

1994 COLORADO FLOOD REPORT

by

The Flood Control and Floodplain Management Section
Colorado Water Conservation Board
Colorado Department of Natural Resources

DRAFT



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I. EXECUTIVE SUMMARY

During the winter of 1993-94, Pacific and Arctic storm tracks affected the Colorado mountains in primarily two (2) ways. First, typical winter storms from the Pacific area moved mostly across southern Colorado causing a large snowpack to accumulate. Meanwhile, the rest of the state, including the central and northern mountains plus the eastern high plains, received snow accumulations from Arctic storms from Canada and Alaska. In many of the state's river basins, snowpacks were moderately above normal.

As the spring snowmelt season approached, many communities were concerned about flooding. However, snowmelt flooding never materialized due to a normal spring warming trend that was severely moderated by periods of cool weather. As is often the case, this set the stage for the possibility of flooding which results from summer thunderstorms along the Front Range.

As expected, Front Range communities from Fort Collins to Pueblo experienced violent thunderstorms which dropped significant amounts of rainfall in short periods of time throughout the summer months. Often, the results were widespread. In June, the Minnequa Lake area in Pueblo was inundated by slow moving thunderstorms two days in a row. The first storm saturated the ground thereby reducing the soils permeability and its ability to absorb additional moisture. Then the following evening, an even larger thunderstorm dropped anywhere from 2-4 inches of rain in less than two (2) hours in the same area. As a result, 160 homes received varying degrees of flood damage. This was the most costly flood event of the summer. July was relatively quiet except for afternoon thunderstorms which affected the Denver metro area mainly causing street flooding. Then in August, the skies seemed to open up every afternoon somewhere along the Front Range. Significant flood events occurred in Larimer County, the Denver metro area, Idaho Springs, Lyons, Canon City and again in Pueblo. The summer thunderstorm flood season ended in September with significant flood events in Green Mountain Falls, Woodland Park, Colorado Springs and Fountain.

Damages from these summer thunderstorms were costly both to residents and local governments. Residents without flood insurance sought local and state financial assistance finding little, if any, available. Technical assistance was provided to residents in most areas through cooperative efforts from state and local governments. Two post-flood disaster workshops provided residents with viable options to reduce future flood damages.

II. 1994 SUMMER FLOOD EVENTS

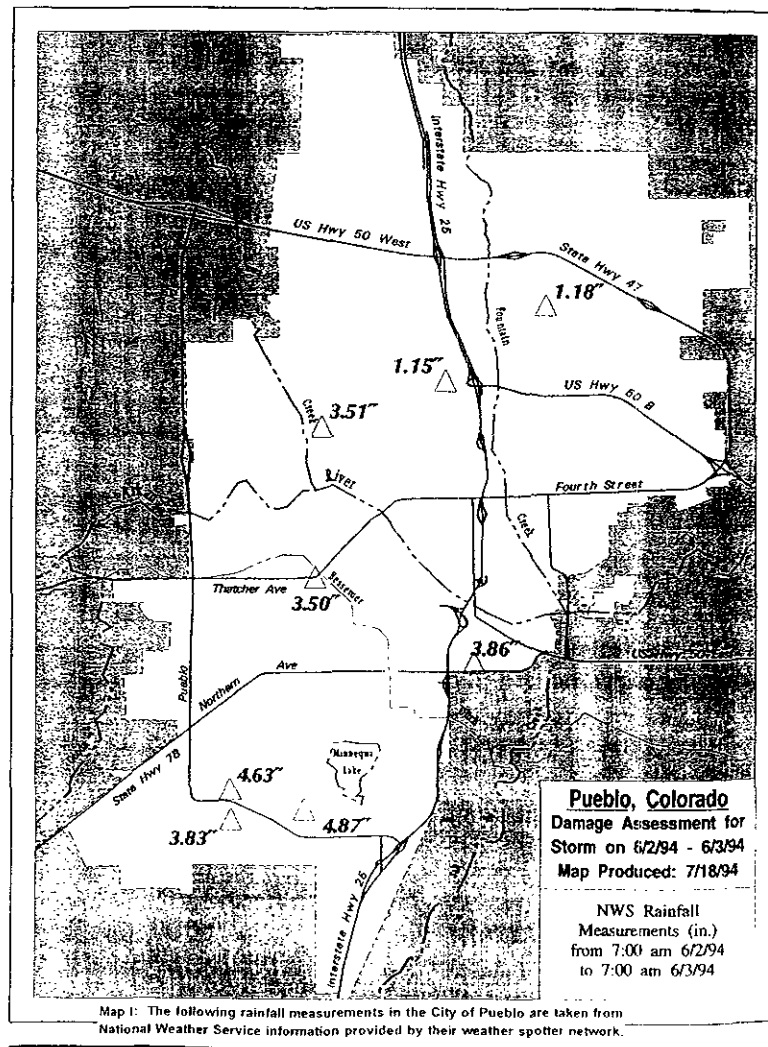
As is usually the case, flooding from large thunderstorms is hard to predict. Those areas with flood warning systems do have an advantage. Damages can be reduced if appropriately alerted local government responders and residents take appropriate actions to mitigate flood losses. Sadly enough, such actions were not able to be implemented during the 1994 summer thunderstorm season since most of the streams which experienced flooding did not have flood alert systems. A summary of 1994 flood events follows.

