DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

WATER RESOURCES INVESTIGATIONS/
OPEN-FILE REPORT 80-201

Winter Water--The Flooding at Boise, Idaho, January 11-12, 1979

By
R. W. Harper and E. F. Hubbard

INTRODUCTION

A mid-winter flood occurred in the area of Boise, Idaho, January 11 and 12, 1979. Although of relatively short duration and moderate intensity, the flood caused property damage and much inconvenience to residents.

Boise is situated at the base of the southwest flank of the Boise Mountains, locally called the Boise Front. Urban development is moving into the mountain foothills, where streams with steep grades and normally dry washes can become devastatingly active torrents.

The Boise Front is deeply incised by erosion channels or gullies. Some carry small but perennial creeks, which once emptied directly into the Boise River but now are partially obstructed by urbanization. Where structures located near the mouths of steep gullies encroach on flood plains, the potential for flood damage increases.

The purposes of this report are to: (1) Present a case history of the event that would be of value in subsequent flood investigations, (2) compare the magnitude of this flood with those of past floods, (3) describe the hydrologic conditions that caused flooding, and (4) indicate the need for a network of data sites to obtain information for planners and designers.

THE WEATHER

A January thaw is not an unusual local phenomenon. The respite from cold weather is welcome, but the combination of warm rain and rapidly melting snow on frozen ground can create serious flood problems.

On January 10, after several weeks of subfreezing temperatures and unusual amounts of snow, low clouds moved into the Boise area. Characterized by the National Weather Service (Lee Krogh, oral commun., 1979) as a strong, westerly flow with numerous minor disturbances, the weather system intensified during the day. A temperature inversion was created as warm, moist air slid over heavy, cold air trapped in the valleys. Precipitation began in the morning as rain at the 3,000- to 4,000-foot level, and reached the valley floor as snow, sleet, and freezing rain. Driving conditions rapidly deteriorated (fig. 1).

Amounts of precipitation varied locally from light to moderately heavy along the Boise Front. The National Weather Service precipitation gage at Ourada's ranch, about 7 miles north of Boise (map location A), recorded 0.72 inch during the day, most of which was rain. The storm intensified during the evening, and rain turned to heavy, wet snow after sunset.

Several inches of new snow greeted early risers on January 11. The low pressure over western Idaho deepened during the day. Snowfall increased, and winds in excess of 23 miles per hour created near-blizzard conditions. With rising temperatures, the snow turned to light but steady rain. The largest amounts of precipitation were recorded at higher altitudes along the Boise Front in rain gages operated by the U.S. Department of Agriculture, Northwest Watershed Research Center. The most precipitation recorded was 1.64 inches at the 5,100-foot level near the head of Maynard Gulch (map location B), about 6 miles east of the State Capitol in Boise. The gage at Ourada's ranch recorded an inch of rain. Other valley amounts included 0.66 inch at the Boise Air Terminal and 1.2 inches at Caldwell, about 20 miles northwest of Boise.

The snow melted rapidly under the steady rain. Runoff in streams draining the mountains increased, and water soon began to fill many surface depressions (fig. 2). Downward percolation of water was blocked by frozen ground. Along the Boise Front, observations made by the Northwest Watershed Research Center indicated little or no thawing of the frozen ground. Below about the 4,000-foot level, steep slopes rapidly shed their accumulation of snow. The stage for flooding was set.

THE FLOODING

Flooding began in midafternoon on January 11, and by evening, was serious in many areas adjacent to the foothills. Hardest hit was the Highlands, a residential area along Crane Creek (map location C). Residents there worked frantically to protect their property (fig. 3). Sandbags were distributed by local agencies to anxious homeowners who filled and placed them. Teams of workers hastily constructed dikes of any material at hand, even plastic bags filled with snow (fig. 4). Many residents could only watch as ice-choked storm drains backed up to flood basements or lower levels of homes.

