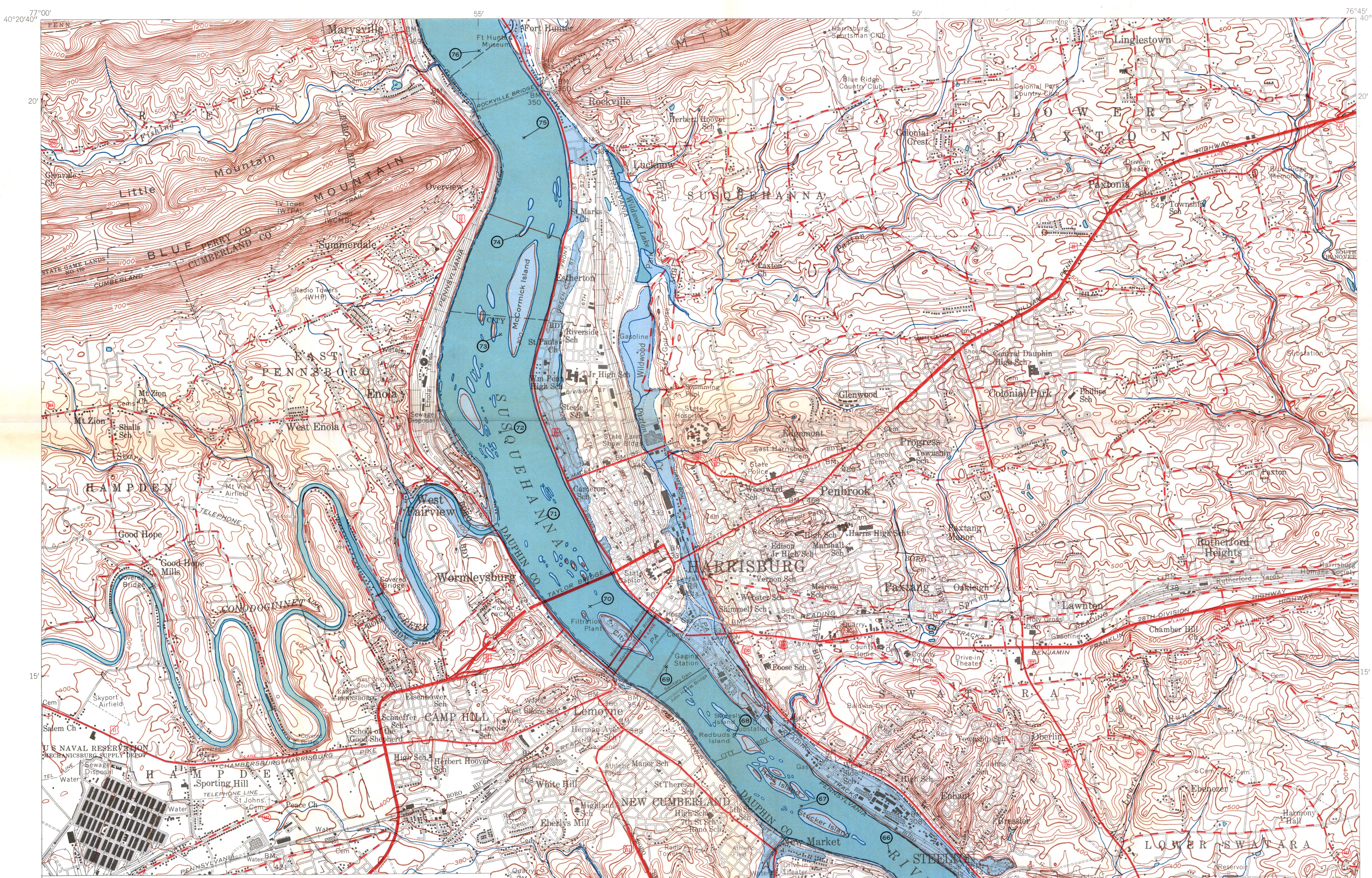
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA-57

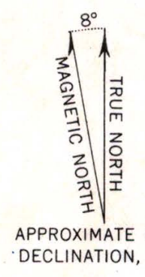



Photograph by 28th Division Aviation, Pennsylvania National Guard

AERIAL VIEW OF FLOODED HARRISBURG, PENNSYLVANIA MARCH 19,1936

40°10′
77°00′

Base map by Topographic Division
U.S. Geological Survey, 1956



APPROXIMATE MEAN
DECLINATION, 1956

SCALE 1:31 680

1 ½ 0 1 MILE

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

1962

50′

40°10′
76°45′

EXPLANATION

▨ Flood limit 1936

(63) River miles measured upstream from the mouth at Chesapeake Bay

FLOOD ON THE SUSQUEHANNA RIVER AT HARRISBURG, PENNSYLVANIA, IN 1936

The approximate area inundated by the Susquehanna River in the vicinity of Harrisburg, Pa., during the flood of March 19, 1936, is shown on a topographic map base in order to record the flood hazard in graphic form. The flood of March 19, 1936, on the Susquehanna River is the highest known to have occurred at Harrisburg, since 1784, and probably the highest since 1740 or an earlier date. Greater floods are possible but no attempt has been made to show their probable overflow limits. New highways and other cultural changes may influence the inundation pattern of future floods.