<u>Community</u>	<u>Date</u>	<u>Streamcourse</u>
Pueblo	June 3	Bessemer Ditch (Lake Minnequa area)
Fort Collins	June 20	Small local drainages
Clear Creek County	June 20	Small local drainages
Larimer County	June 20	Small local drainages near La Porte and Loveland
Idaho Springs	August 1	Virginia Canyon
Lyons	August 10	Small local drainages
Larimer County	August 10-11	Local drainages
Denver metro area	August 10-11	Local drainages
Canon City	August 11	Orchard Ave. basin
Green Mtn. Falls Woodland Park Colorado Springs Fountain	September 2	Fountain Creek Fountain Creek Upper Shooks Run Jimmy Camp Creek

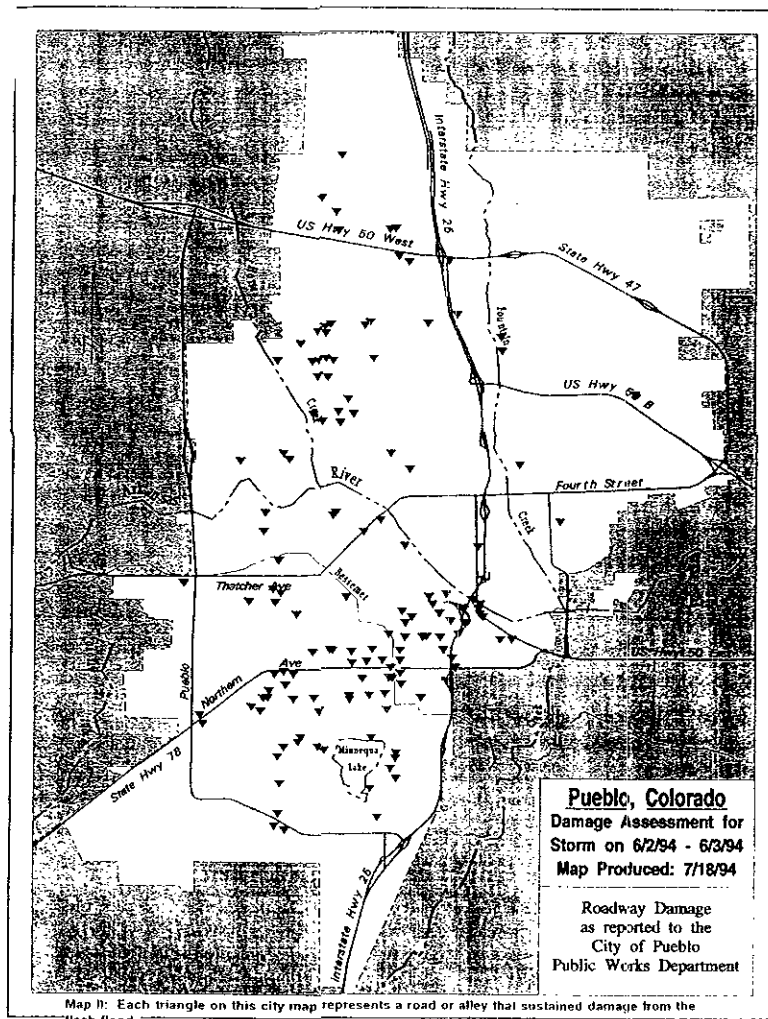
June

June 3 - A heavy thunderstorm dropped up to 2 inches of rain on Pueblo early in the evening on Thursday, June 2, 1994. The rain caused localized street flooding and cars were stalled in flooded intersections. Colorado Springs received 2.5 inches that day, but stretched out over an entire afternoon. More rain was predicted over the next few days. Early Friday morning, just past midnight, Pueblo received another storm that pounded the city with up to 4.87 inches of rain in just over an hour. Just before the storm, the National Weather Service (NWS) issued warnings of heavy rains which were likely to cause street flooding and possibly small stream flooding.

