Lots 1-18, Blk 15 Peakview Add.
74054-21-001	445	Oklahoma Rd	Lot 16, Blk 16 Peakview Add.
74054-21-002	443	Oklahoma Rd	Lot 15, Blk 16 Peakview Add.
74054-21-003	436	Kiowa Rd	Lot 14, Blk 16 Peakview Add.
74054-21-005		Kiowa Rd	Lot 5, Blk 16 Peakview Add.
74054-21-006		Kiowa Rd	Lots 1-4, Blk 16 Peakview Add.
74054-21-007	444/46	Oklahoma Rd	Lots 6&7, Blk 16 Peakview Add.
74054-21-008		Oklahoma Rd	Lots 8,9,10, Blk 16 Peakview Ad
74054-21-009		Oklahoma Rd	Lots 11-13, Blk 16 Peakview Add
74054-22-001		Kiowa Rd	Lots 1,2,3, Blk 17 Peakview Add
74054-22-006		Pinon Ln	Lot 5, Blk N
74054-24-001		Holtz St	Lots 5&6, Blk 4 Sunny Crest Add
74054-24-002		Tarrant St	Lots 2-4&7&8, Blk 4 Sunny Crest
74054-24-003		Baker St	Lot 9, Blk 4 Sunny Crest Add.
74054-24-009		Cedar Ln	Lot 1, Blk 3 Arterberrys Sub.
74054-24-010		Cedar Ln	Lot 2, Blk 5 Arterberrys Sub.
74054-24-011		Cedar Ln	Lot 3, Blk 3 Arterberrys Sub.
74054-24-012		Cedar Ln	Lot 4, Blk 3 Arterberrys Sub.
74054-24-018		Cedar Ln	Lot 11, Blk 2 Arterberrys Sub.
74054-24-031		Pinon Ln	Lot 2, Blk 2 Arterberrys Sub.
74054-24-035		Tarrant St	Lot 5, Blk 5 Sunny Crest Add.
74054-24-036		Baker St	Lot 6, Blk 1 Sunny Crest Add.
74054-24-037		Baker St	Blk 2, Sunny Crest Add.
74054-24-038		Cedar Ln	Lots 5&6, Blk 3 Arterberrys Sub
74054-24-040		Holtz St	Lot 1, Blk 3 Sunny Crest Add.
74054-24-041		Holtz St	Lots 10-16, Blk 3 Sunny Crest
74054-24-042		Cedar Ln	Lots 19&20, Blk 2 Arterberrys
74054-24-044		Cedar Ln	Lots 5&6, Blk 2 Arterberrys Sub
74054-24-046		Tarrant St	Lots 1-4, Blk 5 Sunny Crest Add
74054-25-006	486	El Paso Blvd	
74054-25-010		Cedar Ln	Part of Lot 2
74054-25-011		Kortz Path	Part of lot 2
74054-25-016		Cedar Ln	Part of Lot 2, Blk N
74054-25-017	103	Pinon Ln	
74054-25-018		S. View Terr	Blk G Albrechts Resub.
74054-25-019		S. View Terr	Blk F Albrechts Resub.
74054-25-020		Pinon Ln	Pt of Lot 2 Albrechts Resub.
74054-25-021			Lot 22, Blk D Albrechts Resub.
74054-25-022			Block F Albrechts Resub.
74054-26-001	487	El Paso Blvd	Lots 11-14 Smiths Resub. Comm
74054-27-001		El Paso Blvd	E 5 Ft Lot 15 Pt lots 2-5 Blk N
74054-27-021	108	Pinon Ln	Lot 4, Blk 2
74054-27-022	112-114-116	Pinon Ln	Lots 5-7, Blk 2
74054-28-004	469	El Paso Blvd	Lots 3-6, Blk 1 Comm
74054-28-007		Manitou Ave	Lots 2&3, Blk N Comm
74054-28-008		Manitou Ave	Part of Lot 4, Blk N
74054-28-004		Manitou Ave	Part of Lot 5, Blk N Comm
74054-29-005		Cliff Road	Pt of Lots 1&2, Blk C Albr. Resub
74054-30-004		Cliff Road	Lot 1, Blk B Albrechts Resub.
74054-30-006		Cliff Road	Lots 13-15, Blk B Albrechts Resub.
74054-30-007		Cliff Road	Lots 16&17, Blk B Albrechts Resub.
74054-30-008		Cliff Road	Lot 18, Blk B Albrechts Resub.
74054-31-002		Ridge Drive	Lot 1, Blk A
74054-31-003		Old Mans Tr.	Lots 9-15, Blk A Albrechts Resub.
74054-32-010		Old Mans Tr.	Lots 44&45, Blk 7 Mansions Park Pl
74054-32-011		Burns Road	Lots 46-53, Blk 7 Mansions Park Pl
74054-32-012		Old Mans Tr.	Lot 54, Blk 7 Mansions Park Place

74054-32-013		Burns Road	Lot 55, Blk 7 Mansions Park Place
74054-32-014		Burns Road	Lots 56&57, Blk 7 Mansions Park Pl
74054-32-015		Burns Road	Lot 58, Blk 7 Mansions Park Place
74054-32-016		Burns Road	Lots 59-61, Blk 7 Mansions Park Pl
74054-33-019		Burns Road	Lots 39,41-43 Mansions Park Place
74054-33-006			Lot 10, Part lot 11 Mansions Pk Pl
74054-33-007			Blk 15 Mansions Park Place
74054-34-003			Lot 2 Blk 1&Lot 1 Blk 2 Panarama Re
74054-34-004		Panarama Pl	Lot 3, Blk 1 Panarama Resub.
74054-34-008	121-125	Washington Av	Lots 13-15, Blk 12 Mansions Pk Pl
74054-34-009	115-119	Washington Av	Lots 16-18, Blk 12 Mansions Pk Pl
74054-34-010	113	Washington Av	Lot 19, Blk 12 Mansions Park Place
74054-34-012		Panorama Pl	Lots 7-9, Blk 12 Mansions Park Pl
74054-34-015		Panorama Pl	Lot 1, Blk 1 Panorama Resub.
74054-35-002	138	Washington Av	Lot 1, Blk 10 Mansions Park Place
74054-35-003	143-149	Wichita Way	Lots 2-5, Blk 10 Mansions Park Pl
74054-35-004	141	Wichita Way	Lot 5, Blk 10 Mansions Park Place
74054-35-008	134	Wichita Way	Lot 6, Blk 9 Mansions Park Place
74054-35-014	125,27,29	Wichita Way	Lots 15,16,19, Blk 10 Mansions Pk
74054-35-015	131	Wichita Way	Lot 12, Blk 10 Mansions Park Place
74054-35-016	133	Wichita Way	Lot 11 pt of lot 9 Blk 10 Mans Pk
74054-35-017	112,14,16,18,20	Wash Av	Lots 10,13,14,17,18 Blk 10 Mans Pk
74054-35-018	122	Washington Av	Part of lot 9, Blk 10 Mansions Pk
74054-35-020	129	Lovers Lane	Lot 3, Seven Minute Spring
74054-35-021		Washington Av	Lot , Seven Minute Spring
74054-35-022	127	Lovers Lane	Lot 2, Seven Minute Spring
74054-35-023	26	Washington Av	Lot 4, Seven Minute Spring
74054-35-024	524	El Paso Blvd	Parcels 1,2,3,4,5 Seven Min. Spring
74054-36-005	10-12	Burns Road Lots	24,26, Blk 7 Mansions Park Pl
74054-36-011	20	Burns Road	Lot 16, Blk 7 Mansions Park Place
74054-36-014	419	Washington Av	Lot 12, Blk 7 Mansions Park Place
74054-36-016	423	Washington Av	Lot 10, Blk 7 Mansions Park Place
74054-36-019	508	El Paso Blvd	Lots 1-8, Blk 7 Mans Pk Pl Comm.
74054-39-005		Manitou Ave	Pt. Lot 3, Blk L Manitou Springs
74054-39-019		High Street	Pt. Lot 1, Blk L Manitou Springs
74054-41-008		Fountain Pl	Lots 6&7, Blk 6 Resub.
74054-41-013		Tulsa Rd	Lots 1-3, Blk 22 Peakview Add.
74054-41-014		E. Fountain Pl	Lot 4, Blk 22 Peakview Add.
74054-42-023	439	Bond St	Lot B Nelsons Place
74054-42-024	441	Bond St	Lot A Nelsons Place
74054-43-001	427	Bond St	Lot H, Blk 2 Atkinsons Resub.
74054-43-002	429	Bond St	Lot G, Blk 2 Atkinsons Resub.
74054-43-003	431	Bond St	Lot F, Blk 2 Atkinsons Resub.
74054-43-004	433	Bond St	Lot E, Blk 2 Atkinsons Resub.
74054-43-005	435	Bond St	Lot D, Blk 2 Atkinsons Resub.
74054-43-006	437	Bond St	Lot C, Blk 2 Atkinsons Resub.
74054-43-007	439	Bond St	Lot B, Blk 2 Atkinsons Resub.
74054-43-009	604-610	Indian Rd	Lots 15-21, Blk 7 Bestview Add.
74054-43-011	616-618	Indian Rd	Lots 4,5,11,12, Blk 7 Bestvw Add.
74054-43-015		Bond St	Lot 3, Nelsons Place
74054-43-016	612-614	Indian Rd	Lots 13&14, Blk 7 Bestview Add.
74054-44-001		Peakview Blvd	All Blk 1 Bestview Addition
74054-45-001	602	Peakview Blvd	Lots 1-10, Blk 2 Bestview Add.
74054-45-002		Peakview Blvd	Lots 11&12 Bestview Addition
74054-45-003		Peakview Blvd	Lots 13-23, Blk 2 Bestview Add.
74054-45-004	642	Peakview Blvd	Lots 24&25, Blk 2 Bestview Add.
74054-45-005	103	Puma Path	Lots 26&27, Blk 2, Bestview Add.

