FLOOD OF DECEMBER 1987 IN CENTRAL AND EASTERN ARKANSAS

By Braxtel L. Neely, Jr.

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CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, rather than the inch-pound units used in this report, the following conversion factors may be used:

Multiply inch-pound unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
inch (in.)	25.4	millimeter (mm)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

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ABSTRACT

Heavy rain fell across Arkansas December 24-28, 1987. During this period, 6 to 12 inches of rain fell in a 100-mile wide belt, extending roughly from Texarkana to West Memphis, Arkansas. The intense rainfall produced flooding throughout much of central and eastern Arkansas. Peak discharges associated with the flood had recurrence intervals of 100 years at two gaging stations. Peak stages, discharges, and recurrence intervals for this flood are documented for 41 gaging stations in this report. Also included are flood profiles for Bayou Meto, Bayou Two Prairie, Cache River, and L'Anguille River, and flood hydrographs for gaging stations on Bayou Meto near Lonoke and Cache River at Patterson.

INTRODUCTION

The flood of December 1987 affected southwestern, central, and eastern Arkansas and the southwestern part of Tennessee. The areas of Arkansas that were hardest hit by the flooding were located between Little Rock and West Memphis. In West Memphis, approximately 650 houses were flooded to depths of up to 4 feet.

The purpose of this report is to present peak stage and discharge data and document the recurrence intervals of the December 1987 flood at gaging stations and miscellaneous sites in central and eastern Arkansas (fig. 1). Precipitation data presented in this report were provided by the National Weather Service (National Oceanic and Atmospheric Administration, 1987) and the Naval Air Station in Millington, Tennessee. Streamflow and peak-stage data documented in this report were collected by the U.S. Geological Survey and the U.S. Army Corps of Engineers, Memphis District. The report was prepared in cooperation with the Arkansas Soil and Water Conservation Commission.

DESCRIPTION OF STORM

Heavy rain fell across Arkansas beginning on December 24, 1987, and continued until December 28, 1987. During this period, 6 to 12 inches fell in a 100-mile wide belt extending southwest to northeast, with an axis centered, roughly, from Texarkana to West Memphis, Ark. The remaining areas of the State received between 3 and 6 inches of rain during the same period. Lines of equal rainfall for the storm of December 24-28, 1987, are shown on figure 2.

The National Weather Service reported that 12.79 inches of rain were measured December 24-28, 1987, at the West Memphis gage. An unofficial measurement of 18 inches of rain 3 miles north of West Memphis was reported by a local resident. The Naval Air Station in Millington, Tenn., which is located about 20 miles northeast of West Memphis, measured 14.64 inches of rain during this period.

The most intense rainfall during the storm occurred between noon on December 24 and 6 a.m. on December 25. Cumulative totals of rain measured at the National Weather Service gages at North Little Rock, Ark., Brinkley, Ark., Wynne, Ark., and Memphis, Tenn., and at the Naval Air Station at Millington, Tenn., are shown on figure 3. All of the rainfall values were recorded at 1-hour intervals except those at the gage at Millington which were recorded at 6-hour intervals. The maximum rain that fell during a 6-, 12-, and 24-hour period is shown in table 1.

Table 1.--Maximum rainfall for the 6-, 12-, and 24-hour period of the December 24-28, 1987, storm (National Oceanic and Atmospheric Administration, 1987)

Station	Maximum rainfall during indicated period, in inches		
	6 hour	12 hour	24 hour
North Little Rock, Ark.	2.97	4.95	6.36
Brinkley, Ark.	3.10	4.10	5.40
Wynne, Ark.	3.20	5.80	7.80
Memphis, Tenn.	3.47	4.26	4.96
Millington, Tenn.	4.89	9.20	10.05