Where Crane Creek emerges from the foothills, it is diverted into an underground conduit to carry runoff to the Boise River. As flow increased, pressure built up in the conduit, and water dislodged manhole covers and spilled out to flood streets, yards, and basements in the northern part of Boise (map location D).

Residents of other neighborhoods were concerned by water flowing into the city and suburbs by way of Polecat Gulch, Stewart Gulch, and Cottonwood Creek on the north side of Boise, and Threemile, Fivemile, Eightmile, and Tenmile Creeks on the south. More severe flooding was averted as nightfall brought an end to the rain, and lower air temperatures curtailed snowmelt.

In the industrial area near the airport (map location E), and westward along the course of Fivemile Creek, many businesses, homes, and farms were flooded by the water, which continued to rise all night on January 11 and did not recede until late on the 12th. Shallow water covered large areas southeast of Boise, surrounded low-lying homes, and caused minor damage (fig. 5).

After the flood, measurements by the Northwest Watershed Research Center showed that about 5 inches of water remained stored in the snow at about the 5,000-foot level in the watershed of Maynard Gulch. Elsewhere on the Boise Front, in the watersheds of Cottonwood and Crane Creeks, comparable amounts of water probably remained. Water content of this magnitude in the remaining snowpack had the potential to prolong the flood period or to increase the depth of flooding.

Minor local flooding resulted where water backed up from culverts, some of which were plugged by ice and debris. In some places, irrigation ditches were opened to provide relief from local flooding, but actions taken to alleviate a local condition can sometimes compound problems further downgrade.

Fortunately, structural damage was not severe, because flow velocities and flood stages were generally low. Most of the damage was confined to the lower levels of homes and shops where floors, walls, furniture, equipment, and personal effects were submerged.

Many residents were unaware of the availability of flood insurance. Federal agencies have made preliminary studies of the potential for flood damage in the Boise area. Flood-hazard maps, issued by the Federal Emergency Management Agency, delineate areas subject to inundation by floods having recurrence intervals of 100 and 500 years (1- and 0.2-percent chance of occurrence, respectively, each year). The reports also have profiles for the 10-year flood. Buildings located within the 100-year flood boundary are eligible for government-subsidized flood insurance. City or county zoning ordinances in Boise and vicinity now restrict or prohibit some types of new construction in flood-prone areas.

To estimate the peak discharge of a flood after it has subsided, indirect procedures are required that include a survey of high-water marks and cross sections and an analysis of channel characteristics. Indirect procedures were used to estimate flood peaks at the nine stream sites listed in table 1. Letters that identify the site locations on the map correspond to those in table 1. The sites were selected on the basis of suitability for computing discharges, severity of the flooding, and availability of data for previous floods.

COMPARISON WITH PAST FLOODS

Maximum discharges of previous floods on Polecat, Stewart, and Hulls Gulches and Cottonwood Creek are included in table 1 for comparison with peaks of this flood. Recorded discharges of previous floods were at least 10 times greater. Although the January 1979 flood was disruptive and damaging, it is emphasized that much more severe floods can occur in the Boise Valley.

To further illustrate this point, the flood peaks having a 10-year recurrence interval on Fivemile Creek at the Idaho National Guard Firing Range and on Crane Creek were estimated using techniques described by Thomas and others (1973). The 10-year flood peak is a discharge value having a 10-percent chance of occurring as a maximum each year, or that will be equaled or exceeded once at intervals averaging 10 years. The 10-year peak for Crane Creek is estimated to be 220 ft^3/s (cubic feet per second) and for Fivemile Creek at the firing range, 450 ft^3/s. These discharges are considerably greater than the 64 ft^3/s measured on Crane Creek and the 283 ft^3/s measured at the site on Fivemile Creek. This comparison indicates that the flooding that occurred in January 1979, at least at these two sites, and probably at the others that were investigated, has a return period of substantially less than 10 years.

