

EFFECTS OF URBANIZATION ON TIMING OF FLOOD PEAKS ON TOWN CREEK IN JACKSON, MISSISSIPPI

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ABSTRACT

During the floods of March and April 1969 the flood crest on Town Creek occurred at Gallatin Street before crests occurred at some upstream points. Heavy urbanization in the downstream part of the basin probably caused the abnormal sequence of flood peaks in Town Creek.

Flood flow at Gallatin Street is spread over a greater length of time and the peak discharges caused by urbanization in the lower part of Town Creek basin seem to be lower than those that might be expected if the basin were more uniformly urbanized.

INTRODUCTION

This report describes the abnormal sequence of flood peaks observed during two low-order floods on Town Creek during 1969. The report was prepared under a cooperative agreement between the City of Jackson, Miss., and the U.S. Geological Survey.

During a special study of the floods of March 23 and April 17, 1969, sufficient data were recorded, for the first time, to closely determine the time of the flood peaks at the sites shown on figure 1. The time-of-flood-peak data were collected in conjunction with a series of discharge measurements at several sites along the creek. At site 5 the time of the crest was read from a recording-gage chart; at other sites the time of the flood crest was read from hydrographs which were constructed using miscellaneous stage observations and water marks left by the crest of the flood.

Normally, after a general rain, small streams crest first and streams draining larger areas crest later. Times of flood crest in the Town Creek basin for the floods of March 23 and April 17 did not fit the normal pattern. During each of these floods a crest occurred almost simultaneously at the most downstream and the most upstream measuring sites. Rainfall seems to have been reasonably uniform in both time and areal distribution over the basin during both rains.

DESCRIPTION OF BASIN

Town Creek starts in a lightly urbanized area in

northwest Jackson and runs southeast through downtown Jackson (fig. 1). About 20 percent of the basin is urbanized above the gage at site 5 (drainage area, 11.7 sq mi). The heaviest urbanization in the basin above site 5 is in the lower part.

Above the gage at site 5 Town Creek has four principal branches: Town Creek, Airport Branch, West Branch, and East Branch. The drainage areas of these branches are 5.0, 1.9, 1.8, and 2.3 square miles, respectively.

Town Creek. --The upper end of Town Creek, above Airport Branch, drains the area west of Hawkins Field and is about 10 percent urbanized.

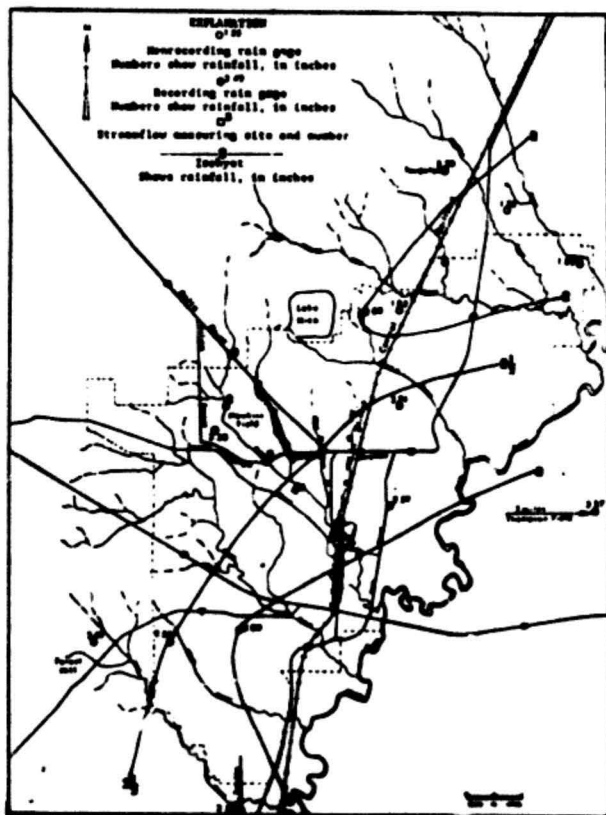


Figure 1.--Map of Jackson, Miss., showing rainfall of April 17, 1969, between 11 a.m. and 3 p.m. and location of streamflow measuring sites.

Table 1.--Times of flood crests for floods of March 23 and April 17, 1969, on Town Creek in Jackson, Mississippi

Site No.	Drainage area (sq mi)	Main channel length (ft)	*Basin slope (ft/mile)	Percent of area urbanized	Flood of March 23, 1969		Flood of April 17, 1969	
					Peak discharge (cfs)	Time of peak	Peak discharge (cfs)	Time of peak
1	1.37	10,600	28.5	10	156	6:15 p.m.	190	4:00 p.m.
2	3.01	15,600	22.7	10	350	7:00 p.m.	590	4:45 p.m.
3	4.40	23,300	17.4	10	---	---	960	4:43 p.m.
4	6.80	28,000	16.9	10	---	---	1,310	4:45 p.m.
5	11.67	34,100	15.8	20	1,700	5:45 p.m.	2,900	4:00 p.m.

