

**FLOODS OF JUNE 1972  
IN THE HARRISBURG AREA, PENNSYLVANIA**

This hydrologic atlas presents information on the frequency, depth, and extent of flooding along a 20-mile reach of the Susquehanna River extending from Marysville, Pa., to Palmyra, Pa., and including the Harrisburg area. The approximate area inundated by the flood resulting from tropical storm Agnes in June 1972 is shown on a topographic base map. The purpose of this atlas is to provide a technical basis from which sound decisions can be made concerning the use of flood-plain lands.

The areal extent of flooding is mapped for the largest known flood, which occurred on June 24, 1972. The delineation along the channel of the Susquehanna River was based largely on interpretation of aerial photographs obtained by the U.S. Geological Survey shortly after the flood crest. Field surveys made shortly after the flood provided the horizontal control necessary to delimit overland flooding. The inundation pattern of future floods may be affected by new highways and bridges, modifications of stream channels, and other cultural changes.

**Cooperation and acknowledgment.**—This report was prepared by the Pennsylvania district of the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Resources, the Susquehanna River Basin Commission, and the U.S. Army Corps of Engineers. The investigation was conducted under the direction of Norman H. Beamer, district chief.

**Flood height.**—The height of a flood at a gaging station is stated in terms of the gage height or stage, which is the elevation of the water surface above a selected datum plane. Gage heights or stages at the gaging station on the Susquehanna River at Harrisburg (01570500), 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 June 24, 1972, was 32.6 and the corresponding elevation above mean sea level was 322.6 feet.

**Flood stage.**—The level at which a river first begins to overflow its banks. Flood stage for the Susquehanna River at Harrisburg as established by the U.S. Weather Bureau is 17 feet, which corresponds to elevation, 307 feet above mean sea level, at the Nagle Street gaging station.

**Gage height and year for each annual flood above elevation, 307 feet.** The gage height and year for each annual flood above elevation, 307 feet, are shown in figure 1. The irregular distribution of floods with respect to time is evident. Bankfull stage was exceeded at least once during each of 25 of the 133 years of record (fig. 1).

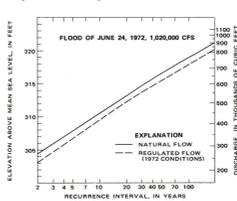


Figure 1.—Exceeds flood stage 17 feet elevation at Nagle Street on Susquehanna River at Harrisburg (01570500), 2,140-2,192.

**History of floods.**—Good records of flood heights are available for all major floods since about 1840, and some information is available for earlier major floods. The flood of June 24, 1972, is the highest known for the Susquehanna River. The eleven highest floods at Harrisburg are shown below in order of magnitude.

| Date of flood | Gage height (feet) | Elevation above mean sea level (feet) |
|---------------|--------------------|---------------------------------------|
| June 24, 1972 | 32.6               | 322.6                                 |
| Mar. 10, 1896 | 29.2               | 319.2                                 |
| June 2, 1889  | 29.6               | 319.6                                 |
| Mar. 22, 1884 | 28.5               | 318.5                                 |
| Mar. 15, 1784 | 28.8               | 318.8                                 |
| Mar. 29, 1846 | 28.4               | 318.4                                 |
| Mar. 3, 1902  | 21.8               | 311.8                                 |
| Mar. 29, 1946 | 21.8               | 311.8                                 |
| Mar. 12, 1964 | 21.8               | 311.8                                 |
| Oct. 2, 1786  | 20.8               | 310.8                                 |
| Mar. 15, 1846 | 20.8               | 310.8                                 |

**Flood discharge.**—The rate of discharge of a stream is the volume of flow that passes a particular location in a given period of time. Discharge rates usually are expressed in units of cubic feet per second. Peak discharge, the maximum discharge attained by a flood, generally occurs at the time of the maximum stage of the flood, but if the stream is affected by variable backwater, the peak discharge may not coincide with the maximum stage. For example, backwater from an ice jam may cause a high stage during a period of relatively low discharge.

**Flood frequency.**—Frequency of flooding on the Susquehanna River was determined from the records of annual peak discharge data for the Nagle Street gaging station at Harrisburg. Analyses were made by the log-Pearson Type III method (Water Resources Council, 1967), the annual-series-peak-discharge-array method, and the regional relationships for the Susquehanna River developed by Tice (1967). The results of these three analyses agree within 4 percent, for return intervals of 2.33 to 100 years. The relationships between discharge and frequency, as determined from the log-Pearson Type III method, are given in figure 2.

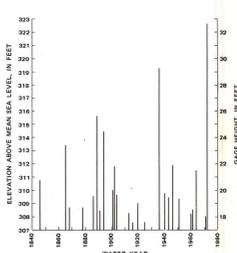


Figure 2.—Frequency of flood discharge of Susquehanna River at Harrisburg (01570500).

