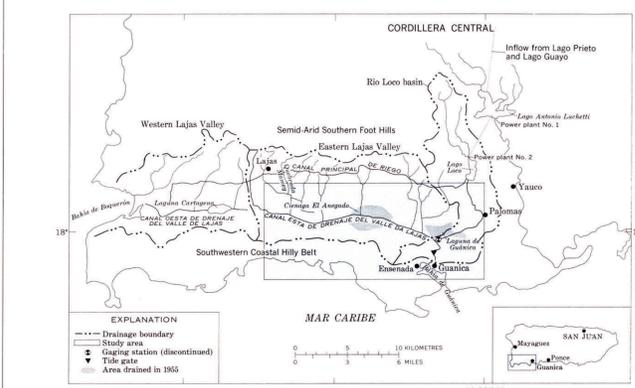


Base from U.S. Geological Survey, Revised 1974  
San Germán, 1965; Sabana Grande, 1965;  
Parguera, 1966, and Guánica, 1966.



**FLOODS IN EASTERN LAJAS VALLEY AND THE LOWER RIO LOCO BASIN, SOUTHWESTERN PUERTO RICO**

This report provides factual and interpretive information pertaining to floods in eastern Lajas Valley and the lower Rio Loco basin. This information provides a technical basis on which individuals, organizations and governmental agencies can make decisions leading to development on the flood plains compatible with the degree of flood risk.

The report is based on data collected from people who live

averages about 7 kilometers wide. The land-surface is generally flat with a maximum elevation of 25 meters above mean sea level in the central part of the valley.

Lajas Valley is divided into two drainage basins along a north-south line that roughly coincides with P.R. Highway 116 (flood map). The western basin has a drainage area of about 23 square miles and the eastern basin (part of the study area) has a drainage area of about 57 square miles. Before 1955 all flow from the western basin emptied into Laguna Cartagena and all flow from the eastern basin emptied into Laguna de Guánica and Ciénega El Anegado. In 1955 an extensive irrigation and drainage system was put into operation by the Puerto Rico Water Resources Authority. The western basin now drains through Canal Oeste de Drenaje del Valle de Lajas into Bahía de Boquerón and the eastern basin drains through Canal Este de Drenaje del Valle de Lajas into Rio Loco, which empties into Bahía de Guánica. Laguna de Guánica and Ciénega El Anegado were drained.

No information can be found on floods in the western basin; even in the eastern basin flood data are few.

**Rio Loco basin.**—Rio Loco, the major stream in the study area, heads on the southern slope of the Cordillera Central and flows south to Bahía de Guánica. The drainage area at the mouth is about 21 square miles, not including the area drained by Canal Este de Drenaje del Valle de Lajas. In 1955 the Rio Loco was droptied from its confluence with the canal to Bahía de Guánica, and a tide gate was installed about 1.8 kilometers above the mouth.

Flow in the lower Rio Loco is partly regulated by releases for hydroelectric power at Lago Loco Dam in the upper valley and diversions through Canal Principal de Rio Loco for distribution to Valle de Lajas Irrigation System. Lago Loco also receives water by tunnel from Lago Antonio Luchetti in the adjacent Rio Yauco basin.

**Land Use.**—The land in the Rio Loco and the Lajas valleys is devoted almost entirely to agriculture (mostly to the production of sugarcane). Irrigation water in the lower Rio Loco valley is principally from wells. In the Lajas Valley only land north of the principal east-west drainage canal is irrigated by the Semi-Arid Southern Foot Hills; on the south it is irrigated from Mar Caribe by the Southwestern Coastal Hill Belt (Pico, 1950). The valley is about 30 kilometers long and

falls in the months from August to November. February and March are the driest months. Occasional tropical storms and hurricanes can produce torrential rains, which usually cause flooding.

**Flood history.**—Parts of the study area have been inundated extensively at least four times since the greatest known flood of September 13, 1928. The second largest flood, which occurred on August 3, 1963, is the highest known since 1928. High-water marks for several floods were recovered at the bridge over Canal Este de Drenaje del Valle de Lajas on Highway 326 at kilometer 8.1 on the base line of the flood map. The date of the flood and corresponding water-surface elevation for these marks are given in table 1.