74054-46-002	614-618	Ridge Rd	Lots 9-11, Blk 3 Bestview Add.
74054-46-004	620-634	Ridge Rd	Lots 1-8, Blk 3 Bestview Add.
74054-46-005	505-612	Ridge Rd	Lots 12-19, Blk 3 Bestview Add.
74054-47-002		Tulsa Rd	Lots 3-7, 9-11, Blk 21 Peakview Ad
74054-47-003	4	Seneca Rd	Lot 8, Blk 21 Peakview Addition
74054-47-004	503-511	Peakview Blvd	Lots 12-20 Peakview Addition
74054-48-002	23-25	Seneca Rd	Lots 1&2, Blk 20 Peakview Add.
74054-48-003	27	Seneca Rd	Lot 3, Blk 20 Peakview Addition
74054-48-004	29-35	Seneca Rd	Lots 4-8, Blk 20 Peakview Add.
74054-48-005	9	Seneca Rd	Lot 27, Blk 20 Peakview Addition
74054-48-006	5-7	Seneca Rd	Lots 25&26, Blk 20 Peakview Add.
74054-48-007	1-3	Seneca Rd	Lots 22-24, Blk 20 Peakview Add.
74054-48-008	115	Otter Path	Lot 9, Blk 20 Peakview Add.
74054-48-010		Otter Path	Lot 14, Blk 20 Peakview Add.
74054-48-011		Seneca Rd	Lots 13,18-21, Blk 20 Peakview Add.
74054-48-013	505	Peakview Blvd	Lot 15, Blk 20 Peakview Add.
74054-48-014		Seneca Rd	Lot 21, Blk 20 Peakview Add.
74054-48-015	12	Seneca Rd	Lots 13,18-20, Blk 20 Peakview Add.
74054-49-001		Peakview Blvd	Lot 1, Blk 19 Peakview Add.
74054-49-002	504-510	Peakview Blvd	Lots 2-5, Blk 19 Peakview Add.
74054-49-003	512	Peakview Blvd	Lot 6, Blk 19 Peakview Add.
74054-49-005		Ridge Rd	Lots 13&14, Blk 19 Peakview Add.
74054-49-007		Peakview Blvd	Lot 24, Blk 19 Peakview Add.
74054-49-008	2,4,6,8	Puma Path	Lots 25-31, Blk 19 Peakview Add.
74054-50-001	437	Oklahoma Rd	Lot 15, Blk 18 Peakview Add.
74054-50-003		Oklahoma Rd	Lots 12-14, Blk 18 Peakview Add.
74054-50-004		Puma Path	Lots 7-11, Blk 18 Peakview Add.
74054-51-001		Oklahoma Rd	Lots 1-6, Blk 6 Bestview Addition
74054-51-002		Oklahoma Rd	Lot 7, Blk 6 Bestview Addition
74061-00-002		?	No Lot #
74061-00-005		?	No Lot #
74061-00-010		?	No Lot #
74061-00-011		?	No Lot #
74061-00-013		?	No Lot #
74061-00-015		?	No Lot #
74061-00-020		?	No Lot #
74061-00-021		?	No Lot #
74061-01-001		Trestle Trl	Lots 1-4, Blk 12 Burnett-Lennon Add
74061-01-004	111	Rock Rd	Lot 9, Blk 12 Burnett-Lennon Add.
74061-01-005	113	Rock Rd	Lot 10, Blk 12 yyyyett-Lennon Ad
74061-01-006	115	Rock Rd	Lot 11, Blk 12 Burnett-Lennon Ad
74061-01-007	117-119	Rock Rd	Lots 12&13, Blk 12 Burnett-Lennon
74061-01-008	121	Rock Rd	Lot 25, Blk 12 Burnett-Lennon Ad (nxt to 123 Rock Rd)
74061-01-010		Rock Rd	Pt. of Lot 8, Blk 1 Burnett-Lennn
74061-01-013	18	Minnehaha Av	Lot 5, Blk 1 Burnett-Lennon Ad
74061-01-017	26	Minnehaha Av	Lot 7, Blk 1 Burnett-Lennon Ad
74061-01-018	36	Minnehaha Av	Lot 10, Blk 1 Burnett-Lennon Ad
74061-01-020	44	Minnehaha Av	Lot 14, Blk 1 Burnett-Lennon Ad
74061-01-027	48	Minnehaha Av	Pt. Lots 15&16 Blk 1 Burnett-Lennon
74061-02-001		Spruce Trl	Lots 1-9, Blk 11 Burnett-Lennon Ad
74061-03-001		Trestle Trl	Lot 44, Blk 5 Burnett-Lennon Ad
74061-03-002		Trestle Trl	Pt. Lots 40&43 Blk 5 Burnett-Lennon
74061-03-004		Trestle Trl	Pt. Lots 37&39 Blk 5 Burnett-Lennon
74061-03-008	128	Pine Ridge Av	Lot 25, Blk 5 Burnett-Lennon Ad
74061-03-009	130-132	Pine Ridge Av	Lots 23&24 Blk 5 Burnett-Lennon Ad
74061-03-010	140-42-44	Pine Ridge Av	Lots 18-20, Blk 5 Burnett-Lennon Ad

74061-03-014	204	Duncan Av	Lot 13, Blk 5 Burnett-Lennon Ad
74061-03-016	216	Duncan Av	Lot 7, Blk 5 Burnett-Lennon Ad
74061-03-019	114-122	Pine Ridge Av	Lots 28-32, Blk 5 Burnett-Lennon Ad
74061-03-020	110-112	Pine Ridge Av	Lots 33&34 Blk 5 Burnett-Lennon Ad
74061-05-001	59	Minnehaha Av	Lot 1, Blk 3 Burnett-Lennon Ad
74061-05-002	45-47	Minnehaha Av	Lots 2&3, Blk 3 Burnett-Lennon Ad
74061-05-003	41-43	Minnehaha Av	Lots 4&6, Blk 3 Burnett-Lennon Ad
74061-05-004	121-127	Pine Ridge Av	Lots 5,8,9,12 Blk 3 Burnett-Lennon
74061-05-005	39	Minnehaha Av	Lot 7, Blk 3 Burnett-Lennon Ad
74061-05-013	135-137	Pine Ridge Av	Lots 16&20, Blk 3 Burnett-Lennon Ad
74061-05=018	215	Pine Ridge Av	Lot 11, Blk 4 Burnett-Lennon Ad
74061-05-019	217	Pine Ridge Av	Lot 12, Blk 4 Burnett-Lennon Ad
74061-05-023	305	Iron Rd	Pt. Lots 14&15 Blk 4 Burnett-Lennon
74061-06-001	211	Duncan Av	Lot 6, Blk 7 Burnett-Lennon Ad
74061-06-009		Mesa Av	Lot 11, Blk 7 Burnett-Lennon Ad
74061-07-006	213	Duncan Av	Lot 5, Blk 6 Burnett-Lennon Ad
74061-08-005	219	Mesa Av	Lot 13, Blk 10 Burnett-Lennon Ad
74061-08-008	229	Illinois Av	Lot 6, Blk 10 Burnett-Lennon Ad
74061-08-011	219	Illinois Av	Lot 1, Blk 10 Burnett-Lennon Ad
74061-08-012	223	Illinois Av	Lot 3, Blk 10 Burnett-Lennon Ad
74061-08-014	225	Mesa Av	Lot 10, Blk 10 Burnett-Lennon Ad
74061-09-002	235	Michigan Av	Pt. lot 9 Blk 9 Burnett-Lennon Ad
74061-09-004	306	Michigan Av	Lot 12, Blk 9 Burnett-Lennon Ad
74061-09-006	226	Illinois Av	Lot 1, Blk 9 Burnett-Lennon Ad
74061-09-011	210	Illinois Av	Pt Lot 8 Blk 9 Burnett-Lennon Ad
74063-02-009		Ruxton Av	Lot 16, Blk 23 Manitou Iron Spg Ad
y4063-02-013		Ruxton Av	Lots 24,25,26 Blk 23 Manitou IrnSpg
74063-02-016		?	Part Block 24 Manitou IrnSpg Ad
74063-03-002	607	Pine St	Blk 22 Manitou IrnSpg Ad
74063-03-003		Pine St	Blk 20 Manitou IrnSpg Ad
74063-03-008		Ruxton Av	Blk 22 Manitou IrnSpg Ad Comm.
74063-03-009	607	Ruxton Av	Pt Blk 22 Manitou IrnSpg Ad
76064-01-001		Grove St	Pt Blk 10 Manitou IrnSpg Ad
74064-01-002		Grove St	Tract 9A Manitou IrnSpg Ad
74064-01-003		Grove St	Tract 11A Manitou IrnSpg Ad
74064-01-009		Spring St	?
74064-01-010	377-395	Spring St	Lots 3-12 Blk 11 Manitou IrnSpg Ad
74064-01-012		Spring St	All Blk 12 Manitou IrnSpg Ad
74064-02-001		Ruxton Av	Pt Blk 13 Manitou IrnSpg Ad
74064-02-002		Fairview Av	Pt Blk 13 Manitou IrnSpg Ad
74064-02-003	430	Fairview Av	Blk 13 Manitou IrnSpg Ad
74064-02-004		Spring St	Blk 14 Manitou IrnSpg Ad
74064-03-003	506	Ruxton Av	Blk 27 Manitou IrnSpg Ad Comm.
74064-03-004	518	Ruxton Av	Blk 27 Manitou IrnSpg Ad
74064-03-005		Ruxton Av	Pt Lot 13 Blk 26 Manitou IrnSpg Ad
74064-04-002		Ruxton Av	Blk 29 Manitou IrnSpg Ad
74064-05-005		Fairview Av	Pt Lot 2 Blk 17 Manitou IrnSpg Ad
74064-05-007		Fairview Av	Blk 18 Manitou IrnSpg Ad
74064-05-010		Fairview Av	Blk 18 Manitou IrnSpg Ad Comm.
74064-05-011	535	Ruxton Av	Blk 18 Manitou IrnSpg Ad
74064-05-012		Fairview Av	Lot 7 Blk 17 Manitou IrnSpg Ad
74064-05-013		Fairview Av	Lot 8 Blk 17 Manitou IrnSpg Ad
74064-06-003		Fairview Av	Lot 1 Blk 19 Manitou IrnSpg Ad
74064-06-004		Fairview Av	Blk 21 Manitou IrnSpg Ad
74064-07-001	405-417	Spring St	Lots 28-34 Blk 15 Manitou IrnSpg Ad
74064-07-002	401	Spring St	Pt Lot 27 Blk 15 Manitou IrnSpg Ad
74064-07-003	403	Spring St	Pt Lot 27 Blk 15 Manitou IrnSpg Ad

