Summary of Floods in the United States During 1956

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FLOODS OF 1956

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Prepared in cooperation with Federal, State, and local agencies

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ABSTRACT

No notably great or destructive floods occurred in the United States during 1956. The catastrophic flood of December 1955 in the Far Western States extended into January 1956, but this last part of it was relatively small in magnitude and very little damage resulted. However, there were many significant localized floods of rare occurrence in widely scattered areas throughout the United States at various times during the year in which streams rose to maximum stages and discharges. The destruction caused by most of these floods was not newsworthy beyond their flood areas.

Reports of 35 of these floods are presented in chronological order in this annual flood summary.

INTRODUCTION

The purpose of this summary, the only chapter in the annual flood series, "Floods of 1956," is to assemble into a single volume information relative to known severe floods during the year in the United States. No flood during the year was important enough to warrant preparation of a separate flood report or a chapter of the annual series.

The floods discussed in this report were widely distributed over the United States (fig. 1), and they occurred in every month of the year except September. They were selected as being unusual hydrologic events in which large areas were affected, great amounts of damage resulted, or extreme discharges or stages occurred.

The U.S. Weather Bureau has estimated that the total flood damage in the United States during 1956 was almost $65 million which was the lowest since 1941. The national average annual flood loss, based on losses during 1942–51 and adjusted to the 1952 price index, is $275 million. The flood losses in 1956 were only about 6 percent of those which occurred in 1951 and in 1955 and 24 percent of the national annual average.

The total loss of life from floods in the United States during 1956 was 42, whereas the national average for the 32-year period, 1925–56, was 86.

The continuing investigation of surface-water resources in the areas included in this report is performed by the Geological Survey in co-

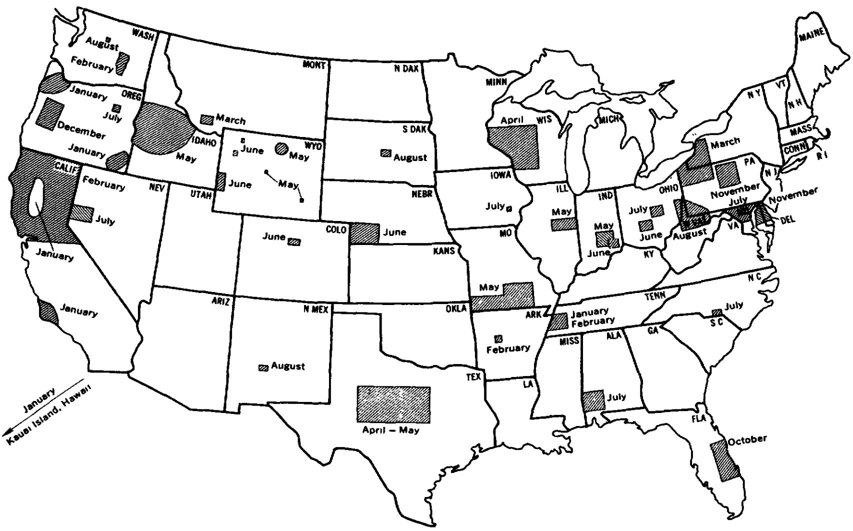

FIGURE 1.—Map of the United States showing areas and months of occurrence for floods in 1956 described in this report.

operation with State agencies, the U.S. Army Corps of Engineers, the Bureau of Reclamation, and other Federal or local agencies. Some data in this report was obtained from U.S. Weather Bureau publications.

The district offices (Surface Water Branch) in whose district the floods occurred collected the basic data, made computations, and prepared the text. Assistance in preparation of the data for the report was given by the Flood Specialists in their respective areas.

The report was assembled and prepared in the Floods Section, Tate Dalrymple, chief.

DETERMINATION OF FLOOD STAGES AND DISCHARGES

The peak stages and discharges at gaging stations and at miscellaneous sites given in this report are from data which are regularly obtained and compiled in the routine procedure of surface-water investigation by the Geological Survey.

The usual method of determining stream discharges at gaging stations is by the application of a stage-discharge rating to the recorded stage. The rating is usually defined by current-meter measurements through as much of the range of stage as possible. The peak discharge at a station may be above the range of the stage-discharge rating, and short extensions of the rating may be made by logarithmic extrapolation, by velocity-area studies, or by use of other measurable hydraulic factors.

Peak discharges at gaging stations which are greatly above the range of the rating and peak discharges at miscellaneous sites are usually determined by various methods of indirect measurements at the site. A general description of these indirect methods can be found in Water-Supply paper 888. Water Supply papers 773–E, 796–G, and 816 contain more detailed descriptions with illustrated examples.

During major floods adverse conditions often make it impossible to obtain current-meter measurements at some sites, and peak discharges are then measured by indirect methods based on detailed surveys of selected channel reaches.

EXPLANATION OF DATA

The floods described herein are given in chronological order. Because of the different characteristics of the floods and because of the various amounts of information available, no consistent form is used in reporting each event.

The data presented include: a description of the storm, the flood, and damage; a map of the flood area showing the location of flood-determination points and for some storms the location of precipitation stations or isohyets; rainfall data; and flood-peak stages and discharges of the streams affected.

In general, rainfall amounts are included in the description of the flood. When considerable rainfall data are available, they are presented in tables which give daily or storm totals; these totals may be shown directly on the map. For a few floods, where sufficient data are available to determine the pattern and distribution of rainfall, an isohyetal map is shown.

A summary table of peak stages and discharges is given for each flood, unless the number of stations in the report is so small that the information is included in the description.

SUMMARY OF FLOODS OF 1956

FLOODS OF JANUARY IN THE FAR WESTERN STATES

Rains continued to fall in January in the Far Western States after the record-breaking floods of December 1955.

The floods of December 1955–January 1956 affected major parts of California and Oregon and small areas of Nevada, Washington, and Idaho (fig. 2). They were the most outstanding floods in the history of the area on the basis of the area involved, the number of lives lost, the amount of damage which resulted, and the number of maximum stages and discharges which occurred. Although the January floods occurred in the 1956 calendar year they should be considered a continuation of the floods which began in December 1955.

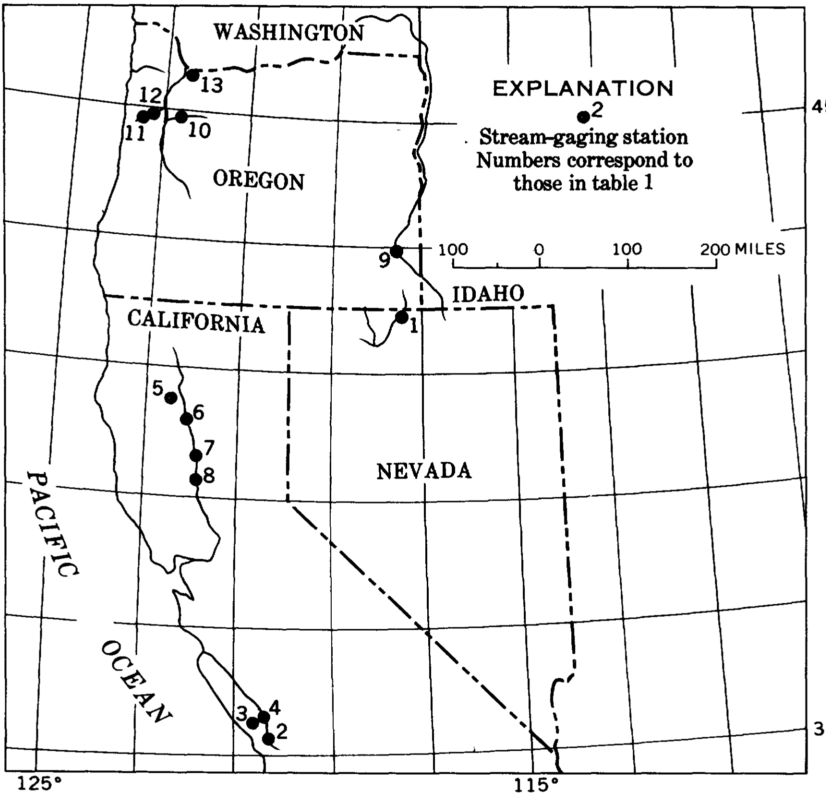

FIGURE 2.—Map of flood area showing location of flood-determination points for floods of January in the Far Western States.

The magnitude of the floods of December 1955 far exceeded that of the floods of January 1956 in all aspects. If the January floods are considered separately however, they are of considerable importance. Many of the January peaks would have been maximum of record had the floods of December not occurred. Furthermore, the flood-damage potential of the January floods was reduced by the damage already caused by the December floods.

Moderate flooding occurred January 14–16 in northern California, but damage was minor. Yuba City was evacuated until danger of a break in the levee on Feather River, repaired since the flood of December 1955, had passed. At the unrepaired levee break near Nicolaus renewed flooding occurred on January 15. Flooding also occurred about January 25 in the southern part of California. A few peak discharges in upper Salinas River basin exceeded those of December but were not record breaking.

In Oregon the peaks of January 4 were almost as high as those in

December 1955 on many streams. The rise of flood waters on January 15 was more marked in eastern Oregon as this area had mostly escaped the floods of December.

In southern Idaho the Owyhee River rose to a high stage which was not the highest of record.

Peaks of January 1956 which exceeded those of December 1955 at selected gaging stations are shown in table 1.

TABLE 1.—*Summary of flood stages and discharges in January in the Far Western States*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Black Rock Desert basin						
1	East Fork Quinn River near McDermitt, Nev.	----------	1948-56	Jan. 15, 1956	8.52	1,380	----------
				Apr. 6, 1952	6.63	940	----------
	Salinas River basin						
2	Salinas River near Pozo, Calif.	72.5	1942-56	Jan. 25, 1956	10.65	4,090	56.4
				Jan. 21, 1943	13.35	7,210	99.4
3	Jack Creek near Templeton, Calif.	25.4	1949-56	Jan. 25, 1956	9.56	5,040	198
				Jan. 15, 1952	7.81	2,690	106
4	Salinas River at Paso Robles, Calif.	389	1939-56	Jan. 25, 1956	16.73	[1] 12,000	----------
				Mar. 9, 1943	16.2	[1] 14,200	----------
	Sacramento River basin						
5	Cow Creek near Millville, Calif.	427	1949-56	Jan. 15, 1956	19.06	33,000	77.2
				Dec. 27, 1951	21.55	45,200	106
6	Sacramento River near Red Bluff, Calif.	9,300	1895-1956	Jan. 15, 1956	22.30	[1] 115,000	----------
				Feb. 28, 1940	38.9	291,000	----------
7	Sacramento River at Butte City, Calif.	----------	1940-56	Jan. 16, 1956	94.66	[1] 157,000	----------
				Feb. 7, 1942	96.87	170,000	----------
8	Sacramento River at Colusa, Calif.	----------	1940-56	Jan. 17, 1956	66.90	[1] 43,200	----------
				Feb. 8, 1942	69.20	[1] 49,000	----------
	Owyhee River basin						
9	Owyhee River near Rome, Oreg.	8,000	1949-56	Jan. 16, 1956	14.77	24,800	3.10
				Apr. 14, 1952	15.60	27,800	3.48
	Willamette River basin						
10	Little North Santiam River near Mehama, Oreg.	110	1931-56	Jan. 15, 1956	12.00	13,300	121
				Dec. 28, 1945	15.20	19,900	181
11	Luckiamute River near Hoskins, Oreg.	34	1934-56	Jan. 4, 1956	10.35	3,780	111
				Dec. 14, 1946, Feb. 17, 1949	13.22	5,560	164
12	Luckiamute River near Suver, Oreg.	240	1905-11, 1940-56	Jan. 4, 1956	30.46	16,200	67.5
				Feb. 18, 1949	33.10	23,800	99.2
				Dec. 29, 1937	33.5	25,000	104
13	Johnson Creek at Sycamore, Oreg.	28.2	1940-56	Jan. 4, 1956	13.23	1,820	64.5
				Feb. 10, 1949	13.77	2,110	74.8

[1] Affected by storage and (or) diversion.

A complete summary of peak stages and discharges for the December 1955–January 1956 flood is given in U.S. Geological Survey Circular 380. A more comprehensive report by Hofmann and Rantz (1963) is in press.

FLOODS OF JANUARY 25 ON KAUAI ISLAND, HAWAII

Exceptionally heavy rains fell over the northeastern section of Kauai Island on January 24–25. At Kilauea, the center of the storm area, 42 inches of rain fell in 31 hours (fig. 3). A recording rain gage operated by the Kilauea Sugar Co. caught 6 inches of rain between 7:30 and 8:00 a.m. on January 25 and the gage overflowed at 8 a.m.

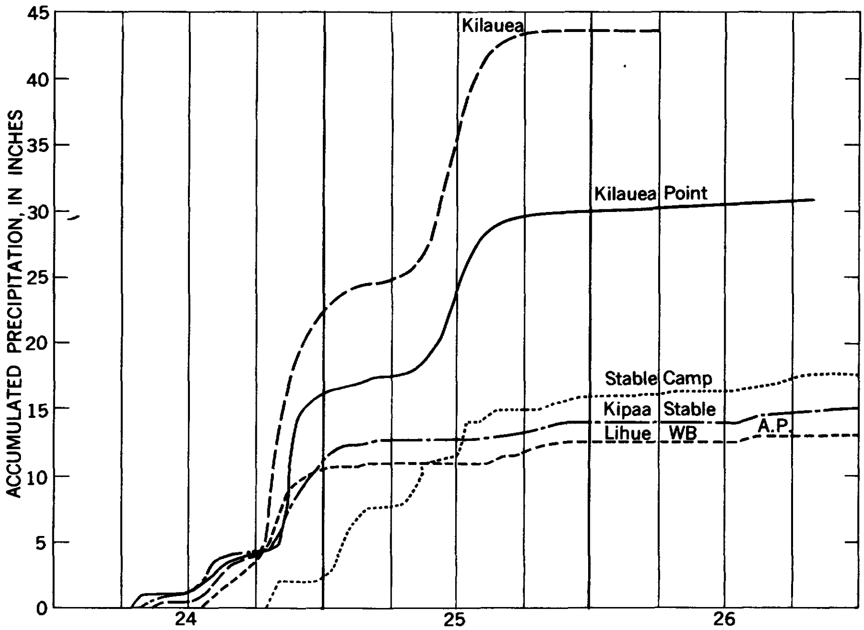

FIGURE 3.—Mass rainfall for storm of January 24–25 on Kauai, Hawaii.

Floods occurred in several basins on Kauai, and the discharges at the gaging stations (fig. 4) were very high (see table 2). There were no gaging stations in an area that had more than 20 inches of rain, and one measurement was made at a miscellaneous site which received about 35 inches of rain during the storm. Some peak discharges in the Kilauea area therefore must have been of a magnitude greater than those recorded.

The storm and floodwater caused the loss of one life and extensive damage to cultivated sugarcane fields and mill equipment, reservoirs

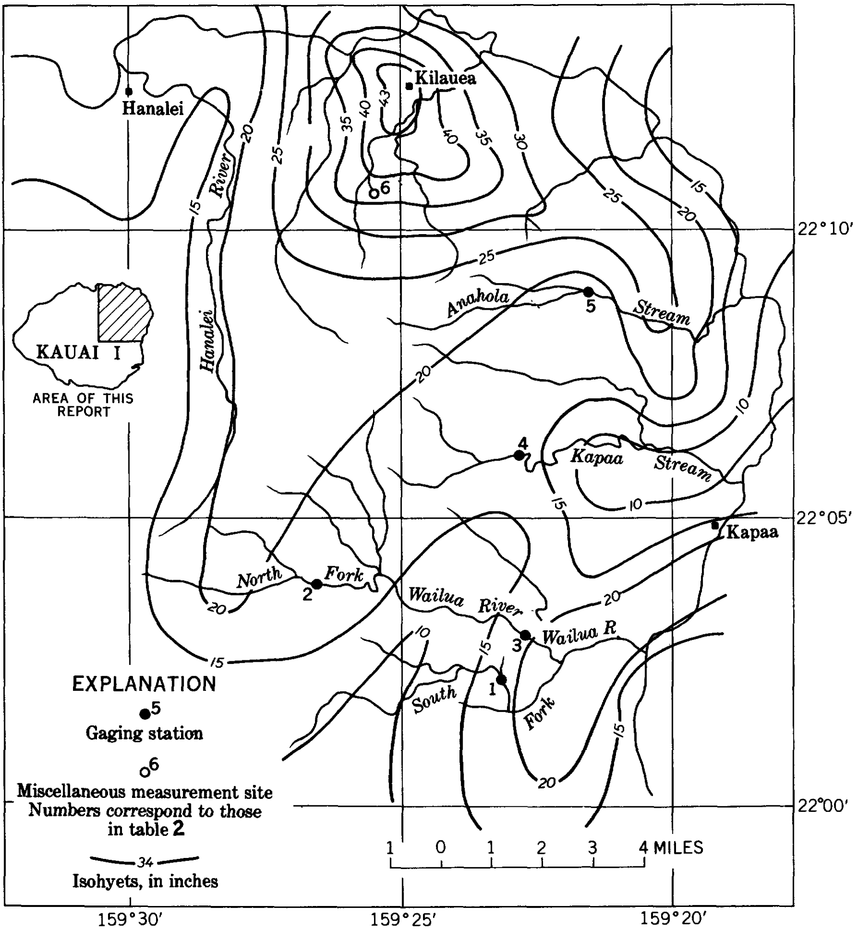

FIGURE 4.—Map of flood area showing location of flood-determination points and precipitation, in inches, for January 24–25, for floods on Kauai, Hawaii.

and irrigation systems, highway and railways, utilities and communication facilities, pineapple and truck crops, and household furnishings. Total damage was estimated by the U.S. Army Corps of Engineers as about $840,000.

The arterial belt road of Kauai, which serves 5,000 persons along the 20-mile strip of the northeast sector, was severed when overbank flow of the Kapaa Stream destroyed both abutment embankments and damaged the concrete bridge. Vehicular traffic was also interrupted by roadway cave-ins, landslides, and flood-borne debris.

TABLE 2.—*Summary of flood stages and discharges, January 25, on Kauai, Hawaii*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
1	South Fork Wailua River near Lihue.	22.4	1911–56	Jan. 25, 1956	8.07	13,000	580
				Nov. 12, 1955	11.52	46,700	2,080
2	North Fork Wailua River at altitude 650 ft near Lihue.	6.6	1914–56	Jan. 25, 1956	11.45	8,530	1,290
				Nov. 12, 1955	13.53	13,200	2,000
3	North Fork Wailua River near Kapaa.	18.7	1952–56	Jan. 25, 1956	16.50	33,400	1,790
				Nov. 12, 1955	19.88	53,200	2,840
4	Kapaa River at Kapahi Ditch intake, near Kapaa.	3.3	1936–56	Jan. 25, 1956	5.34	7,670	2,320
				Nov. 12, 1955 Feb. 7, 1949	4.65	5,520	1,670
5	Anahola River near Kealia	5.5	1910, 1912–56	Jan. 25, 1956	14.6	19,600	3,560
				Apr. 1, 1948	11.06	12,300	2,240
6	Pohakuhanu Stream near Kilauea.	1.8	----------	Jan. 25, 1956	11.0	5,600	3,110

FLOODS OF JANUARY 29 TO FEBRUARY 5 IN WESTERN TENNESSEE

Heavy rains fell over western Tennessee during the period January 28–30 causing floods on some streams in the Obion River basin and in west-side tributaries to the lower Tennessee River (fig. 5). The maximum precipitation observed during the period was 8.38 inches at Humboldt of which 7.98 inches fell on January 29.

The rainfall, as recorded, was distributed in a fairly uniform pattern with no area receiving extreme amounts relative to other areas. The discharge pattern, however, did show extremes from relatively low to very high runoff. The recurrence intervals of the peak discharges at nearly all stations were less than 10 years and those at Birdsong Creek and on Big Sandy River were slightly more than 10 years. (See table 3.) Rainfall over the basin of many of these streams averaged from 6 to 7 inches. The peak discharges in North Fork Forked Deer River at Trenton and in Middle Fork Forked Deer River near Alamo (fig. 6) corresponded to discharges with recurrence intervals of about 30 years and more than 50 years, respectively, and the rainfall recorded over their basins averaged from 7 to 8 inches. The high rate of runoff at these two sites should not be attributed solely to basin characteristics but also to rainfall intensity—7.98 inches in 1 day at Humboldt, near the upper end of each drainage basin—and to the possibility that more rain fell than was recorded.

Very little damage was reported. Some valley highways were closed to traffic for several days, and a few residents were forced to leave their homes.

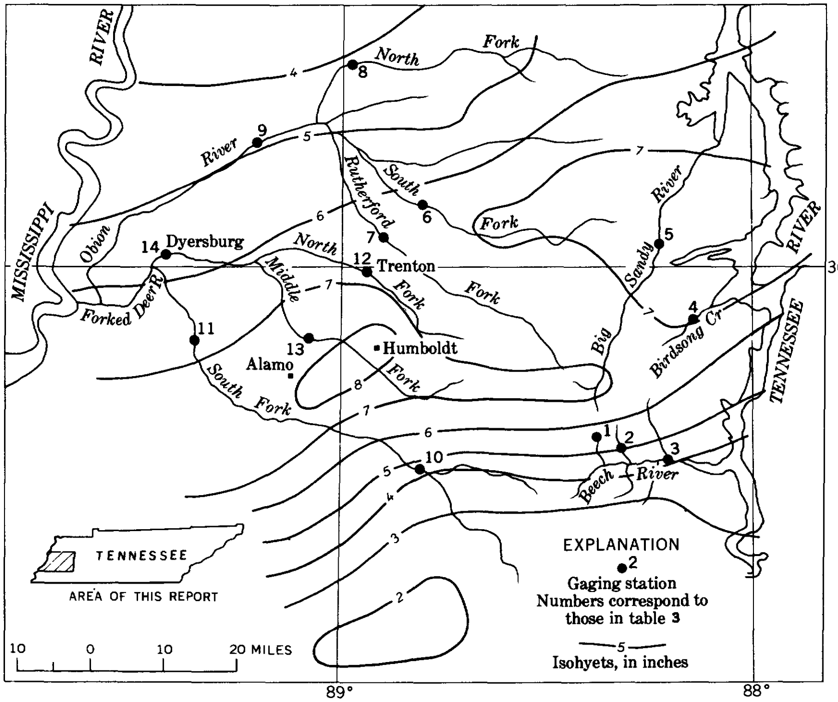

FIGURE 5.—Map of flood area showing precipitation, in inches, for January 28–30 and locations of flood-determination points for floods in western Tennessee.

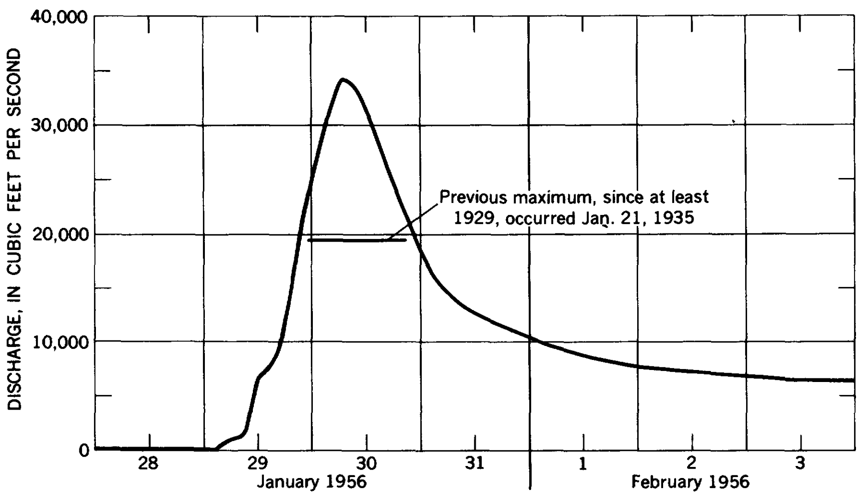

FIGURE 6.—Discharge hydrograph for Middle Fork Forked Deer River near Alamo, Tenn.

TABLE 3.—*Summary of flood stages and discharges, January 29 to February 5, in the Tennessee River basin in western Tennessee*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available. Stations 1-4 are operated by Tennessee Valley Authority. Station 14 is operated by U.S. Army Corps of Engineers, Memphis District]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Maximum floods: Gage height (ft)	Discharge: Cfs	Discharge: Cfs per sq mi
1	Pine Tree Branch near Lexington.	0.14	1941-56	Jan. 29, 1956	17.44	24.9	178
				Aug. 26, 1944	18.72	244	1,740
2	Browns Creek near Chesterfield	20.2	1953-56	Jan. 29, 1956	8.23	2,220	110
				May 4, 1953	7.65	1,570	77.7
3	Beech River near Darden	165	1954-56	Jan. 30, 1956	8.23	5,380	32.6
				Mar. 22, 1955	9.38	6,340	38.4
4	Birdsong Creek near Holladay	44.9	1940-56	Jan. 29, 1956	13.53	9,600	214
				Mar. 16, 1948	13.43	9,520	212
5	Big Sandy River at Bruceton	205	1929-56	Jan. 30, 1956	14.85	11,800	57.6
				Jan. 21, 1935	16.16	17,000	82.9
				March 1897	18	25,000	122
6	South Fork Obion River near Greenfield.	431	1929-56	Jan. 31, 1956	16.98	17,500	40.6
				Jan. 22, 1937	17.82	25,600	59.4
7	Rutherford Fork Obion River near Bradford.	203	1929-56	Jan. 30, 1956	20.47	8,860	43.6
				Jan. 22, 1937	--------	9,730	47.9
8	North Fork Obion River near Union City.	490	1929-56	Feb. 2, 1956	19.06	11,000	22.4
				Jan. 22, 1937	22.0	49,200	100
9	Obion River at Obion	1,880	1929-56	Feb. 3, 1956	20.56	40,100	21.3
				Jan. 24, 1937	25.4	99,500	52.9
10	South Fork Forked Deer River at Jackson.	574	1929-56	Jan. 30, 1956	17.40	6,220	10.8
				Jan. 21, 1935	24.0	43,600	76.0
11	South Fork Forked Deer River at Chestnut Bluff.	1,100	1929-56	Jan. 31, 1956	21.27	26,200	23.8
				Jan. 22, 1935	22.3	45,000	40.9
12	North Fork Forked Deer River at Trenton.	71.3	1950-56	Jan. 30, 1956	13.39	11,800	165
				Jan. 14, 1951	12.16	6,540	91.7
13	Middle Fork Forked Deer River near Alamo.	410	1929-56	Jan. 30, 1956	16.70	34,300	83.7
				Jan. 21, 1935	15.46	19,500	47.6
14	North Fork Forked Deer River at Dyersburg.	867	1939-56	Feb. 3, 1956	27.77	21,600	24.9
				Jan. 16, 1951	26.52	20,400	23.5

FLOODS OF FEBRUARY 15 IN THE VICINITY OF HOT SPRINGS, ARK

Heavy rains in the vicinity of Hot Springs during the evening of February 15 caused flash floods in Hot Springs and Gulpha Creeks (fig. 7). The official Weather Bureau gage at Hot Springs recorded 5.54 inches of rainfall, most of it falling in a 2-hour period. A "bucket" survey indicated that as much as 10 inches of precipitation fell in the Gulpha Creek watershed just east of Hot Springs. The storm was extremely localized as a nearby station indicated less than a quarter of an inch of rainfall.

Hot Springs Creek, which flows through the city of Hot Springs, caused most of the property damage in the downtown district. Gulpha Creek, which drains the area just east of Hot Springs, washed out one small dam and one highway bridge. One person was

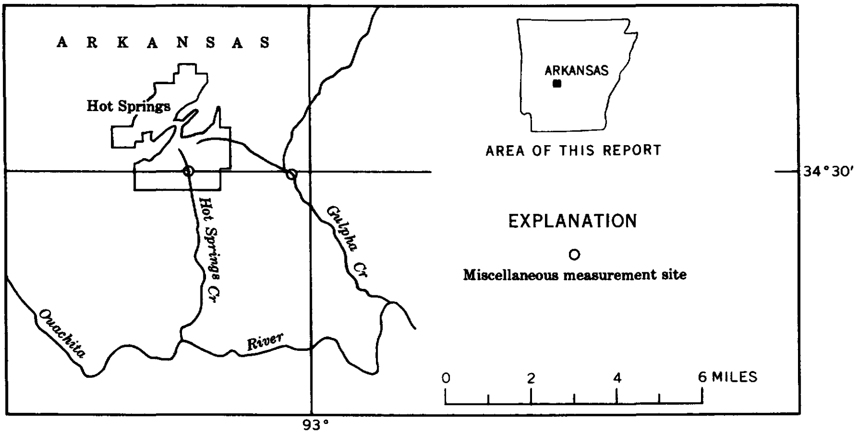

FIGURE 7.—Map of flood area showing location of flood-determination points for floods of February 15, in the vicinity of Hot Springs, Ark.

drowned on a Gulpha Creek tributary. Total property damage was estimated at $250,000.

