DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA-588

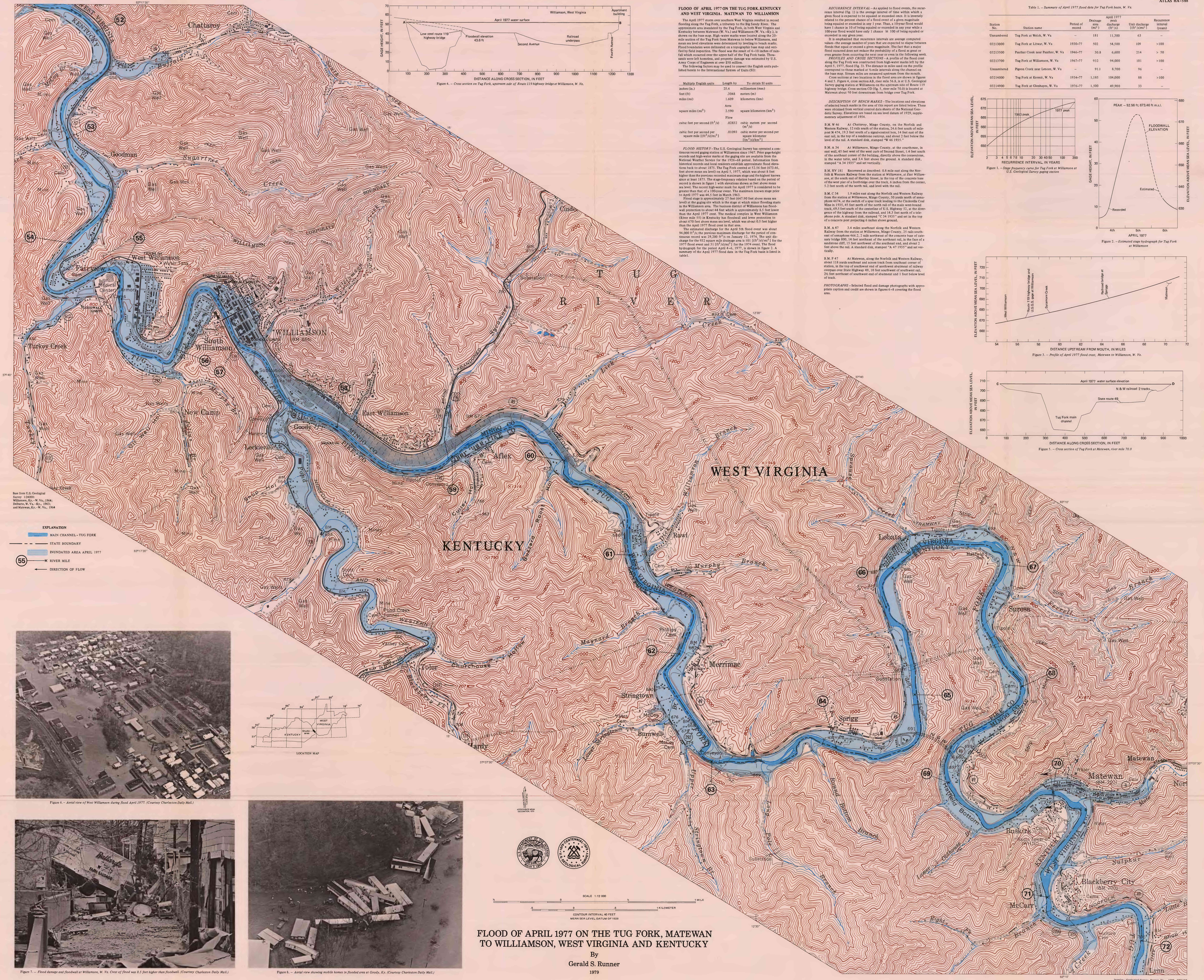

Figure 4. – *Cross section on Tug Fork, upstream side of Route 119 highway bridge at Williamson, W. Va.*

FLOOD OF APRIL 1977 ON THE TUG FORK, KENTUCKY AND WEST VIRGINIA. MATEWAN TO WILLIAMSON

The April 1977 storm over southern West Virginia resulted in record flooding along the Tug Fork, a tributary to the Big Sandy River. The approximate area inundated by the Tug Fork, in both West Virginia and Kentucky between Matewan (W. Va.) and Williamson (W. Va.-Ky.), is shown on the base map. High-water marks were located along the 20-mile section of the Tug Fork from Matewan to below Williamson, and mean sea level elevations were determined by leveling to bench marks. Flood boundaries were delineated on a topographic base map and verified by field inspection. The flood was the result of 4–10 inches of rainfall which occurred over the upper half of the Tug Fork basin. Thousands were left homeless, and property damage was estimated by U.S. Army Corps of Engineers at over $50 million.