Once the storm started dropping nearly 4 inches of rain on Pueblo West, the NWS issued urban and small stream flood advisories. Many people did not learn of the flood until the sound of trickling water awakened them, which gave them little time to escape the rising waters in their homes. The city received between 1.18 and 4.87 inches of rain depending on location. One unconfirmed rainfall report just northeast of the downtown area reported up to 6 inches.



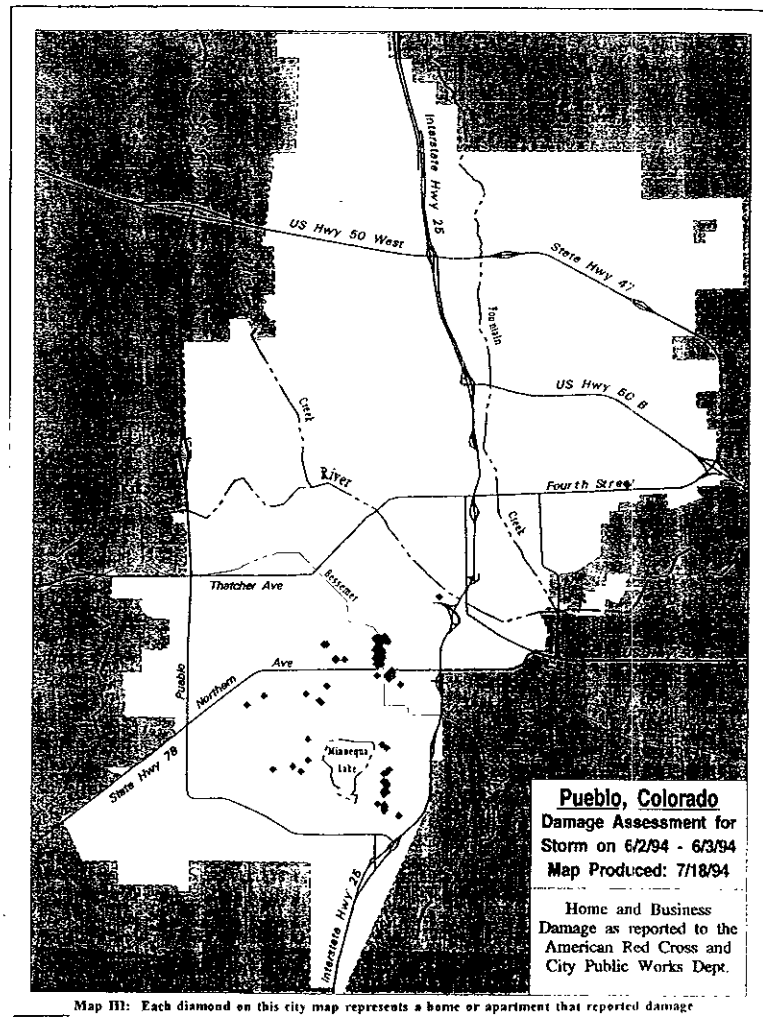
The storm cell came from the west at about 5-10 miles per hour, dropping heavy rains and hail in some areas and lasted about one and one-half hours. Several streets in the city and county were closed. Interstate 25 in the city area was covered by 2 feet of water, mud and debris. The Central Avenue underpass at I-25 filled up with 8 feet of water. The Arkansas River overtopped its banks in some places flooding river trails and parks. Some power lines, gas and phone lines were damaged. Storm drain inlets were clogged with debris. City, county and state crews worked in the dark that morning, before many people realized the extent of the storm and the damage it caused. ¹