Contracted-opening measurements on Hot Springs Creek and on Gulpha Creek at points indicated on figure 7 showed discharges of 4,350 cfs from 5.81 square miles and 21,100 cfs from 50 square miles, respectively.

Residents who had lived near Gulpha Creek for as long as 35 years stated that the flood of February 15 was 2 feet higher than any they had seen there before. A flood greater than that of February 15, 1956, ocurred on Hot Springs Creek on May 14, 1923, after 9.01 inches of rain fell during a 4-hour period.

FLOODS OF FEBRUARY 19–26 IN NORTHERN CALIFORNIA

In California the rains associated with the disastrous floods of December 1955 to January 1956 in the Far Western States ceased on January 27. A severe storm moving southeast from the north Pacific Ocean struck northern and central California on February 19. Heavy rains continued through February 23. All coastal basins north of San Francisco Bay and the entire Sacramento Valley were affected by the storm. Precipitation totals of more than 15 inches from February 19 to 23 were not uncommon. Many Weather Bureau precipitation stations received more than 6 inches of rainfall in 24 hours. At Gasquet Ranger Station 8.50 inches of rain was recorded in 1 day.

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Because of the excessive rainfall during the 2 months preceding the February storm, conditions were favorable for heavy runoff when the February storm occurred. In the Eel River delta area, flood stage was exceeded February 21–23, when inundation of valuable farm and industrial land occurred. Along the Russian River flooding occurred from Cloverdale downstream to the Healdsburg-Guerneville resort region. The peak stage of February 22 near Guerneville had been exceeded only twice during a period of record which began in 1939. Many families were forced to leave their flooded homes in the Russian River lowlands, and many precautionary evacuations took place in the Guerneville area. Operations of the Northwestern Pacific Railway were suspended in the Guerneville-Cloverdale area and also along the Eel River where the tracks were covered by 17 landslides between Dos Rios and Scotia.

The location of selected discharge stations and the location and amount of rainfall, February 19–23, reported at selected Weather Bureau precipitation stations are shown in figure 8.

Roads were flooded in Sonoma County and in Napa Valley. High tides were a contributing factor to local lowland flooding in Napa Valley. Heavy rains at the beginning of the storm period resulted in local flooding in the San Rafael-Kentfield area. No flooding occurred south of San Francisco Bay.

Short periods of intense rainfall caused flooding in the streets of Redding and in the Anderson and Chico areas. Heavy runoff from tributaries between Shasta Lake and Red Bluff raised the Sacramento River above flood stage at Red Bluff, and the peak stage was less than half a foot below that of January 1956; damage, however, was very light.

The levee system in the Yuba City-Nicolaus area along the Feather River prevented any flooding there. A break in the Cache Creek levee near Yolo Bypass caused inundation of 1,000 acres of farmland. Heavy snowfall in the Sierra Nevada disrupted communications.

Although none of the streams had peaks that were maximum for their period of record, the magnitude of the peaks associated with the large area affected makes this flood an event of rare occurrence. At only one gaging station, Sacramento River at Keswick, did the peak stage and discharge during the February 1956 flood exceed those of the December 1955-January 1956 flood. (See table 4.)

TABLE 4.—*Summary of flood stages and discharges, February 19–26, in northern California*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods		
				Date	Gage height (ft)	Discharge (cfs)
	Sacramento River basin					
1	Sacramento River at Delta	427	1944–56	Feb. 21, 1956	13.58	18,700
				Dec. 22, 1955	19.50	37,000
2	Pit River near Montgomery Creek	5,170	1944–56	Feb. 22, 1956	10.53	21,000
				Dec. 23, 1955	14.12	37,100
3	Sacramento River at Keswick	6,710	1938–56	Feb. 24, 1956	27.37	53,800
				Feb. 28, 1940	--------	186,000
4	Cottonwood Creek near Cottonwood	945	1940–56	Feb. 21, 1956	15.14	47,900
				Mar. 1, 1941	15.4	52,300
5	Battle Creek near Cottonwood	362	1940–56	Feb. 22, 1956	8.17	4,920
				Feb. 6, 1942	11.85	12,800
				Dec. 11, 1937	15.8	35,000
6	Sacramento River near Red Bluff	9,300	1895–1956	Feb. 22, 1956	21.83	111,000
				Feb. 28, 1940	38.9	291,000
7	Stony Creek near Hamilton City	764	1941–56	Feb. 22, 1956	14.92	17,900
				Mar. 1, 1941	--------	37,500
8	Butte Creek near Chico	148	1930–56	Feb. 22, 1956	11.22	13,100
				Dec. 22, 1955	13.35	18,700
9	Sacramento River at Knights Landing	----------	1940–56	Feb. 25, 1956	38.76	26,300
				Feb. 9, 1942	[1] 41.83	27,900
10	Feather River near Oroville	3,611	1902–56	Feb. 22, 1956	50.28	71,700
				Mar. 19, 1907	--------	230,000
11	Feather River at Nicolaus	----------	1921–56	Feb. 24, 1956	43.61	74,700
				Dec. 23, 1955	[1] 51.60	357,000
12	Sacramento River at Verona	----------	1926–56	Feb. 25, 1956	35.76	60,900
				Mar. 1, 1940	41.20	79,200
13	Sacramento weir near Sacramento	----------	1926–56	February 1956	No flow	
				Mar. 26, 1938	[1] 32.92	118,000
14	American River at Fair Oaks	1,921	1904–56	Feb. 19, 1956	--------	7,000
				Nov. 21, 1950	13.85	180,000
15	Sacramento River at Sacramento	----------	1948–56	Feb. 26, 1956	22.03	67,600
				Nov. 21, 1950	30.14	104,000
				Jan. 17, 1909	29.6	103,000
16	North Fork Cache Creek near Lower Lake	198	1930–56	Feb. 22, 1956	10.72	10,600
				Dec. 11, 1937	13.98	20,300
17	Cache Creek near Capay	1,052	1942–56	Feb. 22, 1956	17.20	30,100
				Jan. 21, 1943	17.54	35,000
18	Yolo Bypass near Woodland	----------	1940–56	Feb. 25, 1956	27.50	87,500
				Feb. 8, 1942	32.00	272,000
	Coastal basins					
19	Mattole River near Petrolia	242	1911–13,	Feb. 21, 1956	17.40	28,200
			1950–56	Dec. 22, 1955	29.60	90,400
20	Eel River at Scotia	3,113	1910–15,	Feb. 22, 1956	43.45	221,000
			1916–56	Dec. 22, 1955	61.90	541,000
21	Klamath River near Klamath	12,100	1910–26,	Feb. 22, 1956	27.12	147,000
			1950–56	Dec. 22, 1955	49.7	425,000
22	Smith River near Crescent City	613	1931–56	Feb. 21, 1956	30.42	88,200
				Dec. 22, 1955	41.20	165,000

[1] Did not occur at time of maximum discharge.

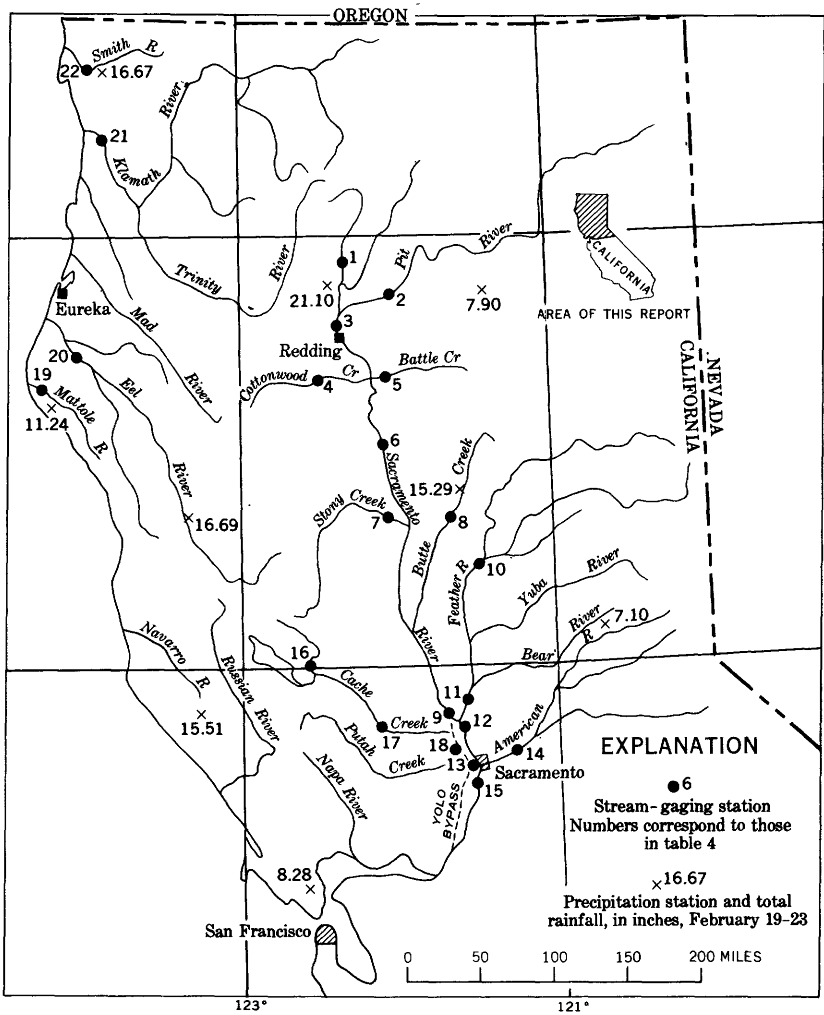

FIGURE 8.—Map of flood area in northern California showing location of flood-determination points and total rainfall, in inches, February 19–23.

FLOODS OF FEBRUARY 21–22 IN ESQUATZEL COULEE AREA, WASHINGTON

Heavy rain falling on frozen ground covered by various amounts of snow caused flooding in the Esquatzel Coulee and adjacent drainage basins (fig. 9). This flood was the greatest known in Connell since the town was settled in 1888.

Extremely low temperatures for several days before the rain began froze the ground to a depth of several inches. Some snow was on the

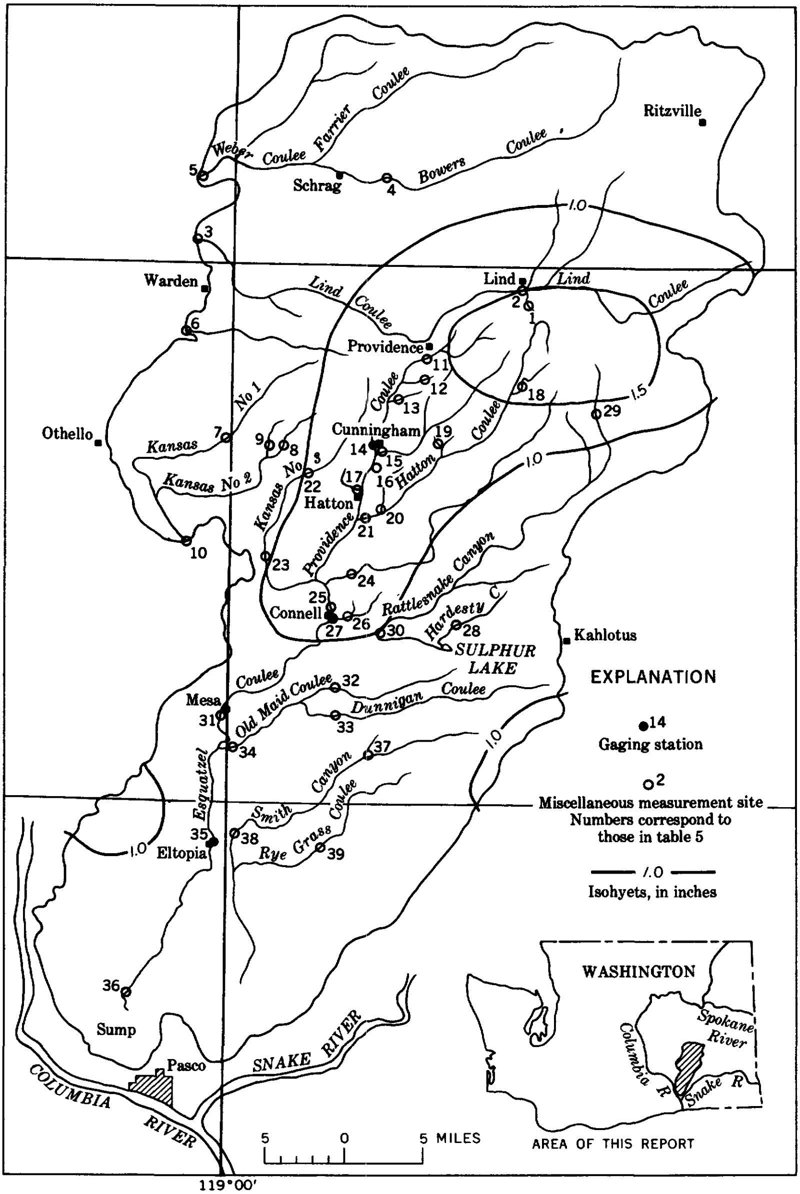

FIGURE 9.—Map of flood area showing location of flood-determination points and precipitation, in inches, for February 20–21, for floods in Esquatzel Coulee area, Washington.

ground, particularly in the headwater areas of Providence Coulee, but the amount of water contributed to the flood discharge is unknown. Rainfall was the principal factor causing the flood, not because the total rainfall was outstanding but because a very large part of it became surface runoff owing to the frozen ground.

The heaviest rainfall during February 20–21 occurred in the headwater area of Providence Coulee (1.57 inches at Providence), and practically the entire area from Providence to Connell received 1 inch or more of rainfall.

Three gaging stations are operated on Providence and Esquatzel Coulees, and complete records of stage and discharge were obtained from them during the flood period. Peak discharges were obtained at 36 miscellaneous sites by indirect measurements (table 5). The location of all flood-determination points are shown on figure 9, and the numbers of these stations correspond to those in the summary table.

The largest unit peak discharge determined in this flood was 372 cfs per sq mi from an area of 7.53 sq mi in Providence Coulee about 9 miles upstream from Cunningham. The basin contributing this discharge was in the area of heaviest precipitation and greatest snow cover. The release of ponded water by the washout of a railroad fill just above the station undoubtedly had an appreciable effect on the magnitude of the peak (2,800 cfs) at the station.

TABLE 5.—*Summary of flood stages and discharges, February 21–22, in Esquatzel Coulee area, Washington*

[Each station in this table has one, two, or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Crab Creek basin						
1	Lind Coulee tributary near Lind.	0.21	----------	Feb. 21, 1956	--------	60.3	287
2	Lind Coulee at Lind	138	----------	do	--------	5,150	37.3
3	Lind Coulee above Weber Coulee near Warden.	299	----------	do	--------	7,160	24.0
4	Bowers Coulee near Schrag	120	----------	do	--------	5,000	41.7
5	Weber Coulee near Warden	265	----------	do	--------	9,400	35.5
6	Warden Coulee near Warden	31.4	----------	do	--------	1,120	35.6
	Scooteney Reservoir basin						
7	Kansas No. 1 near Othello	24.8	----------	Feb. 21, 1956	--------	1,360	54.8
8	Kansas No. 2 near Cunningham	6.06	----------	do	--------	175	28.9
9	Kansas No. 2 tributary near Cunningham.	3.16	----------	do	--------	49.4	15.6
10	Scooteney Reservoir tributary near Othello.	120	----------	do	--------	2,110	17.6

TABLE 5.—*Summary of flood stages and discharges, February 21–22, in Esquatzel Coulee area, Washington*—Continued

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Esquatzel Coulee basin						
11	Providence Coulee near Cunningham.	7.53		Feb. 21, 1956		2,800	372
12	Providence Coulee tributary No. 1 near Cunningham.	0.47		do		88.6	188
13	Providence Coulee tributary No. 2 near Cunningham.	2.74		do		667	243
14	Providence Coulee at Cunningham.	27.8	1953–56	Feb. 21, 1956	10.04	[1] 2,160	77.7
				Jan. 4, 1956	[2] 5.9	333	12.0
15	Providence Coulee tributary at Cunningham.	22.0		Feb. 21, 1956		1,770	80.5
16	Providence Coulee tributary No. 3 near Cunningham.	.93		do		169	182
17	Providence Coulee tributary at Hatton.	3.31		do		76.2	23.0
18	Hatton Coulee tributary near Lind.	2.64		do		117	44.3
19	Hatton Coulee tributary near Cunningham.	.72		do		112	156
20	Hatton Coulee tributary near Hatton.	3.82		do		186	48.7
21	Hatton Coulee near Hatton	49.6		do		1,120	22.6
22	Kansas No. 3 near Hatton	13.5		do		877	65.0
23	Kansas No. 3 near Connell	39.6		do		1,180	29.8
24	Providence Coulee tributary near Connell.	54.2		do		929	17.1
25	Providence Coulee above Connell.	235		do		5,570	23.7
26	Providence Coulee tributary at Connell.	5.53		do		30	5.4
27	Esquatzel Coulee at Connell	240	1953–56	Feb. 21, 1956	12.68	[3] 5,560	23.2
				Jan. 4, 1956	[2] 9.0	1,520	6.3
				February 1949		[4] 1,760	7.3
28	Hardesty Coulee near Connell	10.4		Feb. 21, 1956		105	10.1
29	Rattlesnake Canyon near Lind	14.0		do		1,380	98.6
30	Rattlesnake Canyon near Connell.	98.1		do		1,350	13.8
31	Esquatzel Coulee at Mesa	293		Feb. 22, 1956		4,080	13.9
32	Old Maid Coulee near Connell	17.8		Feb. 21, 1956		171	9.6
33	Dunnigan Coulee near Connell	27.5		do		465	16.9
34	Old Maid Coulee near Mesa	69.4		do		456	6.6
35	Esquatzel Coulee at Eltopia	394	1953–56	Feb. 22, 1956	18.23	3,740	9.5
				Jan. 5, 1956		126	.3
36	Esquatzel Coulee near Pasco	493		Feb. 22, 1956		2,740	5.6
	Smith Canyon basin						
37	Smith Canyon tributary near Connell.	1.71		Feb. 21, 1956		45.8	26.8
38	Smith Canyon near Eltopia	46.2		do		462	10.0
39	Rye Grass Coulee near Eltopia	17.6		do		126	7.2

[1] At site 1¼ miles above station.
[2] Outside gage height.
[3] At site 0.6 mile below station.
[4] About equal to that of August 1907 and greatest outside period of record since at least 1888.

The peak discharge flattened to 2,160 cfs in Providence Coulee at Cunningham. By the time the crest arrived at Connell, a considerable amount of inflow had occurred from tributary basins, receiving on an average more than 1 inch of rainfall, and the peak discharge increased to 5,560 cfs. Downstream from Connell, the peak discharge showed a decrease at each succeeding station and was 2,740 cfs when it entered Pasco Sump. Tributary inflow downstream from Connell was relatively small—the peak discharge from Old Maid Coulee was 456 cfs. See figure 10 for discharge hydrographs of the three gaging stations. The volume of runoff at Eltopia was only slightly greater than that at Connell. A comparison of the volumes at these two stations and that at Cunningham is shown in figure 11.

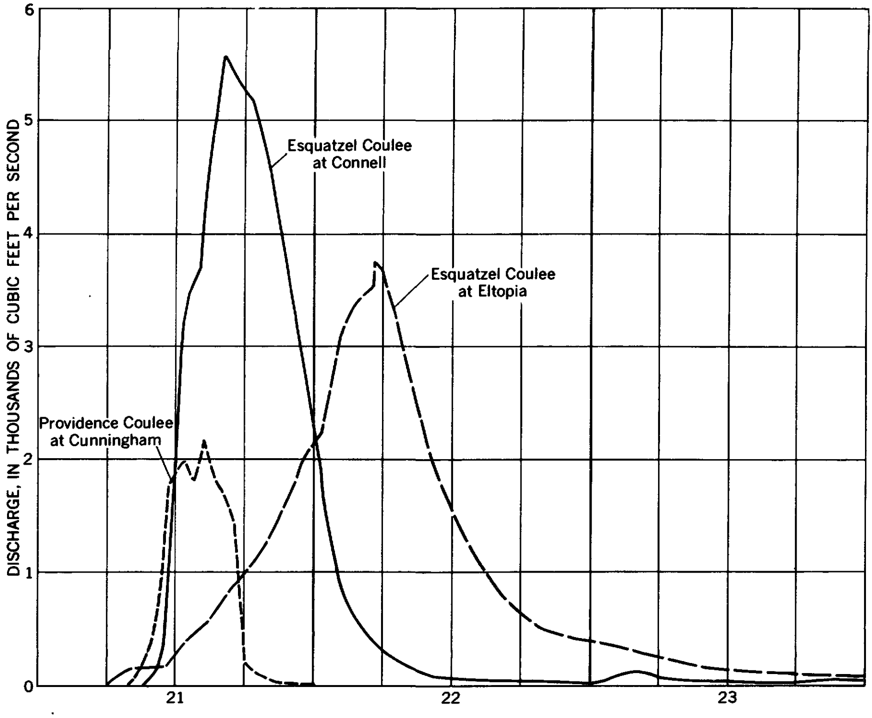

FIGURE 10.—Discharge hydrographs for gaging stations in flood area for floods of February 21-22 in Esquatzel Coulee area, Washington.

Flood damages were high in Connell and Mesa which are on the bottomlands of Esquatzel Coulee. In Connell the floodwaters were as much as 3 feet deep in the business district, 50 families were evacuated, and damage was estimated at about $800,000. The damage in Mesa was estimated at about $300,000, and minor damage occurred in other communities along the channel. Many culverts and bridges were damaged or destroyed. Highway No. 10 was flooded by Weber Coulee north of Warden and Highway No. 395 was closed to traffic in Connell. On the main line of the Northern Pacific Railway, which closely follows Providence and Esquatzel Coulees for almost their

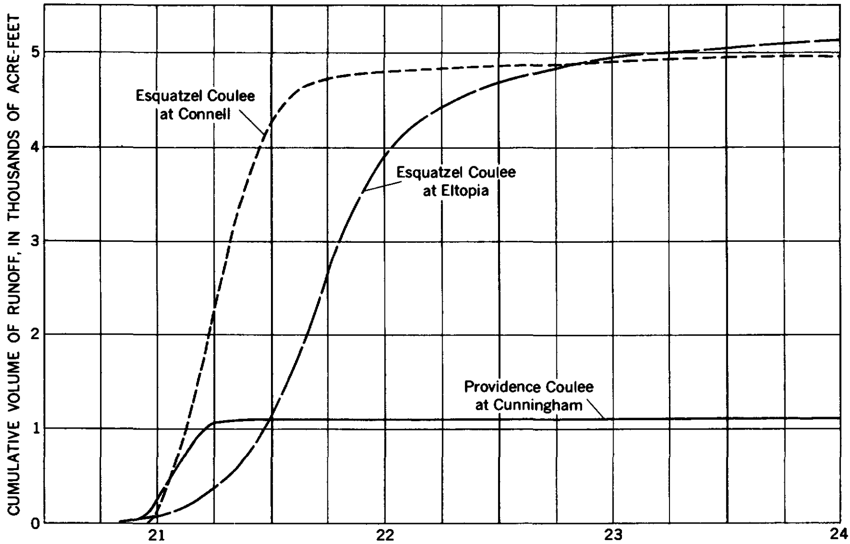

FIGURE 11.—Cumulative volume of runoff at gaging stations in the flood area for floods of February 21–22 in Esquatzel Coulee area, Washington.

entire lengths, tracks were washed out at several places and minor damage resulted at others. Damage to farmland was small as the precipitation was not intense and the frozen soil was not eroded.

The following information on past floods was obtained from residents of Connell: The flood of February 21–22, 1956 (peak discharge, 5,560 cfs) was the greatest since the settlement began in 1888. The floods of August 1907 and of February 1949 (peak discharge, 1,760 cfs) were of about equal magnitude and were probably the second and third greatest. The fourth greatest flood was probably that of February 1906 and the fifth largest that of January 4, 1956 (peak discharge, 1,520 cfs). Smaller floods of unknown magnitude occurred: January 1905, 1906, 1909, 1925; February 1907, 1913, 1916, 1919, 1932; February or March 1912; May or June 1923, 1951.

FLOODS OF MARCH 7–9 IN NEW YORK AND PENNSYLVANIA

General flooding occurred in New York, south of Lake Ontario and west of the Delaware River, and in northwestern Pennsylvania (fig. 12). The runoff was due to moderately heavy rains (table 6) falling on a thick cover of snow of higher than normal water content during a period when the average temperature was 7° above normal.

These rains extended over a large area, so that flooding occurred in the Allegheny River, as well as in the smaller streams.

The most severe flooding occurred in the Allegheny River basin in Pennsylvania and New York and in streams tributary to Lake Erie

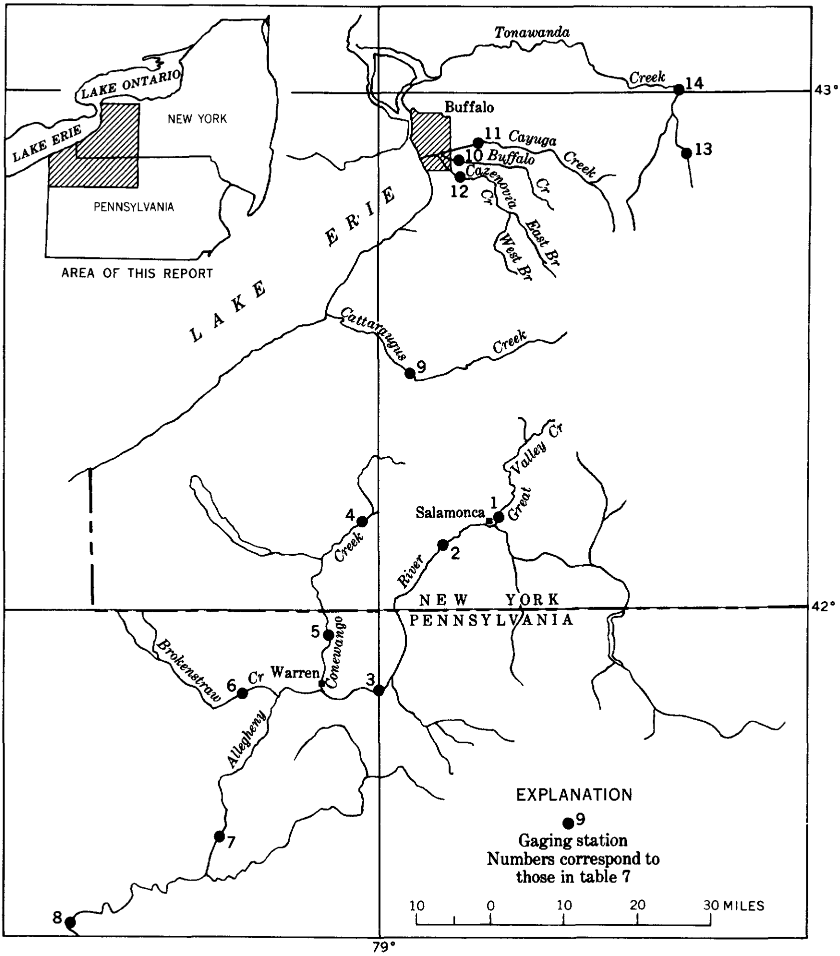

FIGURE 12.—Map of flood area showing location of flood-determination points for floods of March 7-9 in New York and Pennsylvania.

and to Niagara River in New York. Maximum peak discharges occurred at several gaging stations in this area (table 7). The peak discharge in the Allegheny River at Red House, N.Y., was greater than any other during a period of record which began in 1903.