74064-07-005	427	Fairview Av	Lot 25 Blk 15 Manitou IrnSpg Ad
74064-07-006	429	Fairview Av	Lot 24 Blk 15 Manitou IrnSpg Ad
74064-07-008	101	Fairview Av	Lot 21 Blk 15 Manitou IrnSpg Ad
74064-07-010	105	Fairview Av	Lot 19 Blk 15 Manitou IrnSpg Ad
74064-07-013	113-115	Fairview Av	Lots 14&15 Blk 15 Manitou IrnSpg Ad
74064-07-015	119-129	Fairview Av	Lots 7-12 Blk 15 Manitou IrnSpg Ad
74064-07-017	205,7,9	Pine St	Lots 1-3 Blk 15 Manitou IrnSpg Ad
74064-07-018		Fairview Av	Blk 16 Manitou Iron Springs Add.
74064-08-002		?	Manitou Terrace Heights
74064-08-003		?	Lots 1-5 Blk 1 Manitou Terrace Hts
74064-10-001	377	Pilot Knob Av	Lot 5, Blk 1 East Iron Spgs Add.
74064-10-003	369	Pilot Knob Av	Pt Lot 7 Blk 1 East IrnSpg Ad
74064-10-012	336	Pilot Knob Av	Pt Lot 13&14 Blk 1 E. IrnSpg Ad
74064-10-014	202	Illinois Av	Pt Lot 14 Blk 1 East IrnSpg Add.
74064-11-007	322-326	Elk Horn Av	Lots 6-8 Blk 1 Pilot Knob Terrace
74064-11-017	364	Pilot Knob Av	Lot 6 Blk 4 Manitou IrnSpg Add
74064-11-018	368	Pilot Knob Av	Lot 5 Blk 4 Manitou IrnSpg Add
74064-11-019	372	Pilot Knob Av	Lot 4 Blk 4 Manitou IrnSpg Add
74064-11-021	349	Elk Horn Av	Lot 24 Blk 1 Pilot Knob Terrace
74064-11-022	351	Elk Horn Av	Lot 25 Blk 1 Pilot Knob Terrace
74064-11-024	353-355	Elk Horn Av	Lots 26&27 Blk 1 Pilot Knob Terr
74064-11-026		Elk Horn Av	Lot 29 Blk 1 Pilot Knob Terr (near
74064-11-027		Pilot Knob Av	Pt Lot 16 Blk 4 Manitou IrnSpg Ad
74064-11-030	306	Pilot Knob Av	Pt Lot 20 Blk 4 Manitou IrnSpg Ad
74064-11-032	316,18,20	Elk Horn Av	Lots 3,4,5 Blk 1 Pilot Knob Terr
74064-11-032	327-329	Elk Horn Av	Lots 13&14 Pt 15 Blk 1 Pil Knob Ter
74064-11-034	343-347	Elk Horn Av	Lots 20-23 Blk 1 Pilot Knob Terrace
74064-11-035	325	Elk Horn Av	Lot 12 Blk 1 Pilot Knob Terrace
74064-12-001	303,5,7,9	Elk Horn Av	Lots 1,2,4,5 Pt 3 Blk 3 Pilot Knob
74064-12-002	5	Deer Horn	Pt Lot 3 Blk 3 Pilot Knob Terrace
74064-13-001		Deer Horn	Blk 4 Pilot Knob Terrace
74064-13-002		Elk Horn Av	?

APPENDIX G

LEGISLATION WHICH DIRECTLY AFFECTS HISTORIC PRESERVATION

FEDERAL

Antiquities Act of 1906

This Act provided the President the authorization necessary to designate "historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest" as national monuments, provided they were situated on federal lands. Determination of the significance of cultural properties was entrusted to the executive branch.

Historic Sites Act of 1935

A national policy of historic preservation was established, which also provided that federal plans and programs must consider preservation policy in their review process. In 1937, the National Survey of Historic Sites and Buildings began to identify and evaluate cultural resources of national significance based on themes in America's history.

"Surplus Real Property Act" Amendment to the Federal Property and Administrative Services Act of 1949

A structure eligible for or included on the National Register located on surplus federal property may be turned over to a state or municipality at no cost, provided the property is utilized for the benefit of the people as an historic monument.

Reservoir Salvage Act of 1960

This Act provides for preservation of scientific, prehistoric, historic, and archaeologic data which might be lost or destroyed as the result of any alterations caused by the construction of a dam by any federal agency or by anyone holding a federally issued license.

National Historic Preservation Act of 1966

The Secretary of the Interior was given the responsibility for maintaining and expanding the National Register of Historic Places to include cultural resources of state and local significance. Privately owned properties were made eligible for inclusion on the National Register as well. This Act additionally established the Advisory Council on Historic Preservation to be the principal agency for administration of NHPA protections, and encouraged states to develop their own historic preservation programs.

Department of Transportation Act of 1966

The Secretary of Transportation may not approve any project or program unless its potential effect on historic resources has been considered.

National Environmental Policy Act of 1969

Federal agencies are required to take into consideration the effects of their projects on the environment. In many instances environmental impact statements are necessary, which receive comment by the Advisory Council on Historic Preservation regarding impact on historic and cultural resources.

Executive Order 11593, Protection and Enhancement of the Cultural Environment, 1971

Extends Advisory Council's review process to include properties eligible for entry on the National Register of Historic Places, but not yet formally entered. Places addedd responsibility on federal agencies to establish procedures that prevent their activities from impairing non-federally owned cultural properties and to direct their activities so that historic preservation is contributed to in a positive manner.

Flood Disaster Protection Act of 1973

Federally funded acquisition or construction projects in special hazard areas must meet construction standards and flood insurance requirements. Therefore, historic preservation projects in these hazard areas relying in any way on federal dollars, must obtain flood insurance.

Archaeological and Historic Preservation Act of 1974

The Reservoir Salvage Act is amended, with intent to make all projects authorized, licensed, or assisted by federal agencies to be reviewed by the AHPA.

Emergency Home Purchase Assistance Act of 1974

Authorizes federal loans for rehabilitation or restoration of residential buildings on or eligible for the National Register. These loans apply to all structures in an historic district, regardless of whether the individual building is listed as contributing or non-contributing to the historic nature of the area.

Housing and Community Development Act of 1974

Provided for the availability of community development block grant funds for local surveys of historic resources.

Amendment to the Land and Water Conservation Fund Act of 1965 (1976)

National Historic Preservation Fund established to provide funding for historic preservation surveys and plans at the state level. Federal funding for this purpose may be discretionally increased from 50% to 70%. Additionally, federal agencies must recognize properties eligible for listing on the National Register in their planning process as well as those already included.

Tax Reform Act of 1976

Certified historic income-generating or business related properties entitle their owners to a five year write-off of certified rehabilitation costs. Other various tax incentives are also provided.

Public Buildings Cooperative Use Act of 1976

The General Services Administration will give preference to historic or architecturally significant buildings over other existing structures when acquiring space for federal offices, as well as encouraging public use by providing handicapped access.

AMTRAK Improvement Act of 1974, as amended by the Rail Transportation Improvement Act of 1976

Railroad stations listed on the National Register may be developed by the Department of Transportation and the National Endowment of the Arts as intermodal transportation centers or civic or cultural centers.

Amendments to the National Historic Preservation Act, 1980

Provides for nomination and protection of federal properties by federal agencies, broadens participation of local governments, and requires owner's consent for listing on the National Register.

Economic Recovery Tax Act of 1981

Provides significant tax credits for rehabilitation of historic properties.

STATE

Colorado Antiquities Act of 1973

Established the office of the state archaeologist, made designation of state monuments on state owned land possible, and stipulates conditions to be met when issuing permits for disturbing the natural state of historical resources.

Colorado Local Government Land Use Control Enabling Act of 1973

Lists powers of local governments regarding land use control and explains intergovernmental cooperation.

Colorado Land Use Act of 1974

Provides for administration of floodplains so as to "minimize significant hazards to public health and safety or to property," and requires that any development in historically significant areas be conducted so as to "minimize damage to those resources for future use."

Colorado Register of Historic Places Act of 1975

Creates a State Register of Historic Places and explains the procedure and criteria for nomination.

Sources:

Maddex, Diane, ed., 1983. The Brown Book, The Preservation Press, Washington, D.C.

Derry, Anne, et. al., 1977. Guidelines for Local Surveys: A Basis for Preservation Planning, Washington, D.C.

APPENDIX H

PROJECT CHRONOLOGY AND PRESS COVERAGE

This appendix documents the course of this project. It includes (1) the Technical Advisory Committee meeting minutes, (2) related press clippings from the Pikes Peak Journal and the Colorado Springs Gazette, and (3) a memo from Manitou Springs Planner Paul Intemann to the Manitou Springs City Council indicating the first steps toward implementation of the recommendations.