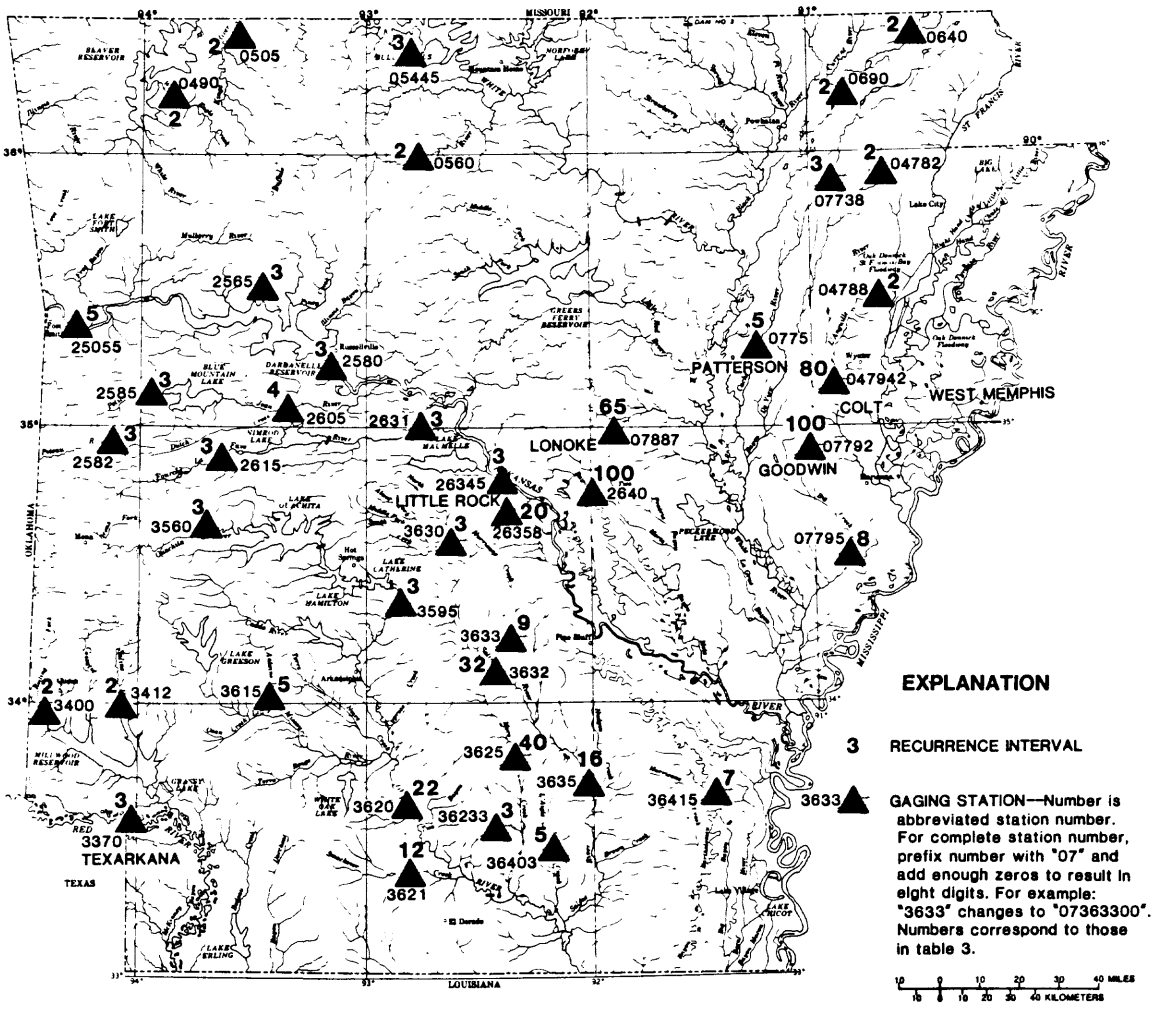


Figure 1.--Locations of gaging stations where recurrence intervals of the December 1987 flood were 2 years or more.

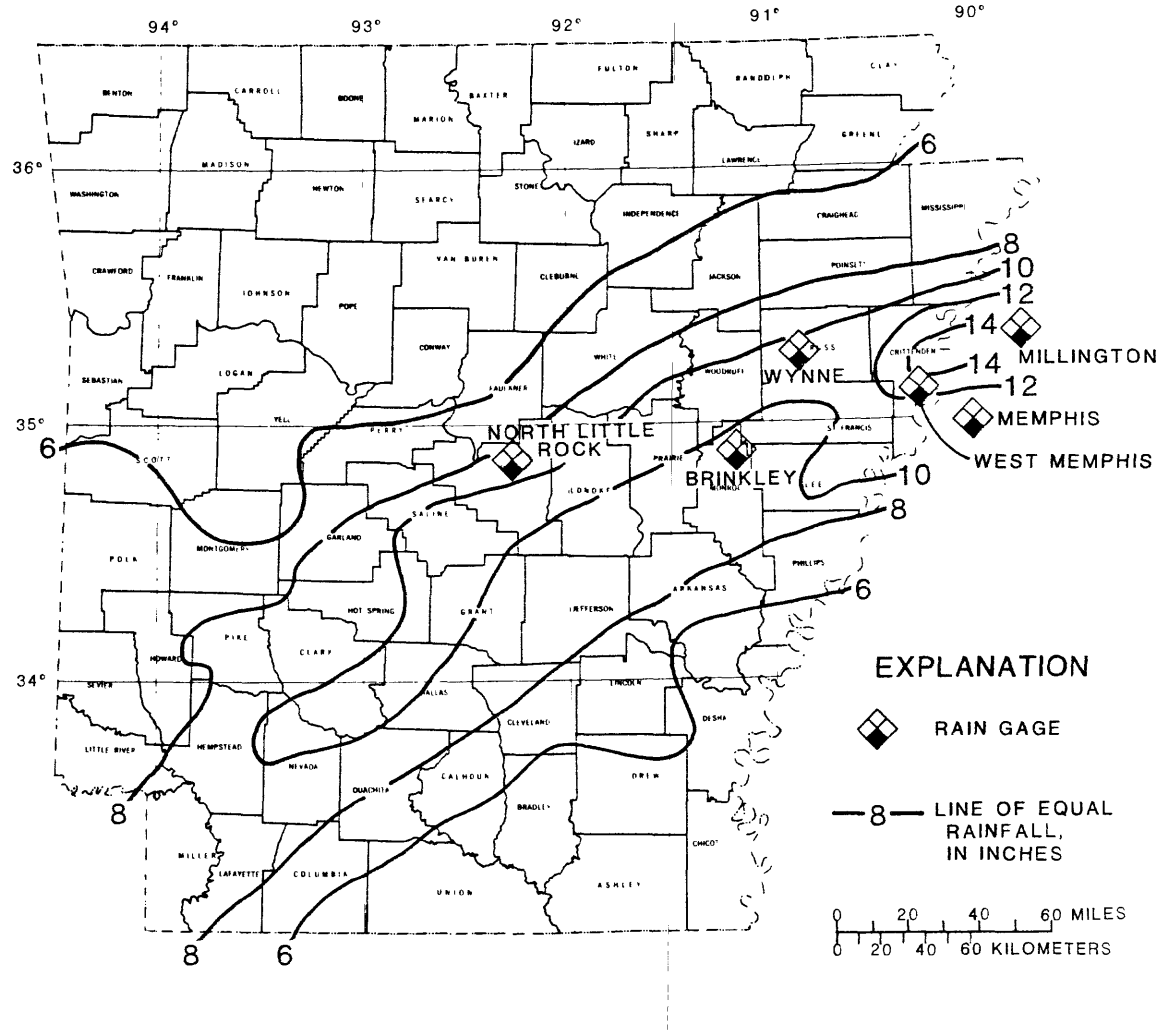


Figure 2.--Cumulative rainfall in southwestern, central, and eastern Arkansas for the storm of December 24-28, 1987.

