FIGURE 9.—*Aerial view of Guyandotte River at mouth of Island Creek during flood of March 1963. Courtesy of The Charleston Gazette.*

FLOODS ON GUYANDOTTE RIVER IN THE VICINITY OF LOGAN, LOGAN COUNTY, WEST VIRGINIA

This report was prepared by the U.S. Geological Survey to further the objectives of the Appalachian Regional Commission. It presents hydrologic data concerning the extent, depth, and frequency of flooding that are useful for an appraisal of the hazards involved in occupancy and development of flood plains along the Guyandotte River in the vicinity of Logan, Logan County, West Virginia. It will aid those individuals, organizations, and government agencies who are responsible for making decisions for the safe and economical use of flood-plain lands along the Guyandotte River. The report will be useful for preparing building and zoning regulations, developing recreational areas, and purchasing and developing unoccupied land for various uses. The map and flood data provide a technical basis for making decisions leading to land uses compatible with the degree and frequency of flooding expected.

The approximate boundaries of inundation along the Guyandotte River by hypothetical floods having recurrence intervals of 5, 25, and 50 years are delineated on an aerial photomosaic map. Greater floods than those shown have occurred in the past and may recur. Depths of inundation and limits of overflow of floods of various magnitudes can be estimated by using the methods and relations presented.

In general, the procedure used in defining flood boundaries was to construct flood profiles: (1) from elevations of floodmarks identified in the field, (2) by computing elevations by the conveyance-slope method for hypothetical floods having recurrence intervals of 5, 25, and 50 years, and (3) from data available in the U.S. Geological Survey files and from other agencies. The flood profiles were used to delineate the extent of flooding on the photomosaic map by interpolation between contours (lines of equal ground elevations). The portrayal of flood boundaries is consistent with the scale of the map (1 inch = 500 feet; contour interval, 5 feet).

Flood height.—The height of a flood at a gage usually is stated in terms of gage height or stage, which is the elevation of the water surface above a selected datum plane. Elevations in this report are in feet above mean sea level. Gage heights at the two gages in this report can be converted to elevations by adding the gage height to the appropriate datum of gage listed in the following table. Location of the gages, measured downstream along the river channel from an arbitrary point about 4.3 miles upstream from the Geological Survey gage on the Guyandotte River at Logan, and the period of flood record also are shown.

Gage	Distance along channel (feet)	Datum of gage above mean sea level (feet)	Period of record
U.S.G.S.	22,900	640.00	October 1960 to date
U.S.W.B.	29,200	639.10	July 1923 to date

Flood history.—Data on floods that occurred outside the period of record of the Geological Survey gaging station were obtained from the U.S. Weather Bureau office in Huntington, W. Va. These data indicate that the flood of March 12, 1963, which reached an elevation of 670.8 feet at the U.S. Weather Bureau gage at Logan, was probably the largest flood since at least 1875. Aerial photographs of this flood are shown in figures 9 and 10. Logan High School is shown completely surrounded by water (fig. 9). The highest known flood prior to U.S. Weather Bureau period of record was that of January 28, 1918, which reached an elevation of 666.4 feet. A flood that occurred sometime in 1875 is believed to have been about 1 foot higher than that of January 28, 1918.

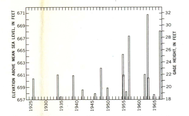

FIGURE 2.—*Floods above 657 feet elevation, Guyandotte River at Logan, 1924–67, U.S. Weather Bureau gage.*

Flood occurrence.—The irregular time distribution of flood events is illustrated by the pattern of flood occurrence at the U.S. Weather Bureau gage on Guyandotte River at Logan during the period 1923–67 (fig. 2). Flood stages above 657-foot elevation occurred 17 times during the 45-year period, an average of about one flood each 2 1/2 years. No flood above 657 feet occurred in 29 years, none occurred during the 7-year period 1927–33, and two occurred in each of the years of 1955 and 1963.