Fortunately there were no major injuries. Cars floated down streets, along with railroad ties and other pieces of property and debris. Small mudslides covered streets and bank erosion was extensive. Fountain Creek changed its course slightly in some areas. People scrambled to gather a few belongings before their doors buckled from the heavy water. Residents of basement apartments climbed out windows when they could not open their

front doors to escape the incoming floodwater. Many residential streets on Friday were littered with soaked furniture and randomly abandoned vehicles.

According to the Pueblo Department of Public Works, an amount of 2.7 inches falling in one hour or an amount of 3.4 inches falling in 6 hours would constitute a 100-year recurrence interval. The rain from this storm reached up to 4.87 inches in approximately one and one-half hours. By Saturday morning, the Red Cross estimated residential and property damage at about \$1 million. Of the 160 homes surveyed, 6 were very heavily damaged, 30 sustained major damage and 120 received minor damage.



June 20 - Fort Collins and the surrounding areas experienced severe thunderstorms one of which approached the 50-year recurrence interval. In less than 2 hours, rain ranging from 1.5 to 2.6 inches fell. The heaviest rains were in western and southern Fort Collins. And the storms did cause damage.

City crews pumped water out of basements in about 30 homes. One irrigation ditch overtopped its banks into adjacent subdivisions at two separate locations. One subdivision owner sustained several thousand dollars in damage to a recently completed landscaping project.

Also on June 20, the moisture-laden system visiting the Front Range caused flooding in Clear Creek County, in and around Lawson and Downieville. Of importance here was a rain-produced flood event which occurred above 7,500 feet in elevation. An unofficial measurement of 3 inches of rain in 1 hour was recorded. The estimated 100-year 6 hour rainfall shown in the NOAA Atlas for the Lawson area where the storm was centered is about 2.2 to 2.4 inches. Because the storm was localized, streams in the area, particularly Clear Creek, did not flood. The problems experienced were local drainage problems. The frontage road along I-70 had significant overland flooding and debris deposition. In Lawson, the ditches on either side of the frontage road filled up and plugged. That sent water down toward Downieville, the next community to the east. A house in Downieville experienced basement flooding. A house in Lawson had water depths 6 inches on the side of the house, just barely below the bottoms of the basement windows. Lucky!! It took the Colorado Department of Transportation 4 men and 2 pieces of heavy equipment nearly 2 weeks to clear and rehabilitate the ditches in the area.

Heavy rain, hail hit foothills, plains

By Jim Kirksey
Denver Post Staff Writer

Heavy weather hit the Front Range foothills and the plains of eastern Colorado causing rock and mud slides, hail and copious amounts of rainfall in some locations.

And, to top it off, Colorado 5 above Echo Lake to the top of Mount Evans was closed because of snow.