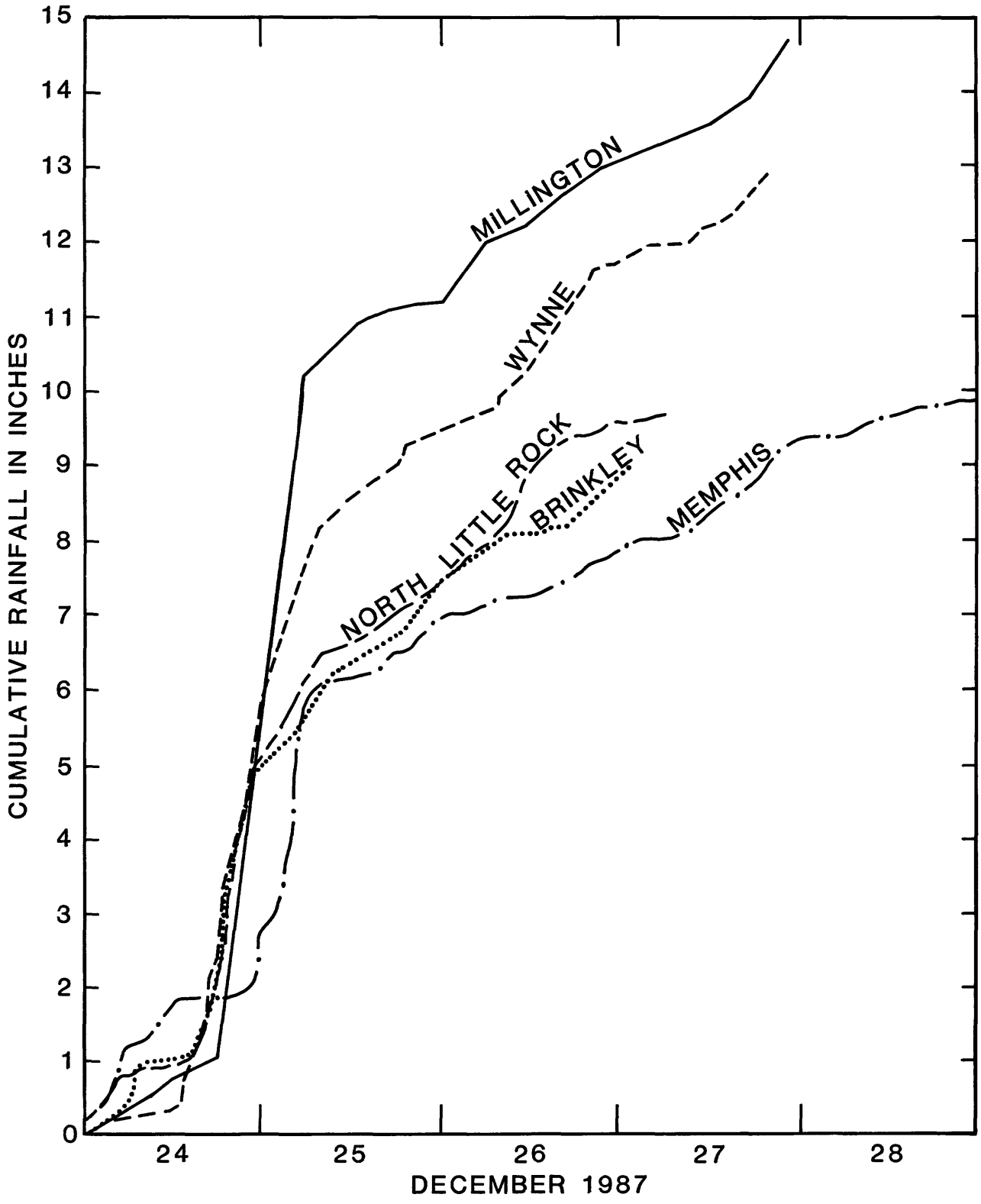


Figure 3.--Cumulative rainfall at National Weather Service gages at North Little Rock, Wynne, and Brinkley, Arkansas, and Memphis, Tennessee, and at the Naval Air Station at Millington, Tennessee.

The maximum rain that is expected to fall during a 6-, 12-, and 24-hour period at North Little Rock, Ark., and Memphis, Tenn., for selected recurrence intervals between 2 and 100 years is given in table 2 (Weather Bureau, 1961). The expected rainfall values shown in table 2 can be compared with actual rainfall values shown in table 1. The maximum 24-hour rainfall at Millington was greater than a 100-year, 24-hour rainfall.

Table 2.--Rainfall amounts for 6-, 12- and 24-hour periods at selected recurrence intervals for National Oceanic and Atmospheric Administration weather stations at North Little Rock, Arkansas, and Memphis, Tennessee (Weather Bureau, 1961)

Recurrence interval, in years	Rainfall, in inches					
	North Little Rock			Memphis		
	6 hour	12 hour	24 hour	6 hour	12 hour	24 hour
2	2.95	3.54	4.07	2.84	3.41	4.01
5	3.75	4.50	5.22	3.57	4.21	4.97
10	4.33	5.12	6.02	4.08	4.81	5.68
25	4.96	5.96	6.95	4.65	5.49	6.44
50	5.33	6.58	7.72	5.18	6.17	7.21
100	6.07	7.33	8.35	5.64	6.76	7.96

FLOOD CHARACTERISTICS

The most severe flooding occurred between Little Rock and West Memphis. The peak discharge associated with this flood had a recurrence interval of 100 years at two gaging stations--Bayou Meto near Lonoke and Big Creek at Goodwin. At the peak of the flood, the depth of water on the Bayou Meto flood plain, which is 2 miles wide and used for farming and for raising catfish, was about 4 feet. The peak discharge of the L'Anguille River near Colt had a recurrence interval of 80 years. The depth of water on the flood plain, which is 1 mile wide and used mostly for farming, was about 3 feet.

Peak Stages and Discharges

Peak discharges associated with the December 1987 flood had recurrence intervals of 2 years or more at 41 gaging stations. Stage and discharge data for this flood and the previous maximum flood at these sites are given in table 3.

The recurrence interval of the December 1987 flood at each site is given in table 3. As used in this report, the recurrence interval is the reciprocal of probability of occurrence multiplied by 100 and is the average number of years between exceedences over a long period of time. This does not mean that floods occur at uniformly spaced intervals. In fact, a flood of this magnitude can be exceeded at any time during a given period.

Table 3.--Summary of peak stages and discharges

[mi^2 = square miles; ft^3/s = cubic feet per second]