The Weather Bureau reported the greatest amount of damage occurred at Warren, Pa., and at Salamanca, N.Y.—both along the Allegheny River. Eight feet of water swirled through Warren causing damage of almost $900,000 (table 8).

TABLE 6.—*Rainfall at selected U.S. Weather Bureau Stations in New York and Pennsylvania, 7 p.m. March 5 to 7 a.m. March 8*

Station	Total rainfall (inches)	Station	Total rainfall (inches)	Station	Total rainfall (inches)
Franklin, Pa	1.74	Warren, Pa	1.69	Friendship, N.Y	3.25
Utica, Pa	1.79	Tionesta Dam, Pa	1.05	Bradford, Pa	3.00
Meadville, Pa	1.80	Jamestown, N.Y	2.69	Coudersport, Pa	2.85
Union City, Pa	2.88	Olean, N.Y	2.89	Clermont, Pa	2.90
Sherman, N.Y	2.80	Franklinville, N.Y	3.41		
Torpedo, Pa	3.41	New Albins, N.Y	2.55		

TABLE 7.—*Summary of flood stages and discharges, March 7–9, in New York and Pennsylvania*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report: the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
	Allegheny River Basin						
1	Great Valley Creek near Salamanca, N.Y.	142	1950–56	Mar. 7, 1956	10.66	9,680	68.2
				Mar. 1, 1955	8.91	6,100	43.0
2	Allegheny River at Red House, N.Y.	1,690	1903–56	Mar. 8, 1956	15.11	49,100	29.1
				July 20, 1942	14.55	45,300	26.8
3	Allegheny River near Kinzua, Pa.	2,179	1935–56	Mar. 8, 1956	19.95	60,500	27.8
				Mar. 22, 1948	18.52	50,800	23.3
4	Conewango Creek at Waterboro, N.Y.	290	1938–56	Mar. 8, 1956	11.58	6,750	23.3
				Apr. 7, 1947	11.35	8,600	29.7
5	Conewango Creek at Russell, Pa.	816	1939–56	Mar. 9, 1956	10.55	14,100	17.3
				Apr. 7, 1947	10.69	14,400	17.6
				March 1936	10.9	14,600	17.9
6	Brokenstraw Creek at Youngsville, Pa.	321	1909–56	Mar. 8, 1956	10.30	11,700	36.4
		304		Mar. 25, 1913	13.2	18,000	59.2
7	Allegheny River at West Hickory, Pa.	3,660	1941–56	Mar. 8, 1956	17.20	101,000	27.6
				Apr. 6, 1947	15.97	84,300	23.0
				Feb. 23, 1945	[1] 17.51		
8	Allegheny River at Franklin, Pa.	5,982	1914–56	Mar. 8, 9, 1956	20.55	134,000	22.4
				Mar. 13, 1920	20.65	138,000	23.1
	Tributary to Lake Erie						
9	Cattaraugus Creek at Gowanda, N.Y.	428	1939–56	Mar. 7, 1956	14.13	34,600	80.8
				Mar. 17, 1942	13.73	35,900	83.9
10	Buffalo Creek at Gardenville, N.Y.	145	1938–56	Mar. 7, 1956	9.42	13,000	89.7
				Mar. 1, 1955	9.43	13,000	89.7
11	Cayuga Creek near Lancaster, N.Y.	93.3	1938–56	Mar. 7, 1956	10.05	8,680	93.0
				Mar. 1, 1955	9.59	7,900	84.7
12	Cazenovia Creek at Ebenezer, N.Y.	136	1940–56	Mar. 7, 1956	14.65	14,800	100
				Mar. 1, 1955	13.82	13,500	99.3
	Tributary to Niagara River						
13	Little Tonawanda Creek at Linden, N.Y.	22.0	1912–56	Mar. 7, 1956	16.04	2,700	123
				Mar. 1, 1955	14.83	2,460	112
14	Tonawanda Creek at Batavia, N.Y.	172	1944–56	Mar. 7, 1956	12.06	5,500	32.0
				Mar. 29, 1950		5,530	32.2

[1] Affected by ice jam.

TABLE 8.—*Damage caused by floods of March 7–9 in New York and Pennsylvania*

[Furnished by U.S. Weather Bureau, Pittsburgh, Pa.]

Locality	Amount of damage	Number of dwellings damaged
Warren, Pa	$886,500	950
Salamance, N.Y	352,000	100
Youngsville, Pa	5,000	1
East Hickory, Pa	17,750	13
Tionesta, Pa	8,750	30
Olean, N.Y	12,000	50
Eldred, Pa	5,000	30
Smethport, Pa	10,300	8
Port Allegany, Pa	60,000	20
Roulette, Pa	5,100	10
Jamestown, N.Y	10,000	34
Russell, Pa	5,000	10

FLOOD OF MARCH 24 IN GRASSHOPPER CREEK, MONTANA

The greatest peak discharge in 21 years (1921–33, 1945–53, 1955–56) of record occurred March 24 in Grasshopper Creek southwest of Dillon (fig. 13), owing to rapid snowmelt.

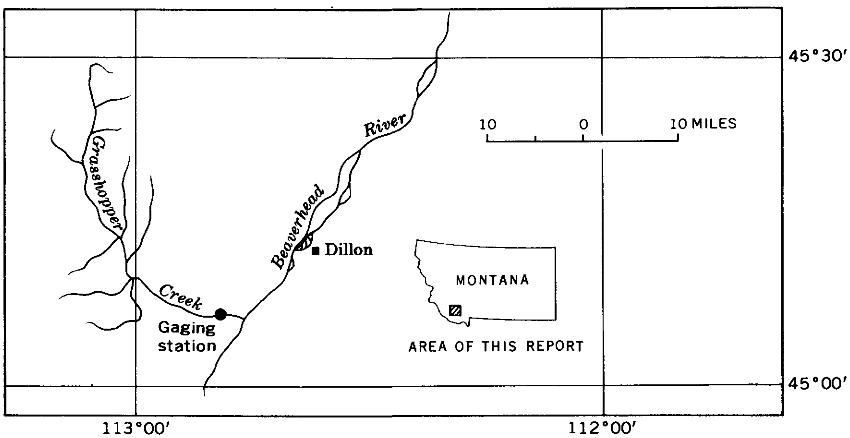

FIGURE 13.—Map showing location of flood-determination point for flood of March 24 in Grasshopper Creek, Mont.

The peak discharge at the gaging station near Dillon (drainage area, 350 sq mi) was 1,870 cfs (gage height: 6.47 ft in gage well, 7.33 ft outside). The previous maximum discharge was 719 cfs on June 4, 1948, and on June 3, 1953 (gage height, 4.51 ft). Though the peak discharge of the March 1956 flood was only 5.4 cfs per sq mi, it was 2.6 times as great as the previous maximum peak discharge in 21 years of record, and this indicates that the recurrence interval of the flood was very great.

FLOODS OF APRIL 2-6 IN WEST-CENTRAL WISCONSIN

The floods of April 2–6 resulted from the melting of heavy snow, which had fallen in March, by warm temperatures and from rain during the early part of April. Precipitation was not excessive—2.6 inches was the highest 8-day total (table 9); but the combination of moderate precipitation, rapidly melting snow, and high soil-moisture content resulted in bankful and flood stages of streams in west-central Wisconsin (fig. 14).

The peak discharges at three gaging stations in the flood area were the maximum of record. The peak discharge of April 4, 1956, in the

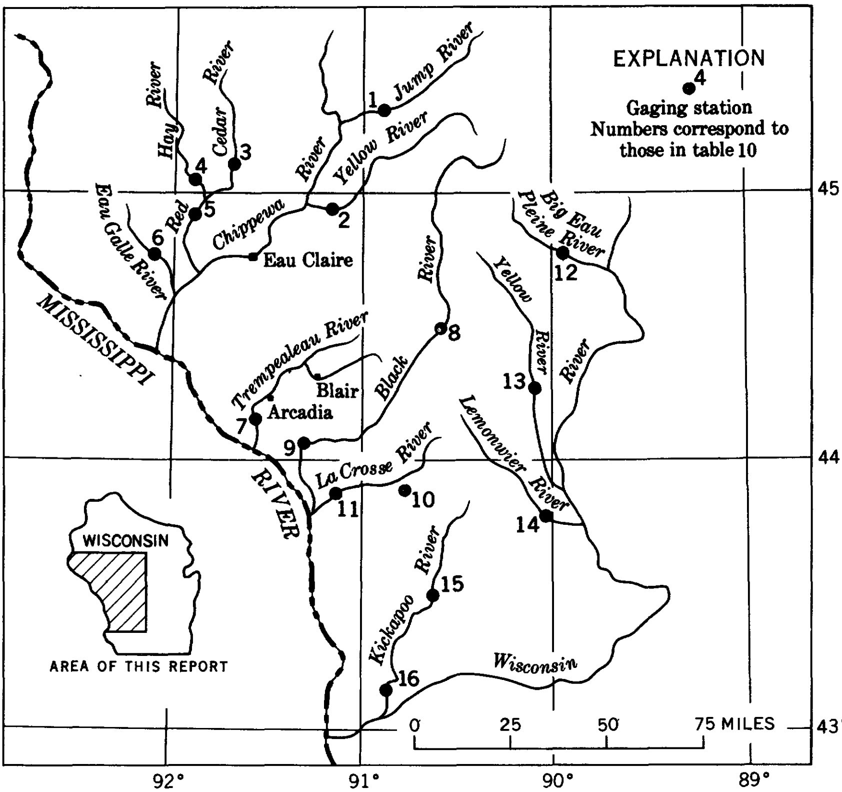

FIGURE 14.—Map of flood area showing location of flood-determination points for floods of April 2–6 in west-central Wisconsin.

Trempealeu River at Dodge was 58 percent greater than the previous maximum peak in 1919, which in turn was the greatest peak since 1876. Table 10 shows the peak discharges of several gaging stations in the flood area.

The greatest flood damage occurred in the Trempealeau Valley in the towns of Arcadia, Whitehall, and Blair. Dams at Blair and Whitehall were severely damaged. Floating chunks of ice added to the destructiveness of the flood.

At least 100 men were working to strengthen the Arcadia dikes, but the effort had to be given up in the morning of April 4 and the dikes failed. This was the worst flood since 1919 in Arcadia. More than 20 blocks in the town were inundated. In low-lying areas the water was as much as 3½ feet deep.

The flood damage in Trempealeau Valley was estimated by the Weather Bureau at more than $250,000.

TABLE 9.—*Precipitation at U.S. Weather Bureau stations in Wisconsin, March 28 to April 4*

Station	Total rainfall (inches)	Station	Total rainfall (inches)
Alma Dam	2.25	Dodge	2.27
Mondovi	0.86	Galesville	2.60
Menomonie	2.23	Hatfield Dam	1.00
Eau Claire	1.37	Neillsville	1.98
Fairchield	1.97	Stanley	1.74
Blair	2.51	Owen	1.77

TABLE 10.—*Summary of flood stages and discharges, April 2–6, in west-central Wisconsin*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Discharge: Cfs per sq mi
	Chippewa River basin						
1	Jump River at Sheldon	574	1915–56	Apr. 6, 1956	10.40	8,090	14.1
				Aug. 31, 1941	18.8	46,000	80.1
2	Yellow River at Cadott	351	1942–56	Apr. 6, 1956	7.10	4,350	12.4
				June 28, 1943	12.15	[1] 15,600	44.4
3	Red Cedar River near Colfax	1,100	1914–56	Apr. 5, 1956	6.25	7,740	7.0
				Apr. 3, 1934	11.4	21,900	19.9
4	Hay River at Wheeler	426	1950–56	Apr. 5, 1956	11.04	5,270	12.4
				Mar. 22, 1953	12.36	6,700	15.7
5	Red Cedar River at Menomonie.	1,760	1907–08, 1913–23, 1925–56	Apr. 5, 1956	6.56	12,900	7.3
				Apr. 4, 1934	16.0	40,000	22.7
6	Eau Galle River at Spring Valley.	64.8	1944–56	Apr. 3, 1956	7.93	5,130	79.1
				Apr. 15, 1954	9.50	7,000	108
				Sept. 18, 1942	[2] 16.98	[3] 33,000	509
	Trempealeau River basin						
7	Trempealeau River at Dodge	643	1913–19, 1934–56	Apr. 4, 1956	10.35	[4] 17,400	27.1
				Mar. 17, 1919	10.2	11,000	17.1
	Black River basin						
8	Black River at Neillsville	750	1905–09, 1913–56	Apr. 3, 1956	16.50	21,500	28.4
				Sept. 10, 1938	23.8	48,800	64.6
9	Black River near Galesville	2,120	1931–56	Apr. 6, 1956	12.90	29,300	13.8
				Sept. 11, 1938	[1] 14.31	58,000	27.4
	La Crosse River basin						
10	Little La Crosse River near Leon.	77.1	1934–56	Apr. 2, 1956	9.15	1,840	23.9
				Aug. 6, 1935	14.43	4,620	59.9
11	La Crosse River near West Salem.	398	1913–56	Apr. 3, 1956	10.40	5,710	14.3
				Aug. 6, 1935	[1] 12.2	8,200	20.6
	Wisconsin River basin						
12	Big Eau Pleine River near Stratford.	224	1914–25, 1937–56	Apr. 5, 1956	16.60	10,500	46.9
				Sept. 9, 1938	24.5	41,000	183
13	Yellow River at Babcock	223	1944–56	Apr. 5, 1956	15.85	8,470	38.0
				Apr. 2, 1952	17.38	11,600	52.0
14	Lemonweir River at New Lisbon.	486	1944–56	Apr. 5, 1956	12.60	5,580	11.5
				Apr. 3, 1952	12.28	5,160	10.6
15	Kickapoo River at La Farge	266	1938–56	Apr. 4, 1956	12.35	6,750	25.4
				July 21, 1951	12.32	6,600	24.8
				August 1935	15.5	8,100	30.5
16	Kickapoo River at Steuben	690	1933–56	Apr. 5, 1956	10.88	6,310	9.1
				July 22, 1951	13.66	10,300	14.9

[1] Maximum observed.
[2] Maximum stage known since at least 1894.
[3] Discharge estimated by Corps of Engineers.
[4] Highest since 1876.

FLOODS OF APRIL 30 TO MAY 3 IN THE BRAZOS RIVER AND COLORADO RIVER BASINS IN TEXAS

Extensive flooding occurred April 29 to May 3, 1956, in the Brazos River and Colorado River basins in central Texas after severe thunderstorms and heavy rains, caused by a series of squall lines that combined with a stationary front extending generally along a line from Fort Stockton in west Texas to Waco in central Texas and northeastward. The most severe flooding and the heaviest rainfall was in an area of about 25,000 square miles (fig. 15). Three precipitation stations reported more than 10 inches of rain, and 18 others reported more than 5 inches.

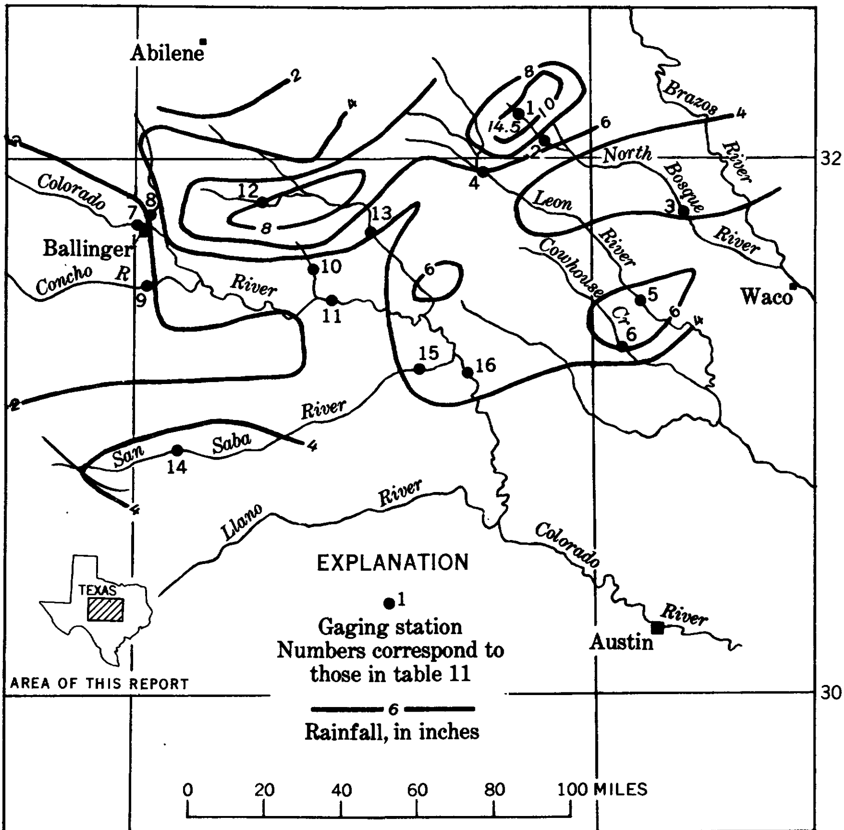

FIGURE 15.—Map of flood area showing location of flood-determination points and precipitation, in inches, for April 29 to May 3 for floods in the Brazos and the Colorado River basins in Texas.

Maximum rainfall reported was 14.54 inches at a site in the area—bounded by Dublin, Stephenville, and Hico—in the upper North Bosque River watershed. According to the Soil Conservation Service, the weighted-average rainfall was 9.49 inches in this area of greatest rainfall. Three miles northeast of Stephenville, Erath County, 11.57 inches of rain was measured during the period with a maximum intensity of 3 inches in 45 minutes on April 30. Up to 8 inches of rain in 2½ hours was reported as occurring in that area on April 30.

Peak discharges approached or were the highest of record at gaging stations in the North Bosque and Leon River subbasins (tributary to the Brazos River), on Elm and Mukewater Creeks, and in the Pecan Bayou subbasin (tributary to the Colorado River) (table 11).

The greatest peak discharge in the Brazos River subbasins was 55,800 cfs at Cowhouse Creek near Pidcoke on May 1. It was probably the largest discharge at that site since at least 1882.

The flood on Elm Creek at Ballinger (discharge, 38,500 cfs, May 1) was the greatest in 24 years of gaging record and reached the highest stage not affected by backwater from the Colorado River since at least 1904. The stage of Hords Creek at Coleman (discharge, 25,100 cfs) was highest since July 1932. The stage in 1932 was 2.6 feet higher at a site 6,000 feet downstream. Brownwood Reservoir on Pecan Bayou, 10 miles above the gaging station, reached the record-high content of 192,000 acre-feet on May 2, and the water level was 6.4 feet above spillway crest. The reservoir was first filled in July 1932. The Colorado River at Winchell reached the fourth-highest stage since at least 1924, and substantial flooding occurred on the San Saba River.

Flood damage was limited mainly to residential and agricultural properties and to highways and highway structures. No loss of life was reported, but highways were inundated and closed in the upper part of the North Bosque River basin. Seven and a half inches of rainfall in Valera on May 1 caused flooding in the Pecan Bayou subbasin, and 75 persons were rescued by boat. Mud, 18 inches thick, was deposited in flooded homes at Thrifty, northwest of Brownwood, and about 200 homes were evacuated in Brownwood on May 2. Gas lines were broken, telephone lines were down, and trains had to be rerouted.

Along the Brazos River and Tehuacana Creek below Waco, considerable flooding occurred which washed out about 30 bridges, flooded about 22,000 acres of crops, damaged about 80,000 acres of planted cropland, an destroyed about 100 miles of farm fences.

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TABLE 11.—*Summary of flood stages and discharges, April 30 to May 3, in the Brazos and Colorado River basins in Texas*

[Each station in this table has one or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Brazos River basin						
1	Green Creek subwatershed No. 1 near Dublin.	3.18	1955–56	Apr. 30, 1956	--------	9,910	3,120
2	Green Creek near Alexander.	45.5	1954–56	----do	23.95	23,900	525
				May 19, 1955	13.24	4,000	87.9
				May 23, 1952	28.0	55,800	1,230
3	North Bosque River near Clifton.	988	1923–56	May 2, 1956	27.82	29,900	30.3
				Apr. 22, 1945	[1] 23.2	39,000	39.5
				May 9, 1922	[1] 25	--------	--------
4	Leon River near Hasse	1,242	1939–56	May 1, 1956	20.18	30,700	24.7
				May 24, 1952	21.49	38,500	31.0
				May 1908	27	--------	--------
5	Leon River near Gatesville.	2,279	1950–56	May 1, 1956	31.06	25,300	11.1
				May 19, 1955	28.18	10,600	4.65
				May 1908	35	--------	--------
6	Cowhouse Creek at Pidcoke.	475	1950–56	May 1, 1956	38.76	55,800	117
				May 19, 1955	29.70	23,000	48.4
				1900, 1944	37.5	--------	--------
	Colorado River basin						
7	Colorado River at Ballinger.	16,840	1907–56	May 1, 1956	21.40	14,000	(2)
				Sept. 18, 1936	28.6	75,400	(2)
				1884	36	--------	--------
8	Elm Creek at Ballinger	458	1932–56	May 1, 1956	11.90	38,500	84.1
				May 14, 1946	10.84	32,800	71.6
				August 1906	[3] 14.6	--------	--------
9	Concho River near Paint Rock.	5,538	1915–56	May 1, 1956	--------	[4] 1,910	--------
				Sept. 17, 1936	43.4	301,000	54.4
				August 1882	40	--------	--------
10	Mukewater Creek at Trickham.	70.4	1951–56	May 1, 1956	15.83	15,000	213
				May 10, 1955	10.85	4,320	61.4
				1927	18	--------	--------
11	Colorado River at Winchell.	24,580	1923–34, 1939–56	May 1, 1956	44.55	57,800	(2)
				Oct. 15, 1930	51.8	76,100	(2)
				Sept. 19, 1936	62.2	--------	--------
12	Hords Creek at Coleman	107	1940–56	Apr. 30, 1956	21.50	25,100	235
				June 26, 1941	18.60	10,600	99.1
				June or September 1900.	(5)	--------	--------
13	Pecan Bayou at Brownwood.	1,614	1917–18, 1923–56	May 2, 1956	16.08	26,500	16.4
				Oct. 14, 1930	16.92	31,600	32.7
				September 1900	21.7	(6)	--------
14	San Saba River at Menard.	1,151	1915–56	May 1, 1956	17.54	48,000	41.7
				July 23, 1938	22.2	130,000	102
				June 5 or 6, 1899	23.3	--------	--------
15	San Saba River at San Saba.	3,042	1904–06, 1915–56	May 2, 1956	28.55	35,600	11.7
				July 23, 1938	[7] 45.18	203,000	66.7
				June 6, 1899	[7] 42.6	--------	--------
16	Colorado River near San Saba.	30,600	1915–56	May 3, 1956	32.75	54,100	(2)
				July 23, 1938	63.2	224,000	(2)
				Sept. 25, 1900	58.4	184,000	(2)

[1] At site 1.1 miles upstream. Flood of 1922 reached a stage of about 35 ft at present site.
[2] Cubic feet per second per square mile not indicative; approximately 11,900 sq mi of drainage area is probably noncontributing.
[3] Some backwater effect from Colorado River.
[4] Maximum daily discharge during flood period.
[5] Flood of 1900 was about 6.3 ft higher than that of Apr. 30, 1956, at point about 6,000 ft downstream.
[6] Flood of July 3, 1932, probably the greatest known, reached a discharge of about 235,000 cfs as flood entered Brownwood Reservoir 10 miles upstream.
[7] At site 1.8 miles downstream at datum 8.80 ft lower.

FLOODS OF MAY 14–16 IN SOUTHERN MISSOURI

Heavy rains fell over the southern part of Missouri on May 14–15 causing flooding in tributaries to upper reaches of the White River. The Weather Bureau station at Hailey reported 7.6 inches of rain for the 2-day period, and many other stations reported more than 6 inches (table 12). In a strip averaging about 30 miles wide and extending from Seligman to Ellington, the rainfall at Weather Bureau stations totaled more than 5 inches. The basins in the area of heaviest rainfall were those of Flat Creek, the lower part of James River, and the headwater tributaries to Current River.

Peak discharges were determined at 6 gaging stations and at 1 miscellaneous site (fig. 16) in the flood area. The peak discharges in Big

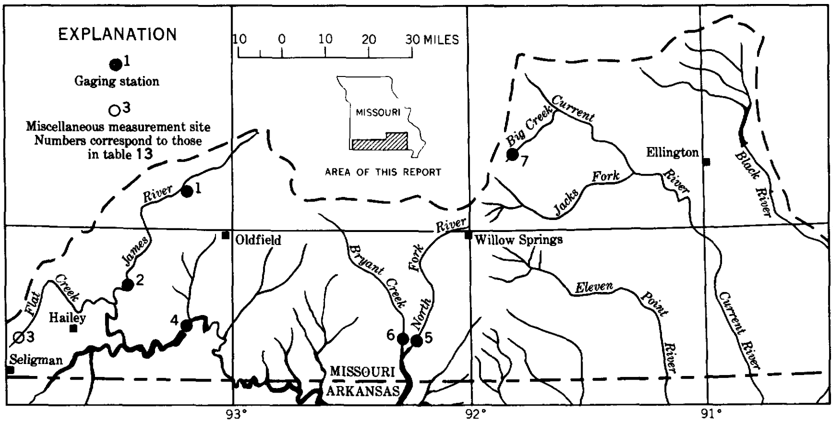

FIGURE 16.—Map of flood area showing location of flood-determination points for floods of May 14–16 in southern Missouri.

Creek, James River, and Flat Creek were exceptionally high (table 13). The peak discharge in Big Creek near Yukon was about equal to that of a 50-year flood, and the peak discharge in Flat Creek at Cassville was somewhat higher than that of a 50-year flood. The

TABLE 12.—*Rainfall at U.S. Weather Bureau stations in Missouri, May 14–15*

Station	Total rainfall (inches)	Station	Total rainfall (inches)	Station	Total rainfall (inches)
Neosho	2.96	Galena	6.90	Ava	5.61
Granby	2.78	Hailey	7.60	Vanzant	4.98
Anderson	4.85	Cassville	7.31	Willow Springs	5.94
Pierce City	3.42	Seligman	7.06	Houston	5.85
Monett	4.48	Lampe	6.15	Tyrone	5.12
Mount Vernon	2.88	Ozark Beach	4.82	Summersville	5.31
Springfield	2.94	Forsyth	5.14	Round Spring	6.56
Rogersville	4.26	Mountain Grove	5.20	Ellington	6.05
Ozark	5.97	Mansfield	4.81	Van Buren	3.00
Oldfield	6.17	Topaz	5.14	Eminence	5.35

peak discharges at the two gaging stations on the James River were more than three times as great as that of a 50-year flood. The stages of the James River and several of its tributaries were higher than any other remembered by residents. The peak discharges in White River, North Fork River, and Bryant Creek were each less than that of a 10-year flood.

Resorts on Lake Taneycomo sustained some flood damage and two persons were drowned near Cassville.

TABLE 13.—*Summary of flood stages and discharges, May 14–16, in the White River basin in southern Missouri*

[Each station in this table has one, two, or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
1	James River near Springfield	246	1955–56	May 15, 1956	15.20	12,400	504
				July 1909	22		
2	James River at Galena	987	1921–56	May 15, 1956	20.98	27,200	276
				May 20, 1943	29.82	52,700	534
3	Flat Creek at Cassville	32.6		May 14, 1956		8,970	275
4	White River near Branson	4,022	1951–56	May 16, 1956	36.9	89,100	22
				Mar. 21, 22, 1955	23.60	40,600	10
				Apr. 16, 1945	52.8	203,000	50
5	North Fork River near Tecumseh.	561	1944–56	May 15, 1956	15.65	22,100	39
				Jan. 4, 1950	18.05	27,400	49
6	Bryant Creek near Tecumseh	570	1944–56	May 15, 1956	19.64	26,800	47
				Jan. 4, 1950	19.50	26,500	46
7	Big Creek near Yukon	8.36	1949–56	May 15, 1956	6.15	4,860	581
				July 7, 1949	5.78	3,510	420
				April 1945	10.5		

FLOODS OF MAY IN THE SNAKE RIVER BASIN, IDAHO

During the spring of 1956 runoff was high in many parts of the Columbia River basin on streams fed by high elevation snow fields. The cause is apparent when the results of snow surveys, and climatological data for May are considered. The surveys of May 1 showed unusually heavy snow packs at high elevations. The snow was at high density, which favored rapid melting under warm-weather conditions or heavy rainfall. The water content of snow measured in the Salmon River basin (fig. 17) was 29 inches (about 145 percent of normal) and had a density of nearly 50 percent. Although temperatures during the first half of May were cool, those during the second half were warm enough to bring the monthly average temperatures above the long term means. Above-average rainfall was measured at many precipitation stations.