Yesterday afternoon, heavy rainfall caused flooding in the areas west of Fort Collins and Loveland, with Colorado 14 closed near Ted's Place, northwest of Fort Collins, because of high water, according to the National Weather Service.

"Some of the rainfall amounts from the storms have been very heavy in the mountains just to the west of Denver, where some high water and mudslides have caused problems," the weather service later reported.

Snow closes highway on way to Mount Evans

The Clear Creek County Sheriff's Department said there was a foot of water over the roads in the Lawson area near Interstate 70, and some rock slides near Fall River Road.

Among the heaviest rain noted yesterday was more than 3 inches in northern Elbert County; 3.52 inches about 3 miles west of Loveland; 2.59 inches 2.5 miles west of Colorado State University in Fort Collins; 2.5 inches at Horsetooth Reservoir in Larimer County; 2 inches of rain and high water on Interstate 25 in Douglas County; 1.75 inches in an hour and 25 minutes 6 miles northeast of Boulder.

Besides Ted's Place and Lawson, street flooding was reported west of Loveland and in Fort Collins. Hail progressively got

larger west of Fort Collins, from one-half inch, to three-fourths inch, to 1 inch in diameter.

Hail up to three-fourths inch in diameter also was reported near Woodrow in Washington County. There was a rock slide near Laporte in Larimer County.

Funnel clouds were reported at Boedecker Lake in Larimer County and near La Salle and Hudson in Weld County.

Residents of the Denver area experienced some relative minor rain storms.

Today, Denverites can expect partly cloudy skies this morning, with increasing cloudiness in the afternoon and a 50 percent chance of thunderstorms, according to weather service forecasters.

Highs should be in the low-to-mid 80s. Much the same is forecast for the metropolitan area for tomorrow.

The Associated Press contributed to this report.

Elsewhere around the state on this date, heavy weather caused rock and mudslides plus snow which closed Mt. Evans Road. Colorado Hwy. 14 was closed near Ted's Place northwest of Fort Collins because of high water. Among the heaviest rain recorded on this date was more than 3 inches in northern Elbert County; 3.52 inches about 3 miles west of Loveland; 2.59 inches 2 miles west of Fort Collins; 2.5 inches at Horsetooth Reservoir in Larimer County; 2 inches of rain and high water on Interstate 25 in Douglas County; 1.75 inches of rain in 1.25 hours 6 miles northeast of Boulder. Street flooding was reported west of Loveland and in Fort Collins. There was also a rockslide near LaPorte in Larimer County.

August

August 1 - The month began with a bang. A gully washer pounded Idaho Springs on Monday afternoon, August 1 beginning about 1:15 p.m. and lasting 45 minutes. About an inch of rain fell in the area according to Bill Ray of the NWS in Denver. Volunteers teamed with employees of the city, Clear Creek County and the state to fill 1,000 sandbags along creeks that flow through town. A foot-deep morass of rocks and mud washed down Virginia Canyon damaging 8 homes. The rocks and debris backed up pipes and culverts that normally direct water off roads.

Mudflow cascades into town

Crews fill sandbags, operate plows to help Idaho Springs cope with downpour's fallout

By Joe Garner
Rocky Mountain News Staff Writer

A gully washer pounded Idaho Springs Monday afternoon, sending mudflows streaming through the steep streets of the mountain town.

After weeks of dry weather, the rain-storm camped over the town for 45 minutes beginning around 1:15 p.m., Mayor Bill Macy said.

"Mud and rocks were coming down into the streets and the yards and the doorways," Macy said. "Mud was every-

where."

No injuries were reported, and no homes had to be vacated because of the flash flood, he said. But Virginia Canyon Road was closed for a while, and mudslides were reported on Interstate 70 near the town.

About an inch of rain fell in the area during that frantic 45 minutes, according to radar estimates, said meteorologist Bill Ray of the National Weather Service in Denver.

