FLOODS OF SEPTEMBER 15-16, 1992, IN THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

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Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer
ton per acre	2.242	megagram per square hectometer

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

Floods of September 15-16, 1992, in the Thompson, Weldon, and Chariton River Basins, South-Central Iowa

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ABSTRACT

Water-surface-elevation profiles and peak discharges for the floods of September 15-16, 1992, in the Thompson, Weldon, and Chariton River Basins, south-central Iowa, are presented in this report. The profiles illustrate the 1992 floods along the Thompson, Weldon, Chariton, and South Fork Chariton Rivers and along Elk Creek in the south-central Iowa counties of Adair, Clarke, Decatur, Lucas, Madison, Ringgold, Union, and Wayne. Water-surface-elevation profiles for the floods of July 4, 1981, along the Chariton River in Lucas County and along the South Fork Chariton River in Wayne County also are included in the report for comparative purposes. The September 15-16, 1992, floods are the largest known peak discharges at gaging stations Thompson River at Davis City (station number 06898000) 57,000 cubic feet per second, Weldon River near Leon (station number 06898400) 76,200 cubic feet per second, Chariton River near Chariton (station number 06903400) 37,700 cubic feet per second, and South Fork Chariton River near Promise City (station number 06903700) 70,600 cubic feet per second. The peak discharges were, respectively, 1.7, 2.6, 1.4, and 2.1 times larger than calculated 100-year recurrence-interval discharges. The report provides information on flood stages and discharges and floodflow frequencies for streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins using flood information collected through 1995. Information on temporary bench marks and reference points established in the Thompson and Weldon River Basins during 1994-95, and in the Chariton River Basin during 1983-84 and 1994-95, also is included in the report. A flood history summarizes rainfall conditions and damages for floods that occurred during 1947, 1959, 1981, 1992, and 1993.

INTRODUCTION

Evaluation of flood hazards and the planning, design, and operation of various structures on flood plains require information about floods. Flood-profile reports provide water-surface-elevation profiles and specific information for selected floods and are used by planners and engineers to evaluate the magnitude and frequency of floods in a river basin. This flood-profile report was prepared by the U.S. Geological Survey (USGS) in cooperation with the Iowa Highway Research Board and the Project Development Division of the Iowa Department of Transportation.

Purpose and Scope

This report presents water-surface-elevation profiles for the floods of September 15-16, 1992, in the Thompson, Weldon, and Chariton River Basins in south-central Iowa. Profiles for the floods of July 4, 1981, on the Chariton and South Fork Chariton Rivers also are presented in this report for comparative purposes. The report provides information on flood stages and discharges and floodflow frequencies for streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins using flood information collected through 1995. Information on temporary bench marks and reference points established in the Thompson and Weldon River Basins during 1994-95, and in the Chariton River Basin during 1983-84 and 1994-95, also is included in the report. A flood history summarizes rainfall conditions and damages for floods that occurred during 1947, 1959, 1981, 1992, and 1993.

Acknowledgments

Various Federal, State, and local agencies cooperated in the collection of streamflow records used in this report, the acknowledgment of which is contained in the annual water-data reports of the USGS (U.S. Geological Survey, 1919-96). The authors express their gratitude to the following: B.R. Armstrong, P.S. Armstrong, A.J. Daley, R.F. Einhellig, E.E. Fischer, J.G. Gorman, G.F. Grimm, R.L. Kopish, P.D. Lustgraaf, T.C. Melcher, P.J. Soenksen, J.R. Sondag, D.M. Umphum, and J.J. Wellman for collecting the field data for the 1992 floods and surveying level-lines to establish sea-level elevations for the temporary bench marks and reference points; and T.L. Birkenholtz for preparing the maps for this report.

STUDY AREA

The Thompson, Weldon, and Chariton River Basins are located in south-central Iowa (fig. 1) and drain into northern Missouri as part of the Missouri River Basin (not shown). The Thompson River Basin in Iowa is oriented in a general northwest-southeast direction, includes parts of six counties, and covers 729 mi^2 (Larimer, 1957, p. 123). The Thompson River is a left-bank tributary to the Grand River in Missouri (not shown). In Iowa, the Thompson River is known locally as the Grand River. The Weldon River Basin in Iowa is oriented in a general north-south direction, includes parts of three counties, and covers 240 mi^2 (Larimer, 1957, p. 124). The Weldon River is a left-bank tributary to the Thompson River in Missouri (not shown). The Chariton River Basin upstream of Rathbun Dam is oriented in a general west-east direction, includes parts of six counties, and covers 549 mi^2. Operation of Rathbun Dam (fig. 1) began in 1969. The Chariton River is a left-bank tributary to the Missouri River in Missouri (not shown). The South Fork Chariton River is a principal tributary to the Chariton River with a drainage area of 235 mi^2 (Larimer, 1957, p. 23).

Land use in south-central Iowa is primarily agricultural with some livestock operations. To provide flood protection and facilitate farming practices along the lower river valleys in south-central Iowa, several river channels in the Thompson, Weldon, and Chariton River Basins were straightened. The majority of the channelization work occurred between 1905-20 (Iowa Natural Resources Council, 1958, p. 51-55). The Thompson River was channelized in Decatur County from downstream of Davis City to the Iowa-Missouri State line; major parts of the Weldon River and Steel Creek, a tributary of the Weldon River, were channelized in Decatur County; and the major part of the South Fork Chariton River in Wayne County was channelized.

The Thompson, Weldon, and Chariton River Basins lie within the Southern Iowa Drift Plain landform region of Iowa (Prior, 1991, p. 31-34). The Southern Iowa Drift Plain is characteristic of a postglacial landscape that has eroded to form a steeply to gently rolling topography and a well-established drainage system (Prior, 1991, p. 58-61; Iowa Natural Resources Council, 1958, p. 3-6; Cagle and Heinitz, 1978, p. 4-5). The Southern Iowa Drift Plain formed as a result of repeated continental glacial advances across southern Iowa, during which the bedrock surface of the uplands was smoothed and the valleys were filled with thick deposits of glacial till. Periods of glaciation were followed by interglacial periods of erosion. The sequence of repeated glacial scour and fill formed a nearly level drift plain across southern Iowa. The topography of southern Iowa developed as a result of the dissection of this drift plain; common terrain characteristics are integrated drainage networks, stepped erosional surfaces, and exposed bedrock in the deeper alluvial valleys (Prior, 1991, p. 34). South-central Iowa can be topographically divided into flood plains and terraces, uplands, and sideslopes; where well-developed flood plains and terraces occupy broad stream valleys underlain by alluvial deposits (Cagle and Heinitz, 1978, p. 4; Iowa Natural Resources Council, 1958, p. 6). The majority of the uplands are characterized as relatively rugged, moderately-to-highly dissected areas composed of hills, knobs, and ridges, but at places the uplands are gently rolling to slightly dissected. Nearly all of the upland soils of southern Iowa are formed from moderate deposits of wind-blown loess that subsequently covered the glacial tills. In general, soils in south-central Iowa are characterized as loess over clay loam till and clay paleosol; loess deposits in the area range from 75 to 200 in. (6.2 to 16.7 ft) (Oschwald and others, 1965, p. 6).