The following factors may be used to convert the English units published herein to the International System of Units (SI):

Multiply English units	Length by	To obtain SI units
inches (in.)	25.4	millimeters (mm)
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
	Area	
square miles (mi^2)	2.590	square kilometers (km^2)
	Flow	
cubic feet per second (ft^3/s)	.02832	cubic meters per second (m^3/s)
cubic feet per second per square mile ($[ft^3/s]/mi^2$)	.01093	cubic meter per second per square kilometer ($[m^3/s]/km^2$)

FLOOD HISTORY–The U.S. Geological Survey has operated a continuous record gaging station at Williamson since 1967. Prior gage-height records and high-water marks at the gaging site are available from the National Weather Service for the 1926–68 period. Information from historical records and local residents establish approximate flood elevations back to about 1875. The Tug Fork crested at 52.56 feet (673.46, feet above mean sea level) on April 5, 1977, which was about 8 feet higher than the previous recorded maximum stage and the highest known since at least 1875. The stage-frequency relation based on the period of record is shown in figure 1 with elevations shown as feet above mean sea level. The record high-water mark for April 1977 is considered to be greater than that of a 100-year event. The maximum known stage prior to April 1977 was 44.5 feet in March 1963.

Flood stage is approximately 27 feet (647.00 feet above mean sea level) at the gaging site which is the stage at which minor flooding starts in the Williamson area. The business district of Williamson has floodwall protection to about 44 feet which is approximately 8.5 feet lower than the April 1977 crest. The medical complex in West Williamson (River mile 553) in Kentucky has floodwall and levee protection to about 670 feet above mean sea level, which was about 0.5 feet higher than the April 1977 flood crest in that area.

The estimated discharge for the April 5th flood event was about 94,000 ft^3/s; the previous maximum discharge for the period of continuous record was 39,200 ft^3/s on January 12, 1974. The unit discharge for the 932 square mile drainage area is 101 $([ft^3/s]/mi^2]$ for the 1977 flood event and 31 $([ft^3/s]/mi^2]$ for the 1974 event. The flood hydrograph for the period April 4–6, 1977, is shown in figure 2. A summary of the April 1977 flood data in the Tug Fork basin is listed in table1.

RECURRENCE INTERVAL–As applied to flood events, the recurrence interval (fig. 1) is the average interval of time within which a given flood is expected to be equaled or exceeded once. It is inversely related to the percent chance of a flood event of a given magnitude being equaled or exceeded in any 1 year. Thus, a 10-year flood would have 1 chance in 10 of being equaled or exceeded in any year while a 100-year flood would have only 1 chance in 100 of being equaled or exceeded in any given year.

It is emphasized that recurrence intervals are average computed values–the average number of years that are expected to elapse between floods that equal or exceed a given magnitude. The fact that a major flood occurred does not reduce the probability of a flood as great or even greater from occurring the next year or even in the following week.

PROFILES AND CROSS SECTIONS–A profile of the flood crest along the Tug Fork was constructed from high-water marks left by the April 5, 1977, flood (fig. 3). The distance in miles used on the profile correspond to those marked at ½-mile intervals along the channel on the base map. Stream miles are measured upstream from the mouth.

Cross sections at two locations in the flood area are shown in figures 4 and 5. Figure 4, cross section AB, river mile 56.8, is at U.S. Geological Survey gaging station at Williamson on the upstream side of Route 119 highway bridge. Cross section CD (fig. 5, river mile 70.0) is located at Matewan about ⅘0 feet downstream from bridge over Tug Fork.

DESCRIPTION OF BENCH MARKS–The locations and elevations of selected bench marks in the area of this report are listed below. These were obtained from vertical control data sheets of the National Geodetic Survey. Elevations are based on sea level datum of 1929, supplementary adjustment of 1954.