Station number	Station name and location	Drainage area (mi^2)	Period of record	Maximum floods: Prior to December 1987 — Date	Gage height (feet)	Discharge (ft^3/s)	Flood of December 1987 — Date	Gage height (feet)	Discharge (ft^3/s)	Recurrence interval (years)
07047820	Murray Creek near Jonesboro	1.38	1960-	5-27-73	14.20	1,330	Dec. 25	10.00	505	2
07047880	Pope Creek Tributary at Birdeye	.08	1963-	9-13-78	7.73	511	Dec. 27	4.12	48	2
07047942	L'Anguille River near Colt	535	1971-	12-09-78	15.81	12,000	Dec. 30	17.34	16,300	80
07049000	War Eagle Creek near Hindsville	262	1953-77, 1985-	5-10-43	28.10	50,000	Dec. 26	17.70	14,200	2
07050500	Kings River near Berryville	527	1939-88	4-14-27	38.00	62,000	Dec. 26	21.35	18,100	2
07054450	East Sugarloaf Creek Tributary near Lead Hill	.85	1962-	10-13-68	15.30	2,480	Dec. 28	8.39	360	3
07056000	Buffalo River near St. Joe	829	1915, 1939-	12-03-82	53.75	158,000	Dec. 26	27.29	42,700	2
07064000	Black River near Corning	1,749	1919-	6-13-45	16.92	48,600	Dec. 28	13.05	11,500	2
07069000	Black River at Pocahontas	4,845	1937-78, 1981-	4-17-27	25.90	80,000	Dec. 31	21.08	23,900	2
07076870	Pigeon Roost Creek at Butlerville	23.0	1961-	4-21-74	12.62	8,800	Dec. 26	12.38	7,700	65
07077380	Cache River at Egypt	701	1938-40, 1953-	1-06-66	21.88	8,940	Dec. 29	20.37	5,410	3
07077500	Cache River at Patterson	1,037	1921-31, 1937-	4-19-27	16.10	24,500	Dec. 28	11.90	9,140	5
07077920	Big Creek at Goodwin	31.1	1961-	2-27-62	9.83	910	Dec. 25	10.35	1,250	100
07077950	Big Creek near Poplar Grove	448	1971-	4-23-73	31.74	5,910	Dec. 29	31.72	5,530	8
07250550	Arkansas River at Dam No. 13 near Van Buren	150,547	1927-	5-12-43	38.0[a]	850,000	Dec. 27	392.63	187,000	5
07256500	Spadra Creek at Clarksville	61.1	1953-	6-05-74	19.93	27,400	Dec. 25	9.88	8,000	3
07258000	Arkansas River at Dardanelle	153,670	1938-	5-13-43, 5-25-43	-- 43.6	683,000 --	Dec. 28	31.89	244,000	3
07258200	Pack Saddle Creek Tributary near Waldron	.92	1961-88	5-13-68	9.42	689	Dec. 27	5.35	207	3
07258500	Petit Jean River near Booneville	241	1938	4-16-39	23.42	43,200	Dec. 26	21.22	15,900	3
07260500	Petit Jean River at Danville	764	1916-	4-17-39	31.82	70,800	Dec. 27	24.59	13,300	4
07261500	Fourche LaFave River near Gravelly	410	1939-	12-03-82	32.45	162,000	Dec. 26	24.27	32,100	3

Table 3.--Summary of peak stages and discharges--(continued)

Station number	Station name and location	Drainage area (mi^2)	Period of record	Maximum floods: Prior to December 1987 — Date	Gage height (feet)	Discharge (ft^3/s)	Flood of December 1987 — Date	Gage height (feet)	Discharge (ft^3/s)	Recurrence interval (years)
07263100	Fourche LaFave Tributary near Perryville	1.47	1962-	12-03-82	11.45	1,150	Dec. 25	8.34	390	3
07263450	Arkansas River at Murray Dam at Little Rock	158,030	1933, 1927-	5-27-43	34.6[a] 30.05[a]	536,000	Dec. 28	249.26	264,000	3
07263580	Rock Creek at Little Rock	20.5	1978-	9-13-78	18.26	22,500	Dec. 25	13.94	10,500	20
07264000	Bayou Meto near Lonoke	207	1948-	5-17-68	26.55	4,700	Dec. 29	27.11	5,750	100
07337000	Red River at Index	48,030	1936-	2-23-38	34.25	297,000	Dec. 28	19.75	87,700	3
07340000	Little River near Horatio	2,662	1915, 1930-	8- -15	38.0	124,000	Dec. 27	28.36	29,100	2
07341200	Saline River near Lockesburg	256	1961, 1964-	5-07-61 5-14-68	25.6 20.86	64,700	Dec. 26	16.62	12,200	2
07356000	Ouachita River near Mt. Ida	414	1941-	12-03-82	39.78	102,000	Dec. 26	23.02	29,500	3
07359500	Ouachita River near Malvern	1,585	1903-05 1923-	5-15-23	30.3	140,000	Dec. 26	19.04	41,600	3
07361500	Antoine River at Antoine	178	1905, 1951-	5- -05	29.7	40,000	Dec. 26	24.87	18,900	5
07362000	Ouachita River at Camden	5,357	1882, 1886-	5-12-82 4-03-45	46.00 44.82	243,000	Dec. 29	42.51	173,000	22
07362100	Smackover Creek near Smackover	385	1939-	6-08-74	24.97	52,700	Dec. 28	20.36	18,900	12
07362330	Dunn Creek near Hampton	13.6	1962-	5-01-66	10.11	4,240	Dec. 26	7.93	1,070	3
07362500	Moro Creek near Fordyce	240	1952-	5-02-58	16.47	26,800	Dec. 27	15.86	22,000	40
07363000	Saline River at Benton	550	1927, 1938-	4- -27	30.5	110,000	Dec. 25	23.11	39,800	3
07363200	Saline River near Sheridan	1,123	1938-	2-01-69	22.40	71,000	Dec. 28	22.93	76,800	32
07363300	Hurricane Creek Sheridan	204	1960-	6-27-60	18.55	52,300	Dec. 27	16.83	20,000	9
07363500	Saline River near Rye	2,102	1938-	5-18-68	31.40	74,500	Dec. 31	30.76	67,800	16
07364030	L'Aigle Creek Tributary near Hermitage	.36	1963-	4-23-79	5.52	113	Dec. 26	5.13	88	5
07364150	Bayou Bartholomew near McGehee	576	1932, 1938-40, 1945-	5-11-58	24.49	6,870	Jan. 7	20.8	4,600	7

[a] at former site and datum

Flood Profiles

Water-surface profiles for the December 1987 flood on Bayou Meto, Bayou Two Prairie, Cache River, and L'Anguille River are shown on figures 4-7, respectively. These profiles were developed from high-water marks recovered after the December 1987 flood. The high-water marks on the Cache River and some of the high-water marks on Bayou Meto were identified by the U.S. Army Corps of Engineers, Memphis District. The other high-water marks on Bayou Meto, Bayou Two Prairie, and L'Anguille River were recovered by personnel of the U.S. Geological Survey.

High-water elevations for the December 1987 flood in West Memphis are shown on figure 8. Tenmile Bayou runs through West Memphis and drains most of the city. The high-water elevations shown on figure 8 were furnished by the U.S. Army Corps of Engineers, Memphis District.

