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PREPARED IN COOPERATION WITH THE
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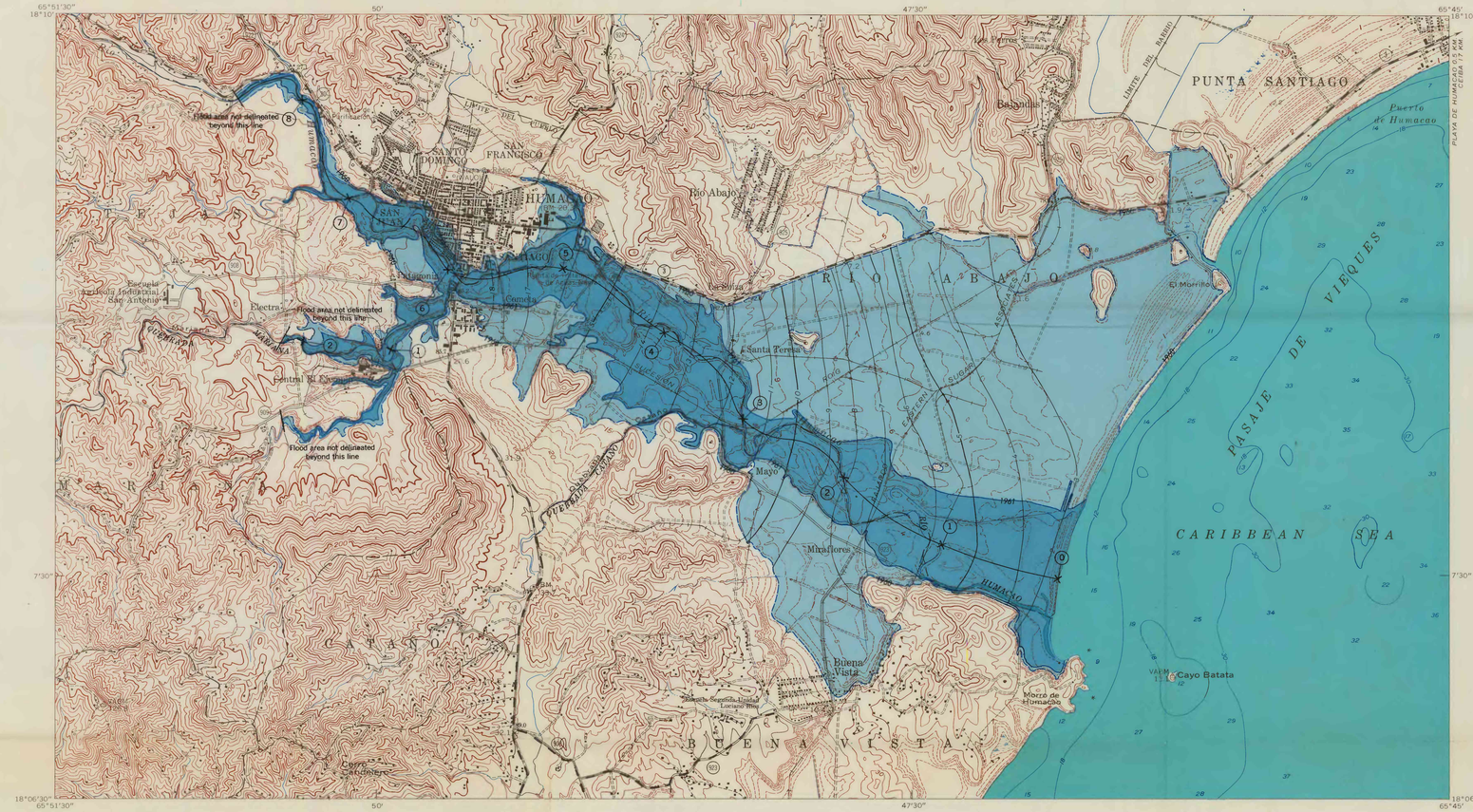
COMMONWEALTH OF PUERTO RICO

HYDROLOGIC INVESTIGATIONS
ATLAS HA-265



FLOODS AT HUMACAO, PUERTO RICO

Floods in Humacao occur frequently and cause much hardship and loss of life and property. The flood of September 6, 1960, which caused at least 90 deaths, was the worst flood in the memory of residents of Humacao. Highway 3 bridge was severely damaged, the railroad bridges in the city and 2 kilometers downstream from Highway 3 were destroyed, and many homes along the north bank of Río Humacao were washed away. The memory of this flood was still fresh in the minds of the residents of Humacao when the flood of August 27, 1961, inundated the lower land in the Patagonia section where some of the 1960 flood refugees were given home sites. The 1961 flood did not cause as much damage as the 1960 flood, but it emphasized the fact that floods can recur at any time.

The areas inundated by Río Humacao, Quebrada Mariana, and Quebrada Cataño during the floods of September 6, 1960, and August 27, 1961, are shown on the topographic base map to record the flood hazard graphically. The flood of September 6, 1960, is the highest since at least 1911. Greater floods are possible, but definition of their probable overflow limits was not undertaken in this report.