RECOMMENDATIONS

Almost no data are available to assess the current flood danger along drainages in the Boise Valley. Sparse information from historic floods indicates that drainages on the Boise Front have potential for some of the highest unit runoff of streams anywhere in the Nation (Thomas, 1963).

As Boise and the surrounding area develop, flooding will become more damaging. More property located in proximity to flood plains will probably be developed in conformance to existing ordinances; impervious surfaces and storm drains will increase runoff and cause it to concentrate faster; and more stream crossings or other encroachment on the flood plains may constrict the natural channels of streams.

In addition uncontrolled urban runoff is generally polluted. It typically includes sediment, organic material, nutrients, pesticides, toxic metals, and other potentially harmful substances. This pollution can have extremely adverse impact on the quality of streams draining an urban area.

To help protect Boise and the surrounding area from flood danger and to protect the Boise River and other streams from pollution, more data are needed to make sound management decisions. Storm-water management--which might include zoning of flood plains, determining size requirements for stream crossings, and protecting streams from uncontrolled runoff of polluted water--depends on a thorough knowledge of the magnitude and frequency of flooding on principal streams and drains for both rural and urban conditions. It is recommended that a network to collect flood, precipitation, and water-quality information during storm events be established in the Boise Valley. These data would provide a basis for good storm-water management.

REFERENCES

Thomas, C. A., 1963, Cloudburst floods at Boise, Idaho, August 20, September 22, 26, 1959: U.S. Geological Survey Open-File Report, 12 p.

Thomas, C. A., and others, 1973, Magnitude and frequency of floods in small drainage basins in Idaho--A design method: U.S. Geological Survey Open-File Report, 43 p.

Table 1. Summary of flood discharges

Station No.	Stream	Map location	Drainage area (mi^2)	Maximum during flood: Peak flow Jan. 11-12, 1979 (ft^3/s)	Maximum previously known: Discharge (ft^3/s)	Maximum previously known: Date
13205750	Polecat Gulch near Boise, Idaho	F	1.01	3	210	6-21-67
13205700	Stewart Gulch near Boise, Idaho	G	9.04	40	412	1-29-65
13205635	Crane Creek at Highland Dr. at Boise, Idaho	H	7.50	64	--	--
13205550	Hulls Gulch near Boise, Idaho	J	--	10	5,000	7-25-13
13204800	Cottonwood Creek near Boise, Idaho	K	12.0	125	1,580	8-20-59
13210400	Fivemile Creek tributary at Federal Way near Boise, Idaho	L	8.41	150	--	--
13210440	Fivemile Creek at Idaho National Guard Firing Range near Boise, Idaho	M	14.8	283	--	--
13210500	Fivemile Creek at Overland and Fivemile Roads near Boise, Idaho	N	--	220	--	--
13210800	Fifteenmile Creek near Caldwell, Idaho	P	--	280	--	--