Flood Hydrographs

Discharge hydrographs for Bayou Meto near Lonoke and Cache River at Patterson illustrate the duration of the flooding (fig. 9). Most streams between Little Rock and West Memphis rise and fall slowly because the land in this area is relatively flat. Bayou Meto near Lonoke and Cache River at Patterson were above bankfull stage 18 and 39 days, respectively. The Cache River basin received additional rainfall in January that prolonged the period of above-bankfull stage. The drainage areas at the gaging stations near Lonoke and at Patterson are 207 and 1,037 square miles, respectively.

SUMMARY

The December 1987 flood extended roughly from Texarkana to West Memphis, Ark. Peak stages, discharges, and recurrence intervals of peak discharges are shown for all gaging stations significantly affected by the flood. Peak discharges reached 100-year recurrence intervals at two gaging stations. High-water elevations for the December 1987 flood in West Memphis are shown.

The National Weather Service reported that 12.79 inches of rain were measured from December 24-28, 1987, at its West Memphis gage. An unofficial measurement of 18 inches of rain 3 miles north of West Memphis was reported by a local resident. Cumulative totals of rainfall measured at gages at North Little Rock, Ark., Brinkley, Ark., Wynne, Ark., and Memphis, Tenn., and at the Naval Air Station at Millington, Tenn., are shown.

Flood profiles were developed for Bayou Meto, Bayou Two Prairie, Cache River, and L'Anguille River, using high-water marks recovered after the December 1987 flood. Flood hydrographs on Bayou Meto near Lonoke and Cache River at Patterson illustrate the duration of the flood.

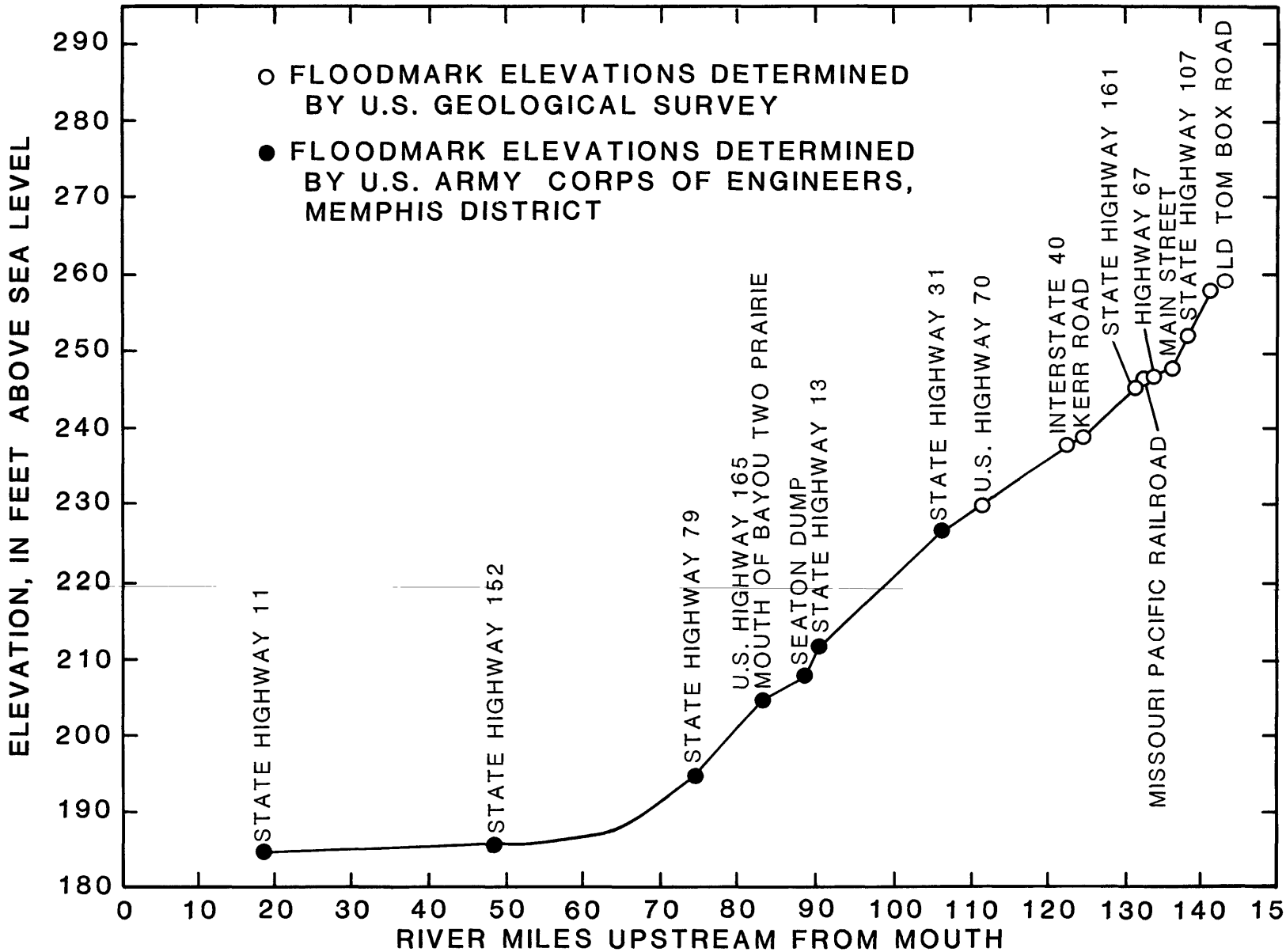


Figure 4.--Water-surface profile of Bayou Meto for the December 1987 flood.