Monthly averages of runoff for May were exceeded at several gaging stations. New maximums were not outstandingly higher than previ-

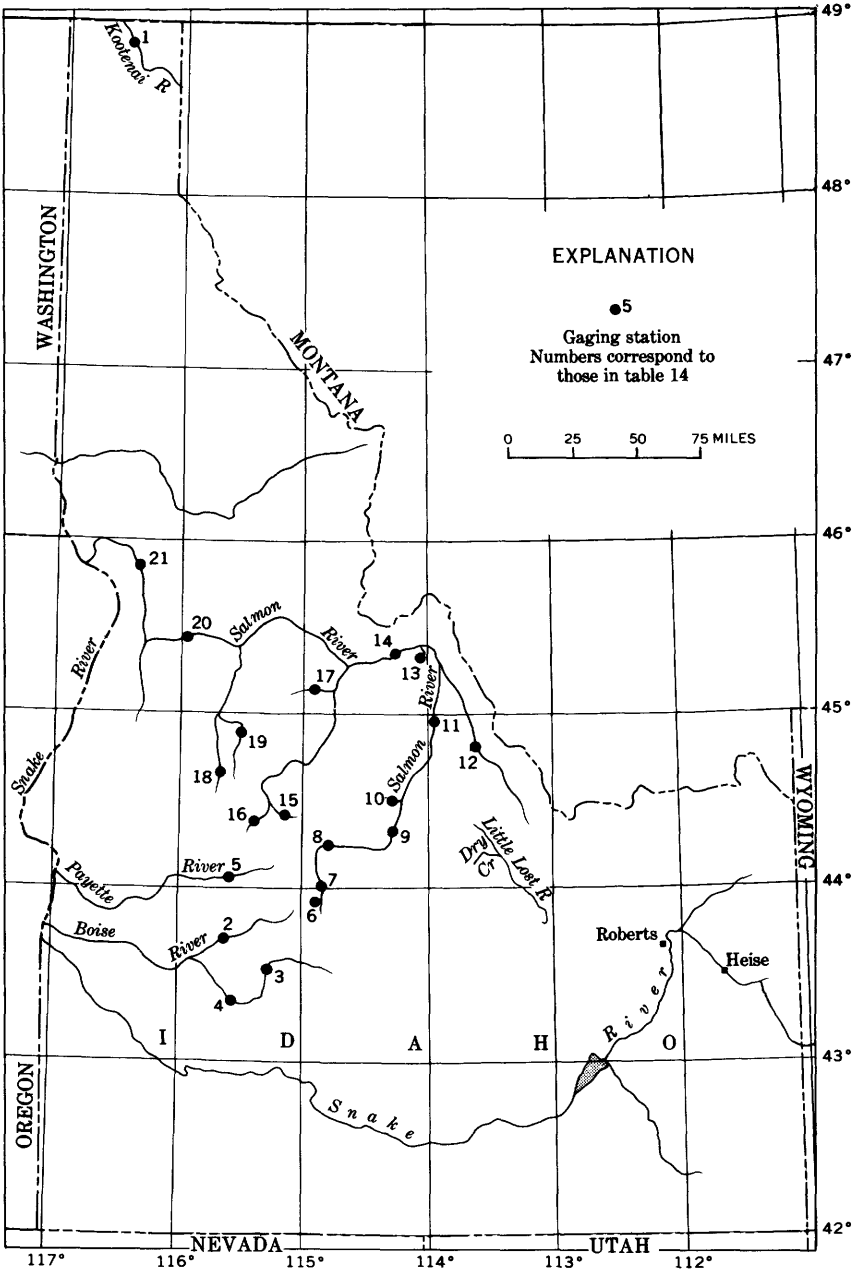

FIGURE 17.—Map of flood area showing location of flood-determination points for floods of May in the Snake River basin, Idaho.

ous maximums but were consistently higher in some areas, particularly in the Salmon River basin (table 14).

The flood height of the Kootenai River is affected by the failure of dikes, and about 20,000 acres of land were flooded when some dikes failed. The dikes which had been raised since the floods of 1948 held at Bonners Ferry, and the peak stage was 1.5 feet higher than the previous maximum although the peak discharge was less.

TABLE 14.—*Summary of flood stages and discharges in May in the Snake River basin, Idaho*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods		
				Date	Gage height (ft)	Discharge (cfs)
1	Kootenai River at Bonners Ferry	13,000	1927–56	May 22, 23, 1956	[1] 37.09	127,000
				May 27, 1948	[2] 35.55	139,000
				June 1894	34.2	
2	Boise River near Twin Springs	830	1911–56	May 24, 1956	8.76	11,200
				May 17, 1927	8.30	10,300
3	South Fork Boise River near Featherville	635	1945–56	May 24, 1956	8.62	7,580
				Apr. 28, 1952	7.47	5,530
4	South Fork Boise River at Anderson Ranch Dam.	982	1943–56	May 25, 1956	10.56	9,850
				Apr. 17, 1943	10.06	9,100
5	South Fork Payette River at Lowman	456	1941–56	May 24, 1956	7.45	7,050
				May 21, 1954	6.83	5,450
6	Valley Creek at Stanley	176	1911–13, 1921–56	May 24, 1956	3.92	2,000
				May 29, 1921	4.4	1,850
7	Salmon River below Valley Creek at Stanley.	535	1925–56	May 27, 1956	4.62	5,070
				June 27, 1927	4.41	5,020
8	Salmon River below Yankee Fork, near Clayton.	841	1921–56	May 24, 1956	11.60	10,300
				June 27, 1927		8,000
9	Salmon River near Challis	1,800	1928–56	May 25, 1956	10.95	15,400
				May 28, 1951	8.74	10,600
10	Challis Creek near Challis	85	1943–56	June 1, 1956	[1] 6.30	508
				June 4, 1948	2.30	418
11	Salmon River at Salmon	3,760	1912–16, 1919–56	May 25, 1956	8.25	16,500
				June 12, 1921	[3] 9.62	16,400
12	Lemhi River near Lemhi	890	1938–39, 1955–56	[4]	3.51	1,090
				May 31, 1939	2.42	758
13	Panther Creek near Shoup	529	1944–56	May 25, 1956	4.30	2,740
				June 13, 1953	4.30	2,640
14	Salmon River near Shoup	6,270	1944–56	May 26, 1956	13.00	24,900
				June 4, 1948	7.90	16,900
15	Middle Fork Salmon River near Cape Horn.	138	1929–56	May 24, 1956	6.96	2,980
				[5]	6.26	2,340
16	Bear Valley Creek near Cape Horn	180	1921–56	May 27, 1956	5.87	3,860
				June 9, 1933	5.49	3,450
17	Big Creek near Big Creek	470	1944–56	May 24, 1956	7.39	5,220
				June 3, 1948	7.12	5,800
18	South Fork Salmon River near Knox	92	1928–56	May 27, 1956	6.33	1,620
				June 9, 1933		1,560
19	Johnson Creek at Yellow Pine	213	1928–56	May 27, 1956	7.64	5,440
				June 9, 1933	7.62	5,150
20	Salmon River near French Creek	12,270	1944–56	May 24, 1956	34.85	88,600
				May 29, 1948	33.50	82,800
21	Salmon River at White Bird	13,550	1910–17, 1919–56	May 24, 1956	33.05	106,000
				June 3, 1948	32.95	103,000
				June 1894	27.5	130,000

[1] Occurred May 24, 1956.
[2] Occurred May 21, 1954.
[3] Occurred Jan. 8, 1942 (ice jam).
[4] Probably June 1, 1956.
[5] June 9, 1933; about May 31, 1943; June 3, 1948.

The Weather Bureau estimated that damages totaled almost $6 million in the Kootenai basin. Most of the damage was to railroads, bridges, and highways and to growing crops.

Some flood damage occurred along the Snake River between Heise and Roberts, near Idaho Falls. Runoff of the Snake River at Heise was the third highest of record. Greater flood damage was prevented by the operation of irrigation reservoirs. However, an irrigation dam failed on Dry Creek, tributary to Little Lost River, causing the loss of two lives and some property damage downstream.

FLOODS OF MAY 25 TO JUNE 6 IN WYOMING

Floods occurred in widely scattered areas in Wyoming in three periods during the last part of May and the first part of June.

Heavy localized rains on May 25–26 produced minor floods on Poison Creek near Shoshoni, Badwater Creek at Bonneville, and Sybille Creek above Bluegrass Creek, near Wheatland (fig. 18). A flood on Hams Fork near Elk Creek ranger station, which peaked on May 25, was affected by snowmelt. Maximum discharges during the period of record occurred on all except Poison Creek; however, the maximums on Badwater Creek and Poison Creek were greatly exceeded during the flood of July 24, 1923 (table 15).

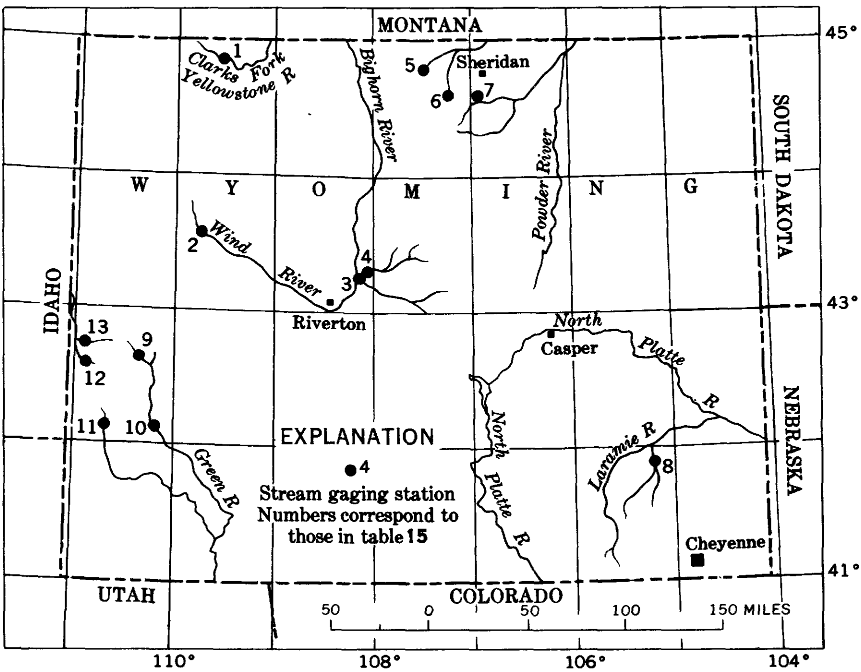

FIGURE 18.—Map showing locations of flood-determination points for floods of May 25 to June 6 in Wyoming

Snowmelt or a combination of rainfall and snowmelt caused maximum discharges of record on several streams in the north-central part of the State—South Fork Tongue River near Dayton, Wolf Creek at Wolf, and North Piney Creek near Story crested on May 28. Higher stages have been observed on South Fork Tongue River and Wolf Creek prior to the establishment of the gaging stations.

High temperatures in late May and in early June caused snowmelt that resulted in peaks on six streams in the northwestern part of the

TABLE 15.—*Summary of flood stages and discharges, May 25 to June 6, in Wyoming*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	oStream and place f determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
			Yellowstone River basin				
1	Clarks Fork Yellowstone River below Crandall Creek near Painter.	446	1929–32, 1949–56	June 1, 1956	9.67	7,740	--------
				June 13, 1953	9.38	7,310	--------
2	Wind River near Dubois	233	1945–56	June 2, 1956	5.66	1,910	--------
				June 17, 1951	5.43	1,720	--------
3	Poison Creek near Shoshoni	519	1949–53, 1955–56	May 25, 1956	3.23	1,560	--------
				July 24, 1955	4.38	2,350	--------
				July 24, 1923	--------	[1] 3,000	--------
4	Badwater Creek at Bonneville	790	1947–56	May 25, 1956	6.6	7,260	--------
				July 22, 1947	6.27	4,690	--------
				July 24, 1923	--------	18,600	--------
5	South Fork Tongue River near Dayton.	85.0	1945–56	May 28, 1956	5.62	1,120	--------
				May 21, 1948, June 15, 1953	[2] 5.61	1,070	--------
				--------	6.36	--------	--------
6	Wolf Creek at Wolf	37.8	1945–56	May 28, 1956	3.93	586	15.5
				June 22, 1948	3.44	442	11.7
				May 18, 1944	5.0	--------	--------
7	North Piney Creek near Story	37.7	1951–56	May 28, 1956	4.57	1,230	32.6
				May 29, 1953	3.30	530	14.1
			Platte River basin				
8	Sybille Creek above Bluegrass Creek, near Wheatland.	265	1941–56	May 26, 1956	5.90	1,870	--------
				June 5, 1949	4.62	1,100	--------
			Green River basin				
9	North Piney Creek near Mason	58	1915–16, 1931–56	June 2, 1956	4.38	619	--------
				June 19, 1916	3.93	613	--------
10	Green River near Fontenelle	3,970	1946–56	June 6, 1956	8.33	13,300	--------
				May 31, 1951	8.11	12,300	--------
11	Hams Fork near Elk Creek ranger station.	128	1952–56	May 25, 1956	7.36	1,010	--------
				June 14, 1953	6.44	664	--------
			Salt River basin				
12	Cottonwood Creek near Smoot	26.3	1932–56	June 2, 1956	3.31	438	16.7
				June 18, 1951	3.07	399	15.2
13	Swift Creek near Afton	27.4	1942–56	June 3, 1956	3.37	565	20.6
				June 10, 1948	[3] 3.41	560	20.4

[1] Estimated by Bureau of Reclamation.
[2] Occurred May 21, 1948.
[3] Occurred May 28, 1957.

State, which were greater than previous maximums. Clarks Fork Yellowstone River below Crandall Creek near Painter crested on June 1, Wind River near Dubois, North Piney Creek near Mason, and Cottonwood Creek near Smoot peaked on June 2, Swift Creek near Afton on June 3, and Green River near Fontenelle on June 6. There were no reports of any extensive damage.

FLOODS OF MAY 27–29 IN EAST-CENTRAL ILLINOIS

Late on May 26 the first of a series of heavy thundershowers occurred northeast of Farmer City, chiefly over streams in the Salt Creek basin. A few hours later there were more heavy showers to the east, principally over the Sangamon River basin but also extending into the Vermilion River basin. The heaviest rainfall extended on an axis eastward from Le Roy through Rantoul and southeastward toward Danville; the maximum total measured was 13.1 inches. Peak discharges at stations nearest the center of the storm were the highest for periods of record extending to 1944.

The Illinois State Water Survey made an extensive field survey of the storm area by collecting and analyzing data. A report including isohyetal maps, depth-duration-area data, and mass rainfall curves has been published in Report of Investigation 35, Hydrometeorological Analysis of Severe Rainstorms in Illinois, 1956–57. Figure 19 shows the distribution of rainfall of the May 26–27 storm, and the points at which peak discharges were determined.

Salt Creek overflowed its banks and was a mile wide for much of a 20-mile reach. Kickapoo Creek flooded in similar fashion for more

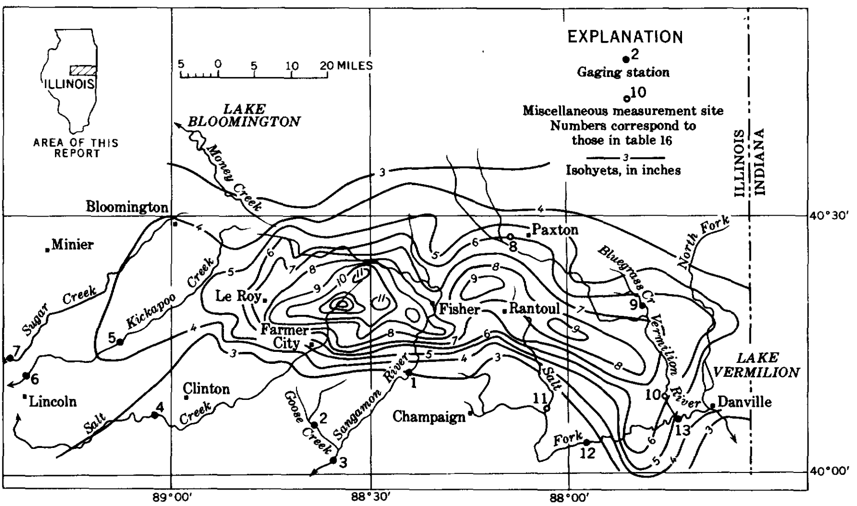

FIGURE 19.—Map of flood area showing isohyets for total rainfall, in inches, May 26–27, and sites of peak-discharge determination for floods in east-central Illinois.

than 10 miles. The peak discharge on Salt Creek near Rowell was second only to the flood of May 18, 1943. On Kickapoo Creek near Lincoln the peak was the highest since establishment of the station in 1944; however, upstream at Waynesville the peak was exceeded in 1950 (table 16).

TABLE 16.—*Summary of flood stages and discharges, May 27–29, in east-central Illinois*

[Each station in this table has one, two, or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
	Illinois River Basin						
1	Sangamon River at Mahomet	356	1948–56	May 28, 1956	19.96	14,600	41.0
				Feb. 22, 1951	16.88	9,100	25.6
2	Goose Creek near Deland	47.3	1951–56	May 28, 1956	6.35	326	6.9
				June 7, 1954	11.21	1,400	29.6
3	Sangamon River at Monticello	550	1908–12, 1914–56	May 29, 1956	16.56	13,600	24.7
				Oct. 4, 1926	18.50	19,000	34.5
4	Salt Creek near Rowell	334	1942–56	May 28, 1956	23.67	10,300	30.8
				May 18, 1943	24.77	12,400	37.1
5	Kickapoo Creek at Waynesville	227	1948–56	May 27, 1956	14.01	6,500	28.6
				Apr 25, 1950	15.02	8,300	36.6
6	Kickapoo Creek near Lincoln	306	1944–56	May 28, 1956	13.29	7,800	25.5
				Apr. 26, 1950	13.66	7,400	24.2
				July 6, 1929	17.4		
7	Sugar Creek near Hartsburg	335	1944–56	May 28, 1956	14.06	10,100	30.1
				Apr. 30, 1947	14.44	8,500	25.4
	Wabash River Basin						
8	Unnamed Creek near Paxton	0.896	1956	May 27, 1956	14.18	177	198
9	Bluegrass Creek at Potomac	34.5	1949–56	May 28, 1956	11.43	4,380	127
				July 9, 1951	10.72	3,540	103
10	Middle Fork Vermilion River near Danville.	417		May 29, 1956	556.3	21,000	50.4
11	Salt Fork Vermilion River at St. Joseph.	145		May 29, 1956	661.8	6,380	44.0
12	Salt Fork Vermilion River near Homer.	344	1944–56	May 29, 1956	10.45	3,020	8.8
				Jan. 4, 1950	14.36	6,170	17.9
				March 1939	18.6		
13	Vermilion River near Catlin	969	1940–56	May 29, 1956	17.45	13,200	13.6
				May 18, 1943	23.35	36,000	37.2
				March 1939	[1]24.4		

[1] Maximum since 1903.

On the Sangamon River the flood was the maximum in 10 years of record at Mahomet, and downstream, at Monticello outside the flood area, the peak was highest since the 1943 flood and fourth highest in 46 years of record. At Fisher, a long-term resident described the flood as the highest in 40 years.

Farther east in the Vermilion River basin, tributary to the Wabash River, peaks at gaging stations were not outstanding except on Bluegrass Creek at Potomac, which was the highest in 7 years of record.

To the northwest, the rains in the Lake Bloomington drainage area resulted in a 5.9-foot rise in lake level, sufficient to end a critical water shortage.

The principal damage in the Salt Creek basin was in the Farmer City area. The intersection of U.S. Highways 54 and 150 was under 3 feet of water, and all traffic was stopped. Damage to a restaurant and an automobile salesroom near the intersection totaled more than $10,000. Basements were flooded and several homes evacuated in Farmer City. Near Weedman, 3 miles northeast, 50 sheep drowned and 12 storage bins containing 66,000 bushels of corn burst open.

U.S. Highway 51 was blocked by a washout near Heyworth. There were two washouts on the Gulf, Mobile, and Ohio Railroad near Minier and one on the New York Central Railroad tracks near Le Roy. Trains on the Peoria and Eastern Railway and the New York, Chicago, and St. Louis Railroad lines were delayed or rerouted because of culvert washouts or weakened bridges.

Much of the flooded area was rural, and damage consisted of the drowning of thousands of acres of young corn and soybeans. Quick runoff from the intense rains caused erosion on farmlands and resulted in gullies 1 to 20 feet wide. Several county-road and farm bridges were washed out.

At Fisher, school was recessed for a day because of water in the school basement and because bus service was halted. U.S. Highway 136 was washed out by the Sangamon River between Fisher and Dewey. Parts of Rantoul were flooded and a few families were evacuated.

Two children were drowned in the flood, one in Salt Creek near Middletown and one in a creek near Rossville.

FLOODS OF MAY 28–31 IN CENTRAL INDIANA

Heavy rains began on May 25 and were climaxed by torrential showers on the morning of May 28 (table 17). From 3 to 4 inches of rain fell in 3 or 4 hours over the headwaters of Eagle Creek north of Indianapolis and over Fall Creek and other small streams in eastern and southeastern Indianapolis (fig. 20). Eagle Creek and other small streams overflowed an area of 40 to 50 square blocks and partly submerged hundreds of automobiles. About 2,000 families were evacuated, mostly in the eastern and southeastern part of the city where water was as much as 6 feet deep in many streets.

The Pennsylvania Railroad spur bridge south of the Washington Street bridge, which had been in use since 1913, was washed out owing to debris piled against its supports.

Some homes in southern Indianapolis were flooded or surrounded by water, and the water moved on to flood many thousands of acres

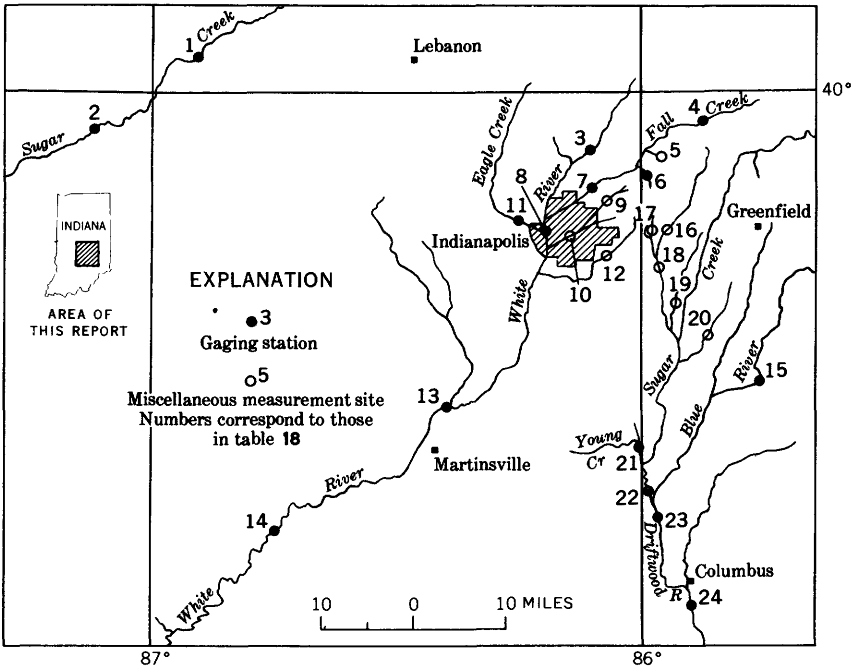

FIGURE 20.—Map of flood area showing location of flood-determination points for floods of May 28–31 in central Indiana.

TABLE 17.—*Rainfall, in inches, at selected U.S. Weather Bureau stations, in Indiana, May 26–31*

[T=Trace, or less than 0.01 inch]

Station	26	27	28	29	30	31	Total
Crawfordsville	T	2.18	3.01	T	T	1.35	6.54
Whitestown	0.51	4.06	2.84	0.17	0.07	.42	8.07
Noblesville	0	1.35	1.50	.46	0	.30	3.61
Anderson	.21	2.02	.50	T	T	.44	3.17
Pendleton Reformatory	2.00	1.80	T	.25	.30	0	4.35
New Castle	0	.76	1.85	.04	0	.17	2.82
Greenfield	1.30	2.30	2.58	.26	.03	.10	6.57
Knightstown	0	1.47	2.60	1.10	0	.24	5.41
Indianapolis Weather Bureau	.72	1.40	.60	T	.24	.05	3.01
Indianapolis Monument Circle	0	1.00	4.06	.67	.01	.24	5.98
Indianapolis Southeast Side	T	1.38	2.82	1.13	T	.27	5.60
Rushville	0	.78	1.82	.67	0	.33	3.60
Martinsville	.10	1.68	.92	.93	T	.85	4.54
Greensburg	.46	2.02	1.51	.05	T	.91	4.95
Columbus	0	.90	.20	0	0	.56	1.66
Cambridge City	0	1.73	1.70	.07	T	.28	3.78
Frankfort	.26	1.21	.50	.05	.63	.37	3.02
Fort Benjamin Harrison	.02	2.11	5.33	1.10	0	0	8.56
Geist Reservoir	.27	3.38	3.10	0	.15	0	6.90
Lewisville	.29	2.11	.58	0	.19	.20	3.37
Waldron	0	2.20	2.10	.28	.30	.09	4.97
Franklin	.55	1.04	2.57	0	.78	.02	4.96
Lebanon	.63	2.82	3.68	0	.64	.98	8.75
Waveland	.69	1.02	.66	.04	.31	.35	3.07

of corn, hay, or other crops downstream. Only one main highway into the city remained open.

Heavy rains in the headwaters of the East Fork White River above Columbus caused flash floods in Sugar Creek, Flat Rock Creek, and Blue River. A levee at the juntcion of Big Sugar and Little Sugar Creeks gave way for the first time since 1913. Sugar Creek flooded U.S. Highway 31 near Edinburg to a depth of 5 or 6 feet and forced rerouting of Pennsylvania Railroad trains around Edinburg because tracks were washed out and a bridge was submerged. Farther downstream, the water of East Fork of White River flooded thousands of acres of corn, hay, and other crops before it receded at the end of May. The White River at Spencer overflowed its banks, closed several highways, inundated several thousand acres of cropland, and forced the evacuation of several families from southwest Spencer.

Hundreds of county bridges on small streams were destroyed in Marian County.

One death is known to have been caused by the flood.

The peak discharges in Sugar Creek near Byron and at Crawfordsville (tributary to the Wabash River) were the highest since 1950. An unusual feature of the flood was that the extremely high discharges on major streams resulted from rainfall over a comparatively small part of the drainage area. For example, White River near Nora, the next station upstream from White River at Indianapolis, had its peak a day later than Indianapolis and did not experience a major flood. Fall Creek at Fortville (drainage area, 172 sq mi), upstream from Fall Creek at Millersville, did not experience a particularly large flood; however, Fall Creek at Millersville (drainage area, 313 sq mi) reached the highest stage since 1913. The White River at Indianapolis, fed primarily by Fall Creek and local drainage within the city, reached the highest stage since 1943 (table 18).

Lawrence Creek at Fort Benjamin Harrison, a tributary of Fall Creek near the center of the storm, had the highest runoff in its period of record, which began in 1952. Eagle Creek at Indianapolis exceeded any stage during its period of record since 1938. On the White River itself, no records were exceeded from this flood; however, in the East Fork White River, the discharge at Sugar Creek near Edinburg and Driftwood River near Edinburg far exceeded those for the periods of record, which began in 1943 and 1941, respectively. The discharge of Sugar Creek was noteworthy because this flow came primarily from a relatively small part of the drainage area, as Blue River at Shelbyville and Youngs Creek near Edinburg had no notable flooding. At East Fork White River at Columbus enough noncontributing drainage area had been added so that, although it was a flood of large magnitude, the crest did not approach record-breaking heights. Many flood discharges from small drainage areas were determined at miscellaneous sites in the heart of the storm center.