After the downpour, it drizzled for the rest of the afternoon, Macy said.

The mayor said about 30 volunteers teamed with employees of the city, Clear Creek County and the state to fill 1,000 sandbags along creeks that flow through the mining town 35 miles west of Denver.

"It was quite outstanding the way people turned out to help," Macy said.

Snowplows were called out to push the mud off streets, said Mike Richards, an employee at the Colorado Department of Transportation's maintenance depot.

"The mud and rocks were coming down onto everything," Richards said. "It was thick mud, but we've got most of it pushed out."

The deluge, Ray said, reflected a typical late-summer weather pattern: "storms that sit and move very slowly."

"That's how they can get flash flooding in these creeks, particularly in the mountain areas," he said.



DRY CREEK: Kelly Babeon catches a sandbag tossed down to him as volunteers hustle to put in flood support along Virginia Creek near Idaho Springs yesterday.

Special to The Denver Post / Tricia McIlroy



**Undermined Culverts and Debris Flow
on Virginia Canyon Creek - August 2, 1994**

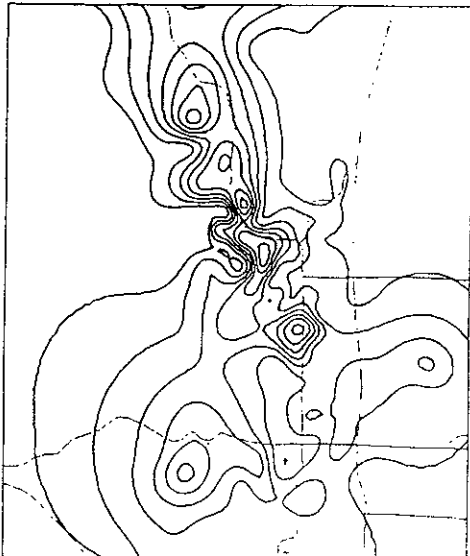


**Debris Flow Area on Tributary
to Virginia Canyon Creek - August 2, 1994**

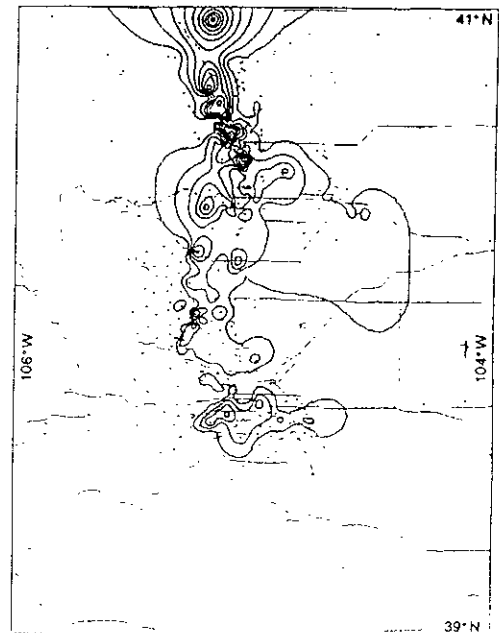
August 10 - The community of Lyons at the confluence of North and South St. Vrain Creeks was impacted by floodwaters on this date. 3 to 3.25 inches of rain fell in less than 45 minutes during the evening hours. Major damage was incurred by public and private properties, including the implosion of a foundation wall, undermined and failed pavement and damage to existing storm drainage facilities. Storm water conveyed 20-28" stones and peeled new portions of asphalt road off its base. Winds associated with the storm collapsed a house under construction.

The August 10 storm also affected most of the Denver metro area. Rainfall of almost 2 inches in 1 hour was recorded at Red Rocks Amphitheater which equates to a 25-year storm event. This was the heaviest rainfall recorded by UD&FCD in 1994. The UD&FCD also recorded the highest discharge in Cherry Creek in four years at Wazee Street (2,350 cfs). Street flooding and intense rainfall were common throughout the region.

