

A PRELIMINARY STUDY OF THE EFFECT OF URBANIZATION
ON FLOODS IN JACKSON, MISSISSIPPI

by

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INTRODUCTION

A cooperative program of the U. S. Geological Survey and the City of Jackson has provided for the collection of flood records from Jackson streams since 1953. This report consists of a preliminary analysis of the flood data collected under this program. The analysis is limited to a study of the peak discharges.

The report "Floods in Mississippi, Magnitude and Frequency" was published by the Mississippi State Highway Department in 1961. It presented curves from which the magnitude and frequency of floods from most rural drainage areas can be estimated by using independent variables of size, shape, and location of basin. The urgent need for flood-frequency data on small urbanized areas necessitated this report on Jackson's streams. The streams analyzed are Eubanks, Town, Lynch, and Three-Mile Creeks. Their drainage basins above the gaged points are outlined on figure 1, a topographic map of Jackson.

FLOOD-FREQUENCY ANALYSIS

Individual flood-frequency curves were drawn for Eubanks, Town, and Lynch Creeks based on annual maximum floods during the period 1953-66. The Three Mile Creek curve was based on a shorter period of annual peaks, 1962-66.

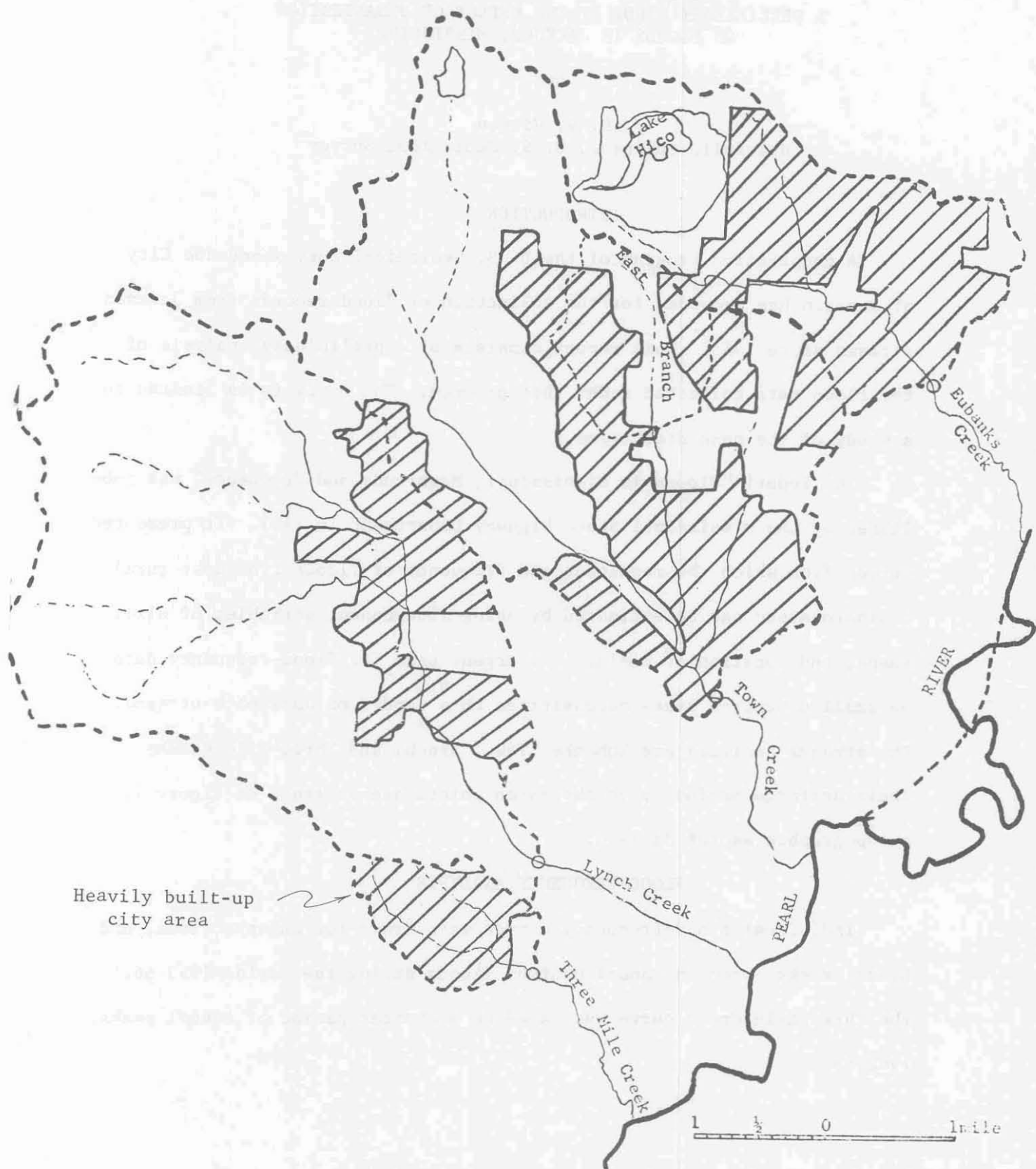


Figure 1.--Topographic map of Jackson, Miss., showing drainage basins of gaging stations.