Table 1.—Flood information at Highway 326 bridge on Canal Este de Drenaje del Valle de Lajas. (See flood map and fig. 4.)

Date of flood	Water-surface elevation, in meters above mean sea level
September 13, 1928	5.5
June 1956	3.1
November 1956	3.1
December 1960	2.8
August 3, 1963	3.4

Note: Irrigation and drainage system completed in 1955.

**Flood discharge.**—The peak discharge of Rio Loco for the flood of August 3, 1963, at kilometer 2.5 on the base line of the flood map, was 1,750 cfs (cubic feet per second) at about 0400 hours. This location is below the confluence of Rio Loco with Canal Este de Drenaje del Valle de Lajas. The peak discharge of Rio Loco for the same flood at the U.S. Geological Survey gaging station (now discontinued) above the confluence, at kilometer 4.1 on the flood map, was 930 cfs at about 0700 hours. The discharge at the gaging station at 0400 hours (time of maximum canal inflow) was only 288 cfs; this indicates that the storm moved across the island from west to east. Lago Loco, which is maintained as full as possible for water supply, caused little or no attenuation of the peak.

**Flood frequency.**—The date of occurrence of a flood of a given magnitude cannot be predicted, but the probable number of such floods during a long period of time can be estimated with reasonable accuracy. The frequency of occurrence is the average interval of time within which a given flood will be exceeded once. For example, two floods of at least the magni-

tude of a 50-year flood can be expected to occur in a 100-year period, on the average. Stated differently, a 50-year flood has a chance in 50 of being exceeded in any one year.

The record of floods in the study area is fragmentary and not of sufficient length to determine a reliable flood-frequency relation. However, because the 1928 flood was the highest during 1928-72, it has an indicated frequency of 43 years, and the 1963 flood, the second highest during the same period, has an indicated frequency of about 22 years.

**Flood profiles.**—Flood profiles were developed on the basis of elevations of floodmarks. The maximum water-surface elevations for the flood of September 13, 1928, on Quebrada Maney, Rio Loco, and Canal Este de Drenaje del Valle de Lajas, referred to the arbitrary base lines on the topographic map, are shown in figures 2 through 4. Figure 2 also shows the maximum elevation for the flood of August 3, 1963, on Canal Este de Drenaje del Valle de Lajas. The base line is not the thalweg but follows a smoother path along the valley and conforms to the general direction of flow. Abrupt changes in the profile indicate the difference in water-surface elevations at the upstream sides of channel constrictions. The drop in

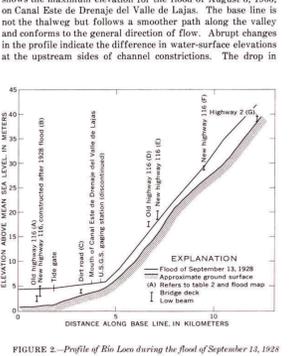


FIGURE 2.—Profile of Rio Loco during the flood of September 13, 1928.

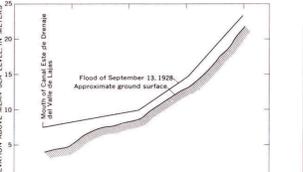


FIGURE 3.—Profile of Quebrada Maney during the flood of September 13, 1928.

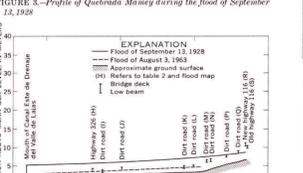


FIGURE 4.—Profile of Canal Este de Drenaje del Valle de Lajas during the floods of September 13, 1928, and August 3, 1963.

Table 2.—Location and elevation of bridges in the flood area. (See flood map and figs. 2 and 4.)