Flood height.—The height of a flood at a gaging station is usually stated in terms of the gage height or stage, which is the elevation of the water surface above a selected datum plane. Elevations shown are in feet above mean sea level. Gage heights or stages at the gaging station on Susquehanna River at Harrisburg, located at Nagle Street (river mile 68.8), can be converted to elevations above mean sea level by adding 290.0 feet. Thus, the maximum gage height at Nagle Street during the flood of March 19, 1936, was 29.2 feet and the corresponding elevation above mean sea level was 319.2 feet.

Flood stage established by the U.S. Weather Bureau at the Nagle Street gage, the stage at which the Susquehanna River first begins to overflow its natural banks in the vicinity of Harrisburg, is 17 feet, which corresponds to elevation 307 feet above mean sea level.

Gage height and year of each annual flood (greatest flood each year), which exceeds elevation 307 feet at the Nagle Street gage on Susquehanna River at Harrisburg, are shown in figure 1. The irregular occurrence of floods is evident. The 307-foot elevation was exceeded at least once during each of 24 of the 177 years of record (fig. 1). Although floods above elevation 307 feet occurred on the average of about 1 time per decade, none were experienced in some decades, whereas 4 occurred during the period 1886–95.

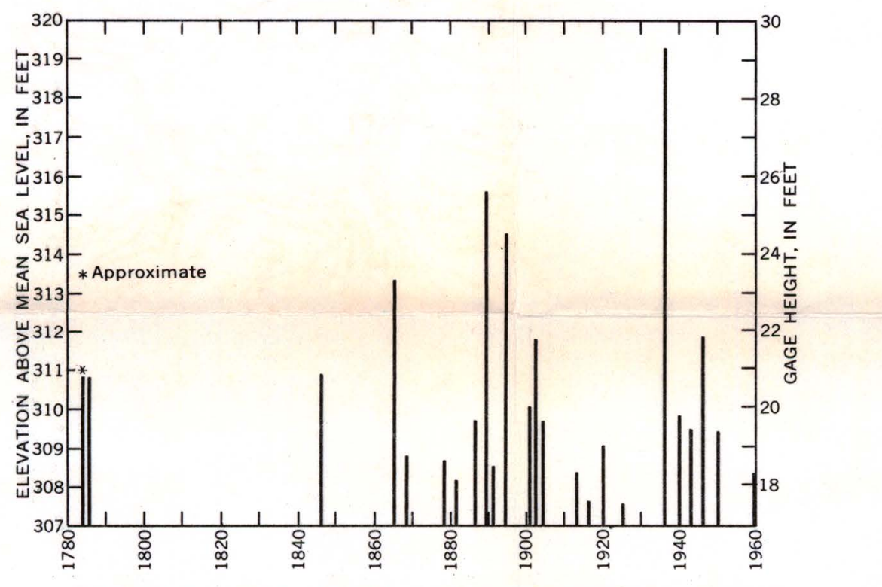


FIGURE 1.—ANNUAL FLOODS OF RECORD ABOVE 307-FOOT ELEVATION, 1784-1960, AT NAGLE STREET, ON SUSQUEHANNA RIVER AT HARRISBURG, PENNSYLVANIA.

Flood frequency.—Frequency of flooding on the Susquehanna River is derived from the continuous record of annual floods since 1874 at Harrisburg, supplemented by records of earlier floods which occurred during the period 1784 to 1873. Flood-peak stages in the Harrisburg vicinity have been converted to equivalent stages at the Geological Survey gaging station at Nagle Street. Large errors may result if the flood frequency curve is extrapolated beyond the limits shown. Frequency of flooding on Conodoguinet Creek, Paxton Creek and Yellow Breeches Creek is not shown.

Recurrence intervals.—As applied to flood events, recurrence interval is the number of years, on the average, within which a given flood height will be equaled or exceeded once. It is inversely related to the chance of a specific flood being equaled or exceeded in any one year. Thus a 20-year flood would have 1 chance in 20 of being equaled or exceeded in any one year, or a 25-year flood would have 1 chance in 25 of being equaled or exceeded in any one year.