A composite frequency curve for Jackson streams was derived as the mean of the four individual curves. This curve is presented as figure 2. According to figure 2, the 50-year flood is only about twice the magnitude of the mean annual flood. This is quite different from larger rural areas whose 50-year floods are about three times the mean annual flood. The difference is accredited to the man-made storm sewers, gutters, and ditches which function well during low-order floods but are overtaxed during extreme floods.

The mean annual floods for each of the four gaged sites were determined from their individual flood frequency curves. These values were from 2 to $3\frac{1}{2}$ times the values for rural streams selected from the report "Floods in Mississippi, Magnitude and Frequency". A plot of these ratios versus the percent of the basin area with storm sewers and improved channel is shown on figure 3. The curve drawn through these points and extended indicates that the mean annual flood for a basin with 100 percent of its area containing storm sewers and improved channels is about $4\frac{1}{2}$ times that of a rural stream.

Curves relating the mean annual flood to drainage area are presented on figure 4. These curves were defined for various degrees of development by using the curve from figure 3 and the mean annual flood curve for natural streams in Hydrologic Area 2 published in "Floods in Mississippi, Magnitude and Frequency". The values of the mean annual floods determined from the individual frequency curves for the four gaged sites are plotted on figure 4.

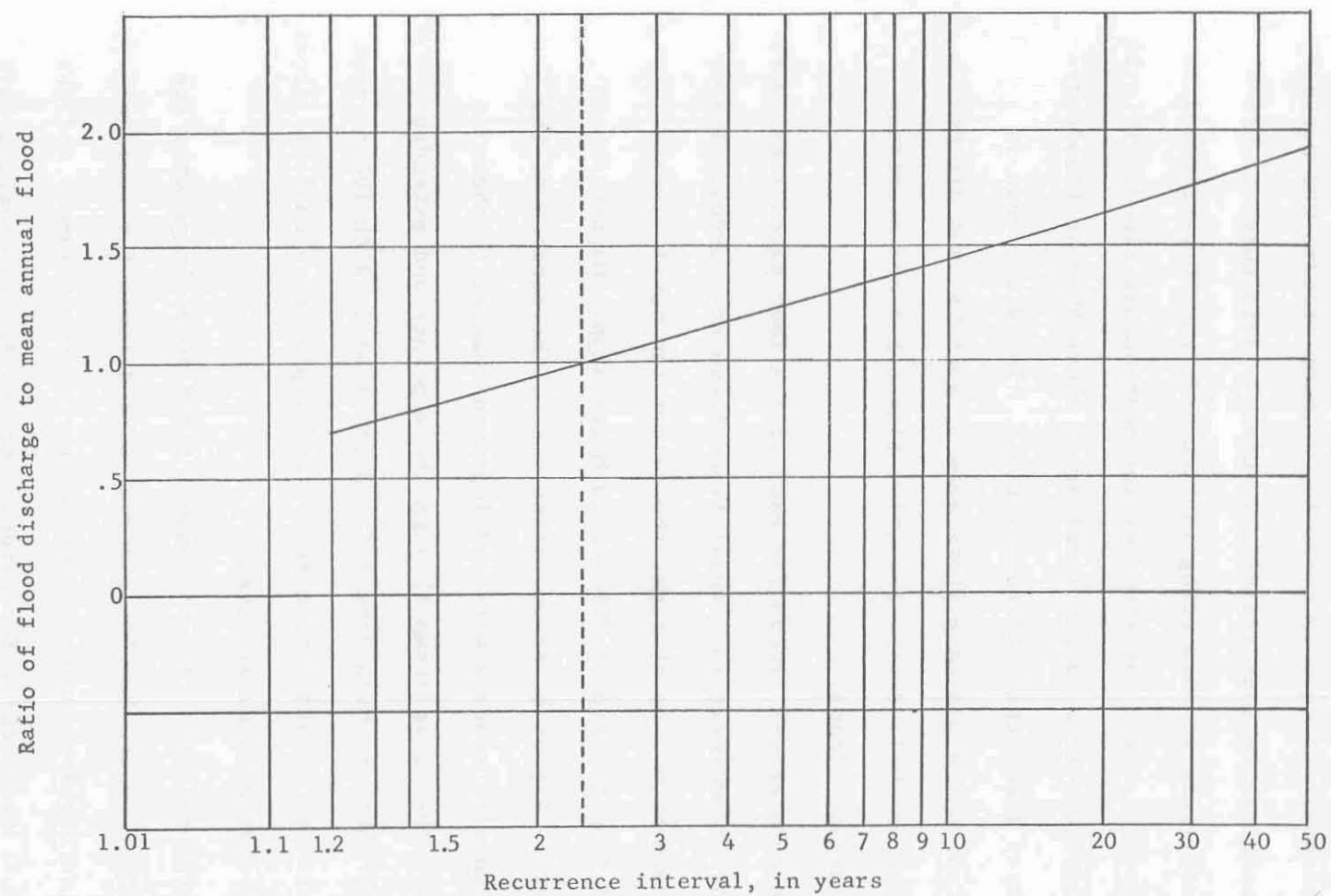


Figure 2.--Composite frequency curve for streams in City of Jackson, Mississippi.