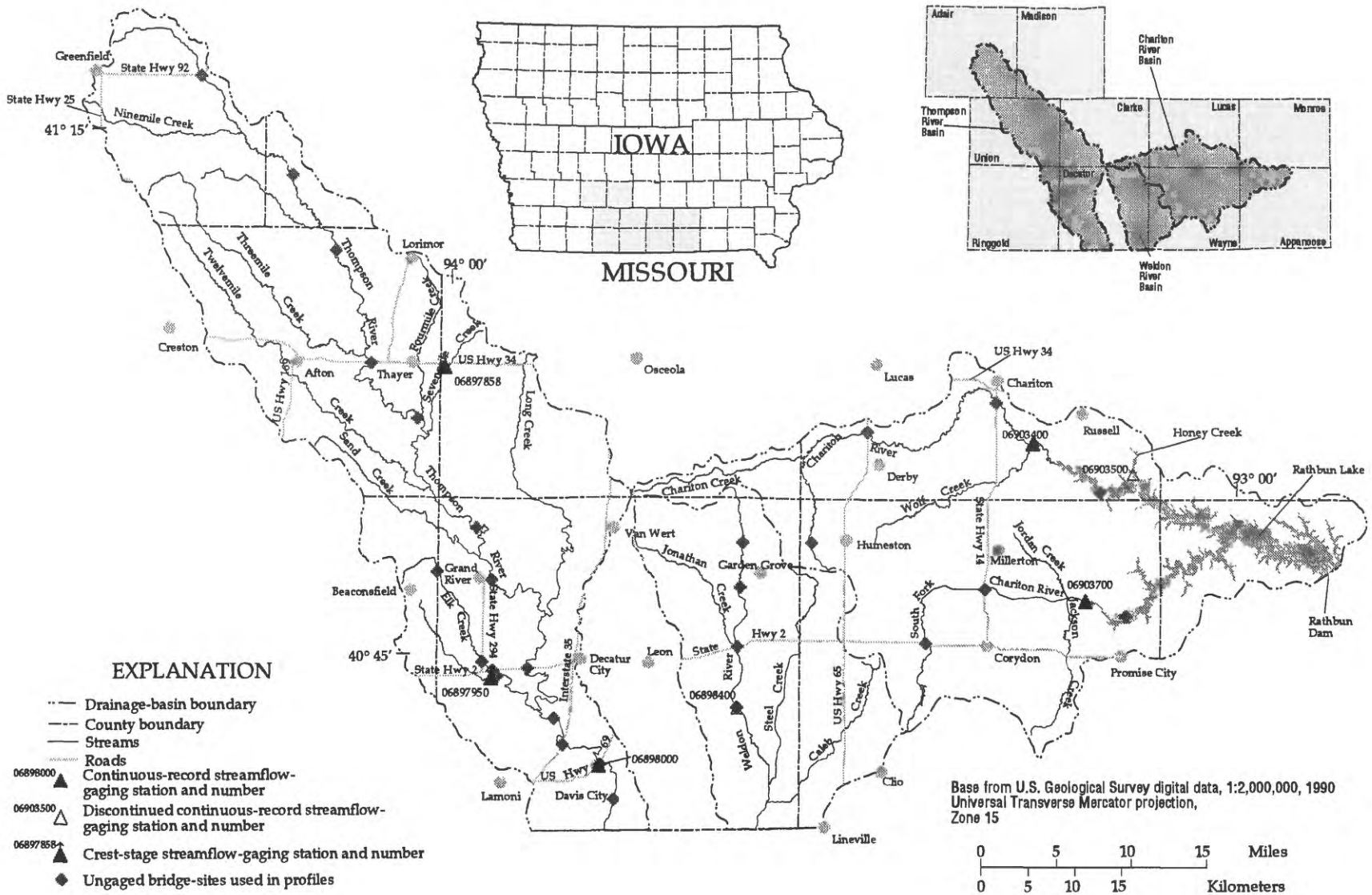


Figure 1. Thompson, Weidon, and Chariton River Basins showing location of bridge sites used in the September 15-16, 1992, flood profiles and U.S. Geological Survey streamflow-gaging stations.

HYDROLOGIC DATA

Gaging-station records are the primary source of data for analyzing and understanding the flood hydrology of a river basin. Flood information is obtained from complete-record streamflow-gaging stations, which provide a continuous chronology of streamflow, and from partial-record, crest-stage streamflow-gaging stations, which provide a chronology of annual peakflows. The location of seven USGS gaging stations in the Thompson, Weldon, and Chariton River Basins are shown in figure 1; five are active gaging stations (three continuous-record gages and two crest-stage gages) and two are discontinued continuous-record gaging stations. The specific location, annual peak stages and discharges, and other information pertaining to each gaging station are presented in Appendix A. Discharge records collected during the operation of these gaging stations are published in the annual water-data reports of the USGS (U.S. Geological Survey, 1919-96).

The computation of discharge records at a gaging station is dependent upon the development of a stage-discharge relation, or rating curve, between water-surface elevations (stages) and the corresponding flow rates (discharges). The high-water part of the stage-discharge relation generally remains stable if the channel downstream from the gaging station remains unchanged. Changes in the stage-discharge relation occur from time to time, either gradually or abruptly, due to changes in the stream channel that result from scour, deposition, or the growth of vegetation (Rantz and others, 1982, p. 328-360).

Mean annual precipitation for 1961-90 at rain gages within and adjacent to the Thompson, Weldon, and Chariton River Basins (Owenby and Ezell, 1992, p. 22-24) are summarized in the table below.

Rain gage and mean annual precipitation for 1961-90, in inches					
Beaconsfield	33.93	Creston	34.79	Leon	35.79
Chariton	36.66	Greenfield	34.44	Lorimor	34.41
Corydon	35.99	Lamoni	36.70	Osceola	35.19

Mean annual runoff in the Thompson, Weldon, and Chariton River Basins was determined at the following streamflow-gaging stations for the following water years (May and others, 1996, p. 222-224; O'Connell and others, 1992, p. 234).

Station number	Station name	Period of record (water years)	Mean annual runoff, in inches
06898000	Thompson River at Davis City	1919-24, 1942-95	7.76
06898400	Weldon River near Leon	1959-91	9.06
06903400	Chariton River near Chariton	1966-95	9.46
06903700	South Fork Chariton River near Promise City	1968-95	10.51

FLOODFLOW FREQUENCIES

The magnitude and frequency of flood discharges, or floodflow frequencies, for a streamflow-gaging station are determined from a flood-frequency curve which relates observed annual-peak discharges to annual exceedance probability or recurrence interval. Annual exceedance probability is expressed as the chance that a specified flood magnitude will be exceeded in any 1 year. Recurrence interval, which is the reciprocal of the annual exceedance probability, is the statistical average number of years between exceedances of a specified flood magnitude. For example, a flood with a magnitude that is expected to be exceeded on average once during any 100-year period (recurrence interval) has a 1-percent chance (annual exceedance probability = 0.01) of being exceeded during any 1 year. This flood, commonly termed the 100-year flood, is the theoretical peak discharge against which actual flood peaks generally are compared. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at shorter intervals or even within the same year.

Floodflow frequencies computed for a gaging station, and recurrence intervals determined for selected flood peaks, are statistics that can change as more data become available. Statistics become more reliable as more data are collected and used in the computations. USGS streamflow-gaging stations are the primary source of the streamflow data used in the computations presented in this report.

The method used in this report for determining floodflow frequencies from streamflow data is outlined in Bulletin 17B of the Interagency Advisory Committee on Water Data (1982, p. 1-28). The Interagency Advisory Committee recommends using the Pearson Type-III distribution with log transformation of the

data, commonly known as the log-Pearson Type-III distribution, as a base method for determining floodflow frequencies. At least 10 years of gaged annual-peak discharges are required to compute floodflow frequencies using this method. In this report, this method for determining floodflow frequencies is referred to as the "Bulletin 17B" method.

Three methods for estimating floodflow frequencies at stream sites in Iowa, including those not gaged, are described by Lara (1987, p. 2-19) and Eash (1993, p. 9-41). Lara (1987) used the physiographic characteristics of Iowa as a guide in defining the boundaries of five hydrologic regions. Regional equations were developed by using the floodflow frequencies for all gaged stations in a hydrologically, homogeneous area, thereby reducing potential errors associated with non-representative, short-term record stations. Eash (1993) developed two other methods for estimating floodflow frequencies for stream sites in Iowa. In one method, significant drainage-basin characteristics were related to the floodflow frequencies for 164 streamflow-gaging stations in Iowa. In the other method, significant onsite channel-geometry characteristics were related to the floodflow frequencies for 157 streamflow-gaging stations in Iowa. Both Lara and Eash used the Bulletin 17B method as the base method for developing their flood-estimation equations.

The floodflow frequencies computed using the Bulletin 17B method, the regional method of Lara (1987), and the drainage-basin and channel-geometry characteristic methods of Eash (1993) are listed in table 1 for the gaging stations in the Thompson, Weldon, and Chariton River Basins. Flood-frequency discharges computed using these four flood-estimation methods differ substantially for several of the gaging stations. Differences in computed discharges between the four methods result from inherent differences between the methods and from differences in the periods of streamflow record that were used in the computation of each method. Flood-frequency discharges computed using the Bulletin 17B method used streamflow data collected through the 1995 water year, the regional method developed by Lara used data collected through the 1984 water year, and the drainage-basin and channel-geometry methods developed by Eash used data collected through the 1990 water year. The significantly greater discharges computed using the Bulletin 17B method are primarily due to inclusion of the 1992 and 1993 floods in the computations. It is noted that different flood-frequency discharges might be computed by other agencies using the Bulletin 17B method if their analyses use different periods of record, different approaches to weighting the skewness (asymmetry) of the frequency distribution of the annual peak discharges, or different approaches to incorporation of historical flood information.

FLOOD HISTORY

Continuous records of streamflow have been collected in the Thompson River Basin in Iowa from May 1918 to July 1925 and since July 1941 at streamflow-gaging station Thompson River at Davis City (station number 06898000, fig. 1). Continuous records of streamflow have been collected in the Weldon River Basin in Iowa from October 1958 to September 1991 at gaging station Weldon River near Leon (station number 06898400, fig. 1). Continuous records of streamflow have been collected in the Chariton River Basin upstream of Rathbun Dam since October 1965 at gaging station Chariton River near Chariton (station number 06903400, fig. 1) and since October 1967 at gaging station South Fork Chariton River near Promise City (station number 06903700, fig. 1). Appendix A contains a complete list of flood peaks for these and three other streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins. Selected flood-peak discharges, including maximum known flood-peak discharges, and recurrence intervals for the seven gaging stations are listed in table 2.

The Iowa Natural Resources Council (1958, p. 48) reports that historical records indicate that major flooding occurred along the Thompson River in Iowa in 1885, 1897, 1903, 1909, 1914, 1915, 1922, 1924, and 1926, but that information is meager regarding the magnitude of these early floods and the damage they caused. Prior to 1992, the greatest known flood in the Thompson River Basin occurred in 1885 (Schwob, 1953, p. 168; see appendix A). The Iowa Natural Resources Council (1958, p. 48) also reports that flooding occurred in the Chariton River Basin in 1892, 1903, 1909, 1928, 1939, 1944, 1945, 1946, and 1947. In general, because many cities and towns in south-central Iowa are located outside the flood plains of major streams, municipal flood damage is relatively low in comparison to agricultural and transportation flood damage; occasional flood damage occurs from small streams located within municipal limits (Iowa Natural Resources Council, 1958, p. 51).