The recurrence interval is the average interval of time within which a given peak discharge will be equaled or exceeded once. The recurrence interval is inversely related to the chance of a given flood discharge being equaled or exceeded in any 1 year. Thus, the 20-year flood has a 5 percent (1-in-20) chance of being equaled or exceeded in any 1 year. No regularity of occurrence is implied. Extrapolation of the flood-frequency curve for Harrisburg beyond a recurrence interval of 200 years is not recommended because of the questionable validity of estimated relations. The recurrence interval for the 1972 flood, which was considerably greater than 200 years, cannot be reliably predicted through analysis of the records available.

The general relationship between recurrence interval and regulated flood elevation at the Harrisburg gaging station is shown in the following table and in figure 2.

| Recurrence interval (years) | Elevation above mean sea level (feet) |
|-----------------------------|---------------------------------------|
| 200                         | 320.2                                 |
| 100                         | 317.9                                 |
| 50                          | 315.5                                 |
| 20                          | 312.5                                 |
| 10                          | 309.6                                 |
| 5                           | 306.8                                 |
| 2                           | 303.1                                 |

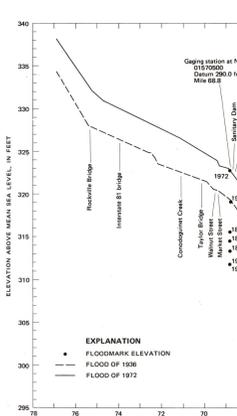


Figure 3.—Profile of floods on Susquehanna River at Harrisburg.

The relationship for natural-flow conditions is derived from log-Pearson Type III analysis of the annual floods from 1861 to 1972. The relationship for regulated flow, as it existed in 1972, is based upon the natural-flow relation and attenuation information provided by the U.S. Army Corps of Engineers, Baltimore.

**Flood profiles.**—Profiles of the water surface along the Susquehanna River, as constructed from surveys of high-water marks left by the floods of June 24, 1972, and Mar. 15, 1846, are shown in figure 3.

Profiles of floods of other magnitudes can generally be plotted parallel to the two profiles shown on this diagram; however, ice jams cause backwater conditions that produce profiles of different shapes. For example, at river mile 69.8 the flood of Mar. 6, 1904, affected by backwater from an ice jam downstream, was about 3 feet higher than the flood of 1966, whereas at river mile 68.8 (Nagle Street) the 1904 flood was almost 10 feet lower than the flood of 1966.

River mileage upstream from the mouth of the Susquehanna at the Chesapeake Bay as shown in figure 3 is also marked along the river on the flood map.

**Flood depths.**—Depth of flooding at any point can be estimated by subtracting ground elevation, as determined from the topographic contour lines on the map, from the water-surface elevation indicated by profiles on figure 3. More accurate ground elevations can be obtained by leveling to nearby bench marks. Spot water-surface elevations and depths of inundation have been inserted on the map to provide a general guide to flood elevations and water depths in areas away from the river channel.

**Tributaries.**—The Susquehanna River is the principal source of major flooding at Harrisburg. The large tributaries flowing through the study area—Comodogant Creek, Paxton Creek, Yellow Breeches Creek, and Swatara Creek—overflow their banks at times. Areas inundated by overflows along these tributaries are not shown, owing to the sparsity of data on the extent of flooding attributable to tropical storm Agnes in such areas.

**Additional information.**—Other information pertaining to floods in the Harrisburg area may be obtained at the office of the U.S. Geological Survey, P.O. Box 1107, Harrisburg, Pa. 17108, and from the following reports:

- Grover, N. C., 1897, The floods of March 1896: U.S. Geol. Survey Water-Supply Paper 799, 607 p.
- Mangan, J. W., 1896, The floods of March 1896 in Pennsylvania: Commonwealth of Pennsylvania, Dept. Forests and Waters, 129 p.
- Stacey, R. E., and Heckmiller, I. A., 1961, Floods at Harrisburg, Pennsylvania: U.S. Geol. Survey Hydro. Inv. Atlas HA-5, 55 p.
- Tice, R. H., 1967, Magnitude and frequency of floods in the United States, Part 1-B: U.S. Geol. Survey Water-Supply Paper 1672, 68 p.
- Water Resources Council, Hydrology Committee, 1967, A uniform technique for determining flood-frequency frequencies: 1055 Vermont Ave., N. W., Wash., D. C. 20005, Water Resources Council Bull. 15, 15 p.

**EXPLANATION**

- AREA FLOODED JUNE 24, 1972
- BOUNDARY OF FLOODED AREA
- DISTANCE UPSTREAM FROM MOUTH, IN MILES
- GAGING STATION
- FLOOD ELEVATION, ABOVE MEAN SEA LEVEL, IN FEET
- FLOOD DEPTH, IN FEET

SCALE 1:24,000

1 INCH = 2 MILES

1:24,000

1 INCH = 2 KILOMETERS

CONTOUR INTERVAL 20 FEET

DATUM IS MEAN SEA LEVEL

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By  
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1973