The flood in this area was a major flood of rare occurrence. Figure 21 shows the relation of the peak discharge of all stations in table 18, with the exception of those on the White River, to the 10-year and the 50-year flood (Green and Hoggatt, 1690). The peak discharges of all stations in the headwaters of the White River, with the exception of Eagle Creek and the peak discharges of all stations above Edinburg, with the exception of Youngs Creek, was of a magnitude greater than a 50-year flood.

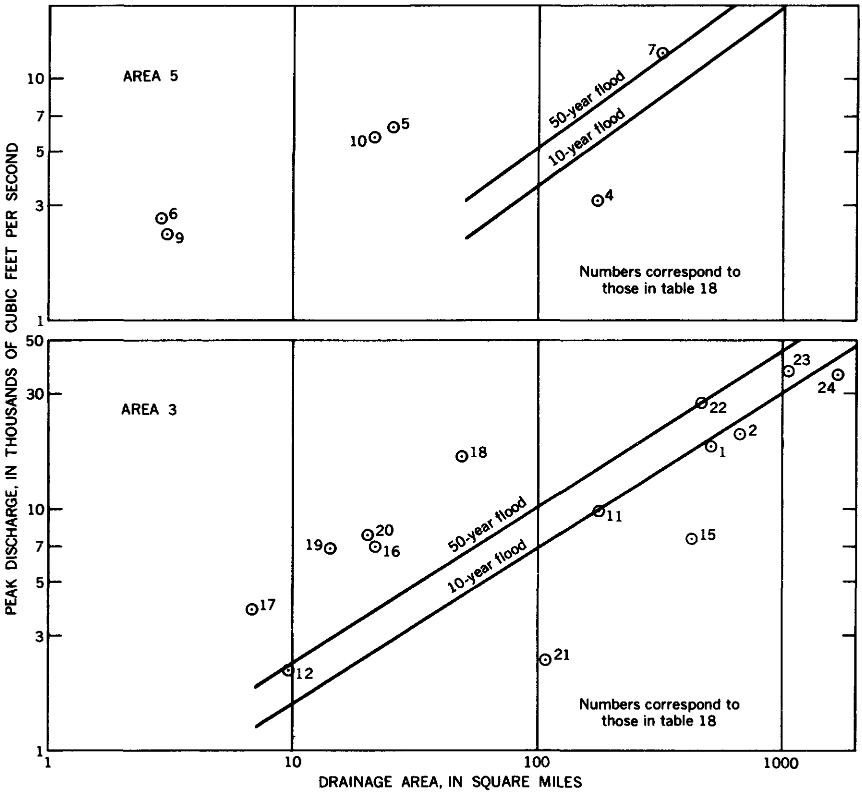

FIGURE 21.—Relation of peak discharges to 10- and 50-year floods in central Indiana.

TABLE 18.—*Summary of flood stages and discharges, May 28–31, in Wabash River basin in central Indiana*

[Each station in this table has one, two, or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Maximum floods: Gage height (ft)	Discharge: Cfs	Discharge: Cfs per sq mi
1	Sugar Creek at Crawfordsville	509	1938–56	May 28, 1956	12.33	18,200	35.8
				May 18, 1943	14.02	24,000	47.2
				March 1913	17.3	36,000	70.7
2	Sugar Creek near Byron	668	1940–56	May 29, 1956	17.34	20,600	30.8
				May 18, 1943	20.68	28,700	43.0
3	White River near Nora	1,200	1929–56	May 29, 1956	13.11	12,000	10.0
				May 19, 1943	18.19	32,400	27.0
				Mar. 26, 1913	22.4	58,500	48.8
4	Fall Creek near Fortville	172	1941–56	May 28, 1956	7.93	3,130	18.2
				May 18, 1943	9.77	8,240	47.9
5	Indian Creek near Oaklandon	25.2	----------	May 28, 1956	--------	6,340	252
6	Lawrence Creek at Fort Benjamin Harrison.	2.86	1952–56	May 28, 1956	9.32	2,650	927
				Feb. 25, 1956	6.36	1,390	486
7	Fall Creek at Millersville	313	1929–56	May 28, 1956	13.53	12,900	41.2
				May 18, 1943	[1] 11.77	11,100	35.5
				Mar. 26, 1913	16.3	22,000	70.3
8	White River at Indianapolis	1,627	1904–06, 1930–56	May 28, 1956	680.20	31,200	19.2
				May 18, 1943	[2] 681.57	37,200	22.9
				Mar. 26, 1913	690.00	70,000	43.0
9	Pleasant Run Creek at Shadeland Ave., Indianapolis.	3.03	----------	May 28, 1956	--------	2,280	752
10	Pleasant Run Creek at Madison Ave., Indianapolis.	212	----------	do	--------	5,760	272
11	Eagle Creek at Indianapolis	179	1938–56	do	13.62	9,920	55.4
				May 11, 1943	[3] 13.03	9,660	54.0
				March 1913	16.0	--------	--------
12	Lick Creek at Beech Grove	9.56	----------	May 28, 1956	--------	2,140	224
13	White River near Centerton	2,435	1946–56	May 29, 1956	16.25	35,400	14.5
				Jan. 6, 1950	--------	43,000	17.7
				March 1913	--------	90,000	37.0
14	White River at Spencer	2,980	1925–56	May 31, 1956	21.37	37,400	12.6
				May 15, 1933, Jan. 16, 1937	23.2	59,400	19.9
				Mar. 26, 1913	28.5	100,000	33.6
15	Blue River at Shelbyville	425	1943–56	May 29, 1956	14.29	7,560	17.8
				Jan. 5, 1949	--------	14,800	34.8
16	Buck Creek at Cumberland	21.7	----------	May 28, 1956	--------	6,960	321
17	Grassy Creek near Cumberland	6.89	----------	do	--------	3,840	557
18	Buck Creek near Indianapolis	49.5	----------	do	--------	16,600	335
19	Little Sugar Creek at Pleasant View.	14.2	----------	do	--------	6,900	486
20	Snail Creek near Fairland	20.1	----------	do	--------	7,820	389
21	Youngs Creek near Edinburg	109	1942–56	do	8.76	2,370	21.7
				Jan. 27, 1952	13.4	10,700	98.2
22	Sugar Creek at Edinburg	462	1943–56	May 29, 1956	18.38	27,600	59.7
				Nov. 17, 1955	16.58	18,200	39.4
23	Driftwood River near Edinburg	1,054	1941–56	May 29, 1956	16.80	37,500	35.6
				Jan. 27, 1952, Nov. 17, 1955	[4] 16.55	34,500	32.7
				March 1913	20.3	--------	--------
24	East Fork White River at Columbus.	1,692	1948–56	May 30, 1956	14.22	36,500	21.6
				Jan. 28, 1952	16.00	48,700	28.9
				March 1913	17.9	100,000	59.1

[1] Occurred May 14, 1933.
[2] Occurred Jan. 16, 1937.
[3] Occurred Jan. 4, 1950.
[4] Occurred Jan. 27, 1952.

FLOOD OF JUNE 4 ON CLEAR CREEK, COLO.

Rapid snowmelt early in June increased the storage in White Reservoir until Georgetown Dam failed on June 4. The peak discharge at the Clear Creek station near Lawson (fig. 22), about 3 miles downstream from the dam, was 6,130 cfs, the maximum of record and about three times as great as the peak discharge which might be expected during a year of heavy snow cover. The previous maximum of record (1946–56) was 2,230 cfs, which was also caused by failure of Georgetown Dam on June 9, 1952. There was considerable damage to U.S. Highway 6–40, to bridges on secondary roads, and to homes, business establishments, and small mines in and near the town of Idaho Springs. The peak discharge in Clear Creek diminished to 5,250 cfs at the gaging station near Golden about 25 miles downstream. The maximum peak discharge near Golden during the period of record (1908–9, 1911–56) was 5,890 cfs on September 9, 1933, and the maximum peak discharge known at the station 5½ miles upstream was 8,700 cfs on August 1, 1888, from reports of State engineer.

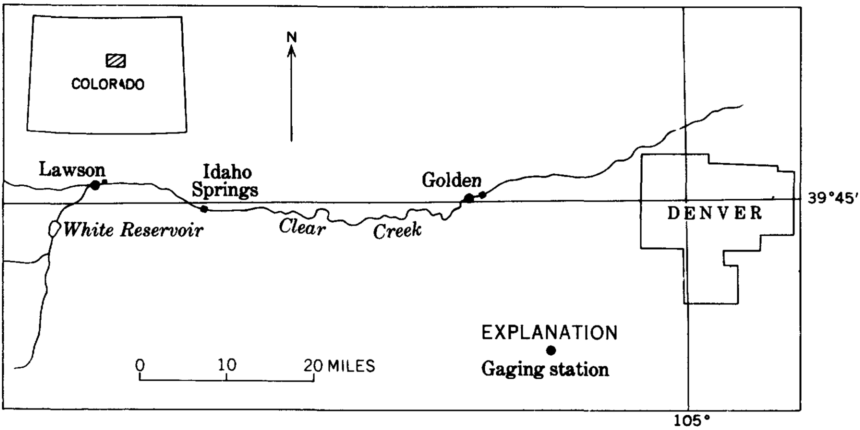

FIGURE 22.—Map showing location of flood-determination points for floods of June 4 on Clear Creek, Colo.

FLOODS OF JUNE 16–18 IN FRENCHMAN CREEK BASIN, NEBRASKA

Heavy rainfall during the evening of June 16 in the southwest corner of Nebraska adjacent to Colorado and Kansas caused flooding in the Frenchman Creek basin from Enders Reservoir to the mouth of Frenchman Creek.

The highest peak discharge observed and the greatest amount of damage occurred at Wauneta.

Precipitation was relatively light above Enders Reservoir and the peak discharge into the reservoir, determined at the gaging station near Imperial, was small (824 cfs) compared with previous peaks (1,860 cfs) of June 14, 1943, and May 21, 1951.

Precipitation data collected by the U.S. Weather Bureau and U.S. Bureau of Reclamation indicate that a single storm pattern developed and released rainfall in amounts ranging from 2 to 9 inches from about 6:00 p.m. to 9:00 p.m., June 16. At Wauneta, 2.50 inches fell between 6:45 p.m. and 7:00 p.m., 3.00 inches fell between 7:00 p.m. and 8:00 p.m., and light rain after 8:00 p.m. brought the total rainfall to 5.90 inches. Rainfall data (table 19) was compiled by the Weather Bureau from field notes made by Bureau of Reclamation personnel investigating the unofficial observations of precipitation made by residents.

TABLE 19.—*Rainfall, June 16, in the vicinity of Wauneta, Nebraska*

Location	Rainfall (inches)	Location	Rainfall (inches)	Location	Rainfall (inches)
Wauneta: [1]		Enders [2]—Continued		Enders [2]—Continued	
4 NW	4.8	5 NE	5+	8 SW	2.5
5 NW	5.0	5 NE	[3] 6	9 SW	1.5
4 NNW	5.5	6 NE	5.0	1 W	4.5
13 NNW	5−	7 NE	4.7	Imperial:	
2 NNE	4.78	8 NE	4.0	2 N	2.5
1 E	4.5	9 NE	4.0	3 N	2.25
2 S	4.25	3 E	5+	3 ENE	6.0
9 SSW	4.3	3 SE	4.5	1 E	2.0
3 SW	4.8	4 SE	3.6	4 E	6.5
4 SW	2.9	5 SE	4.3	5 E	[3] 8
5 SW	3.8	7 SSE	4.9	7 E	6.0
8 SW	4.5	5 S	4.0	7 E	9.0
9 SW	3.8	7 S	3.2	3 ESE	2.5
10 SW	4.0	5 SSW	3.8	2 SE	2.11
3 W	4.0	5 SW	4.0	5 SE	4.45
Enders: [2]		6 SW	3.0	6 SE	6.0
3 NE	7.0	7 SW	2.9		

[1] Rainfall, 5.90 inches.
[2] Rainfall, 5.7 inches.
[3] Estimated.

Figure 23 shows: the area affected by this storm; isohyetal lines for total rainfall, in inches, on June 16; and sites of the peak-discharge determinations. The isohyetal lines shown are based on those developed by the U.S. Army Corps of Engineers, Kansas City district.

The heaviest rainfall was concentrated in a narrow area north-northwest of Wauneta and covered parts of both Spring Creek (tributary to Stinking Water Creek) and Frenchman Creek basins.

The peak discharge on Spring Creek near the point of heaviest rainfall was not determined, but on Stinking Water Creek near Palisade the peak discharge of 3,030 cfs was the maximum for the period 1949–56 (table 20) and was almost 3½ times as great as the previous maximum.

A peak discharge of 9,270 cfs on Frenchman Creek at Wauneta was determined by the U.S. Army Corps of Engineers from a slope-area survey. Residents, who had lived in the town for at least 50 years,

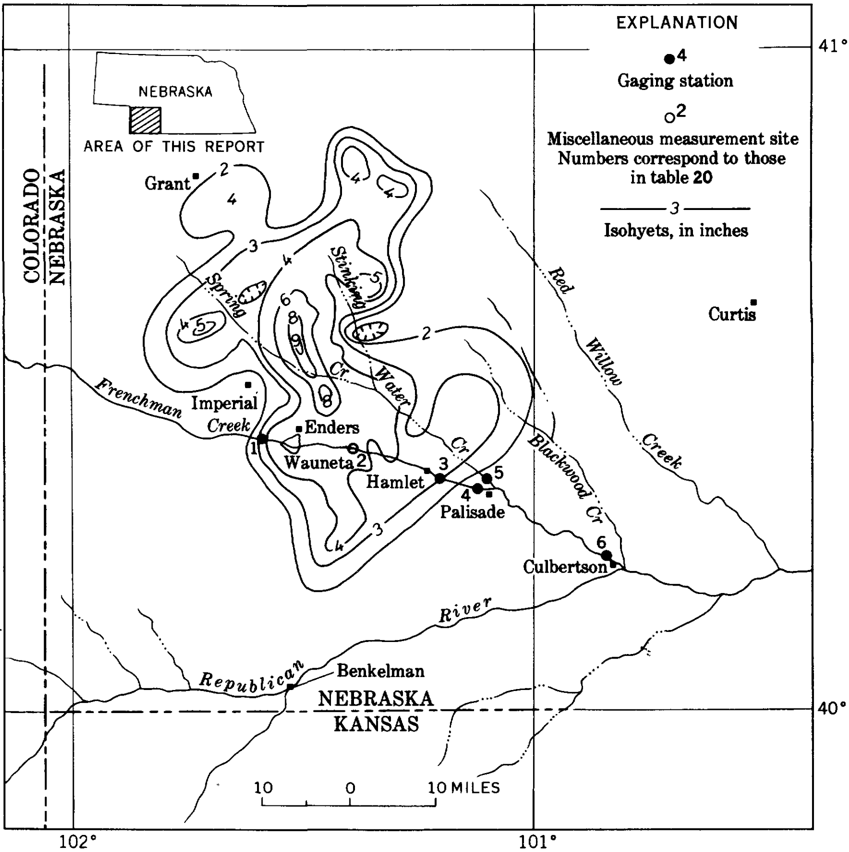

FIGURE 23.—Map of flood area showing location of flood-determination points and precipitation, in inches for June 16, for floods in Frenchman Creek basin, Nebraska.

reported that, in many respects, this flood exceeded the flood of June 6, 1940, which had previously been classed as the worst disaster in the history of the town.

Town officials estimated damage within Wauneta at about $150,000 and in the area immediately surrounding the town at $75,000. About 400 persons were evacuated from the town, 30 homes were damaged (6 or 7 beyond repair), and at almost every business place in town buildings, stock, and fixtures were damaged. Water in the Wauneta business section was reported to be from 3 to 5 feet deep. The powerplant and the waterplant ceased to operate when the diesel engines were flooded and water mains were washed out.

Several thousand acres of cropland were inundated north and northwest of the town and heavy damage resulted.

The superintendent at Enders Reservoir is credited with saving the lives of many Wauneta residents by telephoning a warning to the town when he observed the great amount of runoff pouring into Frenchman Creek from the north slopes just downstream from Enders Dam early in the evening of June 16. He immediately closed all gates in the dam so that no water would be released from Enders Reservoir to contribute to the flood downstream.

A log jam at the concrete bridge on the east edge of Wauneta seriously impeded the flood waters and increased the depth of flooding in the area immediately upstream.

The flood crest subsided appreciably as a result of channel storage between Wauneta and points downstream, as shown in table 20, and the peak discharge at Culbertson, which included the runoff of Stinking Water Creek, was only 3,350 cfs.

TABLE 20.—*Summary of flood stages and discharges, June 16–18, in Frenchman Creek basin, Nebraska*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods		
				Date	Gage height (ft)	Discharge (cfs)
1	Frenchman Creek near Imperial	[1] 1,220	1940–56	June 18, 1956	4.11	824
		[2] 760		June 14, 1943, May 21, 1951	[3] 7.00	1,860
2	Frenchman Creek near Wauneta			June 16, 1956		9,270
3	Frenchman Creek near Hamlet	[1] 1,480	1929–56	June 17, 1956	12.20	7,000
		[2] 960		June 7, 1940		2,400
4	Frenchman Creek at Palisade	[1] 1,500	1894–96, 1950–56	June 17, 1956	8.79	5,560
		[2] 980		June 17, 1951	7.44	[4] 1,630
5	Stinking Water Creek near Palisade	[1] 1,390	1949–56	June 17, 1956	11.30	3,030
		[2] 430		June 17, 1951	10.11	886
6	Frenchman Creek at Culbertson	[1] 3,080	1931–56	June 18, 1956	9.36	3,350
		[2] 1,560		May 31, 1935	14.8	15,000

[1] Total area.
[2] Contributing area.
[3] Occurred June 14, 1943.
[4] May have been exceeded June 30, 1896.

FLOODS OF JUNE 22 IN BLACKLICK CREEK AREA, OHIO

A high-intensity rainstorm centered over the Blacklick Creek area near Reynoldsburg, Ohio, 10 miles east of Columbus (fig. 24) on the evening of June 21 and caused flash floods.

The greatest amount of precipitation recorded was 6.0 inches at the head of South Branch French Run. Apparently the rain was intense over lower Blacklick Creek and tributaries and was lighter to the east. The rainfall figures in table 21 were furnished by the Division of Water, Ohio Department of Natural Resources.

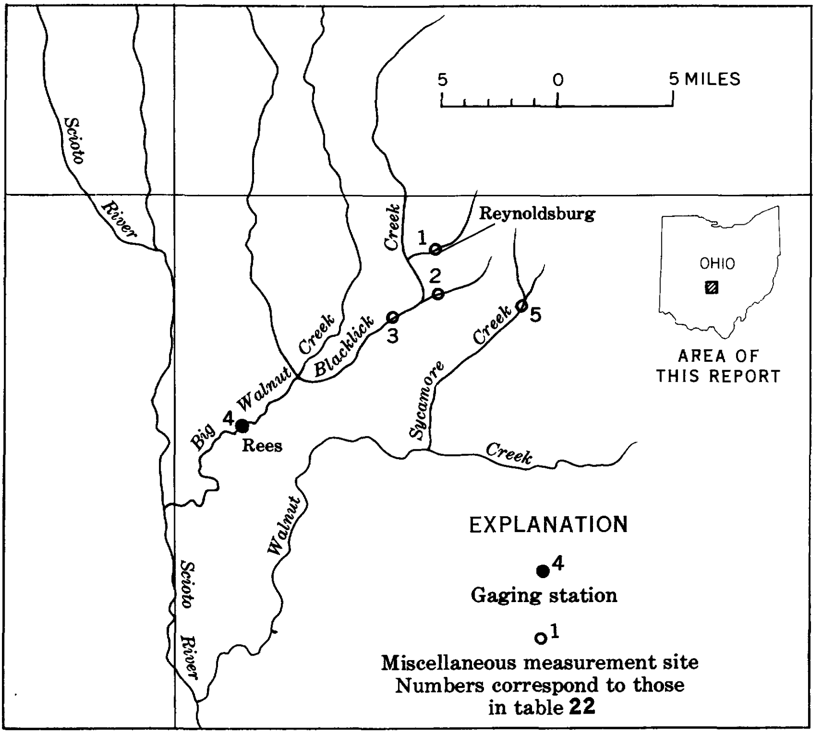

FIGURE 24.—Map of flood area showing location of flood-determination points for floods of June 22 in Black lick Creek area, Ohio.

Peak discharges were determined at 1 gaging station and at 4 miscellaneous sites (table 22). Three of the drainage areas were small and wholly within the area of heavy rainfall, and consequently a high unit rate of runoff resulted. These discharges were noteworthy, although floods of greater magnitude have occurred in similar areas in Ohio. Big Walnut Creek at Rees had only a minor rise because of the flattening of the tributary peaks as they progressed downstream and

TABLE 21.—*Rainfall in Blacklick Creek area, Ohio, June 21–22*

Distance from Reynoldsburg (miles and direction)	*Rainfall (inches)*	*Distance from Reynoldsburg (miles and direction)*	*Rainfall (inches)*
At Reynoldsburg	5. 2	8 east	3. 0
3 north, 2½ east	6. 0	1½ south, 8 east	3. 0
7 north, 6½ east	4. 0	2 south, 5 east	3. 6
3½ north, 7½ east	3. 8	3 south, 1½ east	3. 5
3½ north, 9 east	4. 0	4 south, 1½ east	3. 5
5 north, 12 east	2. 4	4 south, 1½ east	2. 9
3 north, 12 east	3. 0	4 south, 2½ east	4. 6
½ north, 11 east	2. 8	5 south, 2 east	3. 5
8 east	2. 0		

because a major portion of its basin was outside the area of heavy rainfall.

Most of the damage occurred at Reynoldsburg where about 12 houses were flooded and two bridges were destroyed. Damage, exclusive of crop damage, was reported in newspaper accounts as exceeding $250,000.

TABLE 22.—*Summary of flood stages and discharges, June 22, in Scioto River basin in Blacklick Creek area, Ohio*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
1	South Branch French Run at Reynoldsburg.	2.50		June 22, 1956		1,990	796
2	Blacklick Creek tributary near Reynoldsburg.	2.71		do		3,670	1,350
3	Blacklick Creek near Brice	51.9		do		12,300	237
4	Big Walnut Creek at Rees	544	1921–35, 1938–56	do	10.21	5,700	10.5
				Feb. 27, 1929	18.0	21,800	40.1
5	Sycamore Creek near Pickerington.	8.16		June 22, 1956		3,170	388

FLOODS OF JUNE 22 IN HAW CREEK AND CLIFTY CREEK BASINS, INDIANA

A small area thunderstorm produced rainfall in amounts ranging from 6 to 8 inches in the vicinity of Hope (fig. 25) and caused considerable damage from local flooding on Haw Creek, Little Haw Creek, Horse Creek, and Duck Creek.

Peak discharges were determined at 1 gaging station and at 7 miscellaneous sites (table 23).

Figure 26 is a graph showing the relation of peak discharges at each site to the drainage area of the site. The 2 curves designating the 10-year and the 50-year flood are from an open-file report of flood frequencies for Indiana (Green and Hoggatt, 1960). The magnitudes of the peak discharge for 5 of the miscellaneous sites were of the order of a 50-year flood or greater, and those at the gaging station and at 1 miscellaneous site were of the order of about a 10-year flood. The recurrence interval of the peak discharge of the station with only 1 square mile of drainage area can not be estimated, as it is beyond the limits of reasonable extrapolation.

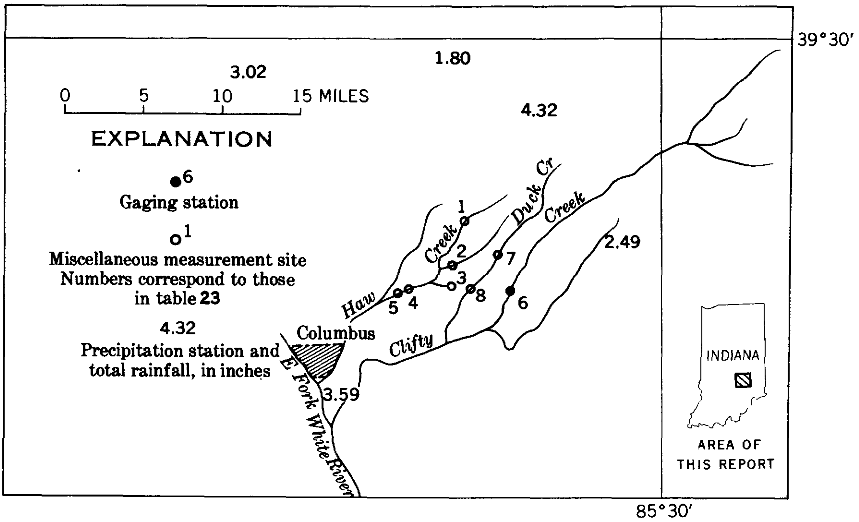

FIGURE 25.—Map of flood area showing location of flood-determination points and total rainfall, in inches, for June 20–23 for floods in Haw and Clifty Creek basins, Indiana.

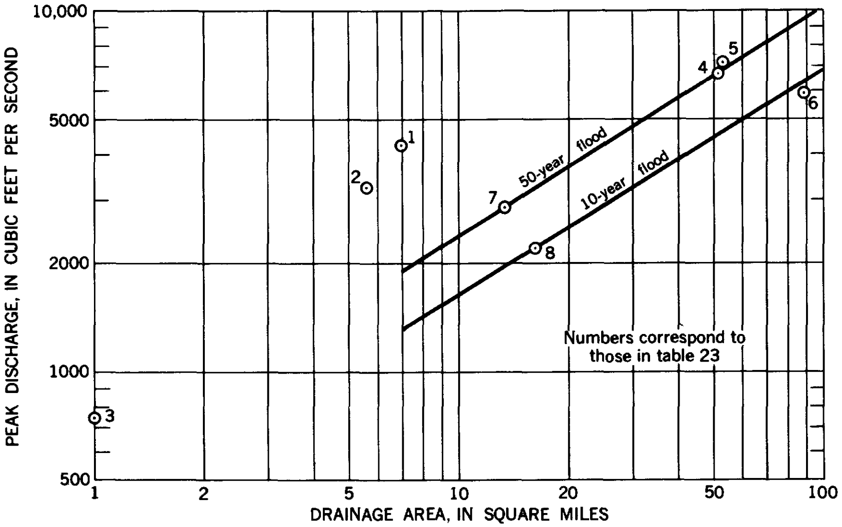

FIGURE 26.—Relation of peak discharges to 10- and 50-year floods in Haw Creek and Clifty Creek basins Indiana.

TABLE 23.—*Summary of flood stages and discharges, June 22, in Haw Creek and Clifty Creek basins, Indiana*

[Each station in this table has one or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
1	Haw Creek near Norristown	6.89		June 22, 1956		4,240	615
2	Little Haw Creek at Hope	5.56		do		3,250	584
3	Horse Creek at Hope	1.00		do		750	750
4	Haw Creek at Columbus	51.8		do		6,730	130
5	Haw Creek at Columbus	52.3		do		7,090	136
6	Clifty Creek at Hartsville	88.8	1948–56	do	11.10	5,890	66.3
				Jan. 5, 1949	13.4	8,100	91.2
				1913	25.1		
7	Duck Creek at Rugby	13.3		June 22, 1956		2,850	214
8	Duck Creek near Hope	16.2		do		2,200	136

FLOODS OF JULY 8 IN CLARKE COUNTY, ALA

A weak tropical disturbance formed off the coast of Alabama on July 5, moved inland over the southwestern part of the State where it produced heavy rains on July 7 and 8, and moved out toward the north.

The main storm center was over Whatley, where a 24-hour rainfall of 10.85 inches and a storm total of 14.22 inches were recorded. A second center was near Chatom, where a rainfall of 9.99 inches for July 8 and a storm total of 10.34 inches were reported. Isohyets of the storm (fig. 27) were prepared from data furnished by the Weather Bureau.