*Between points 10 and 85 percent of the total main stem distance upstream from the site.

Airport Branch.--Airport Branch begins just west of Lake Hico, runs along the east side of Hawkins Field, and joins Town Creek 1.6 miles above site 5. It is about 15 percent urbanized.

West Branch.--West Branch begins just south of Lake Hico, drains mostly residential and commercial areas, joins Town Creek 0.7 mile above site 5, and is about 25 percent urbanized.

East Branch.--East Branch begins just southeast of Lake Hico, drains mostly residential and commercial areas, joins Town Creek 0.2 mile above site 5, and is about 35 percent urbanized.

stations received between 1.0 and 1.2 inches of rain. Several nonrecording rain gages also indicated a rather uniform areal distribution of the rain.

Timing of Flood Peaks

Town Creek peaked at a downstream point on March 23, 1969, before it peaked at more upstream points. The flood crested at 5:45 p.m. (table 1) at site 5, or 30 minutes before the crest occurred 5 miles upstream at site 1. At site 2, 1 mile downstream from site 1, Town Creek peaked at about 7:00 p.m. Although the peak in the upper part of the basin was later than the peak at site 5, no second peak is evident on the stage hydrograph at site 5 (fig. 2).

FLOOD OF MARCH 23, 1969

Rainfall

Four recording and several nonrecording rain gages in and near the city of Jackson are used to relate rainfall to floods (fig. 1). On March 23, 1969, all four of the recording-gage sites received 0.4 inch of rain between 9:00 a.m. and 1:45 p.m. Between 1:45 and 4:45 p.m. each of the four recording

FLOOD OF APRIL 17, 1969

Rainfall and Floods

On April 17 a storm moved across Jackson and 2.2 to 2.4 inches of rain fell between 11:00 a.m. and 3:00 p.m. at the three recording gages west of the Pearl River (figs. 1 and 3). About 9:00 p.m.

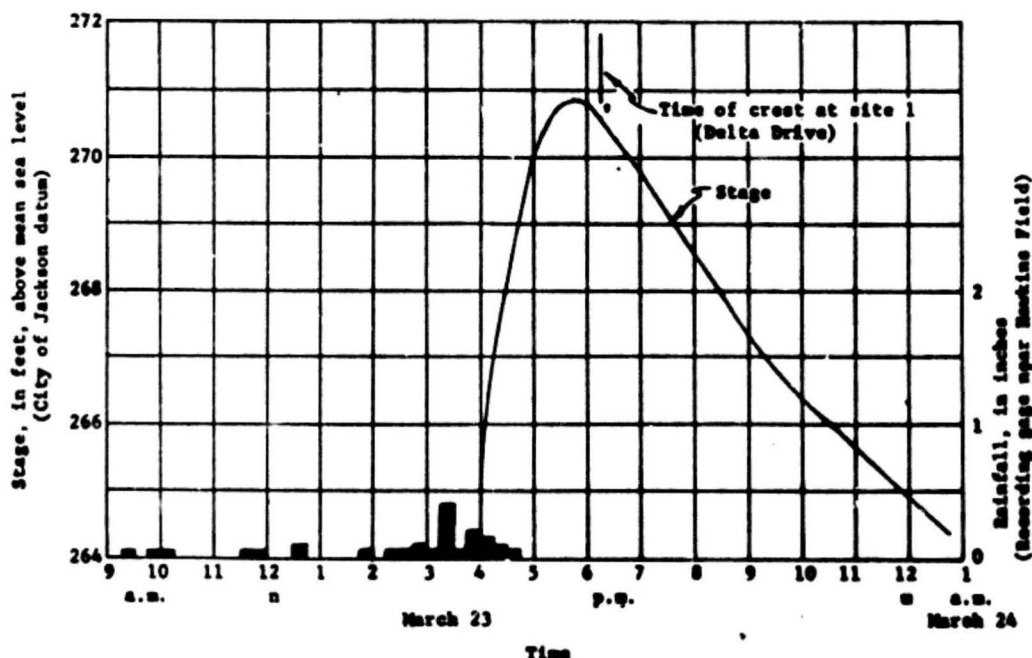


Figure 2.--Stage and rainfall hydrographs, Town Creek at site 5 (Gallatin Street), March 23-24, 1969.