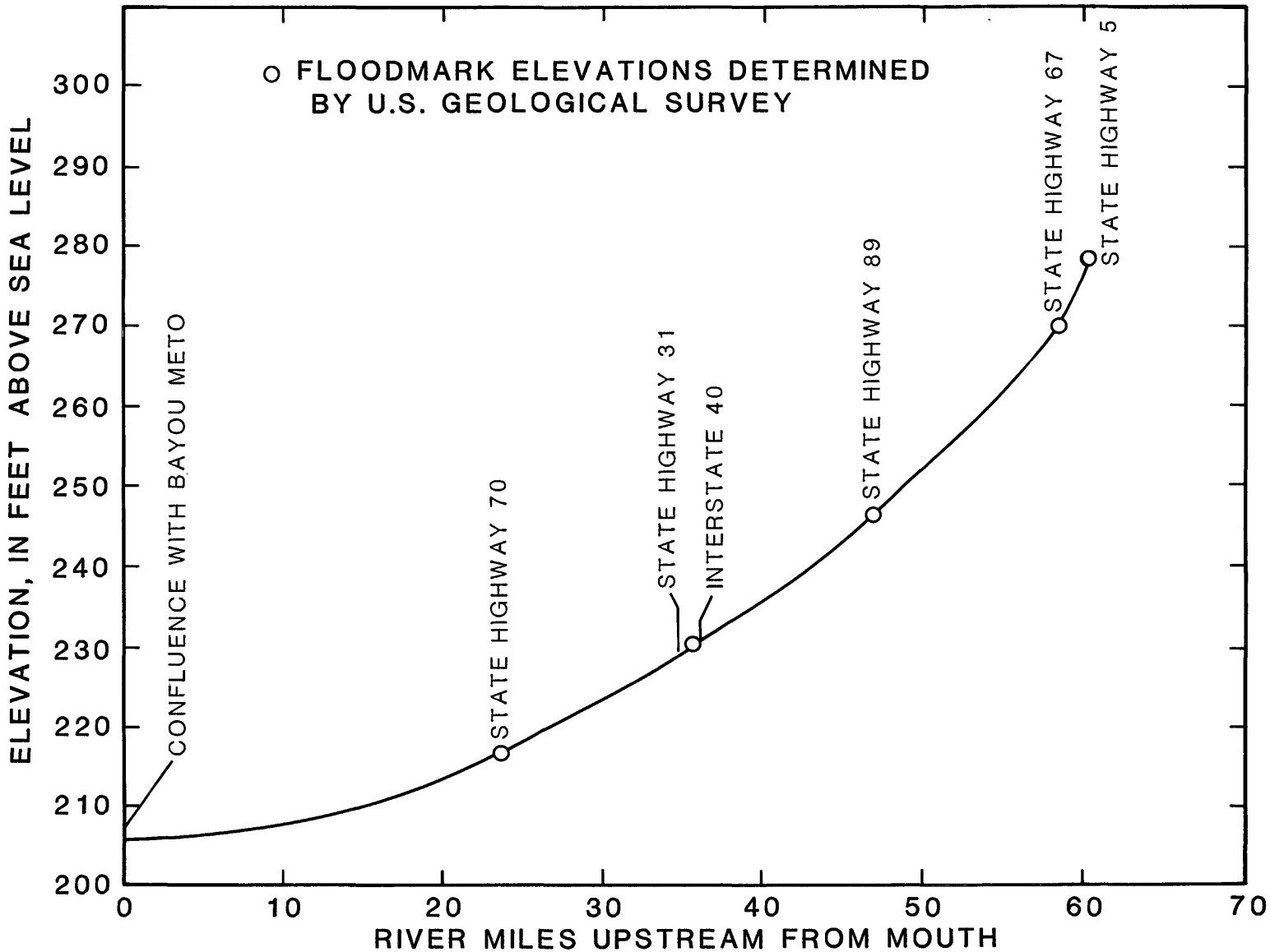


Figure 5.--Water-surface profile of Bayou Two Prairie for the December 1987 flood.

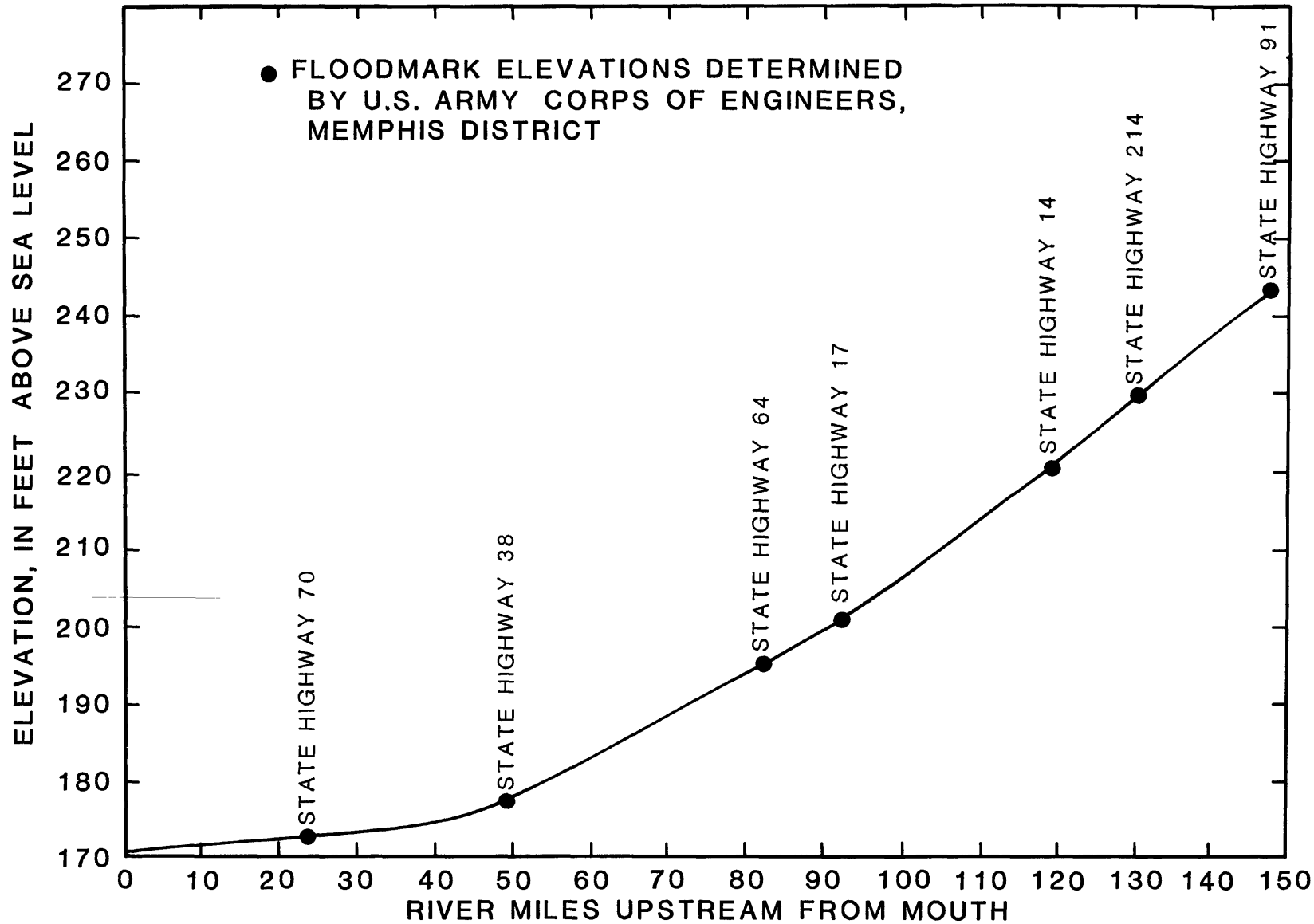


Figure 6.--Water-surface profile of Cache River for the December 1987 flood.

