UNITED STATES DEPARTMENT OF THE INTERIOR

NOTABLE LOCAL FLOODS OF 1939

Part 3. FLOOD OF AUGUST 21, 1939 IN TOWN OF BALDWIN, MAINE

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 967–C

UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

Water-Supply Paper 967–C

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BY

MINER R. STACKPOLE

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1946

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 10 cents

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INTRODUCTION

Storms of the cloudburst type—intense rainfall on small areas, usually associated with thunderstorms and often causing destructive floods—frequently occur throughout the West but rarely occur in Maine. The storm which occurred on the afternoon of August 21, 1939, in the town of Baldwin, Maine, was therefore quite unusual. Precipitation believed to amount to at least 12 inches at the storm center occurred in a period of about 3 hours. The resulting floods on small streams caused the loss of three lives and damaged highways, bridges, and the roadbed and two culverts of the Maine Central Railroad. The general location of the flood area is shown in figure 8.

On August 22 and 23, engineers from the Augusta district office of the Geological Survey visited the flood area to obtain information on the flood flows and the precipitation that caused them. This report contains the results of their investigations as well as the records from the stream-gaging stations adjacent to the flood area.

ADMINISTRATION AND PERSONNEL

This report was prepared in the Water Resources Branch of the Geological Survey, of which C. G. Paulsen was acting chief hydraulic engineer until October 17, 1939, when G. L. Parker became chief hydraulic engineer. The field and office work was performed and the original report prepared in the Division of Surface Water by M. R. Stackpole, district engineer, Augusta district, assisted by his staff. That report was arranged for publication by W. S. Eisenlohr, Jr., in the Division of Water Utilization, under the general direction of R. W. Davenport, Chief.

GENERAL DESCRIPTION OF THE STORM AND FLOOD

Heavy rains of cloudburst intensity covered most of the town of Baldwin and part of the town of Sebago between 2:30 p. m. and 5:30 p. m., August 21, 1939. This storm has been described by the Weather Bureau as follows:

> The storm was of the cloudburst type, the intense rainfall being limited to an area of about 30 square miles, but its causes can be traced to the general meteorological situation which caused rainfall over most of New England on August 21st.

It was not directly a part of the tropical disturbance which passed northward near the Pennsylvania-New Jersey boundary on the 19th and 20th, but the intense rainfall had its source in the same warm, very moist, convectively unstable air which preceded this disturbance.