Many small streams rose quickly to unprecedented stages, overflowed and damaged highways in several places, and washed out several bridges. The highest rates of runoff occurred in the headwaters of streams in the Whately, Grove Hill, and Jackson area (table 24). Two gaging stations were established in the floor area in June 1956, but the period of record is much too short to compare the discharges of the July 1956 flood with previous floods. Indirect measurements of peak discharge were made at four sites (fig. 27). It is apparent that this was a flood of rare occurrence for the area.

A statewide flood-frequency report (Peirce, 1954) includes the area affected by these floods. The peak discharges of the floods of July 8, 1956, are shown on a graph of the relation of the mean annual, the 25-year, and the 50-year flood to drainage areas (fig. 28). The relationship curve is defined for drainage areas of more than 200 square miles and should not be extrapolated to the small drainage areas of the four miscellaneous sites. The positions of the station

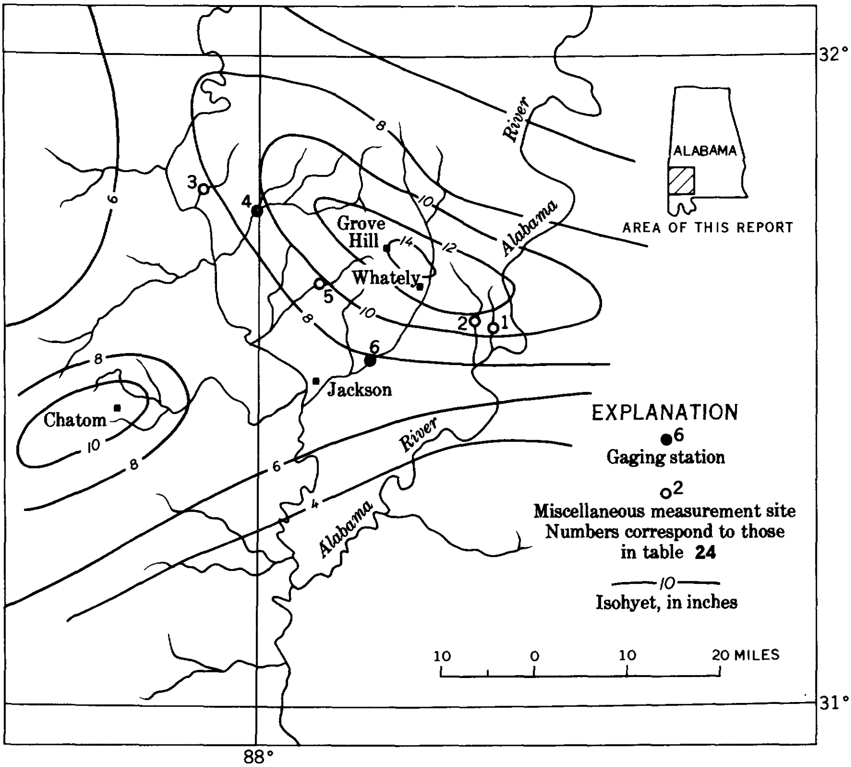

FIGURE 27.—Map of flood area showing location of flood-determination points and precipitation, in inches, for July 7–9, for floods in Clarke County, Ala.

TABLE 24.—*Summary of stages and discharges, July 8, in Clarke County, Alabama*

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Gage height (ft)	Maximum floods: Discharge: Cfs	Maximum floods: Discharge: Cfs per sq mi
	Alabama River basin					
1	Bush Creek near Gosport	4.5			[1] 4,050	900
2	Pigeon Creek near Gosport	22.6			18,800	832
	Tombigbee River basin					
3	Ulkinask Creek near Coffeeville	31.1			25,500	820
4	Satilpa Creek near Coffeeville	166	1956	18.37	25,600	154
5	Jackson Creek near Winn	42.7			[1] 34,000	796
6	East Bassett Creek at Walker Springs	188	1956	12.25	19,300	103

[1] Estimated.

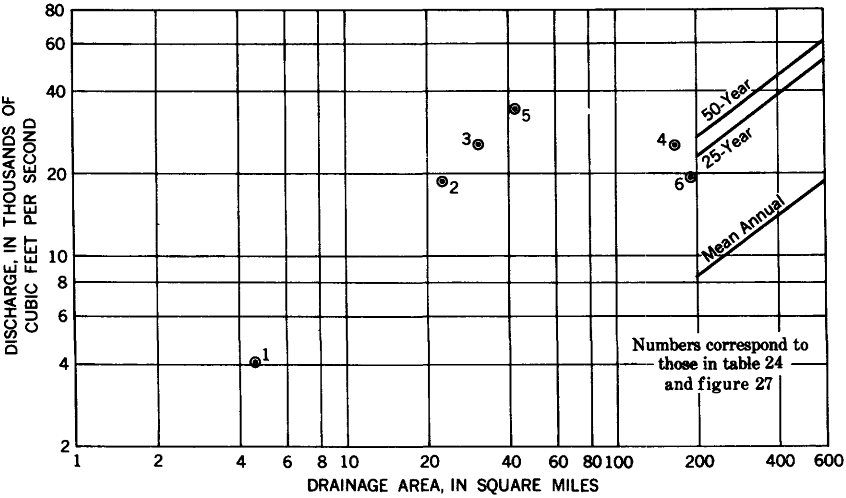

FIGURE 28.—Relation of peak discharges of July 8 to the mean annual, 25-year, and 50-year floods in Clarke County, Ala.

points on the figure indicate, however, that these flood discharges must have been of a very rare occurrence.

Damage from the storm and flood was estimated to have been about $400,000 exclusive of that to crops and livestock. Some crop damage occurred, some livestock were drowned, and soil erosion was extensive. Little damage occurred to modern highway bridges, but several old wooden bridges on rural roads and some railroad bridges were damaged or washed out. A freight train was derailed at a washout near Chatom and 200 yards of track was torn up. Many fish ponds were destroyed. In Grove Hill, floodwaters covered the floors of several business places and houses.

FLOODS OF JULY 8–9 ON ROCKY FORK AND WAKATOMIKA CREEK BASINS, OHIO

On July 8, a high-intensity rainstorm centered over a small area in the upper reaches of Wakatomika Creek, Rocky Fork and North Fork Licking River, in Knox and Licking Counties, Ohio, and produced flooding in this area (fig. 29). The amount of damage was small as the area affected was predominantly woods. Several county highway bridges were destroyed. The State 4–H Camp north of Newark was flooded to a depth of 2 feet, marooning 115 children on high ground for 4 hours. At Utica 4.52 inches of rain fell in 7 hours and a factory was damaged. At Rocky Fork near Hill Church, about 2 miles south of the peak flow determination on Rocky Fork tributary, a resident reported that 6 inches of rain fell during 1½ hours

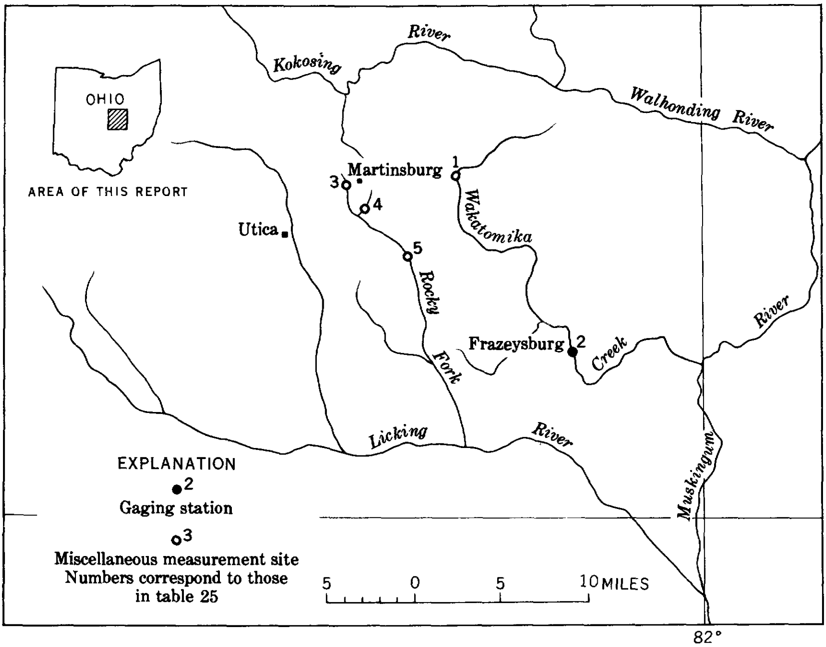

FIGURE 29.—Map of flood area showing location of flood-determination points for floods of July 8–9 on Rocky Fork and Wakatomika Creek basins, Ohio.

in a milk pail that would be equivalent to more than 5 inches net depth. Near this same site, a steel truss bridge had 1½ feet more water over the floor than it had in the 1913 flood.

Five determinations of peak flow (table 25 and fig. 29) were obtained. They indicate that this was a noteworthy flood but not outstanding when compared with previous floods in Ohio.

TABLE 25.—*Summary of flood stages and discharges, July 8–9, in Rocky Fork and Wakatomika Creek basins, Ohio*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
1	Wakatomika Creek at Bladensburg.	33.3		July 8, 1956		10,800	324
2	Wakatomika Creek near Frazeysburg.	140	1936–56	July 9, 1956	9.52	5,090	36.4
				Jan. 27, 1952	11.61	11,300	80.7
3	Rocky Fork near Martinsburg	1.40		July 8, 1956		2,730	1,950
4	Rock Fork tributary near Martinsburg.	1.17		do		2,850	2,440
5	Rocky Fork near Purity	24.0		do		7,850	327

FLOOD OF JULY 10 IN MOUNT VERNON AREA, OREGON

A severe thunderstorm with torrential rains, high winds, and hail struck the Mount Vernon area (fig. 30) about 5:45 p.m. on July 10 and lasted about 45 minutes. No reliable precipitation data are available, but indications were that about 3 to 3½ inches of precipitation occurred in about 1¼ hours with most of the total occurring from 5:45 p.m. to 6:30 p.m. About two-thirds of the Mount Vernon population of 500 were forced to evacuate, and water and mud entered 20 homes. There were no fatalities and only superficial injuries, but there was damage to homes, roads, bridges and fields totaling $69,000, according to the U.S. Army Corps of Engineers.

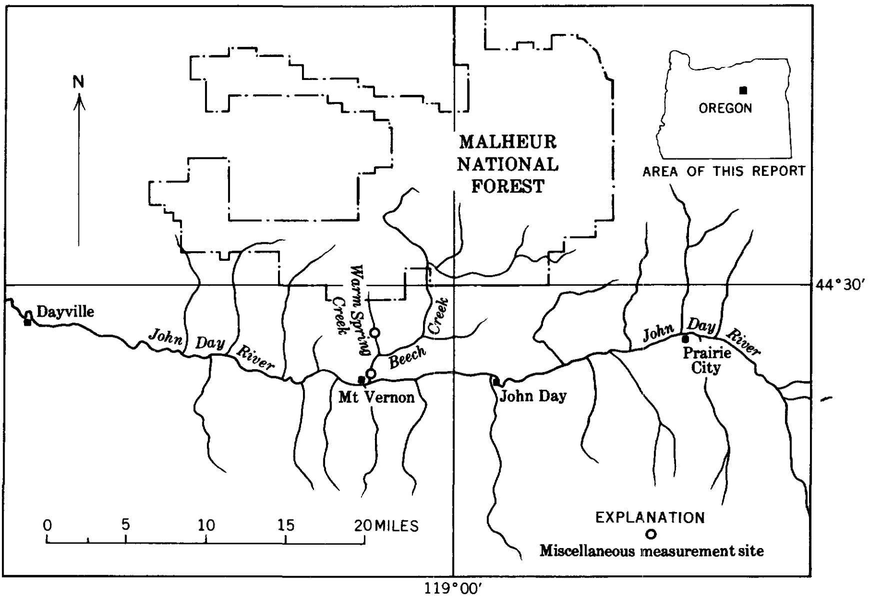

FIGURE 30.—Map of flood area showing location of flood-determination points for flood of July 10 near Mount Vernon, Oreg.

Two indirect determinations of peak flow were made for this flood: one on Beech Creek just above its mouth in Mount Vernon and the other on Warm Springs Creek, a small tributary of Beech Creek about 2 miles northeast of Mount Vernon, near the center of the storm.

The peak discharge on Warm Springs Creek was 393 cfs from a drainage area of 2.73 square miles and that on Beech Creek was 929 cfs from a contributing area of 12.5 square miles out of a total of 113 square miles in the basin.

Floods of this magnitude are not unusual in summer in central and eastern Oregon; this area is so sparsely populated that often little damage results or the event may not be observed or reported.

FLOODS OF JULY 13 NEAR MITCHELL, OREG.

A little before 5 p.m. on July 13 the town of Mitchell was badly battered by floodwaters from Bridge Creek, which had risen rapidly as a result of torrential rains. A State policeman on duty at Mitchell reported that the rise was extremely rapid, flows were extremely high for only 10 or 15 minutes then rapidly dropped about 7 feet, leveled off until about 8 p.m., and then fell slowly.

None of the town's 500 residents were killed, although there were some narrow escapes, about 40 people were left homeless, and some livestock was lost. The U.S. Army Corps of Engineers estimated the damage at $709,000. About 14 homes and business buildings were demolished, 11 bridges were washed out or rendered unusable, several miles of highway were washed out, and agricultural properties were damaged. The destruction in Mitchell could have been much worse had the storm been centered more to the south over Keyes Creek and the upper part of Bridge Creek (fig. 31). A large part of the drainage area of Bridge Creek above Mitchell contributed very little to the flood, whereas Meyers Canyon and a few smaller tributaries of Bridge Creek below Mitchell had exceptionally heavy runoff.

Three measurements of peak flow were made (table 26). Two of the measurements were made on Bridge Creek, one at a site about 2.5 miles below Mitchell but above the high-yielding tributaries draining from the east and the other about 1½ miles above the mouth. The third measurement was made almost half a mile above the mouth of Meyers Canyon, the major tributary draining from the east. Field inspection indicated that all the 12.7 square miles of drainage area of Meyers Canyon above the measurement site was contributing, whereas only about 15 of the 58.5 square miles above the upper measurement site on Bridge Creek was contributing. The unit discharge

TABLE 26.—*Summary of flood stages and discharges, July 13, in John Day River basin near Mitchell, Oregon*

No.	Stream and place of determination	Contributing drainage area (sq mi)	Discharge	
			Cfs	Cfs per sq mi
1	Bridge Creek above Gable Creek	15	14, 400	960
2	Meyers Canyon	12.7	54, 500	4, 290
3	Bridge Creek below Bear Creek	45	16, 300	362

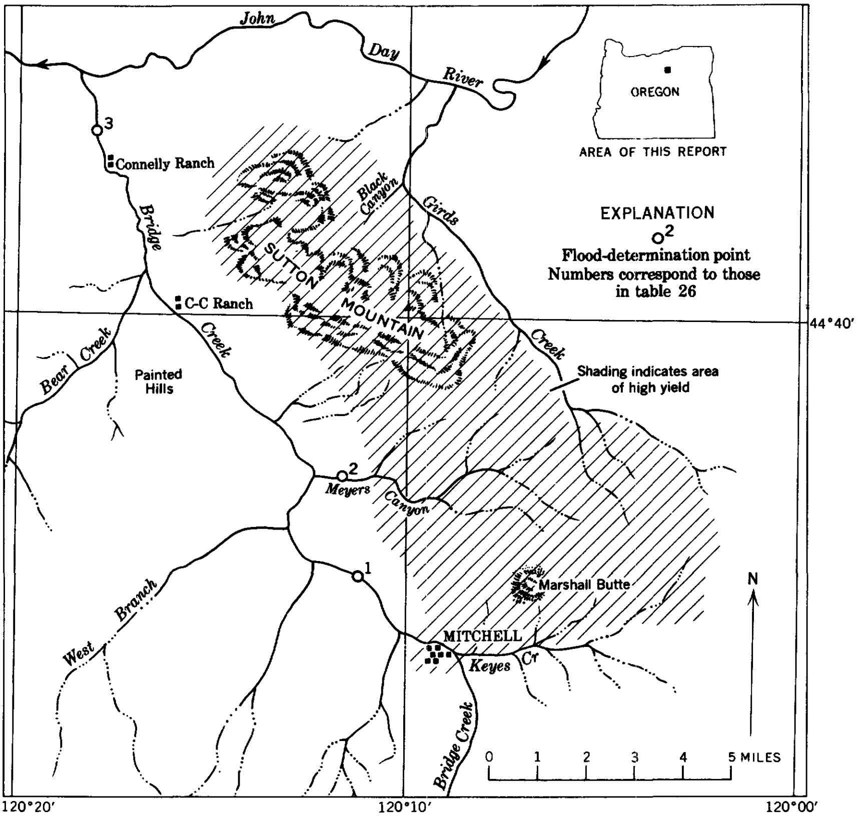

FIGURE 31.—Map of flood area showing location of flood-determination points for floods of July 13 near Mitchell, Oreg.

(cubic feet per second per square mile) from Meyers Canyon was one of the highest ever recorded for a comparable drainage area in the United States.

The Geological Survey operates a gaging station on John Day River at McDonald Ferry, about 100 miles below Mitchell and Meyers Canyon. On July 14 from 3:30 p.m. to 4 p.m., about 1 day after the flood at Mitchell, the discharge at McDonald Ferry rose sharply from 1,400 cfs to 6,600 cfs. The flow then receded gradually to base flow (about 1,600 cfs) by 10 a.m. on July 15. The total volume of flood flow passing this station was computed as about 2,700 acre-feet. Practically all the flood flow came from Bridge Creek and Girds Creek, a tributary of John Day River just above Bridge Creek, and this volume appears consistent with the flood peaks and with the observed duration of the flood.

A witness of the storm in Meyers Canyon reports:

The rain began about 4:30 p.m. and increasing in intensity until 5 p.m. The stream crested at 5:15 p.m. Rain continued in cloudburst proportions until about 6:10 p.m. and then diminished until 6:30 p.m. At this time the rain increased to the east and a second crest, much lower than the first, passed at 6:40 p.m. The storm diminished and the rain stopped by 7 p.m. Sheet runoff was about 2 inches deep at the base of hills west of the observers' location. Velocity in an overflow section was great enough to move an automobile 1,500 feet across a field. The depth of water varied from a few inches to 2½ feet.

The Weather Bureau gage at Mitchell was washed out by the flood, and no reliable precipitation data are available. Information available from catches in tubs indicated that 3½ to 4 inches of precipitation fell. Although the storm lasted for about 2 hours, a large part of this precipitation apparently occurred in 30 minutes. The area of heavy precipitation (shaded area on vicinity map) was delineated by field reconnaissance and after interviews with many residents within a few days after the flood. Interviews with ranchers at the lower end of Bridge Creek indicated that precipitation had been negligible in that area.

FLOODS OF JULY 18 IN RAPID CREEK AND RALSTON CREEK BASINS NEAR IOWA CITY, IOWA

The greatest amount of rainfall in a series of scattered storms covering nearly all the State of Iowa was reached near Iowa City on July 18. Rainfall amounts over the Ralston Creek and a part of the Rapid Creek basins were the largest of any reported by the U.S. Weather Bureau (1956) for that date within the State. Rainfall over this relatively small area reached a point maximum of 4.28 inches for the storm with 3.34 inches of this amount occurring in 1 hour (table 27).

Some damage to crops and urban areas resulted from the runoff from the storm, but amounts of the damage were relatively small.

TABLE 27.—*Rainfall, July 18, in the Rapid Creek and Ralston Creek basins*

[From reports of the U.S. Weather Bureau]

Letter symbol (fig. 32)	U.S. Weather Bureau official designation	Rainfall for July 18, 1956				
		Total (inches)	Inches for hour ending			
			4 p.m.	5 p.m.	6 p.m.	7 p.m.
A	Iowa City Ralston Creek 1	2.63	0.54	1.97	0.12	
B	Iowa City Ralston Creek 2	4.28	.77	3.34	.17	
C	Iowa City Ralston Creek 3	3.43		3.10	.33	
D	Iowa City Ralston Creek 4	2.13	.48	1.52	.13	
E	Iowa City Ralston Creek 5	2.38	.23	1.97	.17	0.01
F	Morse	1.55			1.45	.10
G	Morse, 1 mi northeast	.68		.50	.18	
H	Morse, 4 mi south-southwest	3.20		2.95	.25	
J	Oasis	2.28	.30	1.72	.23	.03

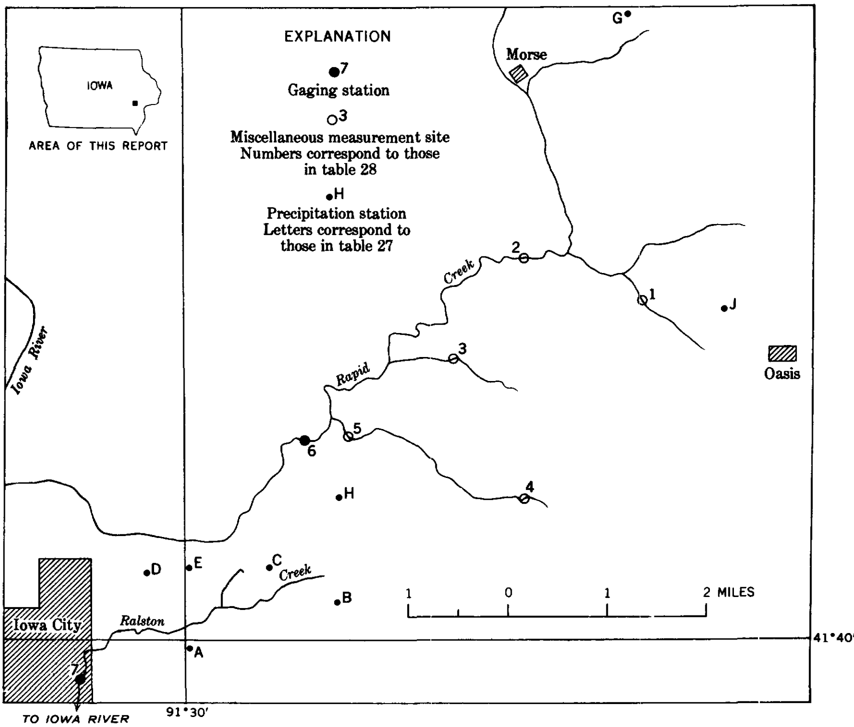

FIGURE 32.—Map of flood area showing location of flood-determination points and precipitation stations for floods of July 18 in Rapid Creek and Ralston Creek basins near Iowa City, Iowa.

Small streams draining the area covered by the intense rainfall reached record stages and discharges. The stream-gaging station on Ralston Creek at Iowa City reached the highest peak discharge of its record, which began in 1924. Several small tributaries of Rapid Creek basin adjoining the Ralston Creek basin also had record peak stages and discharges at crest-stage gages, which have been in operation since 1951. Table 28 shows the peak stages and discharges for 2 gaging stations and 5 crest-stage stations in operation within the two basins. Previous maximum stages and discharges are given at all except 1 of the 7 stations. Figure 32 shows the location of the discharge stations and the rainfall gages.

The intense rainfall within a short period caused sudden rises in the streams. Detailed gage heights and discharges were obtained at the two gaging stations on Ralston Creek and Rapid Creek and at the site of a temporary recorder installation on a Rapid Creek tributary (see fig. 33). The rise began about 4:30 p.m. on July 18 on each of the three streams. The two smaller streams crested at about 6 p.m., and their discharge had dropped to less than 100 cfs by 8:30 p.m. The largest stream (drainage area, 24.6 sq mi) crested at about 6:30 p.m., and the discharge was less than 100 cfs by 3 a.m. on July 19.

TABLE 28.—*Summary of flood stages and discharges, July 18, in the Rapid Creek and Ralston Creek basins near Iowa City, Iowa*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
1	Rapid Creek tributary	1.55	1951–56	July 18, 1956	16.70	260	168
				July 20, 1953	18.23	956	617
2	Rapid Creek	14.8	1951–56	July 18, 1956	21.62	478	32.3
				Feb. 20, 1953	27.34	2,190	148
3	Rapid Creek tributary	1.51	1951–56	July 18, 1956	23.4	1,290	854
				Feb. 19, 1953	21.42	340	225
4	Rapid Creek tributary	1.00	1951	July 18, 1956	18.32	808	808
5	Rapid Creek tributary	3.45	1951–56	July 18, 1956	24.35	1,850	536
				Feb. 19, 1953	23.09	578	168
6	Rapid Creek	24.6	1938–56	July 18, 1956	12.27	2,620	107
				May 20, 1944	[1] 13.05	3,890	158
7	Ralston Creek at Iowa City	3.01	1924–56	July 18, 1956	9.06	1,690	561
				July 1, 1950	8.32	1,510	502

[1] Occurred Feb. 20, 1953.

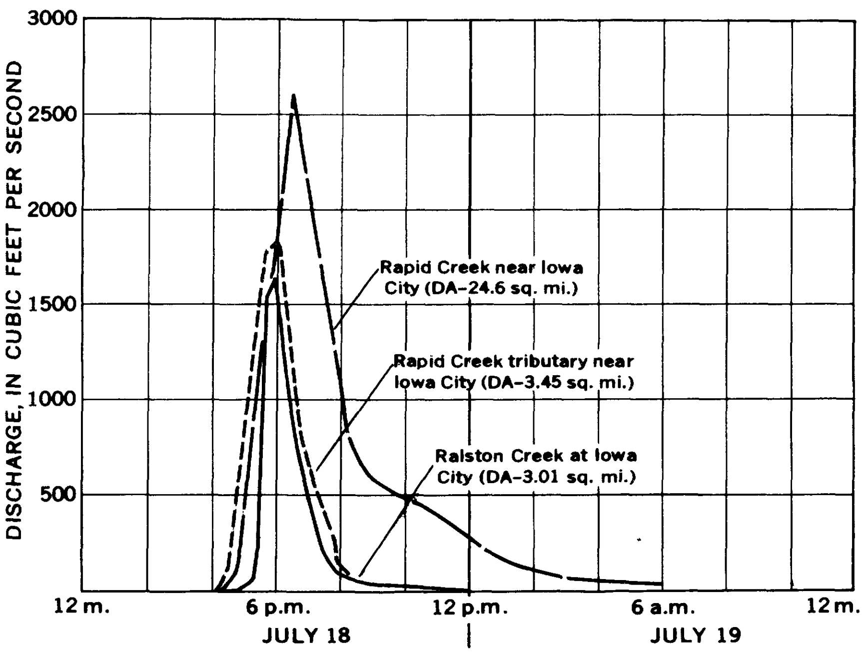

FIGURE 33.—Discharge hydrographs, Rapid Creek and Ralston Creek basins. Abbreviation DA denotes drainage area.

Records of water and sediment discharges are published in the Water-Supply Papers of the U.S. Geological Survey for both the

Rapid and Ralston Creek gaging stations. An unpublished detailed annual progress report covering the Ralston Creek basin has also been prepared each year since 1924 by graduate students of the State University of Iowa, College of Engineering. In addition to the normal streamflow records, these reports include a detailed analysis of precipitation data for flood producing storms, flood hydrographs for peak flows exceeding 100 cfs, ground-water levels, and, since April 1952, records of the sediment discharge at the gaging station. This report, for 1956, indicates a total runoff for the storm of July 18 of 0.98 inch and a total sediment discharge of 2,292 tons for the 4-hour period commencing at 4:30 p.m.