The general relationship between recurrence interval and flood height at the Nagle Street gaging station on Susquehanna River at Harrisburg is shown graphically in figure 2 and is tabulated below:

Recurrence interval (years)	Elevation above mean sea level of Susquehanna River at Harrisburg, Pennsylvania, at Nagle Street (feet)
200	320.0
150	318.5
100	316.6
50	313.6
25	311.0
10	308.2
6.4	307.0 (flood stage)

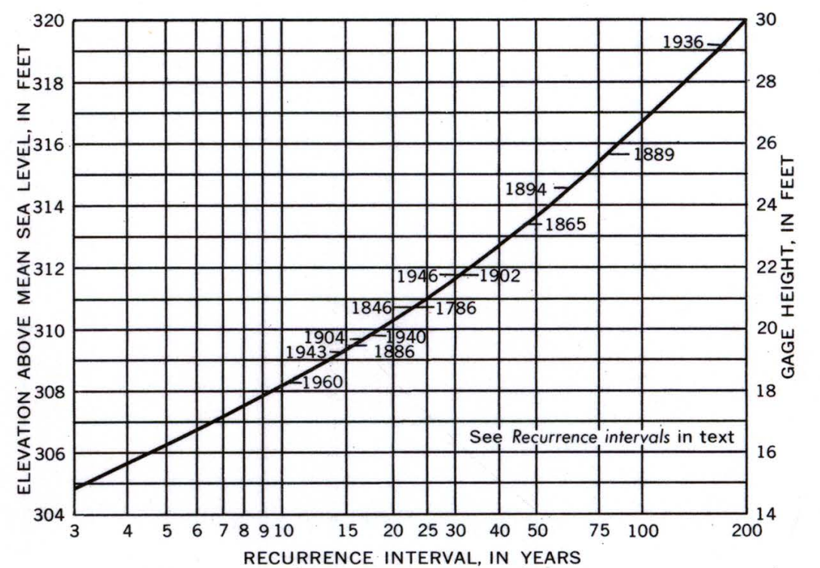


FIGURE 2.—FREQUENCY OF FLOODS AT NAGLE STREET ON SUSQUEHANNA RIVER AT HARRISBURG, PENNSYLVANIA.

It is emphasized that recurrence intervals are average figures— the average number of years in which floods of specific gage height will be equaled or exceeded. Thus, on the Susquehanna River, a flood that reaches a 316.6-foot elevation at Nagle Street is said to have a 100-year recurrence interval. However, because of the erratic nature of flood occurrence, the 316.6-foot elevation may not be reached in any one century, or it may be reached more than once.

Flood profiles.—The profiles of the water surface along the Susquehanna River, constructed from marks left by the floods of March 19, 1936, and June 2, 1889, are shown in figure 3.

Profiles of floods corresponding to other flood heights can usually be plotted on this diagram generally parallel to the profile of the 1936 flood, although occasionally, backwater conditions caused by ice jams produce a considerably different shaped profile. At river mile 60.8, the flood of March 8, 1904, affected by backwater from an ice jam downstream, was about 3 feet higher than the flood of 1936, whereas at river mile 68.8 (Nagle Street) the 1904 flood was almost 10 feet lower than the flood of 1936. The irregular effect of ice jams on flood heights is apparent.

Base line for the profiles is located along the centerline of the river. River miles above the mouth of Susquehanna River (Chesapeake Bay) used for the profiles of figure 3 are also marked along the river on the flood inundation map.

Depth of flooding at any point can be estimated by subtracting the ground elevation from the water surface elevation indicated by the profile in figure 3. The approximate ground elevation can be estimated from information indicated by contours on the map, although more accurate elevations can be obtained by leveling to nearby bench marks. In areas adjacent to tributaries of the Susquehanna River, the profile elevation at the mouth of the tributary should be used to estimate depth of flooding.

Tributaries.—The Susquehanna River is the principal source of major flooding at Harrisburg. The large tributaries which flow through the area, Conodoguinet Creek, Paxton Creek, and Yellow Breeches Creek, overflow their banks at times. Areas inundated by overflows of the tributaries are not shown because few data regarding the extent of their flooding are available.

Additional data.—Other information pertaining to floods at Harrisburg may be obtained at the office of the U.S. Geological Survey, Harrisburg, Pa., and from the following published reports:

U.S. Geological Survey, 1936, Floods in the United States: U.S. Geol. Survey Water-Supply Paper 771.

U.S. Geological Survey, 1937, The Floods of 1936, Part 2. Hudson River to Susquehanna River Region: U.S. Geol. Survey Water-Supply Paper 799.

U.S. Geological Survey, 1960, Compilation of Records of Surface Waters of the United States through September 1950, Part 1-B, North Atlantic Slope Basins, New York to York River: U.S. Geol. Survey Water-Supply Paper 1302.

Water Supply Commission of Pennsylvania, 1916, Water Resources Inventory Report, Part VIII, Floods.

Acknowledgment.—Supplementary floodmark elevations were furnished by Corps of Engineers.

This Hydrologic Investigations Atlas was prepared by Robert E. Steacy and I. A. Heckmiller, Geological Survey.