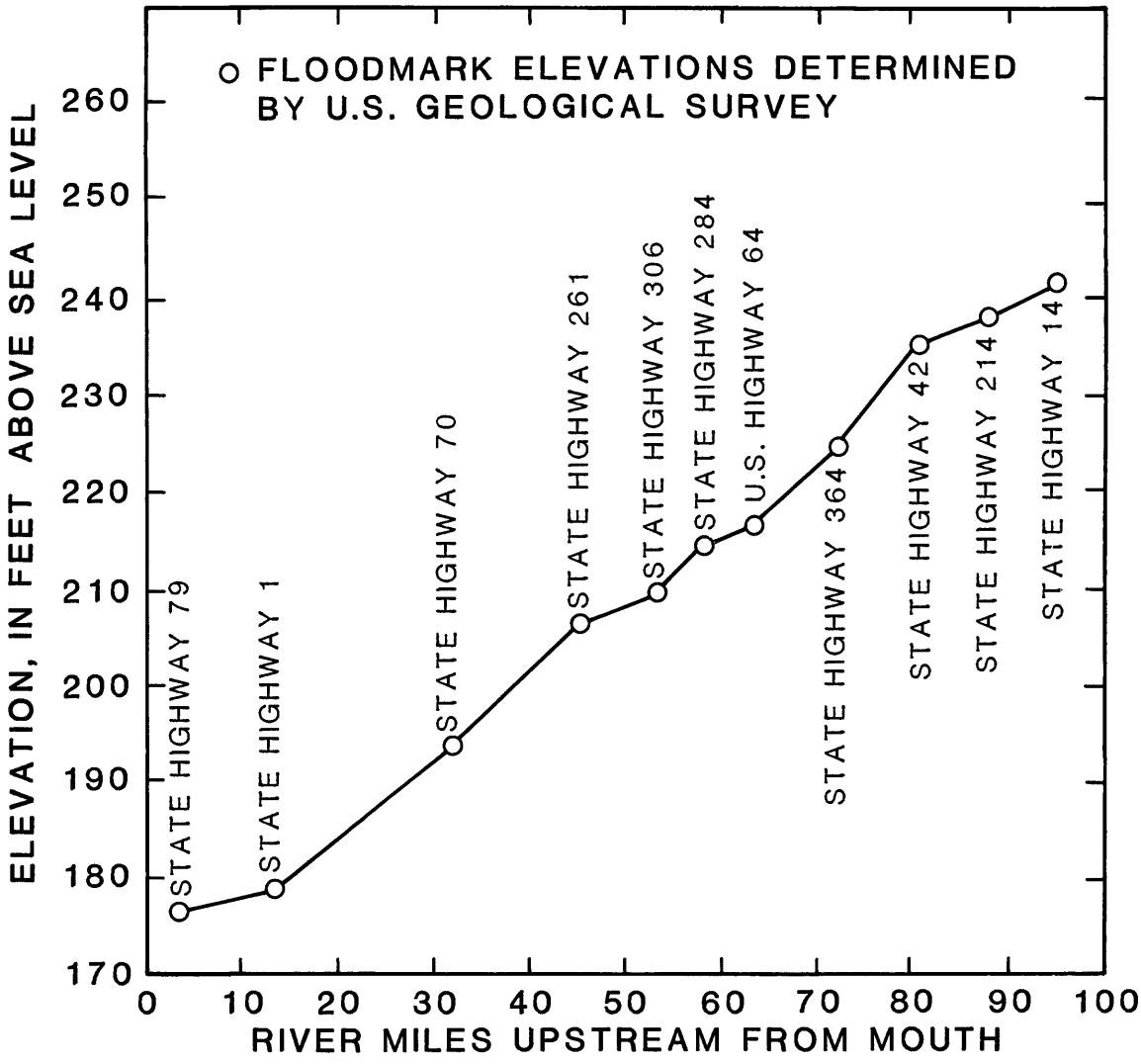
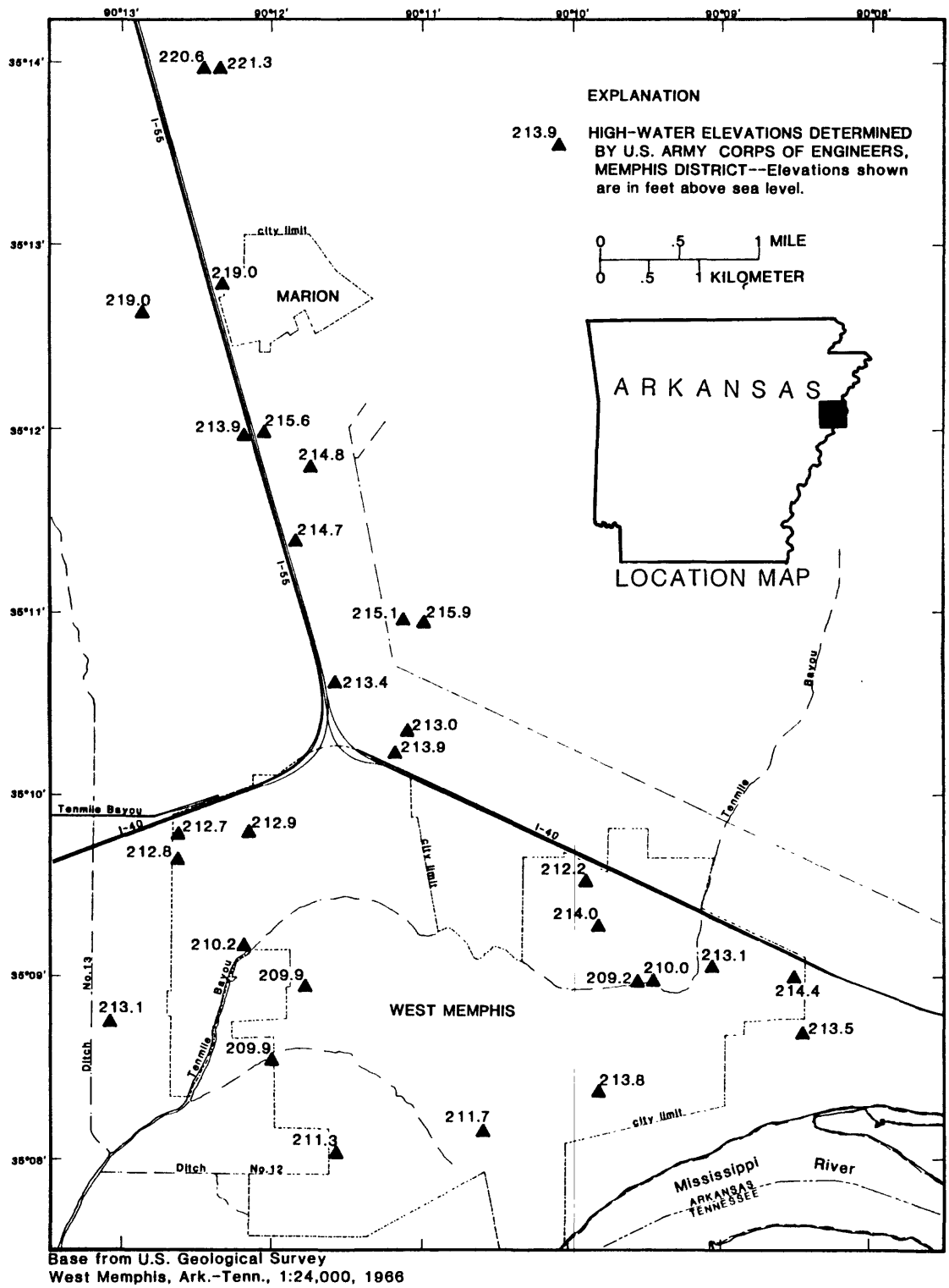