FLOODS OF JULY 19–21 IN SOUTH-CENTRAL NORTH CAROLINA

The storm of July 19 in south-central North Carolina was brief but of high intensity and produced record-breaking floods on many small streams. There was only one Weather Bureau nonrecording rain gage in the area of heavy precipitation. A field party obtained records of rainfall at 26 sites, and this information is shown in a isohyetal map

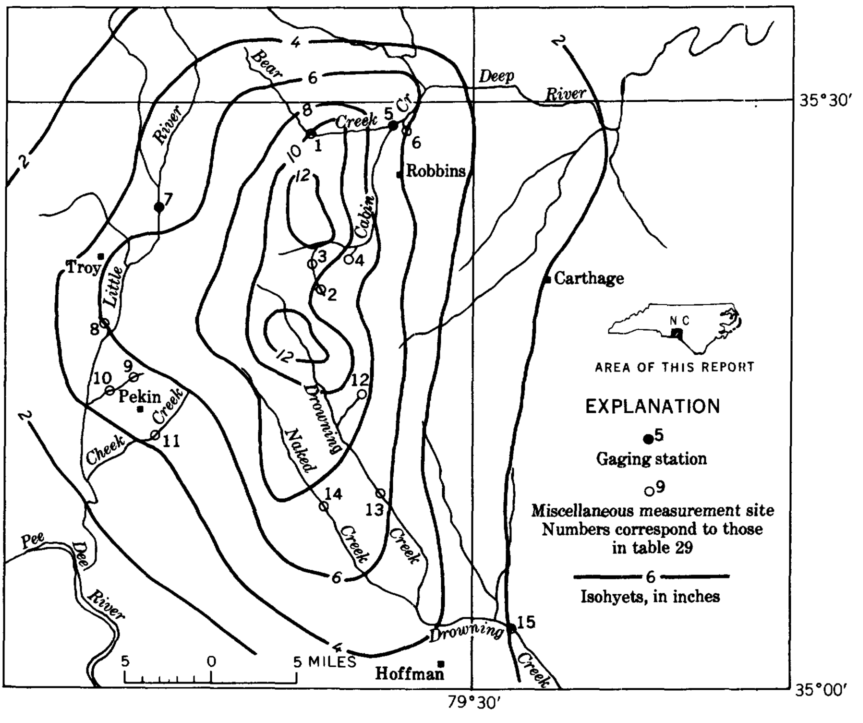

FIGURE 34.—Map of flood area showing location of flood-determination points and precipitation, in inches, for July 19, for floods in south-central North Carolina.

(fig. 34). Storms causing as much as 13 inches of rainfall in 10 hours were reported, although most of the precipitation fell in 4 hours. More than 8 inches fell on an area of about 190 square miles.

About two-thirds of the flood area lies in the rolling hills of the Piedmont region and the remaining part lies in the gentler undulating lands of the Sand Hills region. Stream gradients are steep in the Bear Creek and Little River basins of the Piedmont region and are much flatter in the Drowning Creek basin of the Sand Hills region. Streams at the two gaging stations in the Piedmont region crested early in the morning of July 20 and the stream at the gaging station in the Sand Hills region crested early in the morning of July 21.

Three gaging stations and one crest-stage station are operated in the flood area. The floods of July 19–21 produced the maximum stage and discharge of record at one gaging station and at the crest-stage station and produced the second highest stage and discharge at another gaging station. The gaging station at the edge of the storm area was not greatly affected. The peak discharge at many other sites in the area were greater than any previously known (table 29).

The flood of July 19–21 is considered to be a major flood of rare occurrence. An open-file flood-frequency report (Riggs, 1955) includes the area affected by these floods. In general, the 1956 flood was greater than the 60-year flood. The recurrence intervals are defined up to 60 years in the report, and they should not be extrapolated above that point. By use of table 30, the peak discharges of the 1956 flood can be compared with the 60-year flood. The station numbers correspond to those in table 29. The estimated mean annual flood was obtained from the curves of drainage area versus mean annual flood applicable to the area. The estimated mean annual floods of several discharge sites with small drainage areas are not given, as the data is outside the range of definition in the flood-frequency report.

Flood damage was relatively light for a storm of this intensity, because the flood peaks receded rapidly and because the area is rather sparsely populated and is not industrialized.

Three persons lost their lives. Homes and buildings were inundated or washed away, crops were destroyed and fertile soil was eroded, bridges and culverts were damaged or destroyed, and highway fills were washed out or shoulders were scoured. Several small dams were breached and farm ponds were damaged. The Weather Bureau and the North Carolina State Highway and Public Works Commission estimated the damage in the flood area at more than $500,000.

TABLE 29.—*Summary of flood stages and discharges, July 19–21, in south-central North Carolina*

[Each station in this table has one, two, or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Cape Fear River basin						
1	Bear Creek near Jug Town	23.9		July 19 or 20, 1956		8,340	349
2	Mill Creek near Samarcand	1.90		July 19, 1956		1,480	779
3	Mill Creek near Robbins	9.60		do		8,230	857
4	Wet Creek near Robbins	15.7		do		8,580	548
5	Bear Creek at Robbins	134	1939–56	July 20, 1956	34.57	43,600	326
				Sept. 18, 1945	32.02	38,800	289
6	Persimmon Creek at Robbins.	1.24		July 19, 1956		267	215
	Pee Dee River basin						
7	Little River near Star	97.6	1954–56	July 20, 1956	8.36	2,990	30.6
				Oct. 15, 1954	16.46	10,400	105
				September 1945	20		
8	Long Branch near Capelsie	1.59		July 19, 1956		663	417
9	Thickety Creek near Onvil	1.83		do		1,510	825
10	Thickety Creek near Pekin	6.32		do		2,630	416
11	Cheek Creek near Pekin	14.6	1953–56	do	24.1	6,230	427
				Apr. 14, 1955	20.08	986	68
12	East Prong Drowning Creek near Eagle Springs.	3.25		July 19, 1956		3,810	1,170
13	Drowning Creek below Jackson Springs.	33.4		July 19 or 20, 1956		7,280	218
14	Naked Creek near Norman	8.91		do		1,570	176
15	Drowning Creek near Hoffman.	178	1939–56	July 21, 1956	9.65	8,000	44.9
				Sept. 18, 1945	10.29	10,900	61

TABLE 30.—*Peak discharge of estimated mean annual, estimated 60-year, and 1956 floods*

Station	Drainage area (sq mi)	Mean annual flood (cfs)	60-year flood (cfs)	1956 flood (cfs)
1	23.9	1,400	5,600	8,340
3	9.60	690	2,760	8,230
4	15.7	1,020	4,080	8,580
5	134	5,450	21,800	43,600
7	97.6	3,020	12,080	2,990
11	14.6	710	2,840	6,230
15	178	2,050	8,200	8,000

FLOODS OF JULY 20 NEAR RENO, NEV

High intensity rains fell on the headwaters of Galena Creek near the summit of Mount Rose, about 10 miles southwest of Reno (fig. 35), and caused a flash flood which drowned four persons who were swept from Nevada Highway No. 27 by the floodwaters.

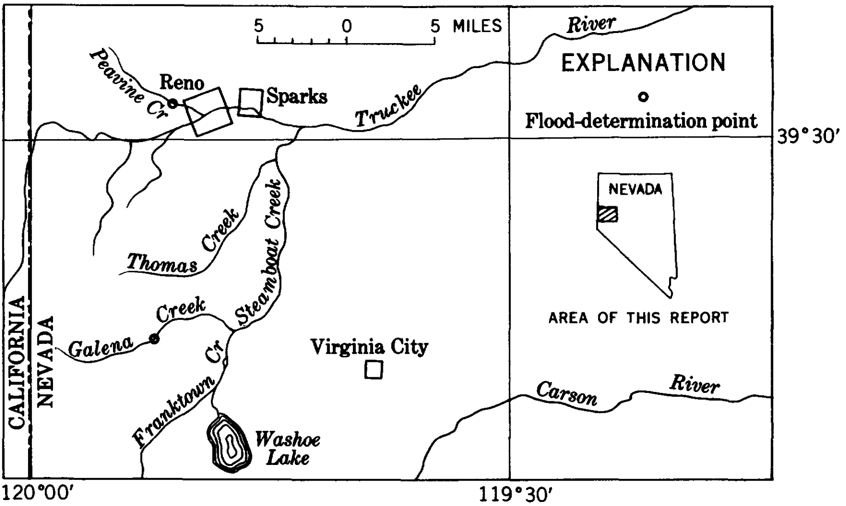

FIGURE 35.—Map of flood area showing location of flood-determination points for floods of July 20 near Reno, Nev.

Three automobiles were swept from the road when debris choked a small bridge on the highway and forced the floodwaters out of the banks and across a low point on the road nearby. Slight damage was done to a U.S. Forest Service Camp grounds, and damage to highways in the flood area totaled about $5,000.

Although there was a high peak discharge (about 4,700 cfs) and much debris at the point where Galena Creek crosses Nevada Highway No. 27, the peak flow 3½ or 4 miles downstream was estimated at about 200 cfs, indicating that the storm was of a high intensity but of a short duration. Apparently the rain was heaviest near the 8,000- to 9,000-foot level and was concentrated in the Galena Creek basin because streams in basins adjacent to Galena Creek were not flooded. No data on the amount of precipitation are available because of the absence of rain gages in the small area affected.

The only other major flood on record on Galena Creek was a similar flood on July 29, 1952. The runoff pattern of both floods were alike in that there were large volumes of water at an elevation of about 7,000 feet, but the peak discharges were of minor magnitude by the time the crests reached the valley floors at an elevation of about 4,500 feet.

Also on July 20 a summer thunderstorm struck the eastern slopes of Peavine Mountain near Reno late in the afternoon. The runoff from this sudden deluge concentrated in Peavine Wash and swept through residential and commercial areas in the western part of Reno.

The Reno Weather Bureau station reported only 0.41 inch of precipitation for the day, and no other records are available because there were no other rain gages in the flood area.

The principal damage consisted of flooded basements and first floors of homes and business establishments, but damage to city streets and to parked automobiles was also extensive. Total damage was estimated by the Reno City engineer at about $250,000.

A discharge measurement made at a miscellaneous site on Peavine Creek near Reno (fig. 35) showed a peak discharge of 2,190 cfs from a drainage area of 3.6 square miles.

According to the Soil Conservation Service the flood of July 20, 1956, may have been exceeded in the past, but it appears to be the largest in the last 50 years. Other floods causing major damage occured in December 1955 and January 1914, and floods causing less damage occurred in July 1955, March 1952, November 1950, January 1942, December 1937, and March 1928. Historical records indicate that floods also occurred in 1890, 1886, 1862, and 1861.

FLOODS OF JULY 20–21 IN MARYLAND

General rains fell throughout July 20, became very heavy during the evening, and continued until early July 21 in the central part of the State (fig. 36). They caused flooding in several drainage basins.

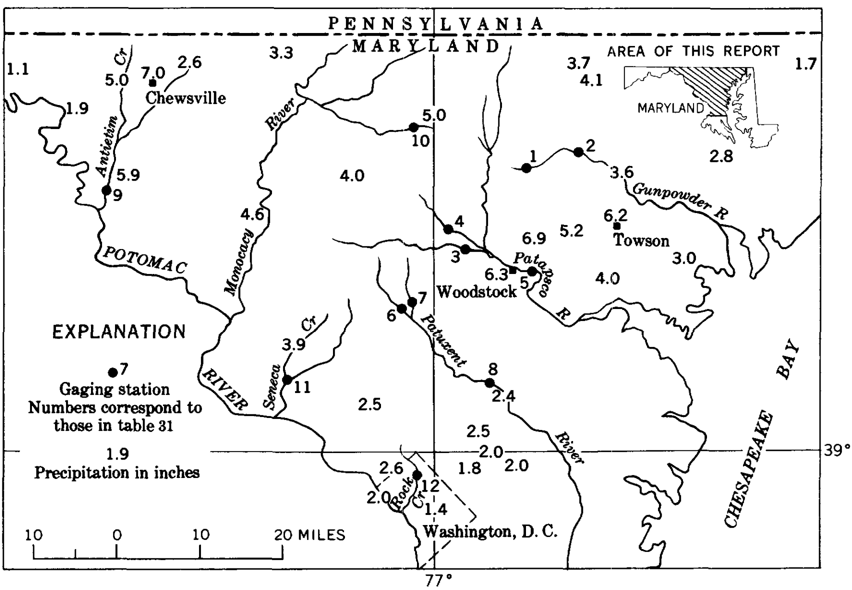

FIGURE 36.—Map of flood area showing location of flood-determination points and rainfall, in inches, July 20–21, for floods in Maryland.

TABLE 31.—*Summary of flood stages and discharges, July 20–21, in Maryland*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods: Date	Gage height (ft)	Discharge: Cfs	Cfs per sq mi
	Gunpowder River basin						
1	Slade Run near Glyndon	2.09	1947–56	July 21, 1956	4.68	485	232
				Sept. 1, 1952	4.53	448	214
2	Western Run at Western Run	59.8	1944–56	July 21, 1956	10.84	5,590	93.5
				Aug. 18, 1946	10.62	5,320	89.0
	Patapsco River basin						
3	South Branch Patapsco River at Henryton.	64.4	1948–56	July 21, 1956	19.4	12,100	188
				May 26, 1952	11.04	4,930	76.6
4	Piney Run near Sykesville	11.4	1931–56	July 20, 1956	12.0	7,380	647
				July 24, 1946	6.95	2,100	184
5	Patapsco River at Hollofield	285	1944–56	July 21, 1956	15.88	19,000	66.7
				June 2, 1946	11.62	13,500	47.4
				August 1933	19.5		
	Patuxent River basin						
6	Patuxent River near Unity	34.8	1944–56	July 21, 1956	14.35	10,700	307
				Aug. 1, 1945	13.58	8,060	232
7	Cattail Creek at Roxbury Mills	27.7	1944–56	July 21, 1956	14.19	10,100	365
				May 25, 1952	9.29	1,060	383
8	Patuxent River near Laurel	133	1944–56	July 21, 1956	16.52	11,800	88.7
				Sept. 1, 1952	10.47	5,200	39.1
	Potomac River basin						
9	Antietam Creek near Sharpsburg.	281	1897–1905, 1928–56	July 20, 1956	16.73	12,600	44.8
				July 18, 1949	11.23	7,720	27.5
10	Little Pipe Creek at Avondale	8.10	1947–56	July 21, 1956	7.50	1,440	178
				July 4, 1956	8.47	1,880	232
11	Seneca Creek at Dawsonville	101	1930–56	July 21, 1956	12.17	15,000	149
				Aug. 24, 1933	10.3	9,300	92.1
12	Rock Creek at Sherrill Drive, Washington, D.C.	62.2	1929–56	July 21, 1956	13.19	7,220	116
				Nov. 22, 1952	11.15	5,420	87.1

Four Weather Bureau stations reported more than 6 inches of rain during this period. One area of intense rainfall extended from Towson to Woodstock and another was centered near Chewsville.

The maximum discharge of record occurred at many gaging stations (table 31). On Antietam Creek at Sharpsburg the stage of the July 1956 flood was 5½ feet higher and, the peak discharge was 63 percent greater than that of the previous maximums in 29 years of record. The peak discharge on Piney Run near Sykesville was 3½ times as great as the previous maximum during 26 years of record, and the peak discharge on Cattail Creek at Roxbury Mills was more than 9 times as great as the previous maximum during 13 years of record.

Five lives were lost in the Seneca Creek watershed, one life was lost in Rock Creek, and one in the Patuxent River. Many small bridges were damaged or washed out by the high water. Flooding streams caused property damage estimated at $500,000. Possibly from $300,000 to $400,000 of damage occurred in Montgomery County mostly to bridges and roadways.

FLOODS OF AUGUST 1 NEAR SOCORRO, N. MEX.

Heavy precipitation on the mesa west of Socorro and north and west of Socorro Peak on the afternoon of August 1, 1956, caused heavy runoff within a small area. The effect of the storm was slight except on two water courses—Socorro Canyon tributary, which flows southward adjacent to the west side of the peak and produced the greatest measured discharge, and Nogal Arroyo, which flows eastward along the north side of Socorro Peak and passes a short distance north of the head of Socorro Canyon tributary (fig 37). The drainage area of Nogal Arroyo extends westward to the Magdalena Mountains. It was estimated that discharge from the area west of U.S. 60 did not exceed 300 cfs.

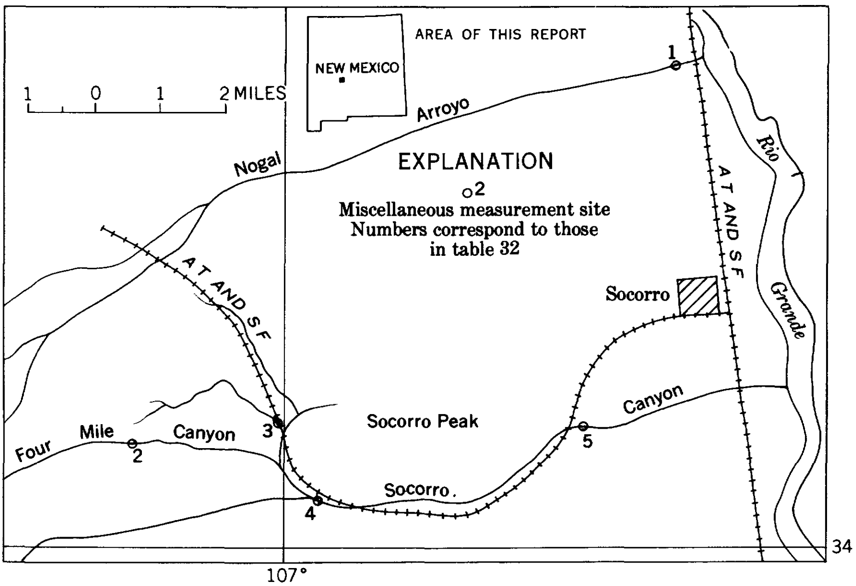

FIGURE 37.—Map of flood area showing location of flood-determination points, for floods of August 1 near Socorro, N. Mex.

Evidence indicates that discharges of the magnitude of those occurring during the August 1 flood (table 32) are of rare occurrence on these arroyos. An owner of property adjacent to the Atchison, Topeka, and Santa Fe Railroad bridge across Socorro Canyon tributary, which was damaged some during the flood, stated that he was there at the time of the storm and subsequent flood. He said that it was the worst flood which he had seen at this site since a similar but somewhat greater flood which occurred 60 years previously.

TABLE 32.—*Summary of flood stages and discharges, August 1, in Rio Grande basin near Socorro, New Mexico*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known]

No.	Stream and place of determination	Drainage area (sq mi)	Discharge	
			Cfs	Cfs per sq mi
1	Nogal Arroyo	60.4	4,670	77.3
2	Four Mile Canyon	3.1	989	319
3	Socorro Canyon tributary	6.67	9,480	1,420
4	Socorro Canyon tributary, below Sixmile Canyon	24.3	6,210	256
5	Socorro Canyon at Socorro	42.2	5,380	127
			[1] 7,650	181

[1] Date of discharge unknown. Discharge is maximum known.

Further evidence of the infrequency of floods of this magnitude in this area is contained in an article appearing in the August 8, 1956, issue of El Defensor, a Socorro newspaper. A statement by an 80-year-old resident of Escondida who said that he had never seen as much water come out of Nogal Arroyo, was quoted in the newspaper.

There was evidence that a previous peak discharge had occurred in Socorro Canyon at Socorro, which was greater than that of August 1, 1956.

FLOODS OF AUGUST 5–6 IN MONONGAHELA RIVER AND CHARTIERS CREEK BASINS

A series of thunderstorms occurred August 5–6 over the southwest corner of Pennsylvania and nearby areas of adjacent States (fig. 38). The location of Weather Bureau stations and the amount of precipitation recorded are shown in figure 38. At Connellsville, Pa., 6.8 inches was measured. No rainfall records are available for Chartiers Creek basin, but it is obvious that heavy rains occurred there.

Heavy rainfall produced high rates of discharge at some gaging stations in the area (table 33). The peak discharge on Chartiers Creek at Carnegie was the greatest in 30 years, and a large part of the town was inundated. The peak discharges at the two gaging sta-

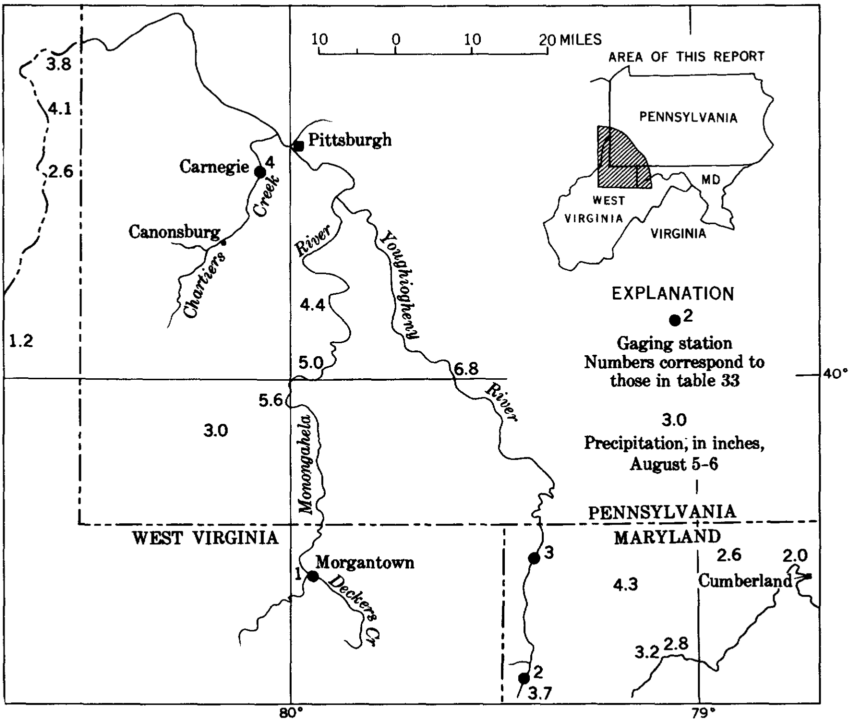

FIGURE 38.—Map of flood area showing location of flood-determination points and rainfall, in inches, for floods of August 5–6 in Monongahela River and Chartiers Creek basins.

tions on the Youghiogheny in Maryland were exceeded only once in 15 years by those produced by Hurricane Hazel in October 1954.

The Weather Bureau reported more than $6 million damage in Chartiers Creek basin (table 34), most of which occurred in and near

TABLE 33.—*Summary of flood stages and discharges, August 5–6, in Monongahela River and Chartiers Creek basins*

[Each station in this table has two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
1	Deckers Creek at Morgantown, W. Va.	63.2	1946–56	Aug. 5, 1956	10.12	5,680	89.9
				Apr. 13, 1948	5.79	3,080	48.7
2	Youghiogheny River near Oakland, Md.	134	1941–56	Aug. 6, 1956	10.00	8,000	59.7
				Oct. 16, 1954	12.16	11,800	88.1
3	Youghiogheny River at Friendsville, Md.	295	1898–1904, 1940–56	Aug. 6, 1956	8.54	11,800	40.0
				Oct. 16, 1954	8.99	13,000	44.1
4	Chartiers Creek at Carnegie, Pa.	257	1919–33, 1940–56	Aug. 6, 1956	16.37	13,500	52.5
				June 17, 1920	16.1	12,800	49.8

Carnegie, Pa. Damage in the flood area in Maryland was limited mostly to eroded roads and fields.

TABLE 34.—*Damage caused by floods of August 5–6 in Monongahela River and Chartiers Creek basins*

[Furnished by U.S. Weather Bureau, Pittsburgh, Pa.]

Locality	Amount of damage	Number of dwellings damaged
Borough of:		
Carnegie		
Heidelburg	$3,680,000	400
Rosslyn Farms		
Scott Township		
Borough of Bridgeville	1,729,000	50
Collier and South Fayette Townships		
Borough of:		
Cannonsburg		
Houston	834,000	225
Strabane and Chartiers Townships		

FLOODS OF AUGUST 7 AND 10 IN HUGHES COUNTY, S. DAK.

A severe thunderstorm during the night of August 7 and another during the evening of August 10 caused high runoff in tributaries of small drainage areas of the Missouri River north of State Highway 34 from 5 to 25 miles east of Pierre (fig. 39). Weather Bureau precipitation records at Pierre showed only 0.92 inch of rain on August 7 and 1.51 inches on August 10, but ranchers a short distance east of there reported 3 to 6 inches during each of the two storms.

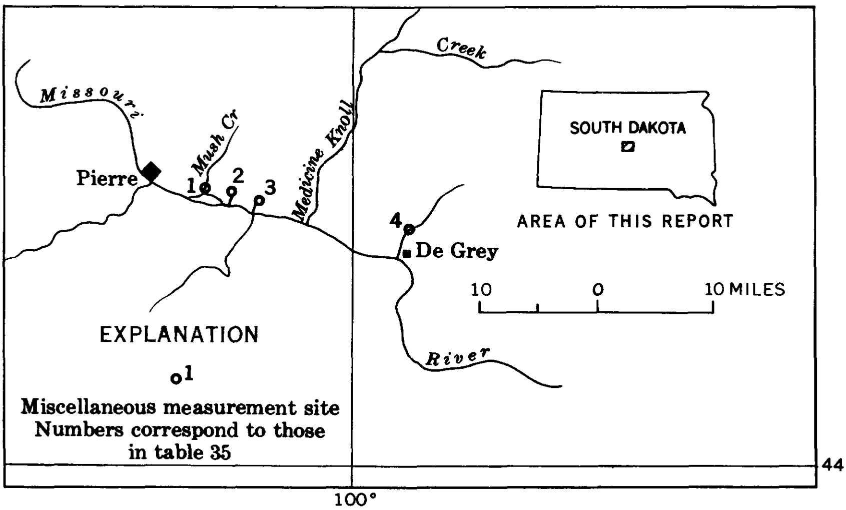

FIGURE 39.—Map of flood area showing location of flood-determination points for floods of August 7 and 10 in Hughes County, S. Dak.

According to one rancher, the peak stage of Mush Creek during the flood of August 10 was from 2 to 2½ feet higher than the most recent floods he could recall, which occurred in 1922 and in 1923.

Rail and motor traffic was disrupted for a short time when tracks and highways were flooded. Little damage resulted because the area is sparsely populated range land.

There are no gaging stations in the flood area, but indirect measurements of peak discharge were made at four miscellaneous sites (table 35). No previous measurements had been made at these sites; so, the magnitude of the August 1956 peak discharges cannot be compared with former peak discharges. It is apparent, however, that this flood was a major flood of rare occurrence for the area.

TABLE 35.—*Summary of flood stages and discharges, August 7 and 10, in Hughes County, South Dakota*

No.	Stream and place of determination	Drainage area (sq mi)	Maximum floods			
			Date	Gage height (ft)	Discharge	
					Cfs	Cfs per sq mi
1	Mush Creek near Pierre	14.6	Aug. 10, 1956	7.49	3,620	248
2	Missouri River tributary near Pierre	.42	do	10.38	705	1,680
3	Missouri River tributary near Rousseau	.20	do	6.40	172	860
4	Missouri River tributary near DeGrey	1.64	Aug. 7, 1956	6.99	976	595

An open-file flood-frequency report (McCabe and Crosby, 1959) includes the area affected by these floods. Flood-frequency curves applicable to the area of the miscellaneous sites show the relation of discharges to 10-, 25-, 50-, and 75-year floods (fig. 40). The curves are defined for drainage areas of 100 or more square miles and cannot be

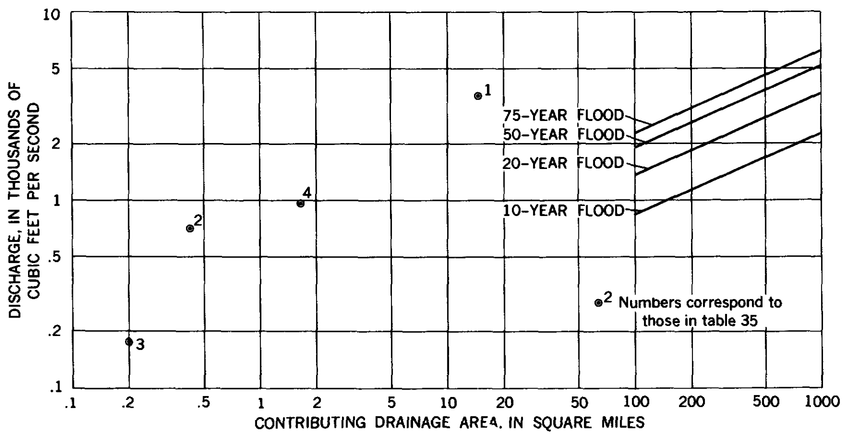

FIGURE 40.—Relation of peak discharge to 10-, 25-, 50-, and 75-year floods in Hughes County, S. Dak.

extrapolated to the small drainage areas of the four sites, and recurrence intervals cannot be directly determined. The positions of the four points on the figure indicate, however, that these flood discharges were rare occurrences.