Recurrence interval.—Although the distribution of flood occurrences is recognized as erratic, the concept of "recurrence interval" is used to evaluate the probable frequency of flooding. As applied to flood events, recurrence interval is the average interval of time within which a given flood will be equaled or exceeded once. For example, about 20 floods of at least the magnitude of a 5-year flood may be expected to occur in a 100-year period, and about 4 floods of at least the magnitude of a 25-year flood may be expected to occur in a 100-year period. Because of the irregular nature of flood events, recurrence interval cannot be used to predict the time of flood occurrence. It can, however, be used to evaluate the probability of occurrence in any year. A flood with a 5-year recurrence interval would have a 20-percent chance of being equaled or exceeded in any given year, and a flood with a 25-year recurrence interval would have a 4-percent chance of being equaled or exceeded in any given year.

It is emphasized that recurrence intervals are average values—the average number of years that will elapse between floods that equal or exceed a specific elevation. Thus, a flood elevation of 669.8 feet at the Geological Survey gage, at Logan, is said to have a 25-year recurrence interval. However, because of the nature of flood occurrences, the 669.8-foot elevation may not be exceeded in any given 25-year period, or it may be exceeded more than once. It may even be exceeded more than once in any 1-year period.

Flood frequency.—Flood-frequency relations were derived from streamflow records for Guyandotte River at Logan combined with the regional flood-frequency relation of floods in the United States (Speer and Gamble, 1965). The regional flood-frequency relations are based upon gaging-station records in the region having 10 or more years of record not materially affected by storage or diversion. The results represent the magnitude and frequency of natural floods within the range and recurrence interval defined by the base data.

The relation between frequency and flood elevation at the Geological Survey gaging station is shown graphically in figure 3. The relations between recurrence interval and discharge for two points on the Guyandotte River, one just above and one just below the mouth of Island Creek, were computed from the regional flood-frequency data mentioned above and are shown graphically in figure 4. The relation between stage and recurrence interval is dependent on the relation of stage to discharge which is affected by changes in physical conditions of the channel. The stage-frequency curve shown in figure 3 is based on channel conditions existing in 1967. Longer records and future changes in channel conditions may define a somewhat different flood-frequency curve.

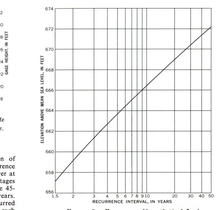

FIGURE 3.—*Frequency of hypothetical flood stages on Guyandotte River at Logan, U.S. Geological Survey gage.*

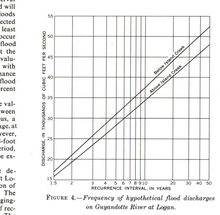

FIGURE 4.—*Frequency of hypothetical flood discharges on Guyandotte River at Logan.*

Accuracy of flood-frequency relations declines as the recurrence interval becomes longer. Extrapolation of the frequency curves beyond the limits shown is not advised.

Flood profiles.—The relation between recurrence interval and flood elevation evaluates the flood likelihood only at the Geological Survey gage site. The flood profiles in figure 5 extend this information to all sites along the Guyandotte River in the study area. The profile for the March 12, 1963, flood is based on the peak water-surface elevation at several points along the stream. The profiles for hypothetical floods having recurrence intervals of 5, 25, and 50 years are based on computed elevations at several river cross sections in the reach of interest. Elevations were computed by routing discharge values through the cross sections using the slope-conveyance method.

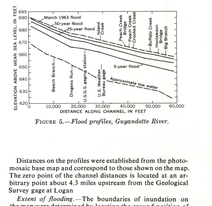

FIGURE 5.—*Flood profiles, Guyandotte River.*

Distances on the profiles were established from the photomosaic base map and correspond to the channel on the map. The zero point of the channel distances is located at an arbitrary point about 4.3 miles upstream from the Geological Survey gage at Logan

Extent of flooding.—The boundaries of inundation on the map were determined by locating the ground position of the water-surface elevations indicated by the 50-year, 25-year, and 5-year hypothetical flood profiles in figure 5. The difference in areal extent of inundation between relatively large and small floods is not great, and boundaries of floods of recurrence interval up to 50 years can be estimated for many practical uses.