Figure 7.--Water-surface profile of L'Anguille River for the December 1987 flood.



Base from U.S. Geological Survey
West Memphis, Ark.-Tenn., 1:24,000, 1966

Figure 8.--High-water elevations for December 1987 flood in West Memphis, Arkansas (Source: U.S. Army Corps of Engineers, Memphis District).

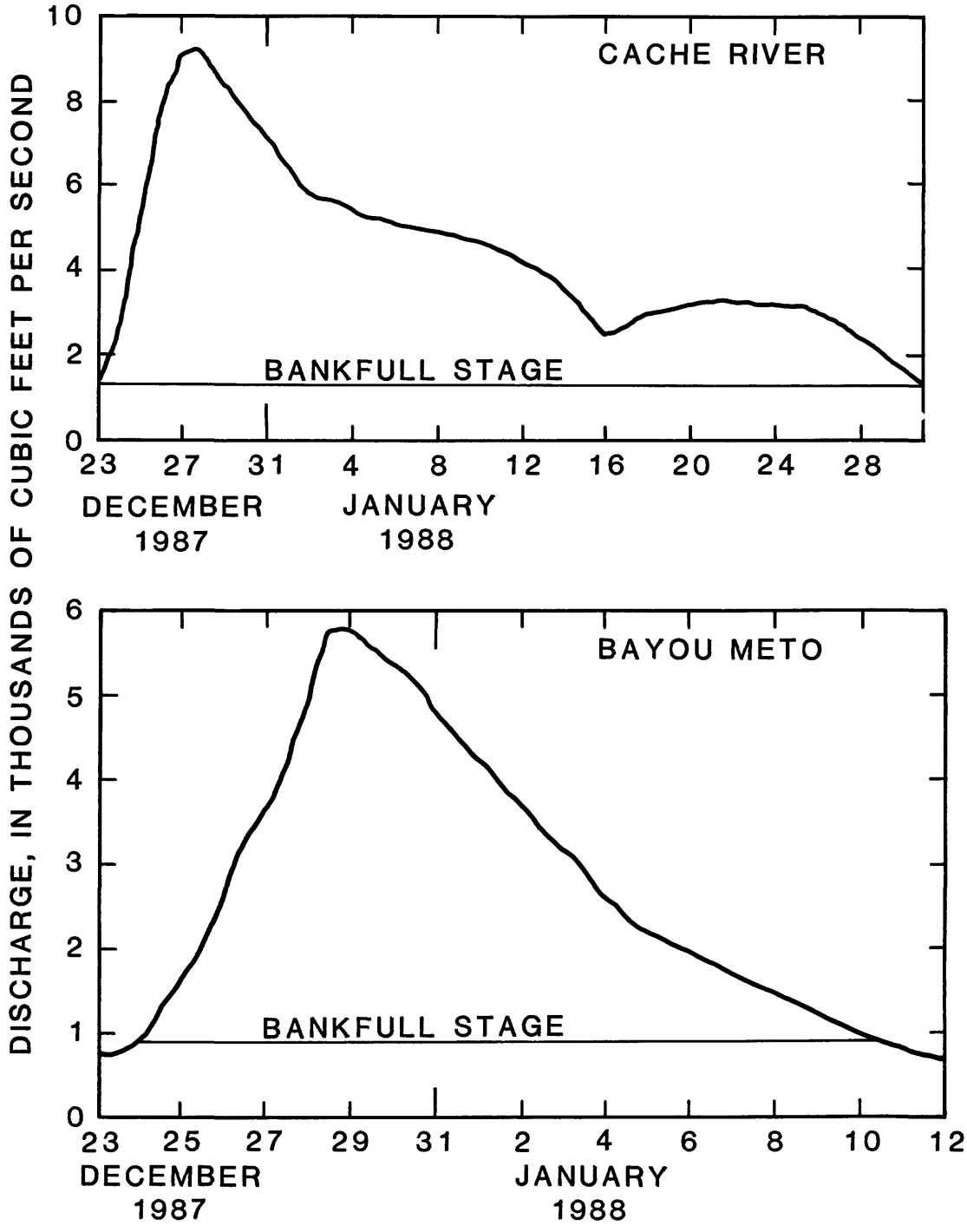


Figure 9.--Discharge hydrographs for Cache River at Patterson (07077500) and Bayou Meto near Lonoke (07264000).

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