The project began November, 1984 when Bill Leon approached City Council about community support for a Flood Hazard Mitigation Planning effort. Initially there was considerable concern about potential adverse publicity about flood problems affecting the local economy. However, by January, 1985 a formal proposal had been submitted to the Federal Emergency Management Agency for funding, and the Division of Disaster Emergency Services and the Colorado Water Conservation Board AND Manitou Springs City Council were involved in the project aimed at improving public awareness and reducing loss of lives and property from flash flooding. The research team was organized and we began our work. Once the Technical Advisory Committee was established (see the minutes for names and affiliations of its members), a Community Task Force was formed. A close working relationship between all parties developed and constructive exchange of ideas, progress reports, suggestions, hopes and fears took place.

When Bill Leon first talked with city officials, they were still disturbed by recent adverse publicity stemming from ineffective efforts by the U.S. Army Corps of Engineers to address the city's flood problems. There was concern that even talking about floods would keep tourists away. In addition the Corps of Engineers has now proposed assisting the community with a flood warning system. Six months later the Economic Development Committee has altered plans for expanding the Chamber of Commerce structure in the floodplain and members of this group are taking the lead in beginning the implementation phase.

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Technical Committee

MINUTES

Monday, February 11, 1985

Manitou Springs City Council Chambers

AGENCIES REPRESENTED	REPRESENTATIVE(S)
City of Manitou Springs	Hugh King, City Manager Paul Intemann Harry Greenman Bob Peters
Federal Emergency Management Agency	Robert Ives Nancy Stone
Department of Disaster Emergency Services	Jack Truby
Colorado Water Conservation Board	Brian Hyde
Colorado Department of Natural Resources	Ron Cattany
El Paso County Disaster Services	Bob McWilliams
Pikes Peak Area Council of Governments	Alan Goins
Center for Community Development and Design	Bill Leon
University of Colorado at Colorado Springs	Eve Gruntfest Robert Jones Pamela Rivers Kelly Todd

The meeting was called to order by Bill Leon at 1:30 PM. A roundrobin introduction was held. Bill Leon and Eve Gruntfest described the project and distributed copies of the tasks and an estimated time line. Robert Jones, Pamela Rivers and Kelly Todd each described their assigned tasks.

1. Jack Truby made comments suggesting that we insure the Corps of Engineers (C.O.E.) be made aware that the impact of flooding in Manitou Springs will be great and that local officials realize that the flood will come. He cited Estes Park as a good example of rebuilding after a flood and said it will take courage to balance the risk of flood and economic needs. He warned that the project should not get sidetracked looking at warning systems too much. He suggested that the technical meeting group needs leadership and that it should be limited in membership to avoid being overwhelmed with inputs.

2. Paul Intemann stressed that the economic base for the city is tourism and any alternatives will have to be weighed against that fact. He would like to see the costs and legal issues of taking property examined. He also expressed a desire to examine redevelopment before the flood occurs. He stated that the community would oppose moving the historic district. The inclusion of contingency planning for the local administration in dealing with flood warnings was mentioned as a needed task.

3. Robert Ives mentioned that Estes Park lost very little in terms of lost tourism following their flood and that recovery efforts do work if done correctly. He stated that Estes Park didn't have plans prior to the flood and a 90 day moratorium was instituted to insure stringent Federal rules on reconstruction in the floodplain were followed. He said that most cities come out better after a disaster; emphasizing a win-win situation with taxpayers not paying for more flood damage and the city turning out better. He said it was imperative for Manitou Springs to have a group similar to the Estes Park Forward Commission to decide on where rebuilding funds should go. He mentioned that there is a wide range of options available for funding post flood action.

4. Ron Cattany said the project should be looked at as leverage for further projects and that it can provide creative ideas as to what the city should be like. He also mentioned how Estes Park designated land uses after the flood. He said that Estes Park had to wait to initiate reconstruction while the plan was finalized, while Rapid City, South Dakota began immediately, because their plan was on the books. Meeting with the people of Estes Park could add a great deal to local Manitou Springs' viewpoints, he pointed out. He suggested that the project check into the satellite warning system and that the Boulder warning system be used as a framework.

5. Hugh King wanted it to be known that Manitou Springs would be in opposition to Federal imposition of moving the city or important structures. He stated that the city council knows the value of the report and wants the project to look at diversions, buyouts, and floodproofing.

6. Brian Hyde stated that the plan would benefit not only Manitou Springs, but Colorado Springs and other communities as well. He suggested that other communities that have similar problems in the areas of historic preservation and tourist based economies be examined.

7. Bob McWilliams described the present warning system along Fountain Creek and mentioned the problems of maintenance costs and the proper location of the devices. He stated, and was agreed with by Harry Greenman, that the present warning system is inadequate. The satellite warning system is a good idea in that it reduces communication time.

8. Alan Goins mentioned that PPACG would be a source of information in discovering where funding for flood projects could be obtained. He stated the need for close liaison with the C.O.E. since their reconaissance study of the Fountain Creek watershed would provide detailed data on the hydrology of the stream.

9. Bill Leon described the community meeting and how certain groups and individuals from the community would be invited to work with the project

staff. He stated that the project staff is keenly interested in community involvement before the final report is issued to insure acceptance and implementation. The final report will involve recommendations with a range of options.

The next meeting of the technical group was scheduled for Wednesday, March 13 at 1:30 PM at the Manitou Springs City Council chambers. This would follow a meeting held that morning at the Pikes Peak Area Council of Governments from 9:00 AM to 12:00 PM where the C.O.E. is to give an update on their study of the Fountain Creek watershed. Representatives from the C.O.E. and the Colorado Springs Engineering Department have been invited to the next meeting of the technical group.

Manitou Springs Flood Mitigation Project

Technical Committee

MINUTES

Wednesday, March 13, 1985

Manitou Springs City Council Chambers

AGENCIES REPRESENTED	REPRESENTATIVE(S)
City of Manitou Springs	Hugh King Paul Intemann
Federal Emergency Management Agency	Nancy Stone Connie Murphy
Department of Disaster Emergency Services	Jack Truby
Colorado Water Conservation Board	Brian Hyde
El Paso County Disaster Services	Bob McWilliams
City of Colorado Springs	Gary Haynes
U.S. Army Corps of Engineers	Tony Apodaca
Pikes Peak Area Council of Governments	Alan Boins
Center for Community Development and Design	Bill Leon
University of Colorado at Colorado Springs	Eve Bruntfest Robert Jones Pamala Rivers

The meeting was called to order by Bill Leon at 1:30 PM. A roundrobin introduction was held. Eve Bruntfest distributed a progress report and gave a short description of the mitigation project and solicited comments from the members of the technical committee. Robert Jones described the historical record of flooding in Manitou Springs showing slides taken from newspaper files on the 1921, 1947 and 1964 floods. He also described the threat posed by the six reservoirs located above Manitou Springs and reviewed warning systems. Pamala Rivers covered the issue of historic preservation in the floodplain, giving an overview of the problem in Manitou Springs and stressing the continuing research into other communities facing a similar situation. She also described the impact of floodplain management on tourism, citing Estes Park as an example. Eve Bruntfest described Kelly Todd's progress in completing the flash flood scenario stressing that members of the local community were very much in favor of the presentation and having it show the effects of a 100 year flood.

1. Tony Apodaca gave a brief description of the U.S. Army Corps of Engineers' reconaissance study for the upper Fountain Creek watershed and stated that structural alternatives to flood control in Manitou Springs had proven to be infeasible. If a sponsor (local governmental agency) for the next phase can be determined the Corps would investigate the feasibility of warning systems for the creek.

2. Jack Truby asked about the administration of funds for the project, reminding the investigastion team that funding should be matched against task completion.

3. Bob McWilliams pointed out that North Catamount Dam should be added to the list of high hazard dams above Manitou Springs. He also described the warning system currently in place within the area and how it relied on outdoor sirens for disseminating warnings.

4. Alan Goins suggested that population and damage figures for the years in which flood events occurred be added to the report.

5. Nancy Stone suggested references that could be utilized in the investigation of historic preservation issues.

6. Gary Haynes acknowledged the impact of the study on Colorado Springs as any changes would affect downstream communities. He described how the city of Colorado Springs is experiencing similar problems along North Cheyenne Creek concerning floodplain development.

7. Brian Hyde suggested that depth-damage information would be an important part of the final report. He stressed that comparisons with Estes Park flooding be examined with the understanding that the flow there was much less than the 100 year flow in Manitou Springs would be. Damage to Manitou Springs would be much greater than what occurred in Estes Park.

7. Hugh King and Paul Intemann asked that questions on historic buildings; specifically, when is a building damaged by flooding no longer historic and can a building damaged 50% or greater be rebuilt if it has been designated historic, be looked into. They stated that the comparisons with Estes Park and other tourist oriented communities would be beneficial.