Table 1. *Floodflow frequencies for streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins*

[Water year, October 1-September 30; mi^2, square mile; 17B, Bulletin 17B (Interagency Advisory Committee on Water Data, 1981); Lara, hydrologic-region flood-frequency equations (Lara, 1987, p. 28); DB, drainage-basin characteristic flood-frequency equations (Eash, 1993, p. 17); CG, channel-geometry characteristic flood-frequency equations (Eash, 1993, p. 25); --, not determined]

Station number (fig. 1)	Station name	Drainage area (mi^2)	Period of flood record [a](water year)	Method	Discharge, in cubic feet per second, for indicated recurrence interval, in years					
					2	5	10	25	50	100
06897858	Sevenmile Creek near Thayer	6.61	1991-95	17B	--	--	--	--	--	--
				[b]Lara	575	1,140	1,610	2,280	2,780	3,350
				DB	604	1,180	1,650	2,290	2,810	3,370
				CG	--	--	--	--	--	--
06897950	Elk Creek near Decatur City	52.5	1959, 1967-95	[c]17B	5,730	12,400	17,100	23,000	27,000	30,800
				[d]Lara	1,500	2,740	3,640	4,900	5,900	6,940
				DB	3,080	5,460	7,280	9,660	11,600	13,500
				[e]CG	3,150	6,010	8,210	11,400	13,800	16,700
06898000	Thompson River at Davis City	701	1885, 1897, 1903, 1909, 1914-15, 1918-26, 1941-95	[c]17B	7,690	12,700	16,800	22,900	28,100	34,100
				[f]Lara	5,450	9,470	12,400	16,200	19,000	22,200
				DB	11,400	17,900	22,600	28,200	32,500	36,800
				[g]CG	7,790	13,200	17,100	22,300	26,300	30,200
06898400	Weldon River near Leon	104	1959-92	17B	5,810	10,200	13,800	19,300	24,200	29,700
				[d]Lara	2,300	4,100	5,380	7,140	8,530	9,980
				DB	3,740	6,410	8,400	10,900	12,900	14,900
				[g]CG	4,370	7,770	10,300	13,800	16,600	19,300
06903400	Chariton River near Chariton	182	1947, 1960, 1966-95	17B	4,000	7,830	11,200	16,400	21,100	26,500
				[f]Lara	2,660	4,740	6,210	8,220	9,800	11,400
				DB	3,580	5,970	7,710	9,880	11,600	13,200
				[e]CG	1,910	3,810	5,330	7,590	9,320	11,400
06903500	Honey Creek near Russell	13.2	1952-62	17B	609	1,350	2,010	3,050	3,980	5,030
				[f]Lara	999	1,960	2,770	3,910	4,780	5,760
				DB	847	1,590	2,190	2,990	3,650	4,340
				CG	--	--	--	--	--	--
06903700	South Fork Chariton River near Promise City	168	1965, 1968-95	17B	6,000	10,900	15,000	21,400	27,100	33,500
				[d]Lara	3,090	5,450	7,070	9,290	11,100	12,900
				DB	3,100	5,180	6,710	8,620	10,100	11,600
				[g]CG	3,150	5,760	7,760	10,500	12,800	15,000

[a]See Appendix A for list of flood peaks.
[b]Flood-frequency equations for hydrologic region 2 were used.
[c]Station skew, instead of weighted skew, was used in flood-frequency analysis.
[d]Flood-frequency equations for hydrologic region 3 were used.
[e]Flood-frequency equations for region 1, bankfull were used.
[f]Flood-frequency equations for hydrologic regions 2 and 3 were used based on weighted average, drainage-area ratios.
[g]Flood-frequency equations for region 1, active-channel were used.

Table 2. *Selected flood-peak discharges, recurrence intervals, and unit runoff for streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins*

[ft, foot; ft^3/s, cubic foot per second; $(ft^3/s)/mi^2$, cubic foot per second per square mile; *, maximum flood-peak discharge known for site; --, not determined]

Station number (fig. 1)	Station name	Date	Gage height [a](ft)	Discharge (ft^3/s)	Recurrence interval [b](years)	Unit runoff [$(ft^3/s)/mi^2$]
06897858	Sevenmile Creek near Thayer	09-15-92	24.92	*[c]1,330	--	201
		07-05-93	23.49	[c]1,220	--	185
06897950	Elk Creek near Decatur City	08-06-59	[d]30.5 to 32.5	--	--	--
		07-20-90	28.19	[e]18,000	12	343
		09-15-92	27.94	16,200	9	309
		07-05-93	29.93	*32,800	[f]1.1	625
06898000	Thompson River at Davis City	08-08-1885	[g,h]24.8	[i]30,000	60	42.8
		06-14-47	[g]22.14	[i]21,300	20	30.4
		08-06-59	[g]20.42	17,500	11	25.0
		06-10-74	19.43	[i]24,300	30	34.7
		09-16-92	24.29	*57,000	[f]1.7	81.3
		07-05-93	20.53	30,300	70	43.2
06898400	Weldon River near Leon	08-06-59	[j]25.27	[e,j]48,600	[f]1.6	467
		09-15-92	[h,k]28.69	*[l]76,200	[f]2.6	733
06903400	Chariton River near Chariton	06-05-47	[h]21.65	11,000	10	60.4
		03----60	[c]23.0	[c]15,000	20	82.4
		07-04-81	23.14	16,600	25	91.2
		09-15-92	[h]29.32	*[e]37,700	[f]1.4	207
		07-05-93	22.60	14,900	20	81.9
06903500	Honey Creek near Russell	05-21-59	11.26	*[e]4,100	50	311
06903700	South Fork Chariton River near Promise City	09-21-65	[h]25.5	[c]18,000	16	107
		07-04-81	29.95	28,000	60	167
		09-15-92	[h]34.84	*[e]70,600	[f]2.1	420
		07-05-93	25.09	16,900	14	101

[a]See Appendix A for datum of gage above sea level for continuous-record streamflow-gaging stations.

[b]Interpolated from Bulletin 17B flood-frequency analysis (Interagency Advisory Committee on Water Data, 1981) and rounded to the nearest 5 years for 20- to 50-year recurrence intervals and to the nearest 10 years above the 50-year recurrence interval.

[c]Approximate.

[d]Referenced to present datum; prior to October 1, 1974, datum was 10.00 ft higher. Flood stage information provided by Decatur County Assistant Engineer.

[e]Discharge computed from indirect measurement.

[f]Recurrence interval discharge larger than the computed 100-year flood is expressed as a ratio of the given flood discharge to the 100-year flood discharge.

[g]Referenced to present datum; prior to February 9, 1967, datum was 2.00 ft higher.

[h]Gage height determined from floodmarks.

[i]Discharge determined from rating-curve extension on basis of velocity-area study.

[j]Greatest since at least 1919.

[k]Gage height affected by backwater.

[l]Discharge estimated by drainage-area ratio transfer of discharge computed from indirect measurement of September 15, 1992, flood at State Highway 2 bridge crossing the Weldon River.

Floods of June 1947

Severe flooding that affected much of Iowa during June 1947 also involved south-central Iowa. Frequent rains and cool, cloudy weather during April and May saturated soils in the area prior to the flooding. Excessive rain fell over most of southern Iowa the night of June 4-5, followed by lighter rains through June 7th. Average rainfall over the area was about 3.5 in. (Iowa Natural Resources Council, 1958, p. 48). Rainfall amounts recorded during June 5-6, 1947 (U.S. Department of Commerce, Weather Bureau, and Iowa Department of Agriculture, 1947, p. 69), are listed in the table below. Runoff from the storms caused general flooding of all streams throughout south-central Iowa.

Rain gage and rainfall for June 5-6, 1947, in inches			
Afton	2.84	Lamoni	3.64
Chariton	4.78	Millerton	4.00
Creston	3.60	Osceola	2.87
Greenfield	3.35		

At the Chariton River near Chariton streamflow-gaging station, the peak discharge (11,000 ft^3/s) and stage (21.65 ft) for the flood of June 5, 1947 (table 2), are both the fifth largest known at this site during 1947-95. The flood-peak discharge of 11,000 ft^3/s at the Chariton gage has a recurrence interval of approximately 10 years (table 2). At the Thompson River at Davis City gaging station, the peak discharge recorded on June 6, 1947, was 19,500 ft^3/s and the peak stage was 19.3 ft (see Appendix A).

During June 11-12, 1947, intense rainfall occurred over mainly the western part of south-central Iowa. Streams throughout the area again rose rapidly and overflowed their banks. Rainfall amounts recorded during June 12-13, 1947 (U.S. Department of Commerce, Weather Bureau, and Iowa Department of Agriculture, 1947, p. 69) are listed in the table below.

Rain gage and rainfall for June 12-13, 1947, in inches			
Afton	3.12	Lamoni	2.21
Creston	4.12	Osceola	3.54
Greenfield	4.84		

As a result of the second storm, the Thompson River at Davis City crested at a higher peak stage (20.14 ft) on June 14, 1947 (see Appendix A; or 22.14 ft when referenced to present datum, table 2). The peak discharge of 21,300 ft^3/s for the flood of June 14, 1947, has a recurrence interval of approximately 20 years and is the fifth largest recorded discharge at this site during 1885-1995 (table 2). Discharges were not determined for four floods that occurred prior to operation of the Davis City gage (gage operation began May 1918) for which peak stages were reported to be higher than the peak stage of 20.14 ft recorded for the 1947 flood (see Appendix A).