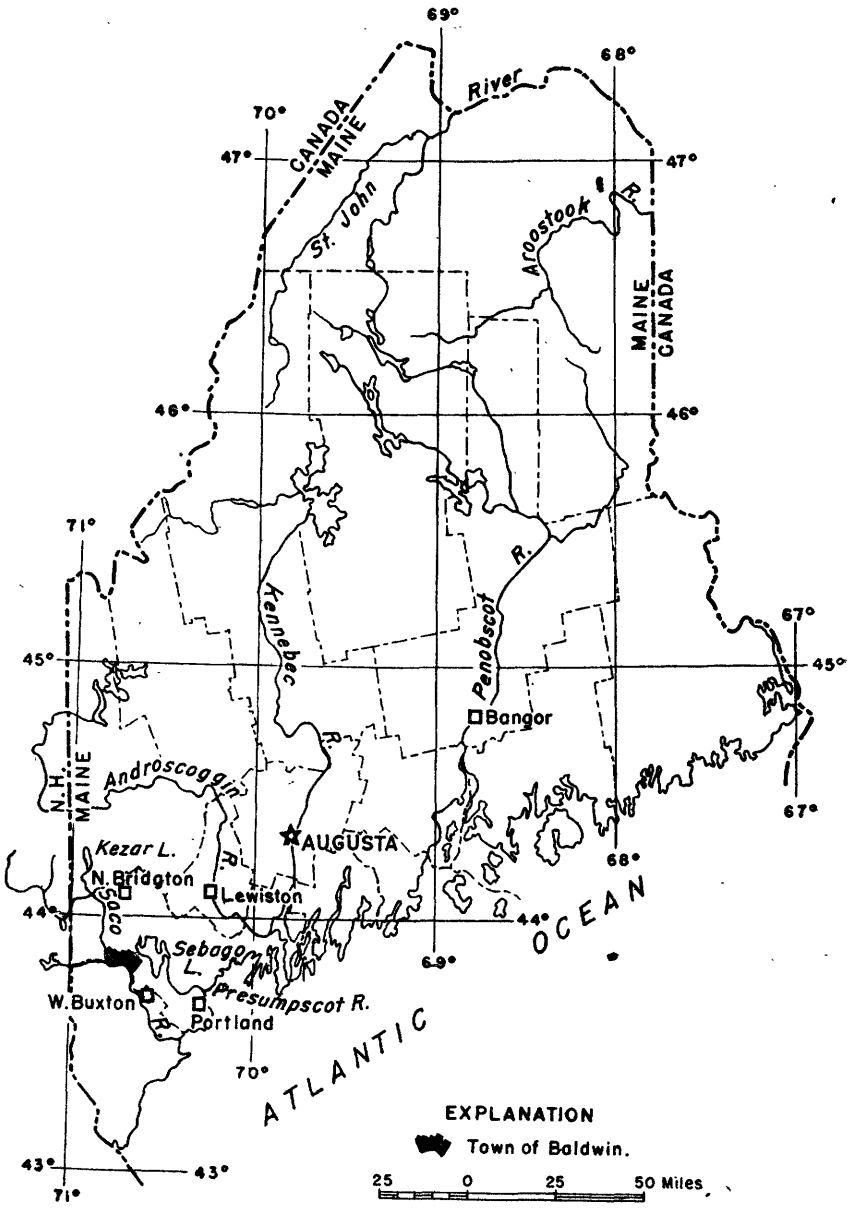


FIGURE 8.—Map of Maine, showing location of town of Baldwin.

The rains were accompanied by lightning but very little wind. The storm covered an area of about 100 square miles, with the center apparently at the divide between the Saco and Presumpscot River Basins, near the north end of Saddleback Hills. The area of intense rainfall was limited to about 30 square miles, extending from West Baldwin to North Sebago (see pl. 12), with the center near Douglas Hill, the northern and highest peak in the Saddleback Hills. From the minor damage to highways there apparently was no intense rain west of Saco River. There were no rain gages in the area of intense rainfall, but from the amounts collected by exposed vessels of various sorts a rainfall of at least 12 inches was indicated. As a result, floods occurred in all the smaller streams draining the area. The outstanding flood discharge was the 340 second-feet per square mile from the 4.7 square miles drained by Breakneck Brook near West Baldwin. Three sightseers standing on a bridge over this stream died as a result of the collapse of the bridge, which had been undermined (see pl. 13, *A*). The area covered by the storm was so small, however, that the peak flows at gaging stations on the larger streams were little more than slight rises in the low-water flow. The maximum increase was probably that reported by the Cumberland County Power & Light Co. near West Buxton, where Saco River rose from 1,000 second-feet to 4,500 second-feet.

Transportation systems suffered the greatest property damage; (See pls. 13, *B*, 14.) Two railroad culverts and 17 highway bridges were destroyed, and roads were eroded to a depth of 4 or 5 feet in places. Damage to private property was not large. A few persons near the brooks suffered losses from flooded buildings, land erosion, and crop damage. The crop damage might have been more extensive had not agriculture in this area been largely confined to vegetable gardening. Three sawmill dams were washed out. Two, near Burnell School, will probably never be replaced as they were seldom used; the other, near East Sebago, has been rebuilt. Estimated dollar value of the damage is shown in the following table:

Type of property	Estimate furnished by—	Cost
Bridges	State Highway Department	$55, 100
State roads	do	8, 000
Town roads		2, 000
Railroad	Maine Central Railroad	35, 000
Private property		5, 000
		$105, 100

RAINFALL RECORDS

There were no rain gages within the area of heaviest rainfall. The following information on rainfall was collected by engineers of the Geological Survey, August 22–23, 1939. Local residents were interviewed concerning the amount of rain caught by exposed pails, jars, and tanks. The information obtained is summarized in the following table:

Miscellaneous measurements of rainfall, August 21, 1939

No. on pl. 12	Location	Reporter or resident	Storm period (hours)	Rainfall (inches)
1	Burnell School, near	Walter Warren	2	5
2	Burnell School, 2 miles northeast of	Clifford Douglas		12
3	Douglas Hill (elevation 950 ft.)	Frank Nelson		11.4+
4	Macks Corner	Guy Lewis	3	8+
5	North Baldwin, near	Abe Parker		9+
6	East Sebago	George Fitch		8.4+
7	North Sebago	L. D. Nisbet	2	6+

It was reported that only light rain fell at Sebago Lake. In addition to the above records for the immediate storm area, rain gage records for adjacent areas are given in the following table. Within the limits of plate 12 the locations of the gages are shown. The place names for the other gages are given in figure 8.