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MANITOU SPRINGS FLOOD HAZARD MITIGATION PLAN
TECHNICAL COMMITTEE MEETING
MINUTES
Thursday, May 9, 1985
Manitou Springs City Council Chambers

Agencies Represented	Representatives
Federal Emergency Management Agency	Clancey Phillipsborn
	Jerry Olson
U.S. Army Corps of Engineers	Bob Roumph
Division of Disaster Emergency Services	Irwin Glassman
	Pat Hagan
Department of Natural Resources	Ron Cattany
Colorado Water Conservation Board	Brian Hyde
Pikes Peak Area Council of Governments	Alan Goins
El Paso County Disaster Services	Bob McWilliams
Colorado Springs City Engineering	Gary Haynes
City of Manitou Springs	Paul Intemann
	Christopher Daly
	Richard Morrelli
Center for Community Development and Design	Bill Leon
University of Colorado at Colorado Springs	Eve Gruntfest
	Robert Jones
	Kelly Todd
	Pamala Rivers
	Carol Phelan
	Carol Weissler

The meeting was called to order by Eve Gruntfest at 9:30 am. A roundrobin introduction was held. Handouts included an agenda, a progress report for those who had not received one in the mail, a draft of the contingency plan, a table of flood hazard mitigation strategies adopted elsewhere, a draft of floodplain management sources of information and assistance, and a packet of tentative tables. Eve gave an overview of the project and spoke about the proposed schedule of remaining work. Kelly Todd presented a draft of the Manitou Springs Flash Flood Scenario. Pamala Rivers gave a review of historic preservation and current floodproofing strategies in Manitou Springs, and solicited comments on the draft contingency plan. Carol Phelan presented a summary of floodplain management strategies adopted elsewhere and their funding sources. Carol Weissler emphasized the lack of vacant land not on a steep hillslope or in the floodplain in Manitou Springs when she presented the results of her vacant land survey. Robert Jones solicited comments on the handout of tentative figures and tables, and presented slides of historical floods in Manitou Springs, Ruxton and Fountain Creek channels, and various maps.

1. Brian Hyde raised the issue of the interrelationships between communities affected by the Fountain Creek floodplain and the possibility of regional funding for implementation of recommendations as well as a regional approach for presentation of the report's findings. He also posed the idea that structural alternatives might be accomodated in a post-flood masterplan rather than as pre-flood recommendations. Brian handed out an outline for the project which reflected potential revisions from the Colorado Water Conservation Board's standpoint, including a section on the state's 406 plan.

2. Paul Intemann suggested breaks in the scenario's slide show to allow for discussion during presentation. He stressed drills for initiation of contingent floodproofing to retain a high level of awareness, and revealed the city's landfill as a potential site for emergency housing in consideration of the lack of suitable land elsewhere. Paul suggested the report's findings be presented at a city council work session and also thought the Pikes Peak Area Council of Governments should coordinate any regional approach for dissemination of information.

3. Ron Cattany, together with Irwin Glassman, stressed the need for additional slides, including a map of the area, in a critique of the Manitou Springs Flash Flood Scenario. Regarding dissemination of findings, Ron suggested a brief presentation to the city council with a list of items to be addressed by them, and reminded the city that the agencies represented by the technical committee will provide information and resources even after the study has been completed.

4. Jerry Olson suggested that the City of Manitou Springs develop a post-flood masterplan, and stressed that although it is valuable to investigate structural mitigation techniques, the cost/benefit ratio seems to favor non-structural measures such as flood insurance. He also suggested that the scenario be shortened to no longer than 15 minutes.

5. Pat Hagan suggested that the media is a source for community awareness and information dissemination, especially in areas where the level of awareness of local officials is low.

6. Christopher Daly, with Paul Intemann, pointed out the sensitivity of Manitou's economy and population to certain structural alternatives. He suggested that the local population does perceive a problem and that communicating information to the public is the city's responsibility, not that of the media. He also stressed the importance of categorizing recommendations so that the city's role is clear.

7. Bob McWilliams stressed the need of Manitou Springs to develop a detailed contingency plan, and offered his assistance.

8. Irwin Glassman emphasized that during the implementation phase Manitou Springs should share information with other nearby communities and stimulate awareness.

9. Bill Leon informed the technical committee that he will arrange for a community meeting the first week of June.

10. Eve Gruntfest said that she will be presenting the project's findings at the Emergency '85 conference in Washington D.C. this month as well as at the Natural Hazards conference in Boulder later this summer.

community meeting:

to obtain citizen views concerning a study of flood hazard potential in Manitou Springs.

A major study aimed at reducing flood hazard potential along Fountain Creek and its tributaries is getting underway. The study will make recommendations to the community on ways to minimize loss of life and property damage in the event of a major flood.

Researchers from the University of Colorado at Colorado Springs will be leading the study in cooperation with Manitou Springs officials; local, state, and federal planners; and concerned citizens. All parties agree that citizen input is vital to the success of this project.

PLEASE COME AND GET INVOLVED IN THE CITIZEN COMMITTEE!!!

first meeting:

monday, february 11, 1985

7:30 pm City Council Chambers Manitou Springs City Hall

This effort is being coordinated by the Center for Community Development and Design, U.C.C.S. For more information, contact Bill Leon at 593-3161 or 578-6136.

everyone welcome!

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May 3, 1985

MEMO

To: Technical Advisory Committee members

From: Eve Gruntfest, Principal Investigator

Re: Manitou Springs Project

Enclosed please find an updated progress report in the form of a revised outline and draft sections of our report. Each section has been identified according to where it fits into our outline. Some of you have made very useful comments and suggestions. We appreciate the feedback and would like to hear from all of you.

Here is the tentative agenda for the 9 May meeting to be held at 9:30 AM at the Manitou Springs City Hall. See you there.

Agenda

9 May 1985

Manitou Springs Technical Advisory Committee

1. Overview and introductions: Eve Gruntfest
2. The flash flood scenario: Kelly Todd
3. Summary of historic preservation, floodproofing and contingency plan: Pam Rivers
4. Summary of land acquisition and relocation: Carol Phelan
5. Slides and maps: Robert Jones
6. Recommendations: Research Team
7. Discussion of reports, recommendations, dissemination and implementation: Everyone

Feb. 15, 1985

Task force probes flood hazards and remedies

Experts have begun looking for middle ground in the business of dealing with potential floods in Manitou Springs. The question of flood waters spilling down Ute Pass, along Ruxton Creek down Englemann Canyon, and via Williams Canyon or Sutherland Creek have usually drawn two kinds of attitudes. The first was denial, with its proponents arguing that since no one could remember a serious flood it wasn't worth worrying about. Others took a more macabre stance, stating that there wouldn't be any way of preventing or countering it, so why worry?

Neither position advanced the city's level of emergency planning and preparation. On Monday evening, however, the first of a series of community meetings addressed the matter of flood planning thanks to a grant from the Federal Emergency Management Agency and representatives of the Center for Community Development and Design at the University of Colorado at Colorado Springs.

A group of researchers under the direction of Bill Leon, director of the Center, hope to come up with a three-fold plan by August. He said that the first goal of the $45,000 grant is to generate plans to reduce existing flood hazards. Secondly, it should outline recovery steps that could be used if a serious flood ever did strike and which would reduce potential damages should another flood occur. Third, Leon hopes the project will increase public awareness of flooding hazards and provide some options for any action the City decides to take.

Manitou is among about 200 other Colorado communities that was developed without much consideration of flooding hazards. If the program is successful, Leon predicts that it could be used statewide or even nationally as an example of emergency preplanning and preparation. Eve Gruntfest, a geology professor at UCCS who is associated with the study, said the study could be used to present an image of Manitou Springs as a community that is planning its future and providing for the safety of its citizens effectively.

The Monday night meeting was preceded by a technical advisory meeting earlier in the afternoon. Everybody who was anybody in the world of disasters and planning was there. Convening with the City Manager were representatives of the Pikes Peak Area Council of Governments, the Center for Community Development and Design at the University of Colorado at Colorado Springs, the Federal Emergency Management Agency, El Paso County Disaster Services, the Colorado Water Conservation Board, The Colorado Department of Natural Resources, the Department of Emergency Services, and delegates of the local Fire and Police Departments.

The study will involve two graduate students and one undergraduate candidate from the school.

Victims of the 1921 Manitou flood lie jumbled near the present site of Stagecoach Inn. The new study hopes to forecast corrective measures for the city.

Volume 103 Manitou Springs, CO 80829 Number 7 Friday, February 15, 1985 20 Cents

Cold freezes directory distribution temporarily

The much-touted City Directory is off the presses but copies will not be delivered until the weather cooperates a little more. According to City spokesperson Cheryl Massaro distribution of the books will be done by the Boy Scouts of Troop 18 and members of their sponsoring organization, the Manitou Springs Kiwanis Club. Bitterly cold weather however has halted the door-to-door distribution effort. Once it warms up, every Manitou household will be getting a free copy of the Directory which lists all residents and business in a mini-phone book format.

HISTORIC MANITOU SPRINGS

1985 BUSINESS and RESIDENTIAL DIRECTORY

Flood study begins Monday

A special meeting to kick off a local flood study will be held at 7:30 p.m. on Monday, Feb. 11 at City Hall. Heading the study is Bill Leon of the Center for Community Development and Design at the University of Colorado at Colorado Springs.

"The whole purpose of the meeting is to get some community input," explained Leon, who said the group wants to visualize the effect a flood would have on Manitou Springs. Ultimately, he hopes the study's results would enable the community to take steps to minimize potential disasters.

A project of students at the University, the findings will be made available to the City of Manitou Springs. The students will be drawing on citizens, state and federal government agencies, and the City of Manitou Springs.

For more information, contact Leon at 593-3161 or 578-6136.

The PIKES PEAK JOURNAL

Volume 103 Manitou Springs, CO 80829 Number 6 Friday, February 8, 1985 20 Cents

The PIKES PEAK JOURNAL

Volume 103 | Manitou Springs, CO 80829 | Number 23 | Friday, June 7, 1985 | 20 Cents

Flood study mixes gloomy forecast with suggestions

The gist of a soon-to-be-published 150 page report on Manitou Springs' vulnerability to floods is that the city is tragically unprepared to deal with the inevitable. That finding comes from the University of Colorado at Colorado Springs' Center for Community Development and Design. Students and professors at the school recently concluded a $25,000 study funded by the Federal Emergency Management Agency to gauge the potential for damage and loss of life and recommendation safeguards for Manitou Springs.

Technically and historically it doesn't look good the eight student, two professor task force agrees. However, there are some low-cost measures that would minimize loss of life and reduce damages if the community is willing to take the report seriously, the group said.