According to estimates calculated by the U.S. Army Corps of Engineers, the June 1947 floods exceeded all other previous floods in south-central Iowa in magnitude of flood damages (Iowa Natural Resources Council, 1958, p. 51). Damage from the 1947 floods was predominantly agricultural; major non-agricultural damage was to highways and roads. Flood damage data compiled by the U.S. Army Corps of Engineers and published by the Iowa Natural Resources Council (1958, p. 51), reports that the June 1947 floods inundated 47,720 acres in the Grand River Basin in Iowa, and caused $1,814,200 of agricultural damage and $233,950 of non-agricultural damage. In the Iowa Natural Resources Council report (1958), the Grand River Basin in Iowa includes the Thompson, Weldon, and Grand River Basins (the Grand River is not shown and is located west of the Thompson River). The floods inundated 39,140 acres in the Chariton River Basin in Iowa, and caused $1,572,450 of agricultural damage and $83,750 of non-agricultural damage.

Floods of August 6, 1959

The August 6, 1959, floods in south-central Iowa occurred as a result of excessive rainfall over Clarke, Decatur, Ringgold, Union, and Wayne Counties during the night of August 5-6, 1959, following moderate rainfall the preceding day. The following information pertaining to precipitation and damages for the August 6, 1959, floods was obtained from the U.S. Department of Commerce, Weather Bureau, and Iowa Department of Agriculture (1959, p. 122 and 125-127). Official rainfall amounts recorded on August 6, 1959, are listed in the table below.

Rain gage and rainfall for August 6, 1959, in inches			
Afton	0.65	Lamoni	1.86
Beaconsfield	5.85	Lorimor	4.45
Corydon	3.62	Osceola	3.80
Creston	3.85		

The center of the storm was along the Iowa-Missouri State line and in the general area of Leon, Davis City, and Lineville, Iowa. A study of weather-radar data, recording rain-gage charts, and reports by local residents indicated that rainfall occurred from about 9 p.m. on August 5th to 6 a.m. on August 6th; high-intensity rainfall was reported to have occurred between 10 p.m. and 2 a.m. Unofficial rainfall data (including "bucket survey" data) collected throughout the five-county area immediately following the storm by the U.S. Army Corps of Engineers and the Weather Bureau ranged from 3 to more than 16 in. The greatest unofficial rainfall reports were from southeastern, central, and eastern Decatur County and southwestern Wayne County, where rainfall amounts ranged from 8 to more than 16 in.; the greatest unofficial rainfall amount reported was 16.70 in. in southeastern Decatur County.

Damage from the floods was estimated to be in the millions of dollars. The U.S. Highway Commission estimated $144,000 damage to primary, secondary, and local county roads. In Decatur County, the County Conservationist estimated 32,000 to 34,000 acres of land (80 percent in row crops) were severely damaged.

At the Elk Creek near Decatur City streamflow-gaging station, information on the 1959 flood obtained from the Decatur County Assistant Engineer prior to operation of the gage (gage operation began October 1967), indicates that the peak stage of the 1959 flood is the greatest known at this site during 1959-95 (table 2). At the Thompson River at Davis City gaging station, the peak discharge (17,500 ft^3/s) for the flood of August 6, 1959 (table 2), is the sixth largest known discharge during 1885-1995. Discharges were not determined for five floods that occurred prior to operation of the Davis City gage (gage operation began May 1918) for which peak stages were reported to be higher than the peak stage of 18.42 ft recorded for the 1959 flood (see Appendix A; or 20.42 ft when referenced to present datum, table 2). The flood-peak discharge at Davis City of 17,500 ft^3/s has a recurrence interval of approximately 11 years (table 2). At the Weldon River near Leon gaging station, the peak discharge (48,600 ft^3/s) and stage (25.27 ft) for the flood of August 6, 1959 (table 2), are both the second largest known at this site during 1919-92. The flood-peak discharge of 48,600 ft^3/s computed from an indirect measurement at the Leon gage is 1.6 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2).

Floods of July 4, 1981

Flooding in south-central Iowa during July 3-5, 1981, occurred as a result of excessive rainfall during July 3rd and 4th, after much of the area had received up to 4 in. of rain less than a week earlier. Flooding was significant in the Chariton River Basin on July 4th, and in basins bordering the Chariton River Basin to the north during July 3-5, 1981. Additional information on the floods of July 1981 is presented in the report "Floods in South-Central Iowa" (Heinitz, 1986). Official rainfall amounts recorded on July 4, 1981, are listed in the table below; unofficial rainfall amounts of 10 to 12 in. were reported for the storm (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and Iowa Weather Service, 1981, p. 10 and 34).

Rain gage and rainfall for July 4, 1981, in inches

Chariton	5.48	Osceola	6.01
Corydon	7.16	Rathbun Dam	4.11

The Agricultural Stabilization and Conservation Service (ASCS) Emergency Board estimated agricultural damage as a result of the flooding exceeded $68 million in a 10-county area that included Appanoose, Clarke, Davis (not shown, located east of Appanoose County), Decatur, Lucas, Madison, Marion, Monroe, Warren, and Wayne Counties (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and Iowa Weather Service, 1981, p. 34). In Lucas County, the State Highway 14 bridge crossing the Chariton River south of Chariton was closed during the flood (Des Moines Register, July 5, 1981). Dennis Reger, Lucas County Soil Conservationist, reported that unofficial rainfall amounts on July 3rd of 5 to 12 in. caused a significant number of terraces to overtop, or to have siltation; damage to soybean and corn crops was significant, and soil losses in Lucas County were estimated to be 30 to 50 tons per acres (Des Moines Register, July 7, 1981). Wayne County agricultural officials reported that unofficial rainfall amounts were as high as 10 in. in one area of the county; crop damage in Wayne County was estimated to be nearly $8 million, including $60,000 of hay that was washed-away; Rolley Glasgon, Wayne County Engineer, reported that seven bridges in Wayne County were destroyed by the flooding and that damage in the county was estimated to exceed $1 million;

damage in Wayne County to corn and soybean crops was estimated to be nearly $100,000 and $300,000, respectively (Des Moines Register, July 7, 1981).

At the Chariton River near Chariton streamflow-gaging station, the peak discharge (16,600 ft^3/s) and stage (23.14 ft) for the flood of July 4, 1981 (table 2), are both the second largest known at this site during 1947-95. The flood-peak discharge of 16,600 ft^3/s has a recurrence interval of approximately 25 years (table 2). At the South Fork Chariton River near Promise City gaging station, the peak discharge (28,000 ft^3/s) and stage (29.95 ft) for the flood of July 4, 1991, are both the second largest known at this site during 1965-95. The flood-peak discharge of 28,000 ft^3/s has a recurrence interval of approximately 60 years (table 2).

Floods of September 15-16, 1992

The largest flood on record in the Thompson and Weldon River Basins in Iowa and in the Chariton River Basin upstream of Rathbun Dam occurred during September 15-16, 1992. The majority of the following information pertaining to precipitation for the September 15-16, 1992, floods was obtained from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and Iowa Department of Agriculture and Land Stewardship (1992, Climatological data, p. 8 and 30-31), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service (1992, Storm summary report, p. 4-5), and Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship (oral and written commun., January 1993). The flooding occurred as a result of thunderstorms that moved into south-central Iowa about mid-morning on September 14th and continued to redevelop over the same area until about noon on the 15th; the majority of the rain fell between 7 p.m. and 5 a.m. Soils in south-central Iowa were already saturated on September 14th when the storms began. Rainfall ranging from 5 to more than 11 in. was common over most of the Thompson and Weldon River Basins in Iowa and over the Chariton River Basin upstream of Rathbun Dam (fig. 2). The greatest rainfall was centered over Clarke, Decatur, Lucas, and Wayne Counties in the headwaters of the Weldon, Chariton, and South Fork Chariton Rivers (fig. 2). Official rainfall amounts recorded on September 15-16, 1992, are listed in the table below. The greatest rainfall amount reported for the storm was an unofficial 16 in. at Van Wert in Decatur County. Other unofficial rainfall reports included 10-13 in. near Chariton, 10 in. at Creston, 13 in. near Millerton in Wayne County, and 14 in. at Thayer in Union County.