Rain-gage records, August 20–22, 1939

Location	Record furnished by	Period	Rainfall (inches)
Kezar Lake outlet	Cumberland County Power & Light Co.	Aug. 21	0.89
Brownfield	C. E. Spring	Aug. 20–21	2.40
Great Falls, near Hiram	Cumberland County Power & Light Co.	Aug. 20	1.11
		Aug. 21, 2–5 p. m.	2.42
		Aug. 21, 5–6 p. m.	.08
Songo Lock	S. D. Warren Co	Aug. 20–22	4.25
North Bridgton	U. S. Weather Bureau	Aug. 21	1.19
Lewiston	do	do	.20
Portland	do	Aug. 20–21	1.37

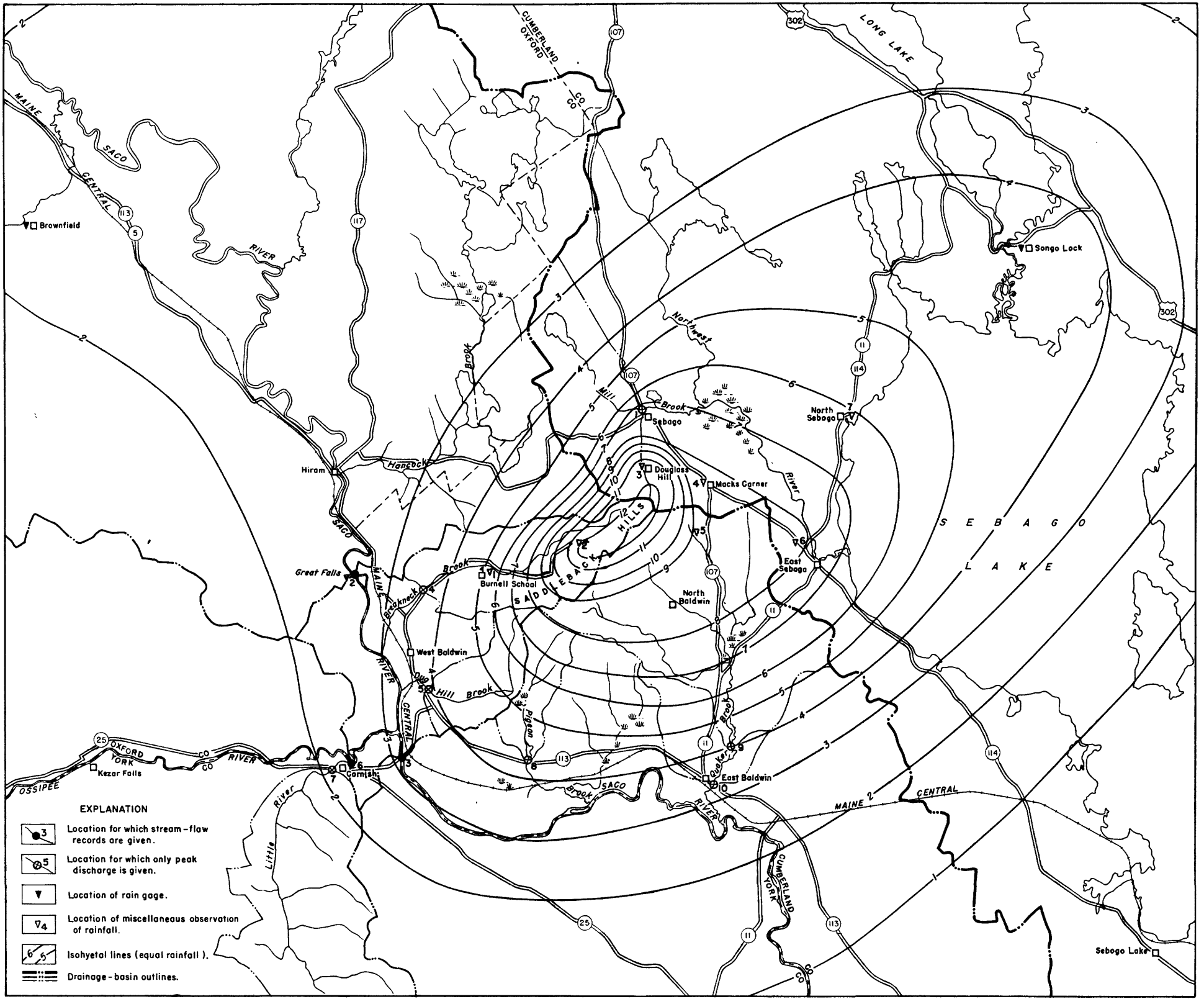
On the basis of the records in the two preceding tables, isohyetal lines were drawn on the map (pl. 12). The areas enclosed by the various lines, as measured with a planimeter, are given below.