Cooperation and acknowledgment.—The preparation of this report is a part of a flood-mapping program financed through a cooperative agreement between the Department of Public Works, Commonwealth of Puerto Rico, and the U.S. Geological Survey. Elevations of floodmarks were obtained by the Sección de Control de Inundaciones, Department of Public Works, after identification by Geological Survey personnel.

Río Humacao drainage basin.—Figure 1 shows the area of this study in relation to the Río Humacao drainage basin. Río Humacao flows generally eastward through the deeply weathered plutonic rock of the interior uplands and enters the alluvial flood plain 8 kilometers from the mouth. The watershed land is used for pasture and growing sugarcane, and the land at higher elevations is largely undeveloped tropical forest. In a distance of 19 kilometers the streambed elevation of Río Humacao drops from about 300 meters to 15 meters at the confluence of Quebrada Mariana in the City of Humacao. From Humacao to the sea, a distance of 7.5 kilometers, the river meanders through a typical coastal flood plain. The major tributary, Quebrada Mariana, flowing in a narrow valley for its full length, enters the Río Humacao flood plain at Humacao. The drainage area of Río Humacao at Highway 3 is 17.3 square miles (including Quebrada Mariana) and at the mouth it is about 26 square miles.

FIGURE 1.—*Río Humacao drainage basin.*

The flood plain of Río Humacao gradually widens from several hundred meters at Humacao to about 4 kilometers along the coast between Morro de Humacao and El Morrillo.

Flood height.—Elevations of recent floods at Highway 3 in Humacao are listed below. Marks of floods prior to 1960 were not found, but interviews with local residents indicated that the 1960 flood was the highest in the last 40 to 50 years. Daily rainfall records at Humacao have been collected since 1898. A review of the records indicates that on two occasions, August 1899 and September 7, 1910, the rainfall exceeded that of the September 6, 1960, storm. There were no reliable data on flood elevations for the storms of 1899 and 1910 so that comparison with the 1960 flood elevation was not possible.

Floods on Río Humacao at Highway 3 in Humacao, P.R., 1960–62.

Date	Elevation (meters)	Peak discharge (cubic feet per second)
September 6, 1960	18.9	40,000
August 27, 1961	16.9	17,000
May 1, 1962	15.6	3,500

Flood discharge.—The peak discharges listed in this study were based on channel conditions and floodmark profiles were defined from field surveys. Changes in the vicinity of Highway 3 in Humacao or other factors that affect the flood profiles may change the relation between stage and discharge at Highway 3.

Flood frequency.—The lack of knowledge of historical flood elevations at Highway 3 in Humacao prevents a reliable estimate of the recurrence interval of the 1960 flood. From the rainfall records it may be assumed that the 1960 flood was the third highest in the period 1899–1965, indicating a recurrence interval of about 23 years. This figure represents the lowest probable recurrence interval and the most conservative. On the other hand, although the total rainfall was less in 1960, the distribution and intensity of the storm may have been such as to produce the highest flood peak since 1899; if true, the 1960 flood has a recurrence interval of more than 68 years.

Flood profiles.—Water-surface profiles of the floods of September 6, 1960, and August 27, 1961, are shown in figure 2. Distances used for the profiles correspond to those marked along the flood plain. Water-surface elevations shown on the profiles represent the flood height near the main channel. Downstream from Highway 923, flood heights vary across the wide flood plain and water-surface contours based on elevations of floodmarks define the height of the flood of September 6, 1960, on the map.

The unusually high elevation of the September 6, 1960, flood at the mouth of Río Humacao was due partly to a sand bar blocking the mouth. In addition, strong easterly winds caused high waves that prevented the rapid discharge of the floodwaters.

Depth of flooding.—The depth of inundation during the 1960 flood at any point along Río Humacao and Quebrada Mariana can be determined by subtracting the ground elevation at the point from the flood elevation indicated by the profile or by the water-surface contour line. The approximate ground elevation can be determined from ground contours shown on the map, although more accurate elevations can be obtained by leveling to nearby bench marks.

Additional data.—Additional information pertaining to floods on Río Humacao can be obtained at the office of the U.S. Geological Survey, Water Resources Division, San Juan, Puerto Rico; or at Sección de Control de Inundaciones, Negociado de Operaciones, Departamento de Obras Públicas, Stop 22 ½ Avenida Ponce de León, Santurce, Puerto Rico.

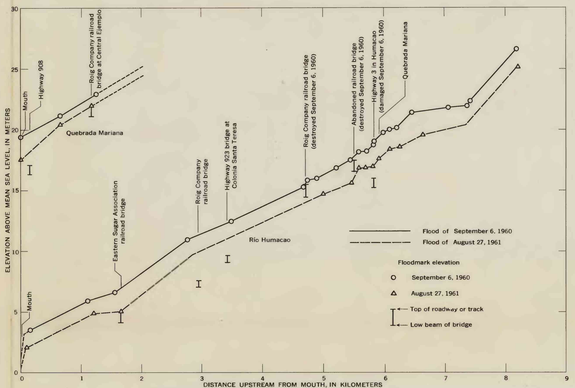


FIGURE 2.—*Profiles of floods on Río Humacao and Quebrada Mariana.*

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