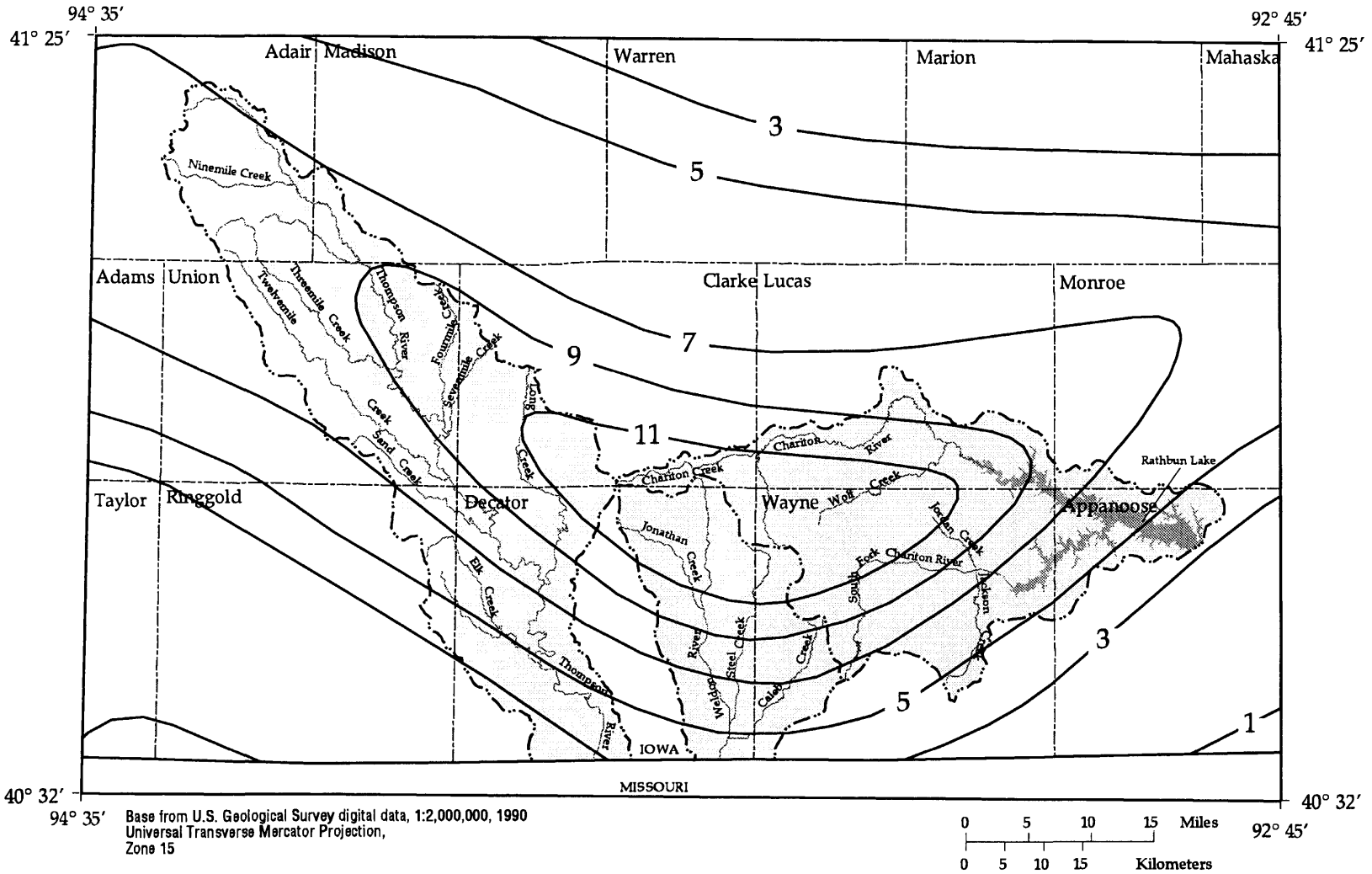
Rain gage and rainfall for September 15-16, 1992, in inches

Beaconsfield	8.32	Leon	7.34
Chariton	7.21	Lorimor	9.01
Clio	5.93	near Promise City	11.05
Derby	12.06		
Greenfield	8.24	Osceola	9.41

A total of 9.3 in. of rain fell at Derby between 11:00 p.m. and 5:30 a.m. during September 14-15, 1992 (fig. 3) (Fischer, 1993, p. 1855 and 1857). The average rainfall intensity for this 6.5-hour period was 1.4 in. per hour. The maximum intensity was 1.2 in. in 15 minutes, which occurred between 11:00 and 11:15 p.m. Rainfall on September 14-15, 1992, exceeded the 100-year, 24-hour recurrence-interval rainfall amount in parts of at least 12 counties. Derby reported 11.7 in. of rain in a 24-hour period ending at 9 a.m. on the 15th, which at the time, was the fifth greatest official 24-hour rainfall ever recorded in Iowa. The 16 in. of rainfall reported at Van Wert was 2.1 times larger than the 100-year, 24-hour recurrence-interval rainfall amount for the area of 7.74 in.

The following information in this section pertaining to inundation and damage for the floods of September 15-16, 1992, was obtained from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service, 1992 (Storm summary report, p. 4-5) and the Des Moines Register (September 16, 17, and 19, 1992, newspaper articles).

During the floods, small creeks became torrents, while rivers quickly became lakes; some of the rivers swelled to as wide as 5 mi. By 9:10 a.m., on September 15, 1992, flood warnings were issued by the National Weather Service for Clarke, Decatur, Lucas, Monroe, Union, Wapello (not shown, located east of Monroe County), and Wayne Counties. Nearly all rivers and streams in these counties had serious flooding. Many highways and county roads in south-central Iowa were inundated and closed during the floods. At least 30 bridges in the area were destroyed by the floodwaters, damages to those bridges alone exceeded $10 mil-



EXPLANATION

7 Line of equal rainfall for September 14-15, 1992--Interval 2 inches

Figure 2. Areal distribution of rainfall for the September 14-15, 1992, storm in south-central Iowa (Fischer, 1993, p. 1855-1856; lines of equal rainfall, in inches, from Hillaker, 1992, p. 3)

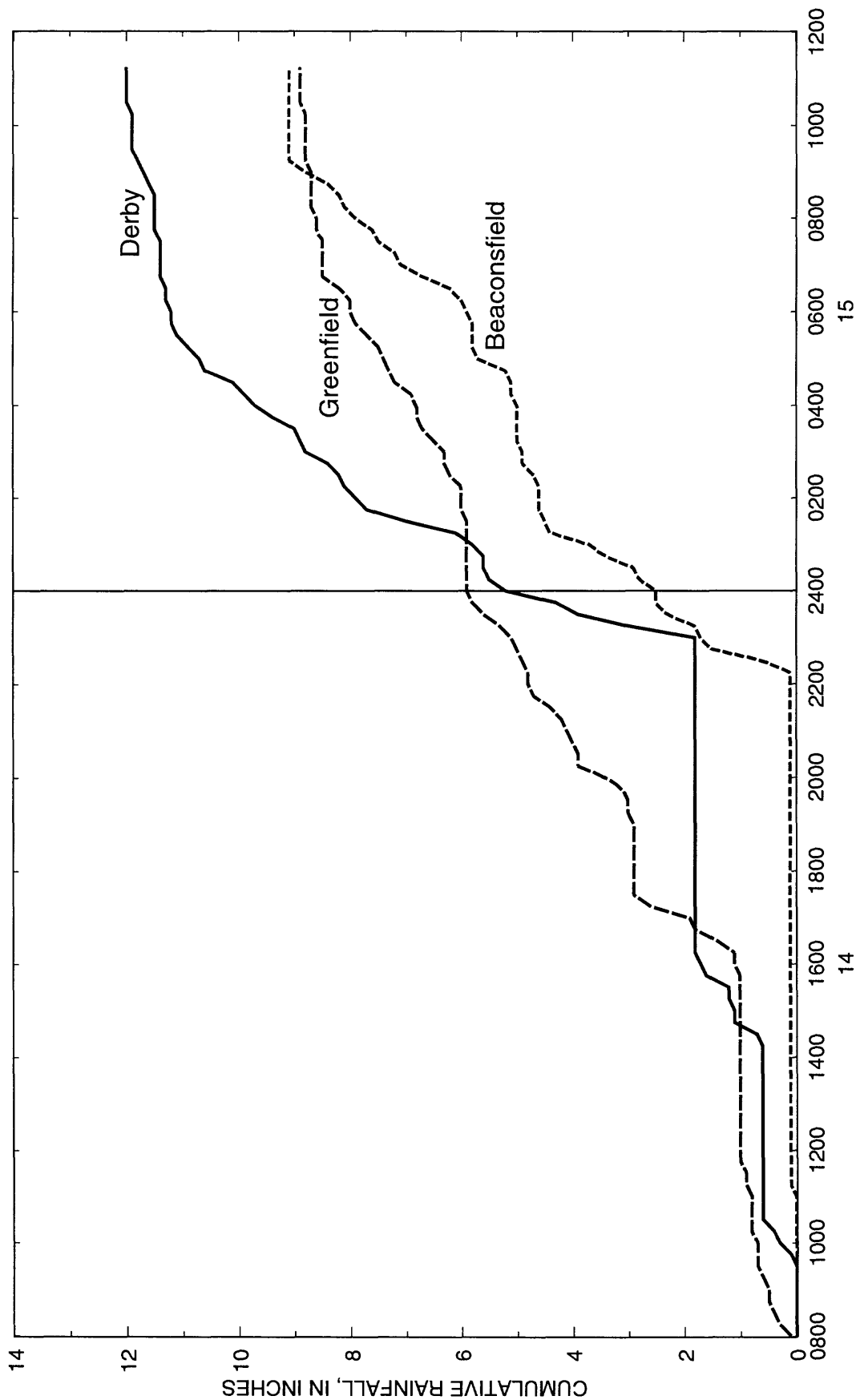


Figure 3. Cumulative rainfall for September 14-15, 1992, at Beaconsfield, Derby, and Greenfield, Iowa (Fischer, 1993, p. 1857; data provided by Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship, written commun., January 1993).

lion dollars. Floodwaters caused scour damage at many other bridges throughout the area; Fischer (1993, 1995) documented contraction scour at the State Highway 2 bridge crossing the Weldon River in Decatur County and at the State Highway 14 bridge crossing Wolf Creek in Lucas County (fig. 1). Road closures caused a few towns to be isolated during the flooding. The flooding interrupted Amtrak and freight-train traffic on the Burlington Northern Railroad across southern Iowa and forced rail traffic to be rerouted during September 15-17, 1992. Because the floods occurred at the end of the growing season, crop damage was severe. Many crops were washed-away or flattened by the flooding. Agricultural officials estimated that thousands of acres of crops were damaged or destroyed, and that crop yields were reduced on about 147,000 acres in a 13-county area. Damage from the floods was extensive to both public and private property. Many homes were flooded and several school districts were closed for 2 days due to high water and flooded schools. No one was killed or seriously injured by the flooding; however, 25 head of sheep and 225 head of cattle were swept away and drowned. Information pertaining to road closures and damages resulting from the September 15-16, 1992, floods were reported for the following counties.