Isohyetal line (inches)	*Area enclosed (square miles)*	*Isohyetal line (inches)*	*Area enclosed (square miles)*
12	0.7	7	18.7
11	1.8	6	28.3
10	3.1	5	42.4
9	4.4	4	74.7
8	11.0		

STREAM-FLOW RECORDS

Stream-gaging stations were in operation on both Saco and Ossipee Rivers at Cornish. Stream-flow records for the flood period at these stations will be found on succeeding pages. Complete records for these stations are published regularly in the series of reports on Surface water supply of the United States, Part 1, North Atlantic slope basins. Methods of obtaining the records are described briefly in those reports and at greater length in the manual, Stream-gaging procedure.[1] A record of the flow past the power plant on Saco River at Great Falls, near Hiram, as furnished by the Cumberland County

[1] Corbett, D. M., and others, Stream-gaging procedure, a manual describing methods and practices of the Geological Survey: U. S. Geol. Survey Water-Supply Paper 888, 1943.



MAP OF FLOOD AREA SHOWING RAINFALL OBSERVATION POINTS, ISOHYETAL LINES, AND DISCHARGE OBSERVATION POINTS

A. VIEW UPSTREAM OF BRIDGE ON BREAKNECK BROOK.
Bridge was undermined and collapsed, drowning three persons.

B. FILL OF MAINE CENTRAL RAILROAD WASHED OUT BY DUG HILL BROOK.
Top of trestle indicates height of original fill.

A. ON UPPER BREAKNECK BROOK.

B. AT MACKS CORNER.

DAMAGE TO ROADS.

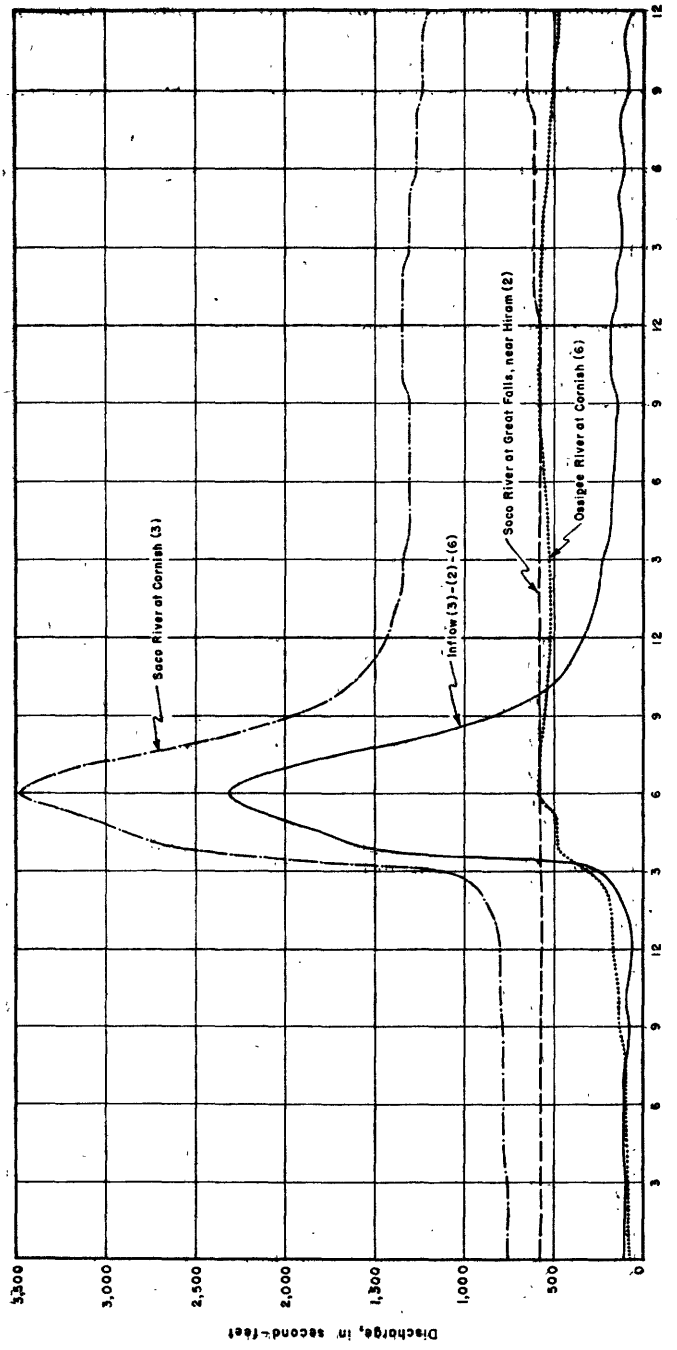


FIGURE 9.—Hydrograph of flood flows in Saco River Basin, August 21-22, 1939.