The areas shown on the map as subject to inundation along tributary streams are those that would be flooded by backwater from the Guyandotte River and do not define limits of inundation by headwater floods on the tributaries. The areas subject to inundation by tributary flow, especially at a distance upstream from the mouth, may be greater than the areas inundated by backwater from the Guyandotte River.

The primary significance of the 50-year flood is its use as the design flood for many land-use developments and projects. The 25-year and 5-year flood boundaries are shown for comparison.

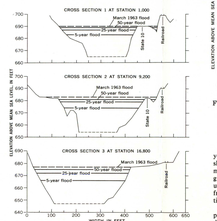

FIGURE 6.—*Cross sections of Guyandotte River and flood plain.*

Depth of flooding.—Depths of flooding by 50-year, 25-year, and 5-year floods at several selected cross sections are shown in figures 6–8. Depth of flooding by floods of selected magnitudes can be estimated at other points by subtracting ground elevations from the water-surface elevations in figure 5. The approximate ground elevation can be determined from contours on the map; however, more accurate elevations can be obtained by leveling from nearby bench marks.

Future conditions.—The flood-elevation data in this report are applicable for flood-control and river-channel conditions existing prior to 1967. Changes which affect the water-carrying capacity of the river channel such as those to waterway openings at highway and railroad bridges, channel improvement, or changes in runoff characteristics of the river basin above the report area that may take place after 1967, could affect the flood height and inundation pattern of future floods of comparable discharge. The future R. D. Bailey flood-control reservoir located about 30 miles upstream, now in the preconstruction design stage, and any other flood-control reservoirs in the Guyandotte River basin above Logan should reduce the frequency of flooding after completion, but will not necessarily eliminate all future flooding.

Bench marks.—The locations and elevations of several bench marks in the area of this report are given below. These were taken from vertical control data sheets of the U.S. Coast and Geodetic Survey. Elevations are based on sea-level datum of 1929, supplementary adjustment of 1961.

B.M. N 35.—2.1 miles southeast along U.S. Highway 119 from the courthouse at Logan, Logan County, at a bridge over Dingess Run Creek, in the top of the north abutment, 12 feet east of the centerline of the highway, and about 6 inches lower than the track. A standard disk, stamped "N 35 1935." Elevation (ft msl) 674.421.

B.M. M 45X.—At Stollings, Logan County, on the Chesapeake and Ohio Railway, at bridge 674 over Dingess Run Creek, in the top of the east end of the south abutment, 6 feet east of the east rail, and about 1 1/2 feet lower than the track. A standard disk, stamped "M 45 X 1935." Elevation (ft msl) 675.474. NOTE.—This mark is also 2.2 miles southeast of Logan.

B.M. 683 (U.S.G.S.).—At Logan, at the courthouse, set vertically in west stone face of the front porch of west entrance to courthouse, 74 1/2 feet south of south curb line of Stratton Street, 30 1/2 feet east of east curb line of a street passing on west side of courthouse, 2 1/2 feet north of southwest corner of porch and about 2 feet above ground. A U.S.G.S. disk stamped "683." Elevation (ft msl) 680.691.

B.M. K 35.—At Logan, Logan County, on Main Street, at the high school, at the south entrance, in the south wall of the west pillar of the entrance arch, 15 yards north of the centerline of Main Street, and about one foot above the walk. A standard disk, stamped "K 35 1935" and set vertically. Elevation (ft msl) 668.657.