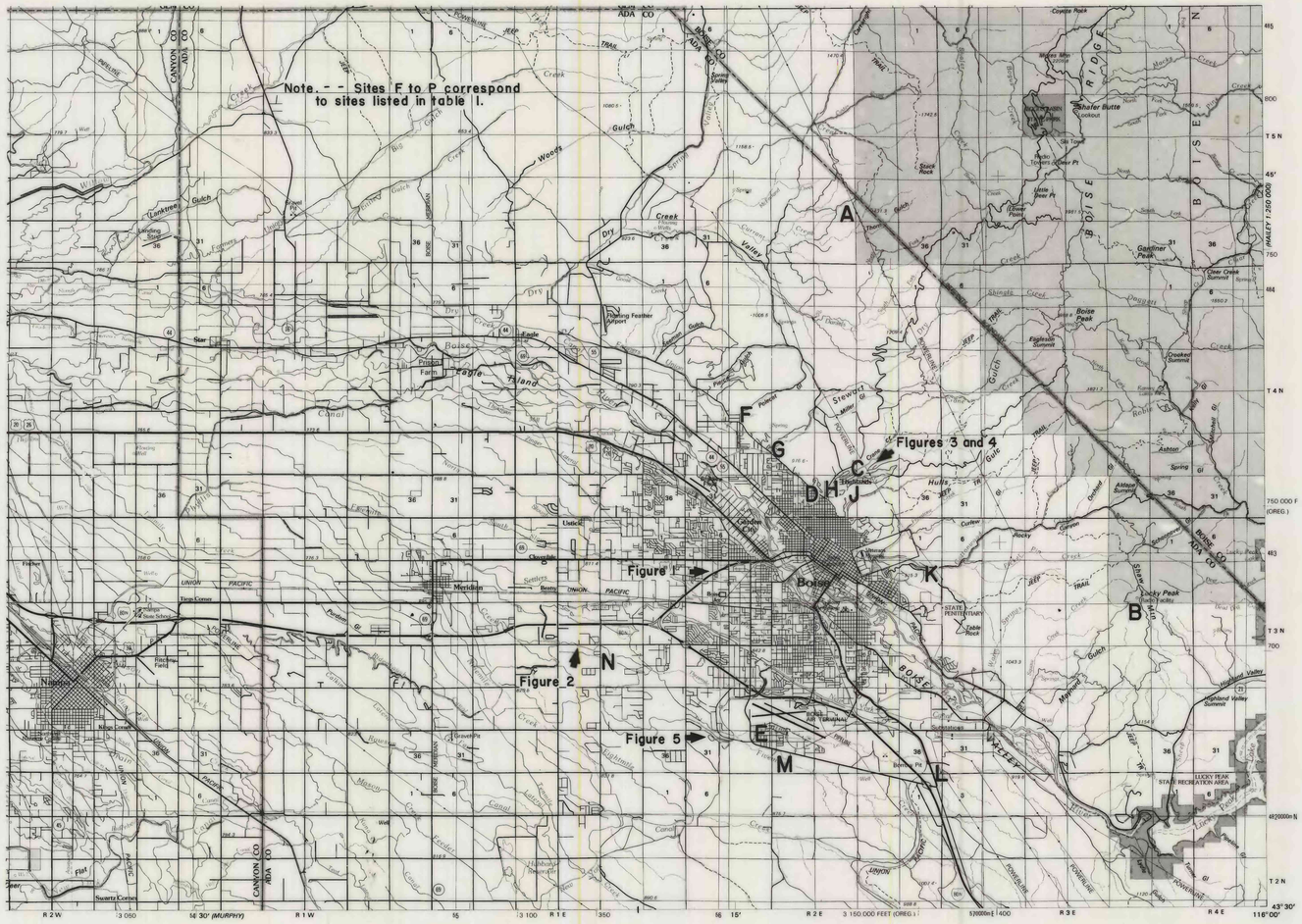

Figure 1.--Freeway west of Boise. (Photograph by Idaho Statesman)

Figure 2.--Flooded depression near Fivemile Creek southwest of Boise. (Photograph by Idaho Statesman)

Figure 3.--Sandbagging a home near Crane Creek in the Highlands. (Photograph by Idaho Statesman)

Figure 4.--Diking along Crane Creek using bags of snow. (Photograph by Idaho Statesman)

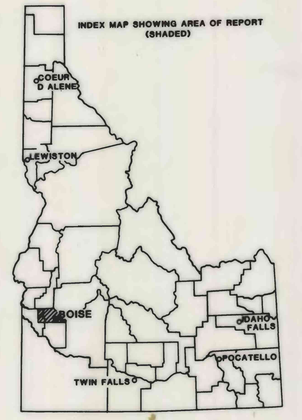

Figure 5.--Nuisance flooding along Fivemile Creek west of the Boise Airport. (Photograph by Idaho Statesman)

WINTER WATER - THE FLOODING AT BOISE, IDAHO, JANUARY 11 - 12, 1979

R. W. HARPER AND E. F. HUBBARD

1980