August 10-11 - A heavy, slow moving thunderstorm system developed near Virginia Dale northwest of Fort Collins this evening where more than 5 inches of rain was reported. It resulted mostly from tropical air from the Pacific Coast meeting a stationary cold front over Colorado's mountains. Storms erupted almost spontaneously throughout the late evening from Livermore southward to Denver. The heaviest rainfalls were reported along the lowest foothills and hogbacks from Lyons northward. Several locations received 3" rainfall totals. The community of LaPorte was especially hard hit. Area roads were washed out or inundated. The road was washed out from Livermore to the Red Feathers Lake area.



Fort Collins-Loveland area enlargement of the 10 August 1994 storm in 0.5 inch increments.



Regional storm totals for 10 August 1994 in 0.5 inch increments.

Southward in the Denver metro area, the NWS reported rainfall of 1-1.5 inches between 9:30 and 11:00 p.m. At least 20,000 homes were without power. Traffic on Interstate 25 was reduced to one lane near Mile High Stadium. One couple rescued their son from their car just before it floated away. Santa Fe Drive was flooded with 2-3 feet of water and stranded motorists stood atop their cars. The South Platte River overflowed and covered the bikepath.

A motorist gets atop his stalled car on southbound Interstate 25 and West Alameda Avenue. Traffic on I-25 was backed up for miles Wednesday night as vehicles stalled by high water made the highway an obstacle course. A patrol car eventually pushed the stalled car out of the way.

Dennis Schroeder/
Rocky Mountain News



Storm lashes Denver area

August 11 - Canon City was also visited by storms this evening causing flood impacts to 20 homes in Orchard Avenue Basin. Damage occurred to crawl spaces, basements and landscaping. This was the same area that flooded three years ago on August 11-12. An estimated 3-4 inches of rain fell in 45 minutes in the watershed just north of Canon City. A ten-mile stretch of County Road 28 received flood damage. As drainages enter city from the watershed to the north, they have been obliterated by farming practices and land leveling for subdivisions. This causes floodwaters to spread out more than normal, increases shallow flooding and affects widespread residential areas. (The flood in 1991 affected over 40 residences.)

August 13 - Pueblo again experienced summer thunderstorm flooding as more than 3 inches of rain pummeled the north side of town in a 35 minute period. Part of the roof at the Fashion Bar clothing store in the Pueblo Mall collapsed; the Villa Pueblo retirement home was evacuated and later closed due to flooding; and dozens of homes and businesses reported flooded basements and damaged windows and roofs.

September

September 2 - Green Mountain Falls, Colorado Springs, Fountain and Woodland Park all experienced varying degrees of flooding on this date due to a slow-moving thunderstorm system which developed just west of Woodland Park. Floodwaters filled culverts and washed out two roads in Woodland Park. Just downstream in Green Mountain Falls, the backside of the Falls Motel was exposed to a depth of 3 feet due to scouring by floodwaters. In Colorado Springs, Upper Shooks Run experienced the biggest flood event of the summer for any watercourse in the city. Intersections were flooded and cars were overtopped. Meanwhile, a park in Fountain on Jimmy Camp Creek was inundated due to effects from the same storm.



**Foundation erosion at Falls Motel in
Green Mountain Falls - September 2, 1994**

III. LOCAL AND STATE GOVERNMENT ACTIONS AND RESPONSE

As the spring 1994 snowmelt flood season approached, the Flood Control and Floodplain Management Section of the Colorado Water Conservation Board (CWCB) made basin by basin flood threat assessments across Colorado. When snowpack averages (issued by the Natural Resources Conservtaion Service, formerly the SCS) are above 150% of normal, the CWCB identifies the drainage basin as having a high probability of snowmelt flooding. Few, if any, drainage basins climbed above the 150% threshold. As snowmelt time began (early May), warm temperatures were not sustained for long enough periods to cause large volumes of snowmelt runoff to accumulate in streamcourses. Instead, May had several periods of cool weather, which effectively moderated any snowmelt which had begun to increase in certain drainage basins. The first two weeks of June also had several intermittent periods of cooler than normal weather, thereby, moderating the last part of the snowmelt season significantly. All in all, the mountain snowpack melted in a uniform manner and very little snowmelt flooding occurred, statewide.