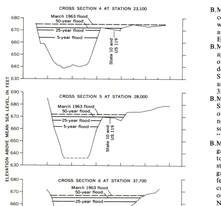

FIGURE 7.—*Cross sections of Guyandotte River and flood plain.*

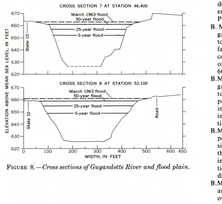

FIGURE 8.—*Cross sections of Guyandotte River and flood plain.*

B.M. H 50.—At Logan, set vertically in the north face of the concrete foundation of the Chesapeake and Ohio Railway station, 12 feet west of northeast corner of building and 1/2 foot above ground. A disk stamped "H 50 1935." Elevation (ft msl) 676.875.

B.M. J 33.—At Logan, about 0.1 mile southwest of the Chesapeake and Ohio Railway station, in the top of north end of east concrete abutment of street bridge over Guyandotte River, 21 feet north of centerline of bridge (formerly State Highway 10), 3 feet south of north end of abutment and 1 foot above level of bridge floor. A disk stamped "J 35 1935." Elevation (ft msl) 677.269.

B.M. Y 14A.—At Logan, at Appalachin Power Company Steam Plant, set in the top of retaining wall at south end of downstream circulation pumphouse intake, 5 feet northeast of southeast corner of pumphouse, 39 feet south of water gage and level with retaining wall. Stamped "Y 14A 1957." Elevation (ft msl) 661.022.

B.M. 1A (A.P.C.).—A 2 1/2 x 2 inch outlined square at Logan at Appalachin Power Company Steam Plant, on the top of retaining wall directly above south side of downstream intake of power plant, 28 feet south of the water gage, 2 1/4 feet west of east edge of retaining wall, 7 1/4 feet east-northeast of southeast corner of downstream circulating pumphouse. The following "BM 660.84" is cut on west side of retaining wall. Elevation (ft msl) 661.022. NOTE: This mark is designated "B.M. Appalachian" on descriptions of BM's at gaging station on Guyandotte River as maintained by the Weather Bureau and Appalachian Power Company.

B.M. 2 (A.P.C.).—A 1 3/4 x 3 inch oblong square at Logan, at Appalachin Power Company Steam Plant, located in the top of the west retaining wall of steps leading to River spray pumphouse, about 37 feet west-northwest of water gage, 16 1/2 feet west of northwest corner of downstream circulation pumphouse, 4 1/2 feet northwest of south corner of top concrete step and 1 foot above ground. Elevation (ft msl) 663.342.
NOTE: This bench mark is designated "BM Square" on description of BM's at gaging station on Guyandotte River as maintained by the Weather Bureau and Appalachian Power Company.

B.M. 3 (A.P.C.).—A 1 1/2 x 1 inch outlined square at Logan, at Appalachin Power Company Steam Plant, in the top of the northwest end of concrete doorsill of northeast face of transformer building, 6 feet southeast of north corner of building, 3/4 foot southeast of northwest end of doorsill and about level with ground. Elevation (ft msl) 665.970.

B.M. 4 (A.P.C.).—A 1 1/4 x 1 inch outlined square at Logan, at Appalachin Power Company Steam Plant, on the top of the south side of the concrete foundation of flagpole, 69 feet northeast of northeast corner of service building, 37 feet southwest of southwest corner of guard building at main entrance and 3/4 foot above ground. Elevation (ft msl) 669.641.

B.M. J 50.—At Peach Creek, Logan County, on the Chesapeake and Ohio Railway, 55 yards north of the station sign, 21 feet west of the centerline of a road, 12.5 feet east of the east rail of the east track, at a railroad water hydrant, in the top of the northeast corner of the concrete foundation, and about one foot higher than the rail. A standard disk, stamped "J 50 1935." Elevation (ft msl) 668.709.

B.M. K 50.—About 2.25 miles south along the Chesapeake and Ohio Railway from the overpass of State Highway 10 over tracks at Pecks Mill, at Henlawson, 382 yards southwest of milepost 61, 89 feet southeast of southeast rail of southeast track, 30 feet southeast of centerline of a road parallel to track, set vertically in the northeast face of concrete foundation of 1-story frame school building, 10 feet northeast of west corner of building and 2 1/2 feet above ground. A disk stamped "K 50 1935." Elevation (ft msl) 667.902.