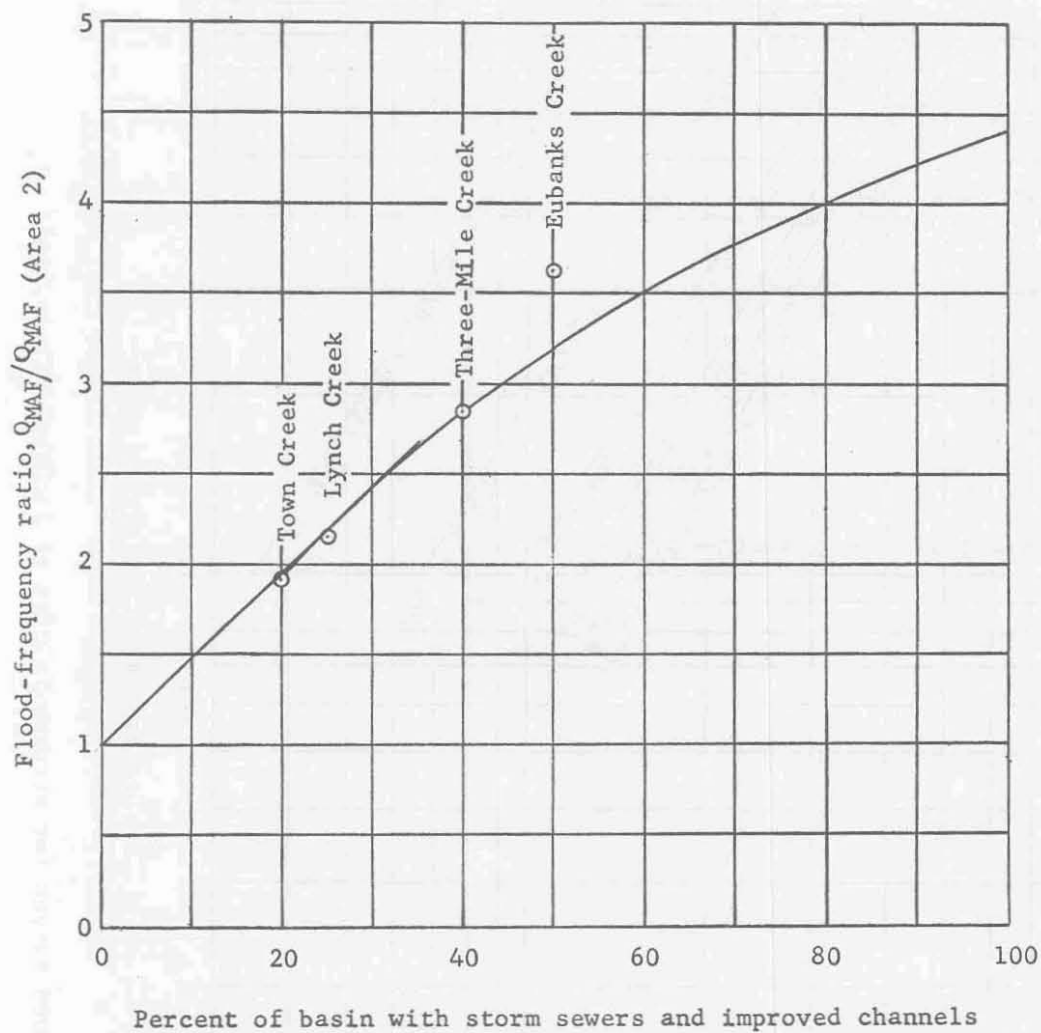


Figure 3.--Ratio of urban mean annual floods to rural mean annual floods

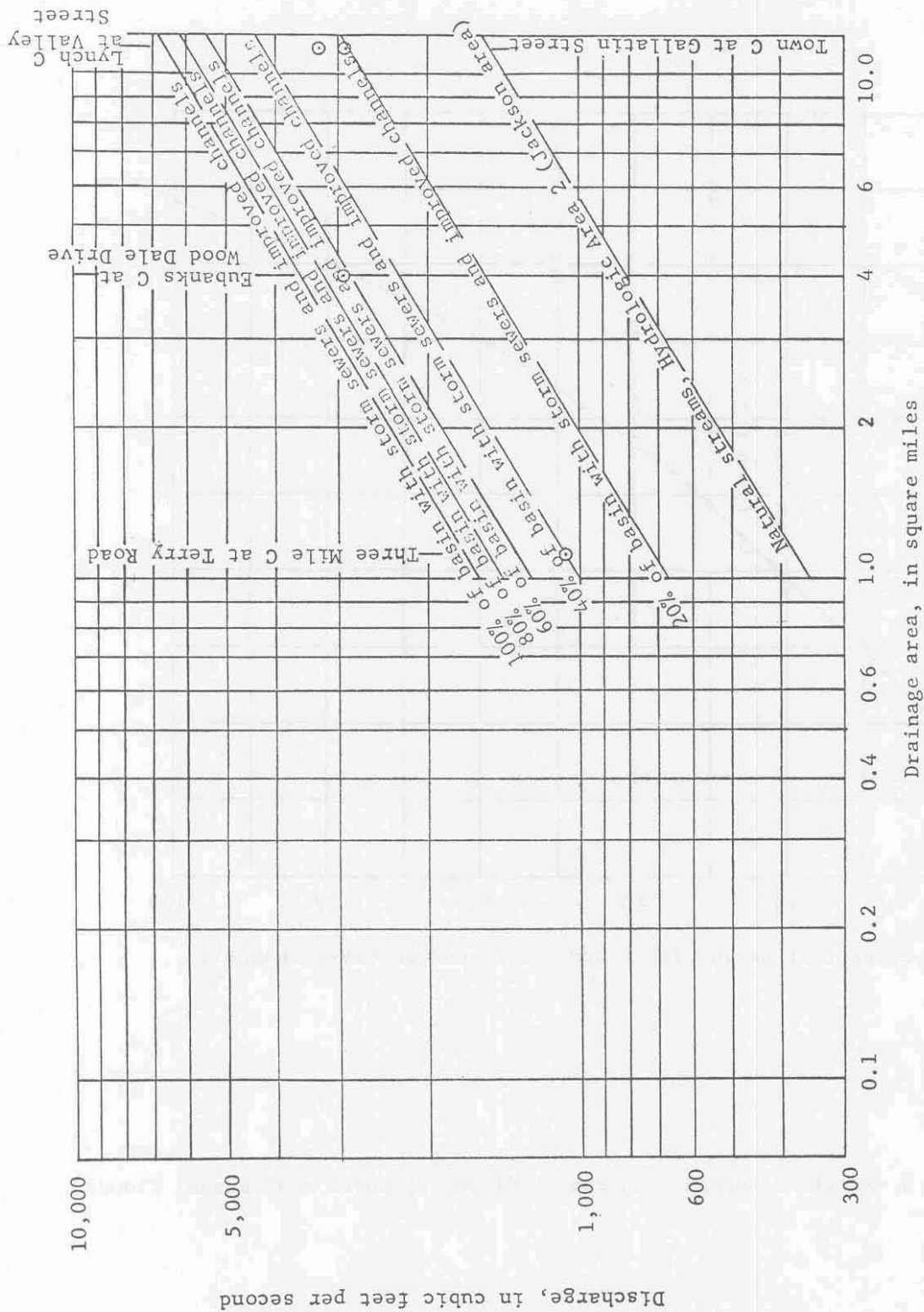


Figure 4.--Mean annual flood curves for streams in City of Jackson, Mississippi.

APPLICATION OF CURVES

The curves presented on figures 2 and 4 can be used to estimate the magnitude and frequency of floods on small streams in the city of Jackson. For the purpose of illustrating the application of these curves, it is assumed that a designer is interested in the 50-year peak discharge on the following stream:

Site.--East Branch of Town Creek at proposed Carnation Street Crossing.

A (drainage area).--1.16 square miles.

Land use.--70% residential; 10% industrial; 20% rural pasture; 20% of basin presently has storm sewers and improved channels, but this figure will be raised to 50% within the next few years.

The discharge can be determined as follows:

1. Using figure 4 and assuming 50% of the basin developed with storm sewers and improved channels, the mean annual flood for 1.16 square miles is about 1,200 cfs.
2. From figure 2, the 50-year flood is 1.92 times the mean annual flood; therefore, the 50-year flood for East Branch of Town Creek at the proposed Carnation Street crossing is $1,200 \times 1.92 = 2\,300$ cfs.