In early June, Colorado's thunderstorm season began in earnest. On June 3, a large, persistent and slow-moving thunderstorm in Pueblo caused the largest dollar damages from flooding in 1994. State and local government employees were out in force to assist in clean up efforts, as well as develop options for residents to reduce future flood damages. City and state road crews worked tirelessly to clean plugged sewers, streamcourses and debis-clogged roads following the storm. Assistance was also provided to homeowners in the Lake Minnequa area where flooding had its biggest impacts.

Then on June 6, Pueblo city officials, local drainage engineers from across Colorado and representatives from the Colorado Water Conservation Board and the Colorado Office of Emergency Management (OEM) met with local homeowners who suffered flood damages. Though direct financial assistance was not available to persons without flood insurance, this "post-disaster flood mitigation workshop" provided homeowners with affordable techniques to reduce future flood damages.

State and local government officials were involved in rescue and clean-up efforts following the other flood events which occurred during 1994. Following the August flood event in Lyons, representatives from the Colorado Water Conservation Board and the Colorado Office of Emergency Management (OEM) met with local homeowners who suffered flood damages. As usual, direct financial assistance was not available to persons without flood insurance, however, another "post-disaster flood mitigation workshop" again provided homeowners with affordable techniques to reduce future flood damages.

IV. MITIGATION RECOMMENDATIONS

Several communities which were impacted by 1994 flooding have follow-up post-flood mitigation activities which should be implemented. The CWCB's recommendations for action are listed below:

<u>Community</u>	<u>Activity</u>	<u>Agency/ Community Involved</u>
Pueblo	Retrofitting residential structures	CWCB OEM Pueblo
Idaho Springs	Channel conveyance improvements, flood warning system	CWCB OEM Idaho Springs
Lyons	Retrofitting residential structures, flood warning system	CWCB OEM Lyons
Canon City	Channel improvements, retrofitting residential structures	CWCB OEM Canon City
Green Mtn. Falls Woodland Park Colorado Springs Fountain	Streambank protection, channel improvements	CWCB OEM El Paso County Bldg. Dept.

V. ACKNOWLEDGEMENTS

The Colorado Water Conservation Board would like to acknowledge the assistance and work provided by the following agencies and individuals during the response to the 1994 thunderstorm flood season. Without their cooperation, much of the assistance provided to communities would not have been possible.

<u>Agency/Community</u>	<u>Type of Assistance</u>
Colorado Water Conservation Board <i>Larry Lang, Brian Hyde and Mark Matulik</i>	Flood threat assessment. Advanced measures. Mitigation recommendations.
Colorado Office of Emergency Mgmt. <i>Bob Kistner, Hal Knott and Len Boulas</i>	Mitigation recommendations.
City of Pueblo <i>Dennis Maroney</i>	On-site mitigation implementation and flood fight.
City of Fort Collins <i>Bob Smith</i>	On-site mitigation implementation.
Town of Lyons <i>Bob Freeman</i>	On-site mitigation implementation.
City of Canon City <i>Bob Saulmon and Greg Hutchison</i>	On-site mitigation implementation.
Town of Green Mountain Falls,	On-site mitigation

VI. REFERENCES

1. Colorado Office of Emergency Management, *City and County of Pueblo Flood Hazard Mitigation Plan, June 3, 1994 Flash Flood.*
2. Rocky Mountain News.
3. Denver Post.
4. CASFM Newsletter.
5. Colorado Climate. Colorado State University, August 1994.