The students' job now is to convince the public that the hazard exists, explained Bill Leon, who served as community coordinator for the study. Leon believes that the greatest dangers now are in discounting the potential for a flood or in failing to plan for one.

Despite the grim findings, Leon is basically optimistic over the study. "What has impressed me the most is the maturity that the city has taken. No one is trying to sidestep either the danger or the issue. There seems to be a real community interest in the

Continued on Page 4

Continued from Page 1

matter," Leon said.

"It's hard to summarize all this work. We started with historical background. There is a substantial flood threat—not that that wasn't known before. However, we worked up a scenario that we hope to use as a flood education tool," Leon said. Students have encapsulated the threat in a slide show that features an imaginary 100-year flood and its effects on the community.

"It isn't a thing to scare people," Leon added. Nonetheless, ninety-seven people are killed in the make believe flood which hits the city in its current state of unpreparedness, hardly a reassuring tale. In contrast, a version of the same flood with emergency planning done ahead of time reflects a much higher survival rate. Leon will present the slide show at Tuesday night's City Council meeting and invites the public to attend. The meeting will be at 7:30 p.m. at City Hall, 606 Manitou Ave.

RECOMMENDATIONS

Three sets of recommendations were made in the report. They deal with warning systems, flood proofing, and pre-emergency planning and awareness.

WARNING SYSTEMS

Three approaches were outlined to alert citizens to possible flood hazards.

THE $200 SPECIAL

The first and cheapest recommendation would be organize volunteer weather watchers who would record rain fall and water levels in streams. "It's only going to be effective if the volunteers are reliable," warned a student. Anticipated cost for the project would be $200.

ADDITIONAL ALARMS FOR CREEKS

The second alternative would cost $10,000 to $50,000. Under that plan more flood alarms would be placed along area creeks. Currently, there is only one alarm with a sensor located in Cascade and the alarm installed in the Manitou Springs Police Department office.

HIGH TECH HOPES

For $500,000, Manitou Springs could have its own answer to NORAD with remote sensing devices to monitor dams (six sensors), streams (eight, strategically placed) and rainfall (a dozen).

FLOOD PROOFING

In the flood proofing department the good news is that some building owners have already undertaken flood proofing measures. Examples are the Barker House, the Promenade, and Alberto's at the Loop. Although they can be costly to building owners, the burden on the taxpayer is minimal since flood proofing is incidental for participation in some other federal government programs for historic properties.

WONDERS OF THE MODERN WORLD

If the city were to undertake flood proofing on its own, it would get expensive warned Robert Jones. With the possibility for flooding from Ute Pass, Williams Canyon, Englemann Canyon (Ruxton Creek) and Sutherland Creek an adequate defense would require structural modifications like raised sidewalks, said Jones.

As an alternative to the Army Corps of Engineers suggestion to build a 16 foot in diameter storm sewer from the mouth of Ute Pass to Fountain Creek just east of the Highway 24 Bypass, Jones suggested modifying the Highway 24 Bypass to serve as a diversion structure. Concrete walls six to eight foot high would be added to the sides of the eastbound roadway, including median strip and shoulder. Jones said a diversion structure at the mouth of the Pass could be built to divert water onto the roadway.

Jones' $6 to $8 million pricetag would beat the Army's $17 million estimated cost for the gargantuan storm sewer. Jones admitted that the heavy construction intensive approaches drew a few dubious comments when the recommendations were made last week to board members of the Manitou Springs Development Company.

Continued on Page 8

Continued from page 4

STRUCTURAL DIVERSIONS

Building a levy along existing creeks is included in the recommendations along with routine clearing of the creekbeds to reduce obstructions and increase streambed capacity. Also suggested was the establishment of an Urban Flood Control District of which Manitou Springs would be a member. The District would oversee major flood proofing efforts and provide a central agency to raise funds—via taxes and possibly, federal grants— for the flood proofing.

LOCAL EMERGENCY OPERATIONS PLAN

She first recommended that the City establish a Local Emergency Operations Plan, something of a modification of the fire drills school children are given. It would include emergency job assignments for critical personnel prior to a flood and educate the public on emergency procedures to be taken. Evacuation routes would be determined and persons with special evacuation needs, such as the handicapped and seniors, to be provided for. The disaster plan should include provisions for emergency medical care, shelter, food and safety following a flood, Rivers said. Additionally, it would be advisable for the city to have a "recovery plan" prepared so that salvage and safety operations could be undertaken with minimal delay.

RECOVERY PLAN

Adequate flood insurance and a written plan for the rehabilitation or demolition of damaged property should be decided upon as a step in the emergency planning, she said. The city should determine the direction it would want to take after a flood and notify the Federal government, which would take a major role in recovery efforts.

"I believe the city should draft a Memorandum of Understanding with the Federal government," Rivers explained, which would give the city more freedom from Federal regulations if a flood does occur. For example, under Federal requirements any building suffering more than 50 percent damage that does not have a pre emergency plan would have to be demolished.

Some Indians had different names in different seasons.

Scenario offers two alternatives to flood hazard

At Tuesday evening's City Council meeting, representatives of the Center for Community Development and Design of the University of Colorado at Colorado Springs presented the findings of a study on the area's flood hazards. As part of that study students offered two fictious scenarios to illustrate how the city would fare given a 100-year flood. The first version is without a pre-emergency plan and public education—the city's current position—while the second demonstrates the advantages of disaster preparation. The two hypothetical situations were illustrated with a slide show, which included both local photos and documentation of the 1976 Big Thompson flood in northern Colorado.

FOR WHOM THE BELL TOLLS

The rain began about 3 p.m., falling on soil that has already been saturated by rains in the last few days. It is a heavy rain but not unusual for Colorado in the summer. By 4:30 the cloudburst has unleashed its full fury. In Cascade, an amateur meteorologist discovers that three inches of rain has fallen in a mere half hour. Debris-laden water churns its way down Ute Pass towards Manitou Springs. The normal dry channel at the bottom of Williams Canyon fills to capacity as sheets of rain fall into the small watershed. Ruxton Creek, too, swells within the narrow confines of Englemann Canyon.

A flash flood warning is issued at 5:35 by the National Weather Service at Peterson Field. In a few minutes the Highway 24 Bypass is cut off from Manitou Ave. at the west end of the city. Fountain Creek has begun to climb out of its banks, rising four feet in an hour. A few residents flee their apartments and homes along the creek, but most residents hope to wait out the flood, amazed at the rainfall but unaware of the danger to follow.

Soon a six foot surge of water along Ruxton Creek breaks through the dining room of a popular restaurant. Structures built over Ruxton Creek suddenly have their foundations wrenched out from underneath them. Debris clogs the channel and the floodwaters spill powerfully across Ruxton Ave., cutting it into pieces.

Lives have already been lost and some bodies will not be recovered. Ironically, most people still fail to take emergency action.

The water grows higher and panic begins to overtake residents. Many try to drive out of town or to higher ground— possibly the single most fatal move to any flood. A young mother attempts to drive her three children to safety. Their bodies will be found two days later, the youngest child's hands still clutching his mother's purse. Those who survive will have to walk by the spot and remember it.

By 6 p.m. three motels have been obliterated under a 10-foot crest that plows down Fountain Creek. A youth command post has been set up at Manitou Springs High School by police and city employees have managed to get two fire trucks to safety. The flood ruptures water and gas mains alike, phone and power lines collapse. Firefighting is difficult to impossible among the secondary hazards that come after the flood. Roadways are torn up or else cluttered with the wreckage of what were homes and businesses.

"Because the city has no pre-emergency plans, efforts are chaotic," asserts the report's narrator. "In most areas the stream is cresting nine feet above its banks," she continues.

In the students' scenario, 97 lives are confirmed lost and a few other people are unaccounted for. "The next few days are spent recovering bodies." Federal Emergency Management Agency (FEMA) personnel and state officials will move in to oversee recovery efforts. Many structures will be declared unsalvagable and removed, regardless of historic appeal. Rebuilding may be prohibited in areas hit hardest by the flood.

ALWAYS BE PREPARED

A second version of the flood paints a more optimistic picture for survival, given adequate pre-planning. The flood levels are the same, but this time citizens know what safety measures to take and the city has a sensitive warning system in place. The 3 p.m. rains again turn into a torrent but at 4:15 p.m. the flood alarm sounds. Manitou Springs has 17 minutes to save lives.

Utilities personnel immediately close down water, gas, and electrical lines. Emergency vehicles are removed from the city garages and a command post is set up again at the High School. Citizens realize that it is futile to drive and walk to higher ground, minimizing traffic problems. Police supervise the evacuation of handicapped and elderly persons following a planning procedure.

The young mother doesn't attempt to drive out of the flood, this time she and her three small children manage to reach a friend's home on higher ground.

Material damage is still extensive but the secondary problems like fires are reduced thanks to pre-planning. Water floods Ruxton, Manitou, and Canon Avenues and some sidestreets but this time the roadways are fairly clear of cars and the damage is lessened.

Soon FEMA personnel will be notified of the flood. They will pull files on Manitou Springs outlining recovery procedures for immediate relief and long-term rebuilding.

council capsules

City hears final report on flood study

By Joanne Garrison

The Manitou Springs Planning Commission and City Council received the final report this week from the University of Colorado Center for Design and Development on the Flood Hazard Mitigtion Plan for Manitou Springs.

The plan includes recommendations for mitigating the flood hazards along Fountain and Ruxton Creeks. Some of the recommendations would be costly, but others could be implemented at fairly low cost. Increasing public awareness of flood hazards, and teaching people what to do if a flood occurs, would save lives and would not be costly to implement, according to the report.