Map symbol	Stationing along base line (kilometers)	Location of bridge	Top of deck (meters)	Low beam (meters)
A	1.0	Rio Loco	3.0	2.0
B	1.1	New Highway 116	3.2	3.1
C	3.2	Old Highway 116	4.3	3.6
D	6.7	Old Highway 116	18.3	17.2
E	7.1	New Highway 116	20.5	18.7
F	8.4	New Highway 116	29.7	28.8
G	12.0	Highway 2	39.7	38.9
H	8.1	Highway 326	4.3	3.7
I	10.1	Dirt road	2.2	2.2
J	10.1	Dirt road	4.6	3.9
K	14.4	Dirt road	4.8	4.2
L	15.0	Dirt road	5.0	4.6
M	15.9	Dirt road	6.2	4.9
N	16.2	Dirt road	6.7	6.1
O	18.2	Dirt road	7.6	7.4
P	18.0	Dirt road	8.5	8.3
Q	18.2	New Highway 116	10.9	10.0
R	18.6	Old Highway 116	10.3	9.8

**Inundated areas.**—The areas inundated by the floods of September 13, 1928, and August 3, 1963, in eastern Lajas Valley are shown on the flood map; Rio Loco and Quebrada Maney overflowed their banks only in 1928. The flood boundaries were delineated by plotting flood-profile elevations on the map and interpolating between the contours. The flood boundaries shown reflect channel conditions during the flood. The inundation pattern of future floods may be affected by changes in channel conditions, alterations of waterway openings at right angles, changes in runoff characteristics caused by increased urbanization, and other cultural developments.

**Water-surface contours.**—Water-surface contours based on floodmark elevations are imaginary lines representing equal elevations of water surface. Generally they are at right angles to the direction of flow. Obstructions to flow, either natural or manmade, and variations in valley width cause irregularities in the contours. The water-surface contours for the flood of September 13, 1928, are shown on the map.

**Depth of flooding.**—Depth of flooding at any point 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 ele-

vation can be determined from contours shown on the flood map. Elevation of the ground and of the water surface at any point can be estimated by interpolation between contours. More accurate elevations can be obtained by leveling to nearby reference marks, which are described in table 3.

Table 3.—Reference marks established by the U.S. Geological Survey in the Lajas Valley area. (See flood map.)

Reference mark	Elevation above mean sea level (meters)	Description
1	14.63	At culvert at Hacienda Beatriz, 4.5 kilometers southeast of Lajas. A brass disk stamped "U.S. Geological Survey," set in concrete on right upstream side of drainage ditch.
2	10.70	At bridge on Highway 315 (old Highway 116), kilometer 4.9, and 414 kilometers south of Lajas. A brass disk stamped "U.S. Geological Survey," set in concrete on top of middle pier of bridge over Canal Este de Drenaje del Valle de Lajas.
3	21.13	At bridge on Highway 116, kilometer 25, and 3.5 kilometers northwest of Guánica. A brass disk stamped "U.S. Geological Survey," set in concrete on left upstream side of bridge over Rio Loco.
4	11.94	At bridge on Highway 116, kilometer 23.6 and 2.1 kilometers northwest of Guánica. A brass disk stamped "U.S. Geological Survey," set in concrete on right downstream side of bridge over Rio Loco.
5	30.55	At bridge on Highway 116, kilometer 33.8, at Barrio Palomas and 5.7 kilometers north of Guánica. A brass disk stamped "U.S. Geological Survey," set in concrete on left downstream side of bridge over Rio Loco.
6	8.43	At bridge on Highway 326, kilometer 14, and 2.2 kilometers north of Guánica. A brass disk stamped "U.S. Geological Survey," set in concrete on right downstream side of bridge over Rio Loco.
7	37.67	At culvert on road to Barrio Maguayes, kilometer 12, and 3.5 kilometers northeast of Guánica. A brass disk stamped "U.S. Geological Survey," set in concrete on downstream side of culvert headwall of irrigation canal.

**ACKNOWLEDGMENTS.**—Selection of the site for this project was made in collaboration with the Area de Prevención de Inundaciones, Puerto Rico Departamento de Obras Públicas. Historical flood data were made available by many residents in the area and by the Puerto Rico Water Resources Authority. **4461/Annual Information.**—Supporting data and computations relative to this report are in the files of the U.S. Geological Survey, San Juan, Puerto Rico, and at the Area de Prevención de Inundaciones, Puerto Rico Departamento de Obras Públicas, Santurce, Puerto Rico, and the División de Riego, Puerto Rico Water Resources Authority, Yauco, Puerto Rico.

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By  
Karl G. Johnson  
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