In Adair County, county roads along the Thompson River downstream of State Highway 92 were closed during the floods. In Clarke County, U.S. Highway 69 was closed during the floods from 2 to 8 mi south of Osceola. Richard McKnight, Clarke County Assistant Engineer, reported that the floods completely destroyed three bridges, severely damaged 38 other bridges, and damaged 70 to 100 mi of roads in the county; dirt roads, that are important to farmers during the fall harvest, were not included as part of the reported road damage. Officials in Clarke County estimated that damage to bridges and roads was at least $1 million. Bart Griffith, Clarke County ASCS, reported that about 5,000 out of 60,000 acres of cropland in the county were flooded.

In Decatur County, Interstate 35 was closed where it crosses the Thompson River for about a day and one half during the flood, this was the first time the interstate had ever been closed due to flooding. State Highway 2 also was closed west of the interstate. Keith Hinds, Decatur County Assistant Engineer, reported that 10 bridges in the county were destroyed by the floods at a cost of about $1.1 million, and that damage to roads was estimated at $150,000. Twenty-five other bridges in the county were severely damaged. Alan Hilleman, Decatur County ASCS Executive Director, reported that about 90 to 95 percent of the bottomland in the county was severely affected by the flooding. Hilleman and other agricultural officials estimated that 35,000 acres of corn and soybeans were inundated, or about 18 percent of the 197,800 acres of cropland in the county.

In Lucas County, U.S. Highways 34 and 65 at Lucas, U.S. Highway 65 south of Lucas, and all highways into Chariton were closed during the floods. At Lucas, 25 empty coal-rail cars were swept off the track and toppled onto their sides during the flooding. David Lundquist, Lucas County ASCS Director, reported 3,000 to 4,000 acres of cropland were inundated, or about six percent of the 67,000 acres of corn and soybeans in the county.

In Union County, floodwaters caused a dam to be breached at Little Lake near Thayer. Curt Greenfield, Union County Engineer, reported that the eastern one-third of the county was "basically devastated" by the floods, one bridge was destroyed and 19 other bridges were severely damaged. Paul Goldsmith, Union County District Conservationist, U.S. Soil Conservation Service, reported the flooding inundated 10,000 to 15,000 acres of land along streams and the Thompson River in Union County.

In Wayne County, U.S. Highway 65 south of State Highway 2, State Highway 14 north of Corydon, and State Highway 2 east of Corydon were closed during the floods. Vernon Brown, Wayne County Chief Deputy Sheriff, reported that every major highway in Wayne County was closed at some time during September 15th. On the afternoon of September 15th, flooded roads blocked access to Corydon for several hours. Mike Olson, Wayne County Engineer, reported that at least one bridge and six large culverts were destroyed by the floods, and that an estimated $300,000 or more of gravel was washed-off of county roads. Don Bethards, Wayne County Assistant Engineer, reported that about one half of the roads in Wayne County lost surfacing and that damage from the floods was the worst he had seen in his 20 years on the job. Officials in Wayne County estimated that damage to bridges and roads was at least $1 million. Jerry Taylor, Wayne County ASCS Director, reported that about 500 farm terraces were damaged in the county, soil erosion affected about 50,000 acres, and an estimated 25,000 acres of corn and soybeans were inundated, or about 12.5 percent of the 200,000 acres of cropland in the county.

Significant flooding also occurred in portions of the Middle River, South River, White Breast Creek, English Creek, and Cedar Creek Basins (not shown, located north of the Thompson and Chariton River Basins), and in portions of the East Nodaway River and Platte River Basins (not shown, located west of the Thompson River Basin) (Gorman and others, 1993, p. 6-8; U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service, 1992, Storm Summary Report, p. 5). As a result of the flooding, the following nine counties were declared Federal disaster areas: Adams (not shown, located west of Union County), Clarke, Decatur, Lucas, Madison, Monroe, Ringgold, Union, and Wayne. Flood damage eligible under the Public Assistance Program of the Federal Emergency Management Agency for the floods of September 15-16, 1992, that does not include residential and agricultural damage, exceeded $2.1 million for the 5-county area of Clarke, Decatur, Lucas, Union, and Wayne Counties (information provided by Jerry Ostendorf, Iowa Emergency Management Division, written commun., December 1996).

A notable feature of the September 15-16, 1992, floods in south-central Iowa is the magnitude of runoff caused by the thunderstorms. Peak unit runoffs (discharge per square mile) (table 2) exceed the majority of those recorded for the 1993 floods (discussed in the next section), for drainage basins of size similar to the Thompson, Weldon, Chariton, and South Fork Chariton River Basins (104 to 701 mi^2) and are among the largest peak unit runoffs recorded in the flood history of the State. The flood of September 15-16, 1992, is the largest peak discharge and second highest peak stage at the Thompson River at Davis City gaging station during 1885-1995. The peak discharge and stage for the 1992 flood are both the largest known at the Weldon River near Leon gaging station during 1919-92, at the Chariton River near Chariton gaging station during 1947-95, and at the South Fork Chariton River near Promise City gaging station during 1965-95. At the Thompson River at Davis City gaging station, the September 16, 1992, flood-peak discharge of 57,000 ft^3/s is 1.7 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2) and the peak stage of 24.29 ft exceeded the flood stage at this site by about 15.3 ft. At the Weldon River near Leon gaging station, the September 15, 1992, flood-peak discharge of 76,200 ft^3/s is 2.6 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2). At the Chariton River near Chariton gaging station, the September 15, 1992, flood-peak discharge of 37,700 ft^3/s is 1.4 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2) and the peak stage of 29.32 ft exceeded the flood stage at this site by about 14.3 ft. At the South Fork Chariton River near Promise City gaging station, the September 15, 1992, flood-peak discharge of 70,600 ft^3/s is 2.1 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2) and the peak stage of 34.84 ft exceeded the flood stage at this site by about 16.8 ft.

Floods of July 5, 1993

From mid-June through early August 1993, severe flooding in a nine-state area of the upper Mississippi River Basin followed an extended period of persistent precipitation that began in January. Flood-peak discharges that equalled or exceeded the 10-year recurrence interval were recorded at 154 streamflow-gaging stations in the flooded region during June through August 1993 (Parrett and others, 1993). The month of July 1993 was the wettest July in Iowa in 121 years of record and also was the wettest month ever recorded in the State during 1873-1993 (Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship, written commun., September, 1993). The floods of July 5, 1993, in south-central Iowa occurred as a result of intense thunderstorms over the area during July 4-5, 1993. Official rainfall amounts recorded during July 4-6, 1993, are listed in the table below (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and Iowa Department of Agriculture and Land Stewardship, 1993, p. 8).

Rain gage and rainfall for July 4-6, 1993, in inches			
Beaconsfield	6.28	Leon	6.82
Chariton	7.63	Lorimor	4.10
Creston	2.32	Osceola	6.79
Greenfield	1.21	Rathbun Dam	4.69
Lamoni	6.22		

Floodwaters from the Chariton River flowed over the emergency spillway at Rathbun Dam for the first time since operation of the dam began in 1969. As a result of the floods of 1993, all 99 counties in Iowa

were declared Federal disaster areas. Flood damage eligible under the Public Assistance Program of the Federal Emergency Management Agency for flooding that occurred from April 13 to October 1, 1993, that does not include residential and agricultural damage, exceeded $1.9 million for the 6-county area of Adair, Clarke, Decatur, Lucas, Union, and Wayne Counties (information provided by Jerry Ostendorf, Iowa Emergency Management Division, written commun., December 1996).

At the Elk Creek near Decatur City streamflow-gaging station, the peak discharge (32,800 ft^3/s) for the flood of July 5, 1993 (table 2), is the largest recorded discharge at this site during 1959-95. The peak discharge of 32,800 ft^3/s is 1.1 times larger than the Bulletin 17B, 100-year recurrence-interval discharge (table 2). Based on information provided by the Decatur County Assistant Engineer, the stage of the 1959 flood at the Elk Creek gage exceeded the stage of the 1993 flood; a discharge was not determined for the 1959 flood at this site (table 2). At the Thompson River at Davis City gaging station, the peak discharge (30,300 ft^3/s) for the flood of July 5, 1993, is the second largest recorded discharge at this site during 1885-1995 (table 2). The peak discharge of 30,300 ft^3/s has a recurrence interval of approximately 70 years (table 2). Discharges were not determined for five floods that occurred prior to operation of the Davis City gage (gage operation began May 1918) for which peak stages were reported to be higher than the peak stage of 20.53 ft recorded for the 1993 flood (see Appendix A).

PROFILES FOR THE FLOODS OF SEPTEMBER 15-16, 1992, IN THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

Water-surface-elevation profiles for the floods of September 15-16, 1992, in the Thompson and Weldon River Basins in Iowa, and in the Chariton River Basin upstream of Rathbun Dam, are shown in Appendix B (figs. 4-10). Profiles for the floods of July 4, 1981, in the Chariton River Basin upstream of Rathbun Dam also are shown in Appendix B (figs. 8-10) for comparative purposes. The flood profiles were determined from high-water marks generally located immediately downstream and 1 bridge-length upstream from selected bridges. The high-water marks were identified within a few days of passage of the flood peak and were later referenced to sea level by differential leveling. Low-water profiles measured on August 2-3, 1995, in the Thompson, Weldon, and Chariton River Basins, and on July 18, 1984, in the Chariton River Basin, also are shown in figures 4-10 to indicate the approximate low-end of the range of stages that can occur within the profiled reaches.