B.M. W 46 At *Chattaroy*, Mingo County, on the Norfolk and Western Railway, 12 rails south of the station, 24.6 feet south of milepost N 474, 19.3 feet south of a signal-control box, 14 feet east of the east rail, in the top of a sandstone outcrop, and about 2 feet below the level of the rail. A standard disk, stamped "W 46 1935."

B.M. A 34 At *Williamson*, Mingo County, at the courthouse, in east wall, 45 feet west of the west curb of Second Street, 1.4 feet south of the northeast corner of the building, directly above the cornerstone, in the water table, and 3.4 feet above the ground. A standard disk, stamped "A 34 1935" and set vertically.

B.M. RV 181 Recovered as described: 0.8 mile east along the Norfolk & Western Railway from the station at *Williamson*, at *East Williamson*, at the south end of Hartley Street, in the top of the concrete base of the west pier of a footbridge over the track, 6 inches from the corner, 5.2 feet north of the north rail, and level with the rail.

B.M. C 34 1.9 miles east along the Norfolk and Western Railway from the station at *Williamson*, Mingo County, 50 yards north of semaphore 4674, at the switch of a spur track leading to the Cinderella Coal Mine in 1935, 45 feet north of the north rail of the main west-bound track, 69.5 feet south of the centerline of U.S. Highway 52, at the divergence of the highway from the railroad, and 14.3 feet north of a telephone pole. A standard disk, stamped "C 34 1935" and set in the top of a concrete post projecting 6 inches above ground.

B.M. A 47 3.4 miles southeast along the Norfolk and Western Railway from the station at *Williamson*, Mingo County, 25 rails southeast of semaphore 466.2, 2 rails northwest of the concrete base of catenary bridge 800, 14 feet northeast of the northeast rail, in the face of a sandstone cliff, 15 feet northwest of the southeast end, and about 2 feet above the rail. A standard disk, stamped "A 47 1935" and set vertically.

B.M. F 47 At *Matewan*, along the Norfolk and Western Railway, about 118 yards southeast and across track from southeast corner of station, in the top of southwest end of northwest abutment of railway overpass over State Highway 49, 10 feet southwest of southwest rail, 2½ feet northeast of southwest end of abutment and 1 foot below level of track.

PHOTOGRAPHS–Selected flood and damage photographs with appropriate caption and credit are shown in figures 6–8 covering the flood area.

Table 1. – *Summary of April 1977 flood data for Tug Fork basin, W. Va.*

Station No.	Station name	Period of record	Drainage area (mi^2)	April 1977 peak discharge (ft^3/s)	Unit discharge ($[ft^3/s]/mi^2$)	Recurrence interval (years)
Unnumbered	Tug Fork at Welch, W. Va	–	181	11,300	63	–
03213000	Tug Fork at Litwar, W. Va	1930–77	502	54,500	109	>100
03213500	Panther Creek near Panther, W. Va	1946–77	30.8	6,600	214	> 50
03213700	Tug Fork at Williamson, W. Va	1967–77	932	94,000	101	>100
Unnumbered	Pigeon Creek near Lenore, W. Va	–	91.1	8,700	96	–
03214000	Tug Fork at Kermit, W. Va	1934–77	1,185	104,000	88	>100
03214900	Tug Fork at Glenhayes, W. Va	1976–77	1,500	49,900	33	–

Figure 1. – *Stage frequency curve for Tug Fork at Williamson at U.S. Geological Survey gaging station*

Figure 2. – *Estimated stage hydrograph for Tug Fork at Williamson*

Figure 3. – *Profile of April 1977 flood crest, Matewan to Williamson, W. Va.*

Figure 5. – *Cross section of Tug Fork at Matewan, river mile 70.0*

Figure 6. – *Aerial view of West Williamson during flood April 1977. (Courtesy Charleston Daily Mail.)*

Figure 7. – *Flood damage and floodwall at Williamson, W. Va. Crest of flood was 8.5 feet higher than floodwall. (Courtesy Charleston Daily Mail.)*

Figure 8. – *Aerial view showing mobile homes in flooded area at Goody, Ky. (Courtesy Charleston Daily Mail.)*

FLOOD OF APRIL 1977 ON THE TUG FORK, MATEWAN TO WILLIAMSON, WEST VIRGINIA AND KENTUCKY

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