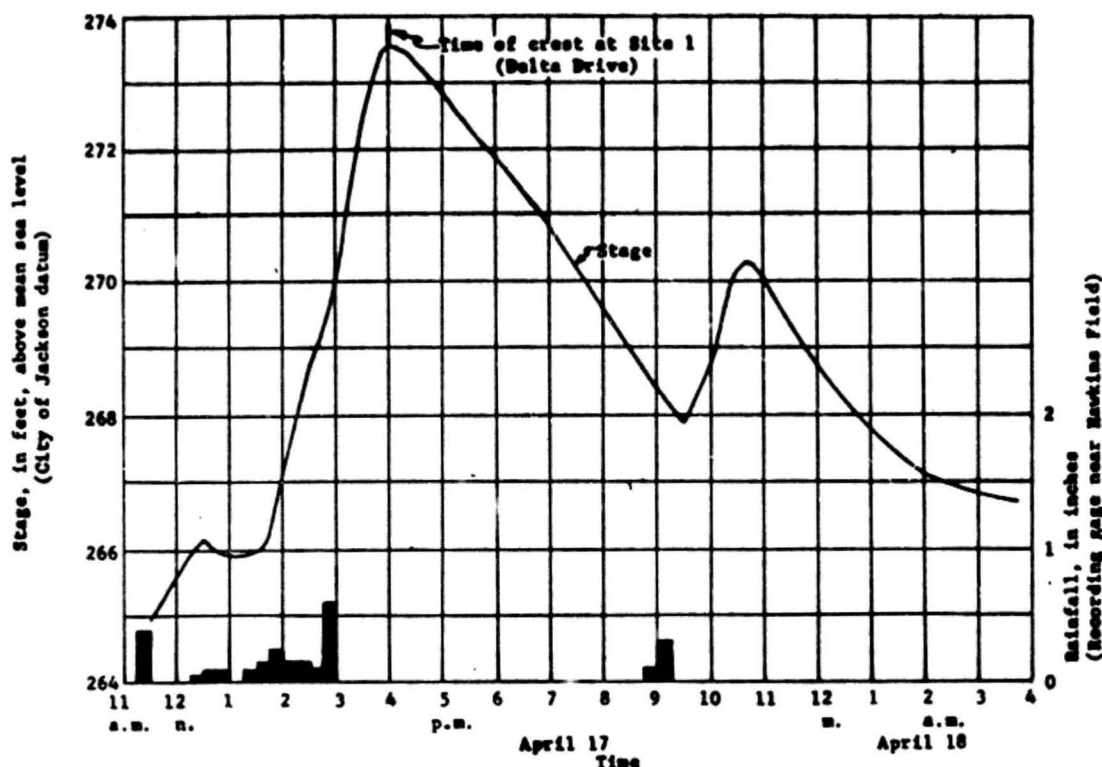


Figure 3.--Stage and rainfall hydrographs, Town Creek at site 5 (Calletin Street), April 17-18, 1969.

that night, 0.3 to 0.5 inch of rain fell in the Jackson area. At site 5 the April 17 flood was the highest during 1969 and had about a 2-year recurrence interval. Overbank flooding was prevalent in the upper part of Town Creek basin, but, in general, the flood was confined to the channel in the lower part of the basin. This pattern of flooding was the reverse of the pattern of rainfall, which was slightly heavier in the downstream area (fig. 1).

Timing of Flood Peaks

On April 17, 1969, Town Creek crested at 4:00 p.m. (table 1), both at site 5 and 5 miles upstream at site 1. Only between sites 1 and 2 did the time of flood crest increase with distance downstream. The crests at sites 2, 3, and 4 were almost simultaneous at about 4:45 p.m. The flow at sites 2, 3, and 4 remained near their peaks for a relatively long period, which may explain why no second peak occurred at site 5 (fig. 3) as a result of the late upstream peaks.

No identifiable second crest was observed on more than 10 other flood hydrographs from the gage at site 5.

SPOT URBANIZATION - POSSIBLE EXPLANATION FOR THE ABNORMAL PEAKS

A high degree of urbanization in the lower part of the basin may explain why low-magnitude-flood crests occur at downstream points before they occur at some points upstream. Based on timing of two flood peaks, it appears that, at least following rains of short duration, the peak discharge at site 5 is

generated from the downstream part of the drainage area.

It is conjectured that urbanization--and consequent faster runoff--in the lower part of the basin causes the lower reach of the stream to crest more quickly than the upper reach. This rapid runoff from the lower part of the basin flows by the gage before the runoff from the upstream part of the basin arrives at the gage--a desynchronization of the flood crests from different parts of the basin (Lull, 1969). Peak discharges at site 5 appear to be lower than those from a uniformly urbanized area (Wilson, 1967).

Storms of longer duration than the two described herein probably cause most of the higher magnitude floods on Town Creek at site 5. During floods caused by long-duration rainfall the effects of nonuniform urbanization probably will be less pronounced (Neely, 1967).

SELECTED REFERENCES

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