The profiles were defined using data obtained by the USGS. The profiles between the measured water-surface elevations are represented by straight lines and are therefore only approximations of the actual water-surface elevations between the measurements. Water-surface elevations for ungaged bridge sites used in the 1992 flood profiles were collected at selected primary highway and paved county road bridges (figs. 1 and 4-10). The majority of the bridge sites used in the profiles were located between 10 and 15 river miles apart. Flood elevations were not collected at both the upstream and downstream sides of all bridges. Water-surface elevations for the 1981 floods were collected at every bridge along the profiled reaches of the Chariton and South Fork Chariton Rivers. Bridges along the Chariton and South Fork Chariton Rivers for which flood elevations were collected in 1981 but were not collected in 1992 are noted on the profiles in figures 9 and 10.

All river miles used in the profiles (figs. 4-10) were measured from the most current 1:24,000-scale USGS topographic maps. River miles measured for the Thompson and Weldon Rivers were referenced to the Iowa-Missouri State line, river miles measured for the Chariton and South Fork Chariton Rivers were referenced to Rathbun Dam, and river miles measured for Elk Creek were referenced to the mouth of Elk Creek. River miles were measured using a geographic information system, except along the Chariton River downstream of State Highway 14 and along the South Fork Chariton River which were measured manually from topographic maps for the 1981 flood profiles (Heinitz, 1986, p. 38-40). Measurements of river miles using larger- or smaller-scale cartographic data or different measurement methods may yield different values than those contained in this report. Bridges are designated by an index number derived from their respective locations using Public Land Survey System coordinates (township, range, section). For example, 6726-13 NE refers to a location in Township 67 North, Range 26 West, northeast quarter of section 13.

A bench mark and a reference point were established at the majority of the bridges in the profiled reaches to reference all the points along the profiles to a common datum. Bench-mark and reference-point descriptions and elevations for bridge sites used in the September 15-16, 1992, flood profiles are listed in Appendix C.

Bridge-deck and low-bridge-chord elevations are shown in figures 4-10 to indicate the relation of the bridge to the high- and low-water surfaces. For sloping bridges, the bridge-deck and low-bridge-chord elevations represent the lower end of each bridge.

CONSIDERATIONS

The user of this report is cautioned that the stage-discharge data presented herein are representative of the physical conditions of the basin at the time of the floods described. Changes in the basin can alter the flood magnitude for a specific frequency. Examples of these basin changes include, but are not limited to, extensive urbanization, implementation of agricultural conservation practices, and installation of drainage systems. Changes in the channel conditions immediately downstream from a streamflow-gaging station can substantially affect the stage-discharge relation. Examples of such changes include the construction of dams, bridges, or levees; changes in the flood-plain vegetative cover; straightening of the channel; and natural scour and fill. Temporary changes can be caused by ice and debris jams that produce backwater conditions that cause water-surface elevations to be higher than would occur in an unobstructed channel.

SUMMARY

This report provides information on the floods of September 15-16, 1992, in the Thompson, Weldon, and Chariton River Basins in south-central Iowa. Information on the floods of July 4, 1981, on the Chariton and South Fork Chariton Rivers is included for comparative purposes. The September 15-16, 1992, floods are the largest known peak discharges at gaging stations Thompson River at Davis City (station number 06898000) 57,000 ft^3/s, Weldon River near Leon (station number 06898400) 76,200 ft^3/s, Chariton River near Chariton (station number 06903400) 37,700 ft^3/s, and South Fork Chariton River near Promise City (station number 06903700) 70,600 ft^3/s. The peak discharges were, respectively, 1.7, 2.6, 1.4, and 2.1 times larger than calculated 100-year recurrence-interval discharges. The report provides information on flood stages and discharges and flood-flow frequencies for streamflow-gaging stations in the Thompson, Weldon, and Chariton River Basins using flood information collected through 1995. Information on temporary bench marks and reference points established in the Thompson and Weldon River Basins during 1994-95, and in the Chariton River Basin during 1983-84 and 1994-95, also is included in the report. A flood history summarizes rainfall conditions and damages for floods that occurred during 1947, 1959, 1981, 1992, and 1993.

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APPENDIX A

PEAK STAGES AND DISCHARGES FOR STREAMFLOW-GAGING STATIONS IN THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

The peak-stage and discharge data for streamflow-gaging stations located in the Thompson, Weldon, and Chariton River Basins were compiled through September 30, 1995. The data are listed in chronological order. In general, independent peak discharges above a pre-selected base (partial-duration series) are listed for the continuous-record gaging stations. The magnitude of the selected base discharge, given in the "Remarks" section of the headnote, was determined so that it would be equaled or exceeded on the average about three times per year. Two peak discharges are considered independent if a plot of the recorded stages indicates a well-defined trough between the peaks and if the instantaneous discharge of the trough is 25 percent or more below that of the lower peak (Novak, 1985, p. 93). Only annual peak discharges are listed for the crest-stage gaging stations.

The peak flow lists for each gaging-station are arranged in downstream order as explained in the annual water-data reports of the USGS (see "References"). The gaging stations are identified by a permanent number that also is used in figure 1 and in tables 1 and 2 of this report. The datum of the gage, when given, is above sea level. Flood stage as determined by the National Weather Service, when given, is the stage at which overflow of the natural banks of the stream begins to cause damage in the reach in which the elevation is measured.

Footnotes used throughout this appendix are selected so that each letter has the same meaning. For example, each occurrence of footnote "e" in any of the lists means "Affected by ice." Not all footnotes may appear in every list.

06897858 Sevenmile Creek near Thayer

Location.--Lat 41°01'37", long 94°00'03", in SE1/4, sec. 18, T.72 N., R.27 W., Clarke County, Hydrologic Unit 10280102, at culvert on U.S. Highway 34, 2.6 mi east of Thayer.

Drainage area.--6.61 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Defined by current-meter measurements and theoretical culvert rating.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1991	June 15, 1991	[a]21.70	--
1992	Sept. 15, 1992	24.92	[b]1,330
1993	July 5, 1993	23.49	[b]1,220
1994	Mar. 1, 1994	15.57	--
1995	May 23, 1995	15.08	[b]100

[a] Gage height revised from previously published value.
[b] Approximate.

06897950 Elk Creek near Decatur City, Iowa

(Hydrologic bench mark station discontinued September 1, 1994)

Location.--Lat 40°43'18", long 93°56'12", in SE 1/4 sec. 34, T.69 N., R.27 W., Decatur County, Hydrologic Unit 10280102, at bridge on County Road R18, 1,000 ft downstream from West Elk Creek, 5.8 mi upstream from mouth, and 5.5 mi west of Decatur City.

Drainage area.--52.5 mi^2.

Gage.--Crest-stage gage. Datum of gage is 924.70 ft above sea level. Oct. 1, 1967, to Sept. 1, 1994, operated as a continuous-record gage, and Oct. 1, 1967, to Sept. 30, 1974, at datum 10.00 ft higher.

Stage-discharge relation.--Defined by current-meter and indirect measurements.

Remarks.--Base for partial-duration series, 500 ft^3/s.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1959	Aug. 6, 1959	[c]20.5 to 22.5	--
1967	June 14, 1967	[c]18.35	[d]17,800
	(Systematic operation of gage began October 1, 1967.)		
1968	Apr. 23, 1968	10.50	2,900
	July 23, 1968	8.14	1,540
	Aug. 4, 1968	9.75	2,450
1969	Apr. 4, 1969	6.11	654
	Apr. 17, 1969	7.55	1,300
	Apr. 26, 1969	11.39	3,490
	May 7, 1969	10.44	2,930
	May 21, 1969	11.32	3,440
	June 12, 1969	8.47	1,700
	June 28, 1969	10.27	2,760
	June 30, 1969	10.40	2,840
	July 9, 1969	15.23	7,710
	July 18, 1969	8.69	1,820
1970	Apr. 18, 1970	8.98	1,990
	May 12, 1970	13.59	5,310
	Aug. 3, 1970	5.77	500
	Sept. 15, 1970	6.72	848
	Sept. 17, 1970	5.93	556
	Sept. 22, 1970	6.79	876
1971	Oct. 9, 1970	5.94	559
	Oct. 26, 1970	6.49	756
	Nov. 9, 1970	5.78	503
	Dec. 10, 1970	6.49	756
	May 6, 1971	6.10	636
	May 7, 1971	6.56	784

06897950 Elk Creek near Decatur City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1972	May 7, 1972	11.46	3,480
	May 12, 1972	7.42	1,220
	June 17, 1972	9.64	2,400
	July 19, 1972	7.76	1,360
	July 26, 1972	9.71	2,470
	Sept. 12, 1972	15.41	8,130
1973	Nov. 13, 1972	6.21	654
	Dec. 29, 1972	--	[b]3,400
	Jan. 16, 1973	10.07	2,640
	Feb. 1, 1973	13.25	4,920
	Apr. 1, 1973	--	[b]2,000
	Apr. 16, 1973	--	[b]2,200
	May 7, 1973	--	[b]700
	Aug. 11, 1973	8.46	1,700
	Sept. 26, 1973	11.50	3,500
1974	Oct. 11, 1973	13.60	5,320
	Nov. 20, 1973	7.49	1,220
	Dec. 4, 1973	9.90	2,540
	Jan. 20, 1974	--	[b]1,000
	Jan. 26, 1974	--	[b]1,300
	Mar. 8, 1974	6.05	598
	Mar. 10, 1974	7.91	1,420
	Mar. 13, 1974	10.77	3,060
	Mar. 25, 1974	9.65	2,390
	Apr. 21, 1974	12.50	4,170
	May 30, 1974	12.47	4,150
	June 9, 1974	--	[b]4,600
	(October 1, 1974, gage at present site at new datum.)		
1975	Oct. 31, 1974	15.14	675
	Mar. 16, 1975	--	[b]800
	Mar. 17, 1975	15.77	832
	Mar. 27, 1975	14.76	582
	May 7, 1975	16.39	1,010
	June 23, 1975	14.98	635
	Sept. 11, 1975	14.87	608
1976	Mar. 6, 1976	--	1,000
	Mar. 29, 1976	16.68	1,400
	Apr. 18, 1976	21.70	5,450
	Apr. 20, 1976	19.51	3,340
	Apr. 24, 1976	25.80	11,400
1977	Sept. 2, 1977	13.60	320