FLOODS OF AUGUST 15 AND 25 IN NORTH-CENTRAL WASHINGTON

Two severe and independent thunderstorms occurred in a 10-day period in areas about 30 miles apart in north-central Washington (fig. 41). Extreme storm runoff and damage was limited to small areas.

About 1½ inches of rain fell in a few minutes on August 15 in the Knapp Coulee area, southwest of Chelan, and sent floodwater, mud, and boulders over highways and railroads; houses, power and telephone lines, and orchards were also damaged. Damage was estimated at tens of thousands of dollars.

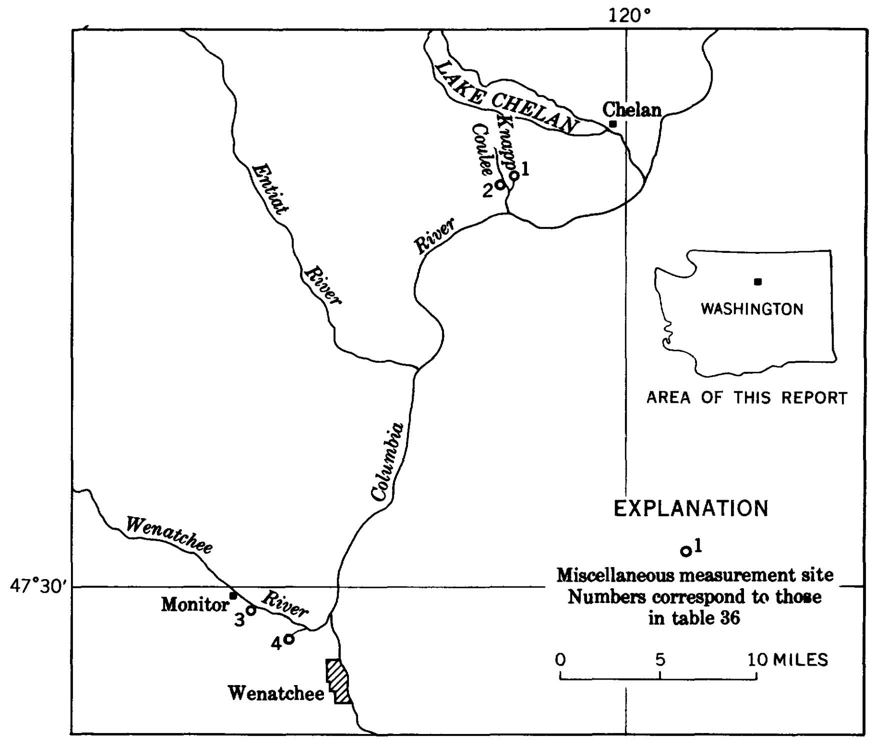

FIGURE 41.—Map of flood area showing location of flood-determination points for floods of August 15 and 25 in north-central Washington.

The severe thunderstorm of August 25 covered an area between Monitor and Wenatchee. The resulting floods near Monitor destroyed buildings, automobiles, and orchards. Much farmland was covered by mud, rocks, and multiton boulders. Flooding was severe also in the Horse Lake Road area northwest of Wenatchee. Roads, railroads, houses, and farmlands were heavily damaged. Damage in each of the two communities was estimated at tens of thousands of dollars.

Four measurements of peak discharge were made (table 36). The drainage area of each measurement site is small, and the unit peak discharges were exceptionally high.

The magnitude of the peak discharge at site 1 (table 35), 6,640 cfs per sq mi from 0.28 square mile, is that of a flood of a vary rare occurrence. The other three unit peak discharges also were extremely high for this area.

TABLE 36.—*Summary of flood stages and discharges, August 15 and 25, in north-central Washington*

No.	Stream and place of determination	Drainage area (sq mi)	Maximum floods		
			Date	Discharge	
				Cfs	Cfs per sq mi
	Knapp Coulee basin				
1	Tributary 6 miles southwest of Chelan	0.28	Aug. 15, 1956	1,860	6,640
2	Tributary 6½ miles southwest of Chelan	.28	do	800	2,860
	Wenatchee River basin				
3	Tributary 0.7 mile southeast of Monitor	0.15	Aug. 25, 1956	903	6,020
4	Tributary 2 miles northwest of Wenatchee	1.32	do	1,950	1,480

FLOODS OF OCTOBER 15–20 IN EAST-CENTRAL FLORIDA

On October 15 and 16 a storm moved northward along the east coast of Florida and concentrated heavy rains in the east-central part of the peninsula. Precipitation measured for the 2-day period ranged from 9 inches at Okeechobee to 15 or 16 inches in the towns of Basinger, Kissimmee, and Fellsmere. This storm was about the fifth largest of record that centered over the Florida peninsula, from information furnished by the U.S. Army Corps of Engineers. The heaviest rain and most flood damage occurred in the eastern half of the peninsula, extending from West Palm Beach northward to Daytona Beach. Major flooding occurred in the St. Johns River basin, the coastal drainage between West Palm Beach and Daytona Beach, and the Taylor Creek basin flowing into Lake Okeechobee (fig. 42). At Dellwood Park, a subdivision on the north city limit of Kissimmee, Shingle Creek overflowed and put the area under 4 to 5 feet of water. At several gaging stations, this flood equaled or exceeded the flood of 50-year recurrence interval (fig. 43).

The prolonged drought which preceded the October 1956 storm had reduced ground-water and surface-water storage to the lowest of record throughout most of the area affected by the flood; runoff therefore was not as severe as the intensity of the rainfall would indicate—particularly on the main stems of the St. Johns and Kissimmee Rivers and other streams serving drainage areas with appreciable surface-water storage capacity.

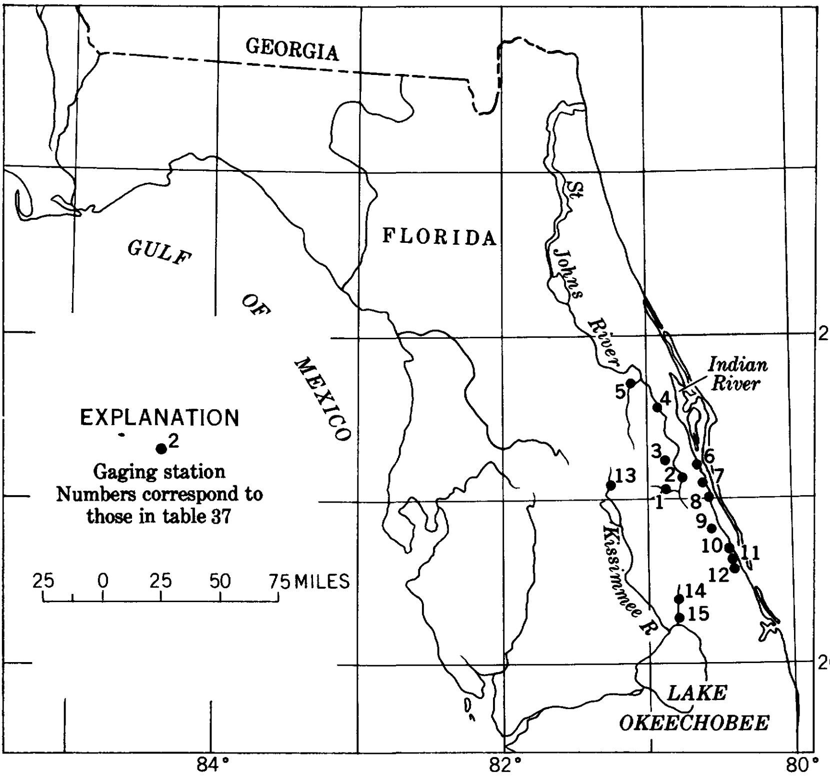

FIGURE 42.—Map of flood area showing location of flood-determination points for floods of October 15–20 in east-central Florida.

A report on the flood, including a description of the storm, is contained in the U.S. Army Corps of Engineers, Jacksonville District, "Report on Flood of 13–17 October 1956," and in U.S. Department of Agriculture, Soil Conservation Service, Gainesville, Fla., Special Storm Report, "Storm of October 14–16, 1956, Taylor Creek Watershed."

Table 37 gives peak discharges at gaging stations.

TABLE 37.—*Summary of flood stages and discharges in October in east-central Florida*

[Each station in this table has one or two entries listed under maximum floods; the first pertains to the flood of this report, and the second pertains to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	St. Johns River basin						
1	Jane Green Creek near Deer Park.	248	1953–56	Oct. 17, 1956	10.95	18,400	74.2
				Oct. 9 or 10, 1953	8.65	6,880	27.7
2	St. Johns River near Melbourne.	874	1939–56	Oct. 18, 1956	[1] 9.45	[2] 18,000	20.6
				Sept. 25, 1948	[3] 9.47	[2] 12,500	14.3
3	Wolf Creek near Deer Park	26.3	1956	Oct. 16, 1956	7.93	7,700	293
4	St. Johns River near Christmas.	1,418	1933–56	Oct. 18, 1956	9.03	10,200	7.19
				Oct. 12, 1953	10.59	11,700	8.25
5	Econlockhatchee River near Chuluota.	260	1935–56	Oct. 18, 1956	17.47	8,850	34.0
				Sept. 24, 1948	18.09	10,000	38.5
	Indian River basin						
6	Elbow Creek near Eau Gallie.	2.69	1954–56	Oct. 16, 1956	6.50	830	309
7	Crane Creek near Melbourne	12.6	1951–56	do	9.98	608	48.3
				Oct. 9, 1953	9.55	539	42.8
8	Turkey Creek near Palm Bay.	95.5	1956	Oct. 16, 1956	13.73	2,790	29.2
9	Fellsmere Canal near Fellsmere.	78.4	1955–56	do	13.20	1,880	24.0
10	North Canal near Vero Beach.	----------	1950–56	do	9.63	1,280	----------
				Oct. 8, 1953	8.07	895	----------
11	Main Canal near Vero Beach.	----------	1950–56	Oct. 16, 1956	14.01	1,450	----------
				Oct. 18, 1950	13.1	1,380	----------
12	South Canal near Vero Beach.	----------	1950–56	Oct. 16, 1956	8.92	1,220	----------
				Sept. 9, 1956	8.86	1,130	----------
	Lake Okeechobee and the Everglades						
13	Canoe Creek near St. Cloud	86.5	1949–56	Oct. 16, 1956	12.17	2,190	25.3
				Oct. 19, 1950	11.4	1,550	17.9
14	Taylor Creek near Basinger	15.7	1955–56	Oct. 15, 1956	7.88	2,540	162
15	Taylor Creek above Okeechobee.	98.7	1955–56	Oct. 16, 1956	9.20	6,930	70.2

[1] Occurred Oct. 20, 1956.
[2] Daily mean discharge.
[3] Occurred Oct. 12, 1953.

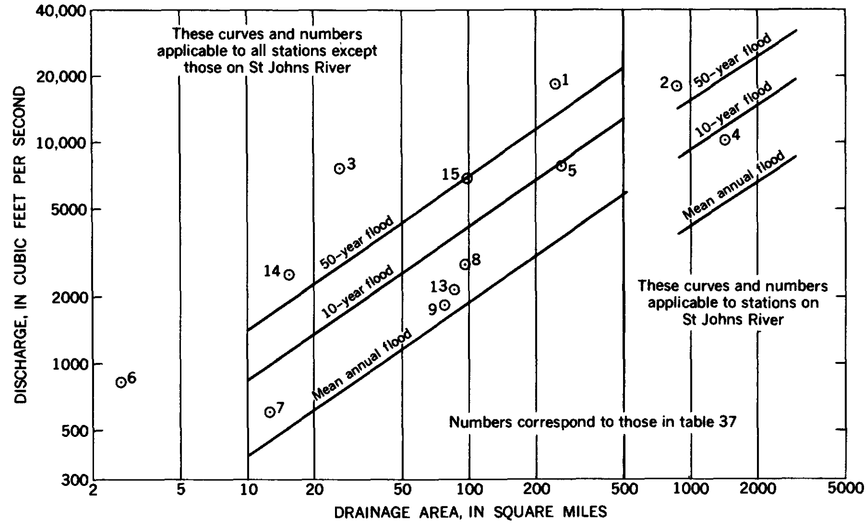

FIGURE 43.—Relation of peak discharge to the mean annual, 10-year, and 50-year floods in east-central Florida.

FLOODS OF NOVEMBER 1-2 IN SUSQUEHANNA RIVER BASIN, PENNSYLVANIA

Heavy rains, accompanied by thunderstorms, fell late in the afternoon of November 1 and early in the morning of November 2 in the lower Susquehanna River, Juniata River, and West Branch Susquehanna River basins. These rains resulted in some flooding of lowlands throughout the basin, principally in the Lycoming Creek and Loyalsock Creek areas (fig. 44).

Cocolamus Creek near Millerstown reached the highest stage since its record began in 1930. Bixler Run near Loysville was about 3.5 feet higher than its previous high of record, and Loyalsock Creek at Loyalsock was within one-half foot of its maximum since the station was established in 1925 (table 38).

No figures of flood damage over the entire area are available. However, in the area bounded by Jersey Shore and Trout Run to the west, Barbours to the northeast, Hughesville to the east, and Lewisburg to the south the total flood damage has been estimated at $136,000. In the city of Williamsport, included in this area, the flood damage was estimated at about $35,000, based on damage to about 450 dwellings.

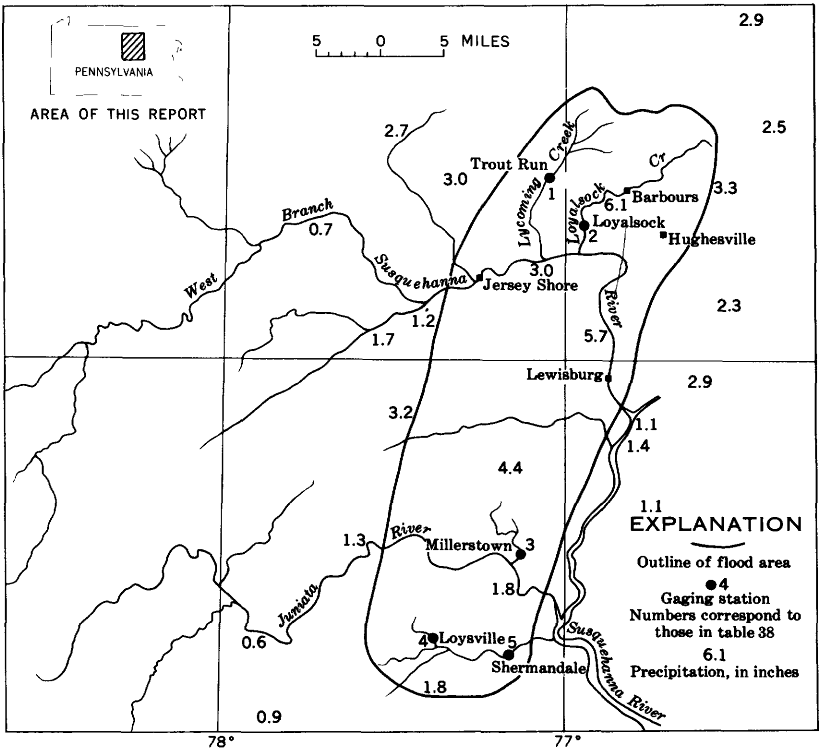

FIGURE 44.—Map of flood area showing location of flood-determination points and rainfall, in inches, for floods of November 1-2 in Pennsylvania.

TABLE 38.—*Summary of flood stages and discharges, November 1–2, in the Susquehanna River basin, Pennsylvania*

[Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report, and the second and third pertain to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
1	Lycoming Creek near Trout Run.	173	1914–16, 1919–56	Nov. 2, 1956	12.21	10,300	59.5
				May 27, 1946	19.37	21,800	126
2	Loyalsock Creek at Loyalsock	443	1925–56	Nov. 2, 1956	11.78	44,600	101
				Nov. 16, 1926	--------	51,200	116
				Nov. 26, 1950	12.32	51,200	116
3	Cocolamus Creek near Millerstown.	57.2	1930–56	Nov. 2, 1956	8.27	4,690	82.0
				Aug. 24, 1933	8.20	4,560	79.7
				Nov. 25, 1950	--------	4,560	79.7
4	Bixler Run near Loysville	15.0	1954–56	Nov. 1, 1956	10.39	8,780	585
				Aug. 13, 1955	6.77	1,080	72.0
5	Sherman Creek at Shermandale	200	1926–56	Nov. 2, 1956	12.75	17,900	89.5
				Aug. 24, 1933	14.05	21,800	109
				July 22, 1927	20.34	--------	----------

FLOODS OF NOVEMBER 2–3 IN MARYLAND AND DELAWARE

Record-breaking rains on November 1–2 over most of Delaware and the part of Maryland between Delaware and Chesapeake Bay (fig. 45) caused flooding on several streams. Maximum peaks of record occurred at five gaging stations in the flood area (table 39)—the maximum peak on the Leipsic River near Cheswold, Del., was more than 50 percent greater than the previous maximum during 17 years of record.

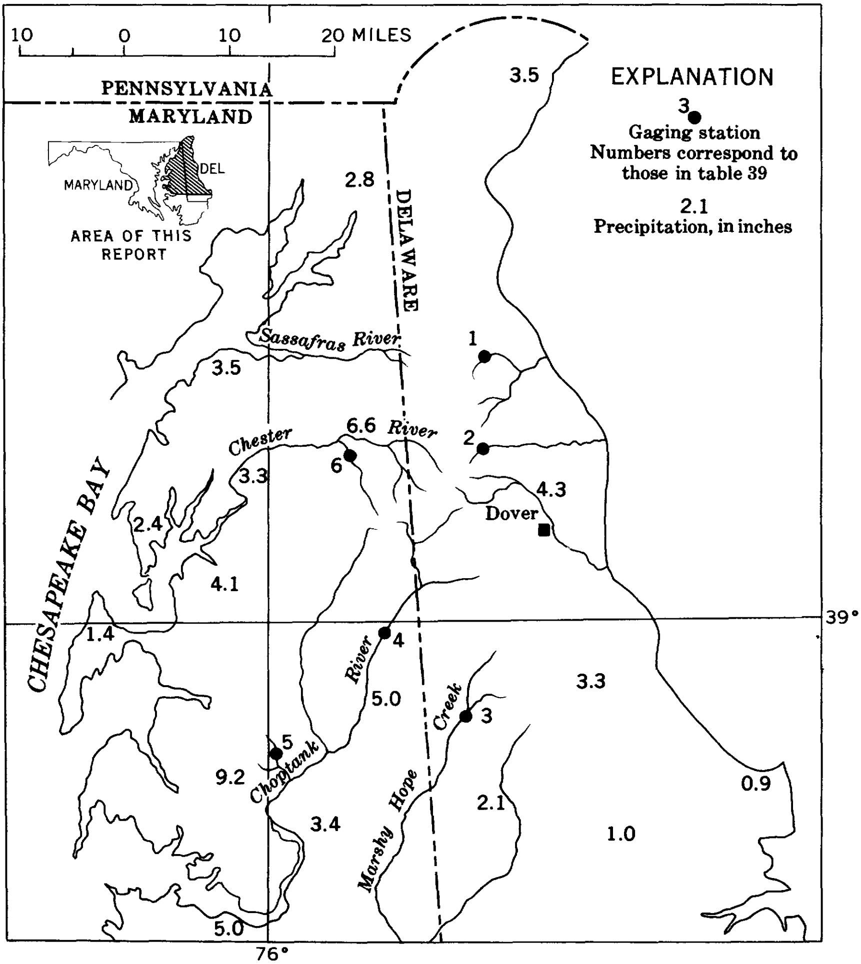

FIGURE 45.—Map of flood area showing location of flood-determination points and rainfall, in inches, for floods of November 2-3 in Maryland and Delaware.

Many roads and bridges were damaged or washed out. Considerable damage occurred to agricultural crops, thousands of chickens were drowned, and much top soil was eroded or washed away in many places.

TABLE 39.—*Summary of flood stages and discharges, November 2–3, in Maryland and Delaware*

[Each station in this table has one, two or three entries listed under maximum floods; the first pertains to the flood of this report, and the second and third pertain to the maximum flood previously known during the period of record]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Delaware River basin						
1	Blackbird Creek at Blackbird, Del.	3.85	1956	Nov. 2, 1956	3.23	235	61.0
	Leipsic River basin						
2	Leipsic River near Cheswold, Del.	9.35	1931–33, 1943–56	Nov. 2, 1956	6.13	1,120	120
				July 9, 1952	--------	730	78.1
				Aug. 23, 1933	6.1	----------	----------
	Nanticoke River basin						
3	Marshy Hope Creek near Adamsville, Del.	44.8	1943–56	Nov. 2, 1956	10.42	1,440	32.1
				July 1, 1946	9.63	1,040	23.2
	Choptank River basin						
4	Choptank River near Greensboro, Md.	113	1948–56	Nov. 3, 1956	11.47	4,140	36.6
				Dec. 22, 1951	9.99	3,640	32.2
5	Beaverdam Branch at Matthews, Md.	5.85	1950–56	Nov. 2, 1956	7.12	1,020	174
				Aug. 12, 1955	5.19	476	81.4
	Chester River basin						
6	Unicorn Branch near Millington, Md.	22.3	1948–56	Nov. 2, 1956	5.49	630	28.3
				Apr. 28, 1952	4.41	383	17.2

FLOODS OF DECEMBER 11 IN SOUTHWESTERN OREGON

Western Oregon (fig. 46) was cold, and snow fell over most of the area on December 5–6 adding to previous snows in the mountains and depositing a few inches of ice and snow at low elevations. The cold weather remained through December 7, and no appreciable amount of precipitation fell. Temperatures rose December 8 at low elevations, and a further rise occurred December 9 which extended

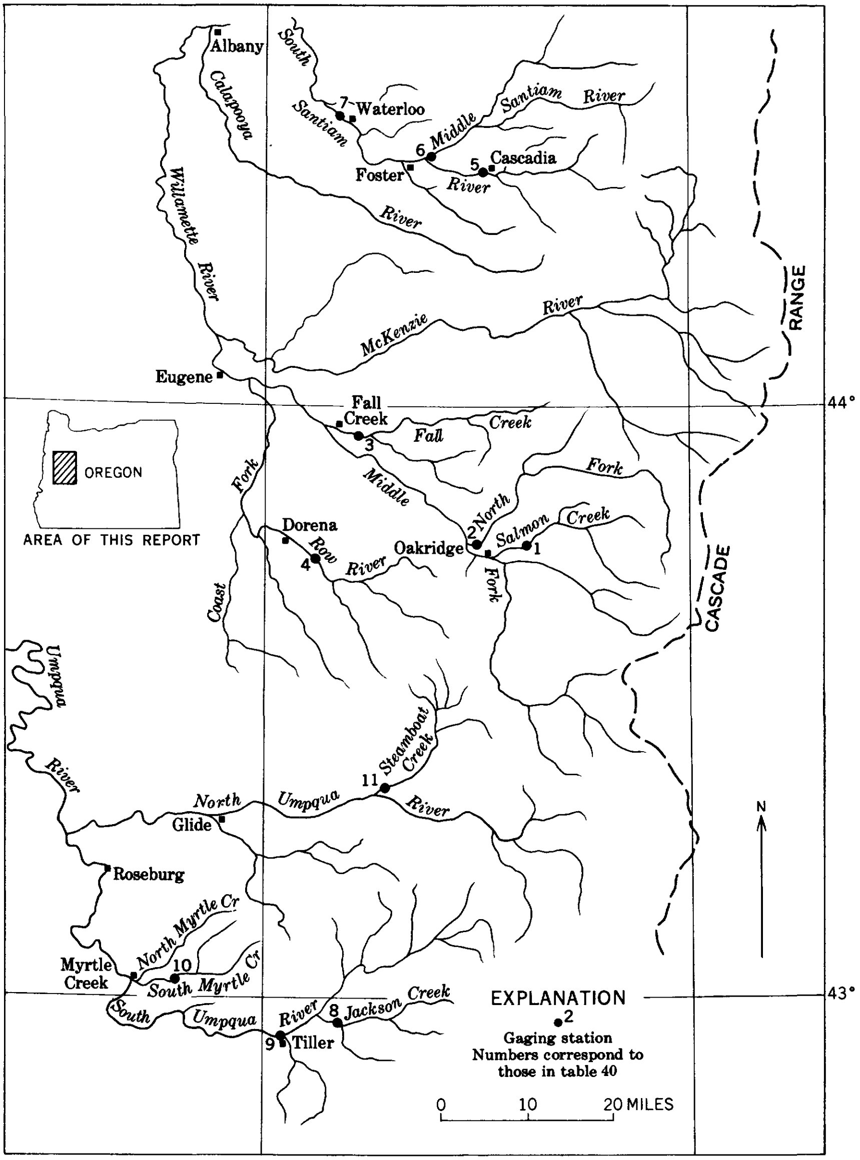

FIGURE 46.—Map of flood area showing location of flood-determination points for floods of December 11 in southwestern Oregon.

to higher elevations and was accompanied by rains ranging from less than an inch in northwestern Oregon to more than an inch in central-western Oregon. Several precipitation stations reported 3 to 4 inches of rain during December 10–11, and a few stations reported 6 to 8 inches.

The heavy rains plus warm weather removed the snow cover up to an elevation of about 7,000 feet. Runoff from rainfall and melting snow produced some flood peaks which were maximums for periods of record of 25 years of more (table 40) in South Santiam River and Umpqua River basins and some tributaries of Middle Fork Willamette River. In the upper Willamette River basin, the December 1945 flood peaks had been the maximums of record for 30 or 40 years, and at some sites the December 1956 peaks exceeded them moderately.

Considerable damage occurred along the smaller streams to roads, bridges, and agricultural lands, but main streams did not flood the more populous lower areas.

TABLE 40.—*Summary of flood stages and discharges, December 11, in southwestern Oregon*

Each station in this table has two or three entries listed under maximum floods; the first pertains to the flood of this report; the second pertains to the maximum flood previously known during the period of record; the third pertains to the maximum flood outside the period of record for which knowledge is available]

No.	Stream and place of determination	Drainage area (sq mi)	Period of record	Maximum floods			
				Date	Gage height (ft)	Discharge	
						Cfs	Cfs per sq mi
	Willamette River basin						
1	Salmon Creek near Oakridge	117	1913–19, 1933–56	Dec. 11, 1956	11.18	10,400	88.8
				Dec. 28, 1945	8.40	8,040	68.7
2	North Fork of Middle Fork Willamette River near Oakridge.	246	1909–16, 1935–56	Dec. 11, 1956	15.47	15,800	64.2
				Dec. 28, 1945	16.6	17,000	69.1
3	Fall Creek below Winberry Creek, near Fall Creek.	186	1935–56	Dec. 11, 1956	18.80	24,700	133
				Dec. 28, 1945	18.0	22,500	121
4	Row River above Pitcher Creek, near Dorena.	211	1935–56	Dec. 11, 1956	12.44	15,300	72.5
				Dec. 28, 1945	14.33	19,600	92.9
5	South Santiam River below Cascadia.	174	1935–56	Dec. 11, 1956	19.35	26,800	154
				Dec. 28, 1945	18.65	23,400	134
6	Middle Santiam River at mouth, near Foster.	287	1951–56	Dec. 11, 1956	20.25	41,000	143
				Nov. 22, 1953	19.67	38,300	134
				Dec. 28, 1945		[1] 41,800	154
7	South Santiam River at Waterloo.	640	1905–07, 1910–11, 1923–56	Dec. 11, 1956	21.10	69,300	108
				Dec. 28, 1945	22.85	74,200	116
	Umpqua River basin						
8	Jackson Creek near Tiller	152	1955–56	Dec. 11, 1956	12.65	9,440	62.1
				Dec. 22, 1955	13.55	10,600	69.7
9	South Umpqua River at Tiller	449	1910–11, 1939–56	Dec. 11, 1956	22.7	46,600	104
				Oct. 29, 1950	[2] 22.35	37,400	83.3
10	South Myrtle Creek near Myrtle Creek.	43.9	1955–56	Dec. 11, 1956	7.72	3,050	69.5
				Dec. 26, 1955	[3] 7.95	2,140	48.7
11	Steamboat Creek near Glide	227	1955–56	Dec. 11, 1956	16.61	23,500	104
				Dec. 22, 1955	17.96	26,900	119

[1] At site upstream; drainage area, 271 sq mi.
[2] Referred to outside gage.
[3] Backwater from debris.

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