"People need to understand that they should climb on foot to higher ground in the event of a flood", explained Pam Rivers from the University. "It is a mistake to try to escape a flash flood in the foothills via automobile", she said. Rivers has been involved with the research for the report since last Fall when it was announced that the University and Manitou Springs had received a grant from the Federal Emergency Management Agency to fund the research and the report.

Other less expensive recommendations in the report include improving the City's flood warning system, and stepping up the City's ability to deal with a flood emergency. "The City is ill-prepared at present to handle a major flood", admitted City Manager, Hugh King. The report recommends the City should devise and practice a Disaster Plan to include removing City emergency equipment to higher ground such as at the High School.

The University presented its Flood Hazard Mitigation Plan to the Board of Directors of the Manitou Springs Development Company on May 29th. The Development Company subsequently passed a Resolution recommending the City take positive steps to implement the University's Plan for Mitigating Flood Hazards in Manitou Springs. The Resolution states the City should act responsibly in increasing public awareness of flood hazards; and should maintain a better level of preparedness for dealing with a flood, as outlined in the Report.

Manitou council considers cleanup of lots, sidewalks

Residents of Manitou Springs may be asked by their city government to put more effort into repairing their sidewalks and cleaning up their lots this spring.

The subject came up as the Manitou Springs City Council, at its monthly meeting Tuesday, was discussing the city Chamber of Commerce's plans for the annual, citywide, spring cleanup May 4 so the city will be more attractive for tourists.

Councilman Christopher Daly said the problems of broken sidewalks and lots cluttered with junk are getting worse.

"Let's get more detail," Councilman Dan Stuart said. The council informally referred the matter to committees for further study.

The council granted "conceptual approval" to plans of Harvey W. and Barbara L. Blasdel to expand their Manitou Motel at 229 Manitou Ave. The approval is not binding.

Pete Susemihl, the Blasdels' attorney, said the couple wanted the approval before submitting for final permission.

Chuck Murphy, a nearby resident and town-house owners association spokesman, said, "The project isn't the way we'd like it to be but it is much more suitable" than before the Blasdels' began consulting with the neighbors.

The commission heard a progress report by the research team from the University of Colorado at Colorado Springs working on the Manitou Springs Flood Hazard Mitigation Plan.

Eve Gruntfest, principal investigator and a geography professor, said, "our literature review is pretty well complete and we have an idea what other city commissions with similar flood hazard problems have done. We're now ready to focus on Manitou Springs."

Manitou's problem is occasional flash flooding.

Formation of special district suggested to lead flood plan

By Glenn Urban
GT Staff Writer

A special district should be formed to be the local leader in a flood control plan for Manitou Springs and Fountain Creek, the board of the Pikes Peak Area Council of Governments was told Wednesday.

Eve Gruntfeldt said that an urban drainage district is the logical agency to represent local governments here in dealing with the Army Corps of Engineers to work on a flood control plan for the upper Fountain Creek area.

Ms. Gruntfeldt recommended a district after it appeared that there will be no lead government agency to deal with the corps as it works to carry out directions from Congress.

Ms. Gruntfeldt is co-director of the Flood Hazard Mitigation Plan, a group working from the geography department at the University of Colorado at Colorado Springs. She is a faculty member there.

The study made by the group is funded by a grant from the Federal Emergency Management Agency and is expected to be completed by June, she said.

Tony Apodaca of the corps office in Albuquerque told the board that the preliminary study showed there is flooding danger in areas along the Fountain, but the corps cannot go ahead with a second phase of the study unless there is a local lead agency to work with.

Being a lead agency may include spending money, and so neither El Paso County nor Manitou Springs has offered to take that role. Its cost was not determined.

PPACG could only offer to be a coordinating agency. It is not a governing agency and has no source of funds to finance part of the expenses of a flood control program.

Apodaca said that the preliminary study made by the corps, known as the Flood Plain Reconnaissance Study, will be completed soon and that he will work with local officials to explain the study, but will be prevented from giving copies of the study to local governments because of rules set in Washington.

Marcy Morrison, board member and vice chairman of the El Paso County commissioners, lives in Manitou Springs. She suggested that the best idea for flood problems in the area might be to establish an early warning system.

Apodaca said he believed that installing a warning system is not permitted by the kind of program the engineers are allowed to do.

Apodaca probably will be back next month for more discussions of the plan with PPACG, he said.

Possibility of flood in Manitou studied

By Chris Cobler
GT Staff Writer

Splitting the town of Manitou Springs, the frozen waters of Fountain Creek create a gorgeous picture.

But those same waters can turn ugly, spilling out of their banks and causing millions of dollars in damage and even deaths.

Experts in hydrology agree Manitou — like nearly 200 other Colorado cities built in the days when flood hazard regulations were unheard of — is in a precarious situation. But for years, the same experts have said there was little Manitou could do about its predicament short of moving its downtown.

Until now, that is. A team of researchers from the University of Colorado at Colorado Springs, in cooperation with the Federal Emergency Management Administration, hopes to change that doomsday attitude.

The team met Monday night at the Manitou City Hall with a handful of town residents to explain their project and ask for support.

"There's a risk in talking about flooding," said Bill Leon, director for for the Center for Community Development and Design at UCCS. "There's an image it could be a disaster waiting to happen.

"But there's another image that Manitou can put forward, that is, a community that is facing its problems and dealing with it effectively."

The researchers hope Manitou can become a statewide and perhaps nationwide example for planning for a disaster before it happens, Leon said. The project was funded in part by FEMA.

"We want to show other ways to people who feel they now have the choice of either denying the threat or deciding it will be so horrible that they shouldn't take any responsibility for preparing for it," said Eve Gruntsfest, a UCCS geology professor leading the project.

The three goals of the project are:

- To create a plan to reduce potential losses from existing flood hazards.
- To ensure that if a flood occurs, the recovery efforts will help reduce the threat from future floods.
- To use citizen participation and encourage public awareness of the flood hazard and the range of policy options.

FEMA and UCCS are financing the $45,000 study, which is expected to be completed by August. The Manitou City Council has endorsed it with a resolution.

However, the business community of the small tourist town, even though it supports the goals of the study, is fearful of a backlash created by publicity of the potential dangers.

"If we get a story that Manitou is a flood disaster waiting to happen in May, tourists will go elsewhere," said Joanne Garrison, president of the town's Economic Development Co. "I happen to dispute that statement, and I represent a lot of history that says we haven't yet (had a disaster). So why now?"

CITY OF MANITOU SPRINGS

"At the foot of Pikes Peak"

606 MANITOU AVENUE MANITOU SPRINGS, COLORADO 80829 (303) 685-5481

DATE: JUNE 25, 1985

TO: CITY COUNCIL

FROM: PAUL INTEMANN, CITY PLANNER

SUBJECT: FLOOD HAZARD MITIGATION PLAN IMPLEMENTATION

The following schedule is proposed in response to the Flood Hazard Mitigation Plan presented on June 11:

CONTINUE EFFORT—Council representation to lead effort

Warning System
- Coordinate with Ute Pass Communities
- Authorize Purchase of Gages
- Organize Volunteers
- Establish Procedures within City

Lobby for Urban Drainage and Flood Control District
- Meet with Other Local Governments and Pikes Peak Area Council of Governments

CITY STAFF AND MANITOU SPRINGS DEVELOPMENT COMPANY

Clear Channel
- Propose Clean-up

CITY STAFF - BRIEF REVIEW

Local Emergency Operations Plan
- Request Assistance from El Paso County Civil Defense

TO BE ACCOMPLISHED THROUGH SPRING

Form Council/Staff/Citizen Group to Strategize on All Recommendations

Educate the Public/Promote Flood Insurance Purchase/Encourage Floodproofing
- Organize Annual Campaign
- Schedule Scenario Showings
- Request Federal Emergency Management Agency workshop
- Request Workshop with Colorado Water Conservation Board

Survey Floodplain Buildings/Initiate Memo of Understanding
- Organize Effort
- Meeting with State Historic Preservation Office, Colorado Water Conservation Board, and Federal Emergency Management Agency

APPENDIX I

SLIDE SHOW NARRATIVE

This brief overview is designed to accompany the showing of the slide show depicting the likely effects of a 100 year or one percent flood in Manitou Springs. The slide show can be borrowed for public showings from the Manitou Springs Public Library.

A. Floodplain Management

Humans have historically settled along waterways in recognition of their many benefits. In constructing these settlements, however, we have often failed to realize that flooding is a natural and inevitable process. In those areas where humans utilize and inhabit land areas that are subject to flooding, a potential conflict arises. Floodplain management is a comprehensive approach toward resolution of this conflict which may include both structural and nonstructural measures and may address both preventive and corrective actions.

The Federal Context

Floods affect thousands of communities in the United States. More than 300,000 people are evacuated due to flood threats. Since 1975 an average of 200 people died in floods each year in the United States, and annual flood damages now average nearly $5 billion (U.S. Department of Commerce, 1985: p. i). Figures 11 and 12 dramatically show the nation's vulnerability to floods. Flash floods are particularly disastrous in terms of loss of lives.

Structural and nonstructural measures have been adopted to limit flood damages. Structural measures include channel enlargement and the construction of levees, reservoirs and bypasses. Structural measures can greatly reduce flood threat and consequent loss but they can also create a false sense of security and encourage development in partially protected areas. Thus, when a rare flood occurs even greater flood losses may be sustained. This may account, in part, for the trend toward increased flood losses as shown in Figure 12 (U.S. Department of Commerce, 1985: p.3).

Colorado Context-Relation to the 406 Plan

A Flood Hazard Mitigation Plan was prepared by the Colorado Water Conservation Board to address critical issues relative to floodplain management at the state level (Colorado Water Conservation Board, 1985). The plan identifies areas which are vulnerable to flooding, documents existing federal, state, and local programs relevant to flood hazard mitigation, and provides guidance to local governments regarding reasonable actions to take to reduce flood damages. The Plan is a resource to help state and local agencies develop, in light of limited budgets, policies and programs which will mitigate flood losses in Colorado.