Power & Light Co., is also given. These records are plotted in figure 9. A study of this figure and plate 12 shows a most unusual situation. The hydrograph of Saco River at Cornish is a typical flood hydrograph. The Great Falls power plant is only 3½ miles upstream, yet the flow was practically constant throughout the flood period. Likewise the hydrograph for Ossipee River at Cornish, 1¾ miles upstream, shows only a small increase in flow during the flood period. Such a situation is ideal for subtracting the measured flow upstream from Saco River at Cornish to get the flood flow from the intervening area of 13.0 square miles. The hydrograph of inflow computed in this manner is also shown in figure 9. The runoff represented by this hydrograph is about 1.4 inches. The peak rate of inflow indicated is probably somewhat less than actual, owing to channel storage between Great Falls and Cornish.

Although there were no gaging stations on the small streams draining Saddleback Hills, it was possible to estimate their peak discharge by means of the slope-area or contracted-opening method or by computing the flow over a dam. These methods are described in the manual, Stream-gaging procedure.[2] Field data were obtained by engineers of the Geological Survey. The high-water elevations were marked out on August 22 and 23 and surveyed later. Computations were made in the Augusta office of the Survey, and the results are given in the summary of flood discharges following the detailed gaging-station records. The peak discharges are not so large as those measured during March 1936, but it must be remembered that this flood occurred as a result of a 3-hour storm in the summer, whereas the flood of March 1936 resulted from much heavier rainfall and melting snow during a period of nearly 2 weeks in the late winter.

SACO RIVER AT GREAT FALLS, NEAR HIRAM, MAINE

LOCATION.—Lat. 43°51′10″, long. 70°47′50″, at Great Falls, 1.7 miles southeast of village of Hiram, York County.
DRAINAGE AREA.—832 square miles.
GAGE-HEIGHT RECORD.—Staff gages in pond above dam and in tailrace read hourly.
DISCHARGE RECORD.—Computed from flow over dam and through wheels.
MAXIMUM.—August 1939: Discharge, 690 second-feet 4 to 7 a. m., Aug. 23.
REMARKS.—Flood run-off materially affected by pondage above station. Records furnished by Cumberland County Power & Light Company.

Mean discharge, August 1939

Day	Second-feet	Day	Second-feet	Day	Second-feet	Day	Second-feet
20	310	23	641	26	599	29	579
21	577	24	617	27	525	30	575
22	606	25	617	28	581	31	575

SACO RIVER AT CORNISH, MAINE

LOCATION.—Lat. 43°48′30″, long. 70°46′55″, just upstream from highway bridge at Cornish, York County, and half a mile downstream from Ossipee River. Zero of gage is 263.7 feet above mean sea level, preliminary determination.
DRAINAGE AREA.—1,298 square miles.
GAGE-HEIGHT RECORD.—Water-stage recorder graph.
DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements for the range of stage used. Gage heights used to half-tenths below 6.0 feet, and to tenths above.
MAXIMA.—August 1939: Discharge, 3,480 second-feet 6 p. m. Aug. 21 (gage height, 5.35 feet).
1916–38: Discharge, 51,300 second-feet Mar. 21, 22, 1936 (gage height, 21.90 feet, from floodmarks).

[2] Corbett, D. M., and others, op. cit., pp. 100–107.

REMARKS.—Flood runoff affected by artificial storage and pondage above station. Peak flow materially reduced by channel storage between Great Falls and Cornish in Hiram Township.