B.M. B 163.—About 1.85 miles south along the Chesapeake and Ohio Railway from the overpass of State Highway 10 over tracks at Pecks Mill, 337 yards northeast of milepost 61, set vertically in the slanting northeast face of a 35-foot high solid rock cliff, 13 feet southeast of southeast rail of southeast main track and about 1 foot above level of track. A disk stamped "B 163 1957." Elevation (ft msl) 661.997.

B.M. A 163.—About 1.05 miles south along the Chesapeake and Ohio Railway from the underpass under State Highway 10 at Pecks Mill, 62 feet northeast and across track from milepost 60, 12.3 feet east of east rail of east main track and on the outside of a curve in track, 31 feet north of east end of a 24-inch corrugated pipe culvert under tracks, set vertically in the west face of a 5-foot high smooth rock in a cut, and about 2 feet above level of track. A disk stamped "A 163 1957." Elevation (ft msl) 664.303.

Acknowledgments.—The selection of the site for this project was made in collaboration with the Appalachian Regional Commission and representatives of the West Virginia Department of Natural Resources. Coordination of planning with the district office of the Corps of Engineers was accomplished through the Office of Appalachian Studies, Corps of Engineers.

The report was prepared by the Geological Survey under the administrative direction of William C. Griffin, district chief, and under the immediate supervision of Prentis M. Frye, hydrologist. Technical assistance was provided by James F. Bailey, hydrologist.

Acknowledgment is made to the U.S. Weather Bureau, Huntington, W. Va. for supplying some of the data on which this report is based. Additional data were obtained from public officials in the area and from field investigations.

REFERENCES

Other information pertaining to floods on the Guyandotte River may be obtained at the office of the U.S. Geological Survey, Charleston, W. Va., and from the following reports:
Barnes, H. H., Jr., 1964, Floods of March 1963—Alabama to West Virginia: U.S. Geol. Survey open-file report, 44 p.
Speer, P. R., and Gamble, C. R., 1965, Magnitude and frequency of floods in the United States, Part 3–A, Ohio River basin except Cumberland and Tennessee River basins: U.S. Geol. Survey Water-Supply Paper 1675, 630 p.
U.S. Geological Survey, 1966, Water resources data of West Virginia: Charleston, W. Va., 171 p.

Horizontal position controlled within the limits of topographic contours only. Photogrammetric compilation of base by Hotzo Jurado. Aerial photography by U.S. Geological Survey, April 1966

FIGURE 10.—*Aerial view of the Copperas Mine Fork one-half mile upstream from mouth during flood of March 1963. Courtesy of The Charleston Gazette.*

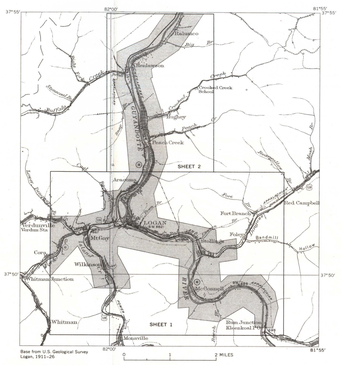

FIGURE 1.—*Index map of Logan area, West Virginia showing location of sheets 1 and 2.*

0 500 1000 1500 2000 2500 FEET
CONTOUR INTERVAL VARIES
DATUM IS MEAN SEA LEVEL

FLOODS ON THE GUYANDOTTE RIVER IN THE VICINITY OF LOGAN, LOGAN COUNTY, WEST VIRGINIA

By
E. A. Friel and G. S. Runner

1972

EXPLANATION

Area flooded
50-year flood boundary
25-year flood boundary
5-year flood boundary
Cross section location
Distance along channel, in feet — 20,000

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1972—80247
For sale by U.S. Geological Survey, price $1.50 per set