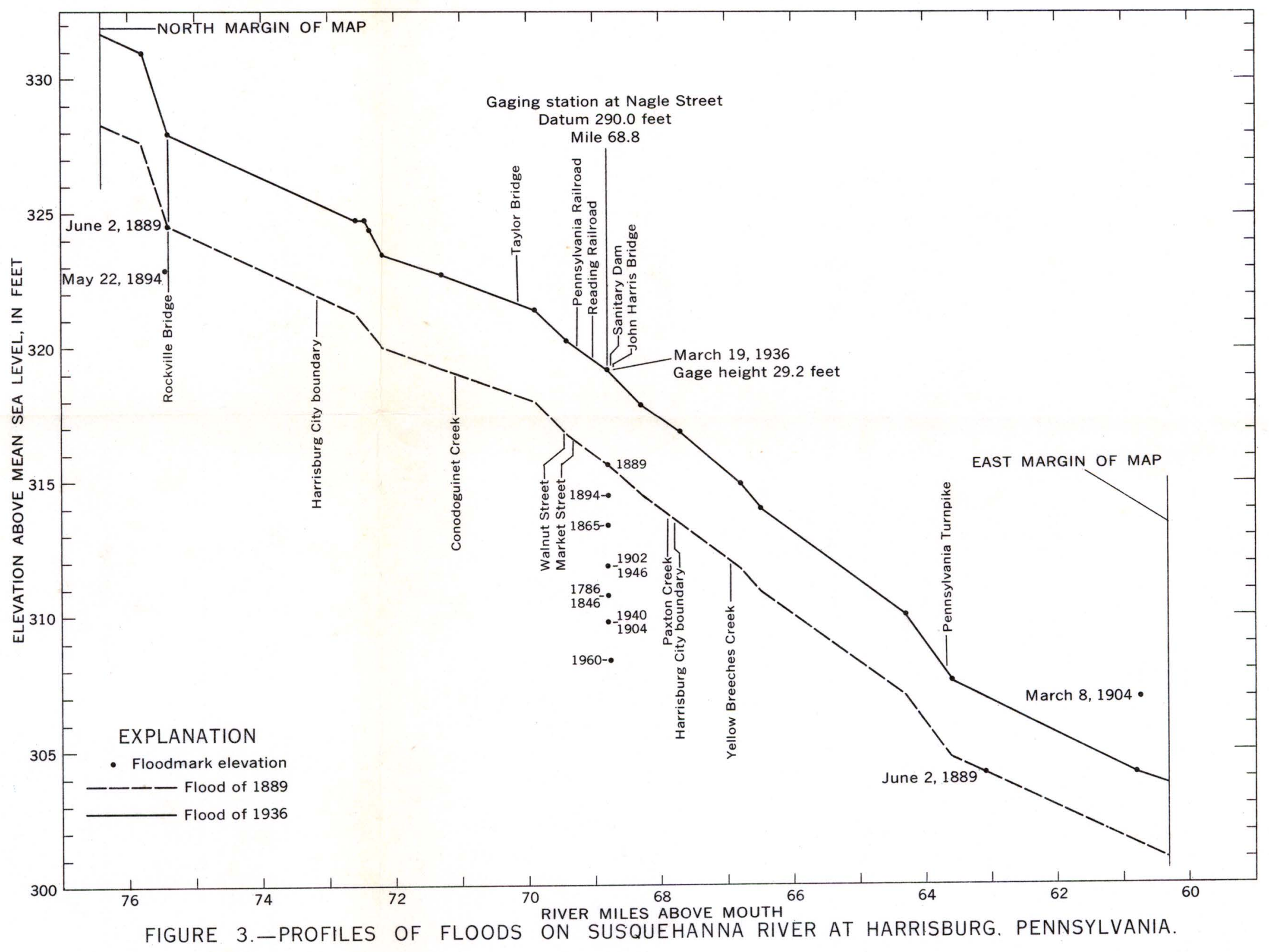


FIGURE 3.—PROFILES OF FLOODS ON SUSQUEHANNA RIVER AT HARRISBURG, PENNSYLVANIA.

SUSQUEHANNA RIVER FLOOD HEIGHTS

Flood heights recorded at the Geological Survey gaging station on Susquehanna River at Harrisburg, Pennsylvania, located at Nagle Street. Overflow limits of only the 1936 flood are shown.

Date of flood	Gage height (feet)	Elevation above mean sea level (feet)
March 19, 1936	29.2	319.2
June 2, 1889	25.6	315.6
May 22, 1894	24.5	314.5
March 18, 1865	23.4	313.4
March 3, 1902	21.8	311.8
May 29, 1946	21.8	311.8

FLOODS AT HARRISBURG, PENNSYLVANIA

For sale by U. S. Geological Survey, price 75 cents

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.– 62036

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