Mean discharge, August 1939

Day	Second-feet	Day	Second-feet	Day	Second-feet	Day	Second-fee
20	590	23	1,130	26	1,100	29	982
21	1,380	24	1,130	27	1,010	30	1,040
22	1,200	25	1,130	28	1,010	31	1,070

Gage height and discharge at indicated time, 1939

Time	Gage height (feet)	Discharge (second-feet)	Time	Gage height (feet)	Discharge (second-feet)
Aug. 21			*Aug. 21*		
1 a. m	2.71	760			
6	2.73	782	10 p. m	4.05	1,680
12 m	2.81	804	11	3.90	1,530
1 p. m	2.83	828	12	3.81	1,440
2	3.00	900			
3	3.40	1,130	*Aug. 22*		
4	4.79	2,630	3 a. m	3.68	1,350
5	5.10	3,080	6	3.66	1,310
6	5.35	3,480	9	3.67	1,310
7	5.15	3,160	12 m	3.70	1,350
8	4.70	2,490	6 p. m	3.62	1,270
9	4.30	1,970	12	3.52	1,200

OSSIPEE RIVER AT CORNISH, MAINE

LOCATION.—Lat. 43°48′25″, long. 70°47′55″, at highway bridge in Cornish, York County, 1¼ miles upstream from mouth. Zero of gage is 277.4 feet above mean sea level, preliminary determination.

DRAINAGE AREA.—453 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current meter measurements for range in stage used. Gage heights used to half-tenths between 1.80 and 3.80 feet; hundredths below and tenths above these limits.

MAXIMA.—August 1939: Discharge 589 second-feet 6–7 p. m. Aug. 21 and 10 a. m. Aug. 22 (gage height, 1.53 feet).

1916–38: Discharge 17,200 second-feet Mar. 21, 1936 (gage height, 15.32 feet).

REMARKS.—Flood runoff affected by artificial storage in Ossipee and Silver Lakes, which have a combined capacity of about 1,000,000,000 cubic feet.

Mean discharge, August 1939

Day	Second-feet	Day	Second-feet	Day	Second-feet	Day	Second-feet
20	87	23	394	26	438	29	394
21	280	24	416	27	416	30	483
22	545	25	438	28	407	31	506

Gage height and discharge at indicated time, 1939

Time	Gage height (feet)	Discharge (second-feet)	Time	Gage height (feet)	Discharge (second-feet)
Aug. 21			*Aug. 21*		
1 a. m	0.17	80	9 p. m	1.46	554
3	.20	86	10	1.44	545
6	.23	93	11	1.41	530
9	.39	132	12	1.40	525
12 m	.51	167			
1 p. m	.54	177	*Aug. 22*		
2	.60	196			
3	.90	307	3 a. m	1.41	530
4	1.30	478	6	1.47	559
5	1.33	492	9	1.51	579
6	1.53	589	10	1.53	589
7	1.53	589	12 m	1.52	584
8	1.51	579	6 p. m	1.43	540
			12	1.30	478

SUMMARY OF FLOOD DISCHARGES NEAR BALDWIN, MAINE

No. on pl. 12	Stream and place of determination	Drainage area (square miles)	Period of record	Maximum flood previously known				Maximum during present flood				Remarks
				Date	Gage height (feet)	Discharge		Time	Gage height (feet)	Discharge		
						Second-feet	Second-feet per square mile			Second-feet	Second-feet per square mile	
	PRESUMPSCOT RIVER BASIN											
1	Mill Brook at Sebago	4.48								180	40	Flow through culvert.
	SACO RIVER BASIN											
2	Saco River at Great Falls, near Hiram.	[1] 832		Mar. 21, 1936		37,600	45.4	Aug. 23, 4–7 a. m		690	.8	Power-plant record.
3	Saco River at Cornish	1,298	1916–39	Mar. 21, 22, 1936	21.90	51,300	39.5	Aug. 21, 6 p. m	5.35	3,480	2.7	Gaging-station record.
4	Breakneck Brook near West Baldwin.	4.69						Aug. 21 [2]		1,600	340	Slope-area measurement.
5	Dug Hill Brook near West Baldwin.	2.13						Aug. 21 [2]		500	230	Computed flow over dam.
6	Ossipee River at Cornish	453	1916–39	Mar. 21, 1936	15.32	17,200	38.0	Aug. 21, 6–7 p. m. Aug. 22, 10 a. m	1.53	589	1.3	Gaging-station record.
7	Little River at Cornish	7.8		Mar. 21, 1936		681	87.3	Aug. 21		160	21	Computed flow over dam.
8	Pigeon Brook near East Baldwin.	1.67						Aug. 21 [2]		400	240	Do.
9	Quaker Brook near East Baldwin.	10.2						Aug. 21 [2]		1,500	150	Do.
10	Quaker Brook near East Baldwin.	12.2		March 1936		3,880	318	Aug. 21 [2]		1,900	160	Flow through culvert.

[1] Previously published as 837 square miles.
[2] Occurred between 4 and 5 p. m.

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1946

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