Manitou Springs is one of more than 200 communities which faces a flash flood threat. Flood hazards exist in all 63 of Colorado's counties. Approximately 150,000 people permanently reside in Colorado's floodplains. At least 350 people have died in Colorado as a result of flooding in the past 100 years. Cumulative flood losses in Colorado's history are estimated to exceed $1.6 billion dollars in present value (Colorado Water Conservation Board, 1985: pp. vii-viii).

Across the state, only about nine percent of all floodplain structures are insured and most are underinsured. In the state there are over 2000 dams. Six of these dams pose some threat to Manitou Springs.

The slide show you are about to see is designed to make you aware of the flood hazard facing Manitou Springs. The script and slides describe what the effects of a 100 year or one percent storm are likely to be (These terms and others are defined in the Glossary provided as Appendix B). Two scenarios have been developed. The first one shows the effects of the storm at the current level of preparedness. The second one shows how Manitou Springs can dramatically reduce loss of life and property damages by being aware of the flood hazard, making preparedness plans, and implementing a warning system.

This slide show is based on the best available information from the Federal Emergency Management Agency, the Colorado Water Conservation Board, the Colorado Division of Disaster Emergency Services, the city of Manitou Springs, and newspaper accounts of historical floods. For further information about flood hazard or what you can do as a student, citizen, teacher or public official to reduce the disastrous potential of a flash flood in Manitou Springs, please refer to the 1985 Flood Hazard Contingency Plan available in the library or at City Hall in the Planning Department. The addresses and telephone numbers of the various state and federal agencies which will provide assistance can be found as Appendix D to that report. A glossary and a bibliography are also included in that report.

As of 1985, Manitou Springs has taken the initiative necessary to begin the long process of long term flood hazard mitigation. A citizen's committee is established. We hope this slide show will be shown often to give residents and business owners an idea of what the consequences of a flash flood are likely to be. It is not meant to frighten anyone. Since Manitou Springs has had little recent experience with major floods, it is easy for people to think a disastrous flood cannot occur. Research shows that a prepared community can effectively reduce loss of life from flooding. Time is very short in a flash flood situation. Knowing appropriate actions to take can save lives.

After you see this slide show think about the following questions:

- What can you do to be better prepared for a flash flood?

- What would you do if you received an official warning to evacuate?

- Where is the high ground nearest your home, your school, your workplace?

- Since flash floods happen so quickly, often, even with a warning system, you cannot be sure that you will get an official warning. What environmental cues might indicate that you should get to high ground?

The slide show can be seen more than once or stopped at significant points for discussion or for clarification. The second scenario offers suggestions for the community and individuals to reduce loss potential.

Please refer to the entire Manitou Springs Flood Hazard Mitigation Plan for detailed background and information on what you can do to reduce the loss of life and property from flash flooding.

APPENDIX J

MEMBERS OF THE MANITOU SPRINGS FLOOD HAZARD INTEREST GROUP

All addresses are in Manitou Springs, CO 80829 unless specified otherwise

Stephen Faulkner	355 Via Linda Vista	685-9836
R. and Joanne Garrison	P.O. Box 72	685-9456
Arlene T. Wood	7 Escondido Valle	685-5781
Raquel Gonzales	104 Capitol Hill	685-1388
Penny Kaufman	934 Manitou Avenue	685-4101
Mike Mathis	953 Manitou Avenue	685-4242
Bob Naatz	106 Pinon Lane	685-9719
Margi Wood	25 Waltham Avenue	685-1339
Jim Wining	113 Deer Path	685-1168
Alan Jensen	8 S. Nevada, #208, C.Spgs. 80903	633-0114
Beverly Argo	313 Clarksby Road	685-1317
Ken Baird	814 Manitou Avenue (Bank of Manitou)	685-5652
Margaret and Sean Harnett	7 Narrows Road	685-1732
Autumn Lewis	Box 992	685-1491
Charles Barsotti	Box 312	685-9195
David Chorpenning	1107 Manitou Avenue	685-5663

APPENDIX K

Program for Regional Observing and Forecasting Services (PROFS)

PROFS is a program studying methods of improving short-range operational weather services through the transfer of scientific and technological advances. The program was initiated in 1980 within the National Oceanic and Atmospheric Administration's Environmental Research Laboratories (ERL) located at Boulder, Colorado.

Information available at PROFS workstations include the following:

1. Visible and infrared satellite data;

2. Radar reflectivity from conventional National Weather Service radars such as those located at Limon, Colorado and Cheyenne, Wyoming;

3. Weather observations such as wind speed and direction, temperature, dew point, pressure, precipitation, and solar radiation;

4. Time-height cross section profiles on wind, dew point and temperature;

5. Lightning data; and,

6. Surface observation data.

PROFS collects this data, stores and processes the information, and then combines and displays the data to forecasters. The increased amount of real-time meteorological data coupled with retrievabale archived weather information provides enhanced severe storm and flash flood warnings and significantly improves weather services.

The current system utilizes large main frame computers but the capabilities will soon be available from minicomputers. Plans for the future include installing the PROFS system in 115 National Weather Service offices across the country including Denver (scheduled to be the first in operation - October, 1985) and Pueblo. It is estimated that the cost for each office will be $150,000. Colorado Springs is not among the 115 providing the necessary coverage. Expenditure of funds to provide the Colorado Springs area with its own PROFS system would allow for more detailed analysis and forecasting for the Pikes Peak region than could be possible through the Denver office.

APPENDIX L

ANSWERS TO QUESTIONS FREQUENTLY RAISED

1. If we constructively take action to reduce our flood loss potential won't we scare tourists away from Manitou Springs?

Manitou Springs citizens are concerned about the costs of recognizing the flood threat. They focus on the unlikely prospect that a well organized flood hazard preparedness plan will scare tourists away. Two points are raised here to counteract this fear of negative publicity. There are costs associated with ignoring the flood hazard. The loss potential from a flash flood in the community is substantial. It is just as likely that a tourist will be pleased that the community has taken a positive, active stance and is prepared in the event that a flash flood should occur. Put simply, public awareness saves lives. It is not costly but requires conscientious effort on the part of residents and business owners.

Many beautiful communities which rely on tourists for a substantial portion of their economic base face flash flood threats. In Boulder, for example, signs are placed in public parking lots located in the floodplain calling attention to the hazard. Boulder's economy has not been hurt by these signs. On the contrary the signs become part of the everyday landscape and should an individual notice the creek rapidly rising, a change in the sound of the creek, or receive an official warning, he or she will know to take action immediately and get to high ground. In the Big Thompson flood, eleven people died driving alone through the canyon (Gruntfest, 1977). Had they known an appropriate action to take perhaps they would have survived.

California's initiative in public preparation prior to a major earthquake is a second example. Earthquake preparedness week is an annual event. A realistic appraisal of the earthquake threat there has incurred no noticeable economic costs.

It is understandable that Manitou residents would be concerned that negative press affects tourism, but there can be positive press as well. Articles can highlight a well-informed, active, innovative community which is effectively dealing with its flood threat by being prepared and setting a national example.

Even a flood event can have minimal negative economic consequences. Estes Park suffered the equivalent of a 500 year flood in July, 1982 due to a dam break. Within a week the town's tourism equalled preflood levels. In fact, Estes Park is the only Colorado community in 1982 to post an increase in tourist dollars during that summer month.

2. I've lived in Manitou Springs for more than 40 years and I have never seen a major flood like the one shown in the flood scenario. I think the engineers are wrong. Why do the "experts" think we are prone to disastrous flash floods when our experience is so limited?

This report is based on the best available information. The research team used the most recent statistics and maps that the Federal Emergency Management Agency, the Corps of Engineers, the Colorado Water Conservation Board, and the other agencies have. We conducted an exhaustive review of newspaper clippings and government documents. We did not undertake new hydrological studies. Even if the reader disputes the specifics of the engineering statistics, the city faces a serious flood threat and must take action. Our work is not meant to be the basis for a fight over hydrologic models. Rather, it is meant as a basis for the implementation of flood hazard mitigation actions in Manitou.

3. We don't have the money to develop a warning system that costs half a million dollars. What can a small community like Manitou Springs do?

This report was designed to provide options for Manitou Springs. It should show that a motel owner or a city council member has a clear range of options based on the best experience of other communities. The findings in this report give individuals a range of actions to take. Choosing a route for getting to high ground before the flood event might save someone's life. A motel owner can think now about how to notify guests and what is the most responsible plan for getting to high ground from the property. Thought given now will save precious time in the actual event. In the Big Thompson Canyon flood, police officers had to spend so much time warning campers at local campgrounds that many people received no warning at all. It is not sensible to panic or to deny the threat.

4. Manitou Springs has many pressing problems. The low probability of a flash flood is not at the top of the list. Why should we spend scarce resources of time and money for this problem?

We realize that in a daily scheme of activities, flash floods often are not mentioned. However, this report should serve as a basis for discussion and action. Manitou Springs now has a more complete picture of the range of adjustments possible than nearly any community in the United States. It can be the foundation of a pre-flood and a post-flood hazard mitigation plan.

Some have suggested that having a post flood plan is not necessary. They argue that planning for after the flood, before a flood, is like locking the gate after the cow escapes. However, a look at how often American taxpayers are called upon to bail out communities time after time reveals the importance of using the disaster as a opportunity to make the community less vulnerable in the future. The Federal Emergency Management Agency now requires a mitigation plan as a condition of recovery and reconstruction funding. If the community develops a plan now with a sense of vision for Manitou Springs, it is likely to be much more thoughtful and useful than one that is put together under pressure following a flood. Preplanning makes all the difference.

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