06897950 Elk Creek near Decatur City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1978	Oct. 23, 1977	17.98	1,960
	Oct. 31, 1977	18.62	2,340
	Mar. 21, 1978	15.78	1,110
	Apr. 10, 1978	16.65	1,500
	Apr. 17, 1978	21.67	5,530
	May 7, 1978	22.45	6,460
	May 11, 1978	17.50	2,010
	July 21, 1978	20.37	4,200
	Sept. 18, 1978	14.42	653
	Sept. 20, 1978	25.73	11,100
1979	Mar. 16, 1979	14.59	677
	Mar. 18, 1979	16.76	1,540
	Mar. 23, 1979	19.85	3,870
	Mar. 30, 1979	16.17	1,420
	May 2, 1979	15.30	1,060
	June 27, 1979	15.83	1,130
1980	Mar. 15, 1980	15.23	892
	June 2, 1980	28.22	16,400
	June 4, 1980	19.26	3,170
	Aug. 31, 1980	22.37	6,220
	Sept. 1, 1980	16.79	1,560
	Sept. 5, 1980	16.99	1,660
1981	Apr. 12, 1981	14.82	746
	Apr. 13, 1981	19.61	3,450
1982	Mar. 19, 1982	26.06	12,600
	Apr. 16, 1982	20.00	4,310
	May 6, 1982	21.40	5,780
	May 14, 1982	20.75	5,070
	May 17, 1982	14.45	776
	May 21, 1982	16.02	1,440
	May 29, 1982	16.40	1,640
	June 8, 1982	19.65	3,990
	June 15, 1982	16.90	1,920
	June 25, 1982	15.50	1,190
	July 6, 1982	23.65	8,690
1983	Dec. 24, 1982	14.83	964
	Dec. 27, 1982	21.08	5,420
	Apr. 2, 1983	14.05	735
	May 6, 1983	18.00	2,640
	May 27, 1983	19.00	3,420
	June 3, 1983	16.18	1,540
	June 29, 1983	16.44	1,680

06897950 Elk Creek near Decatur City, Iowa--Continued

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1984	Nov. 27, 1983	14.10	630
	Apr. 3, 1984	14.85	922
	Apr. 22, 1984	16.06	1,460
	Apr. 27, 1984	14.84	918
	Apr. 29, 1984	17.79	2,490
	May 19, 1984	14.79	899
	May 22, 1984	16.77	1,840
	June 8, 1984	17.95	2,610
	June 9, 1984	19.75	4,080
1985	Feb. 21, 1985	[e]--	550
	Mar. 3, 1985	15.65	1,250
	Sept. 29, 1985	16.23	1,550
1986	Oct. 9, 1985	20.16	4,510
	Oct. 12, 1985	14.37	762
	Nov. 18, 1985	16.66	1,960
	Apr. 3, 1986	18.99	3,410
	May 16, 1986	20.02	4,330
	July 10, 1986	14.06	664
	July 12, 1986	16.20	1,560
	July 14, 1986	14.15	692
	Aug. 13, 1986	24.40	9,800
	Sept. 19, 1986	21.93	4,450
	Sept. 22, 1986	19.49	3,730
	Sept. 24, 1986	14.23	664
	Sept. 30, 1986	17.76	2,810
1987	Oct. 11, 1986	19.01	3,440
	Oct. 24, 1986	15.18	1,470
	Oct. 25, 1986	12.94	524
	Mar. 18, 1987	14.79	1,290
	Mar. 28, 1987	13.48	731
	Apr. 14, 1987	13.47	731
	May 3, 1987	13.46	735
	May 29, 1987	16.34	1,970
	July 7, 1987	25.96	9,340
	July 8, 1987	16.88	2,250
	July 9, 1987	22.92	6,180
	July 10, 1987	15.57	1,630
	July 12, 1987	22.30	5,700
	Aug. 8, 1987	13.00	545
	Aug. 13, 1987	12.98	538
	Aug. 15, 1987	19.59	3,810
	Aug. 26, 1987	18.42	3,090
1988	Nov. 28, 1987	13.08	593
	Dec. 19, 1987	[e]13.38	--

06897950 Elk Creek near Decatur City, Iowa--Continued

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1989	Sept. 8, 1989	14.09	991
	Sept. 9, 1989	23.21	6,410
1990	Mar. 14, 1990	13.48	731
	Mar. 15, 1990	14.24	1,060
	Apr. 27, 1990	13.55	760
	May 4, 1990	14.23	1,050
	May 12, 1990	14.97	1,380
	May 16, 1990	13.63	792
	May 25, 1990	25.85	10,200
	June 7, 1990	18.00	2,890
	June 16, 1990	14.61	1,110
	June 17, 1990	18.24	3,030
	June 20, 1990	13.46	573
	June 22, 1990	14.92	1,300
	July 20, 1990	28.19	[f]18,000
	July 21, 1990	14.12	853
	July 27, 1990	13.79	704
	Aug. 19, 1990	13.76	691
1991	Feb. 3, 1991	[e]--	820
	Mar. 1, 1991	15.69	1,690
	Mar. 17, 1991	15.40	1,580
	Mar. 27, 1991	13.98	825
	Apr. 13, 1991	13.75	730
	Apr. 14, 1991	19.88	4,070
	Apr. 18, 1991	18.63	3,260
	Apr. 27, 1991	18.60	3,250
	Apr. 29, 1991	13.22	505
	May 5, 1991	17.10	2,400
	May 30, 1991	14.61	1,110
	June 15, 1991	20.65	4,600
1992	Feb. 17, 1992	15.57	1,640
	Feb. 18, 1992	14.43	1,000
	Mar. 18, 1992	13.36	526
	Apr. 16, 1992	20.00	4,140
	Apr. 18, 1992	15.89	1,790
	Apr. 19, 1992	14.74	1,180
	Apr. 20, 1992	15.62	1,660
	July 16, 1992	16.71	2,200
	July 25, 1992	18.55	3,210
	July 30, 1992	22.21	5,770
	Sept. 2, 1992	21.35	5,110
	Sept. 5, 1992	18.31	3,070
	Sept. 15, 1992	27.94	16,200
	Sept. 18, 1992	15.85	1,770

06897950 Elk Creek near Decatur City, Iowa--Continued

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1993	Feb. 1, 1993	[e]14.38	710
	Dec. 13, 1992	19.25	3,660
	Mar. 2, 1993	[e]15.09	1,030
	Apr. 8, 1993	14.08	863
	May 7, 1993	17.00	2,350
	May 23, 1993	15.36	1,560
	June 30, 1993	28.27	18,400
	July 5, 1993	29.93	32,800
	July 11, 1993	23.43	8,170
	July 13, 1993	23.02	7,710
	July 20, 1993	19.62	4,390
	July 22, 1993	20.31	4,980
	July 24, 1993	22.58	7,220
	Sept. 22, 1993	14.21	887
	Sept. 25, 1993	15.48	1,620
1994	June 2, 1994	20.19	4,880
	June 11, 1994	13.60	621
	June 12, 1994	14.14	854
	June 23, 1994	14.38	973
(Continuous-record gage discontinued September 1, 1994. Operation of crest-stage-gage began September 1, 1994.)			
1995	June 24, 1995	18.17	3,260

[b]Approximate.
[c]Datum in use prior to October 1, 1974. Flood stage information provided by Decatur County Assistant Engineer.
[d]Estimated from rating curve extended above 5,300 ft^3/s on basis of step-backwater computation.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.

06898000 Thompson River at Davis City, Iowa

Location.--Lat 40°38'25", long 93°48'29", in SE1/4 SE1/4 sec. 35, T.68 N., R.26 W., Decatur County, Hydrologic Unit 10280102, on right bank 15 ft downstream from bridge on U.S. Highway 69 at Davis City, 3.1 mi upstream from Dickersons Branch, and 5.8 mi upstream from Iowa-Missouri State line.

Drainage area.--701 mi^2.

Gage.--Water-stage recorder. Datum of gage is 874.04 ft above sea level. May 14, 1918, to July 2, 1925, July 14, 1941, to Feb. 24, 1942, nonrecording gage, and Feb. 25, 1942, to Feb. 8, 1967, water-stage recorder at same site at datum 2.00 ft higher.

Stage-discharge relation.--Defined by current-meter measurements, prior to 1992 from rating curve extensions above 15,000 and 17,000 ft^3/s on basis of velocity-area study (see footnotes "h" and "j" at end of station list).

Flood-stage.-- 9 ft.

Remarks.--Base for partial-duration series, 4,500 ft^3/s. Prior to October 1918, published as "Grand River."

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1885	Aug. 8, 1885	[g]22.8	[h]30,000
1897	Apr. 24, 1897	[g]21.7	--
1903	Aug. 27, 1903	[g]21.0	--
1909	July 6, 1909	[g]20.3	--
1914	Aug. 16, 1914	[g]20.2	--
1915	Mar. 28, 1915	[g]19.6	--
	(Systematic operation of gage began May 14, 1918, using chain gage.)		
1918	June 6, 1918	14.7	5,660
1919	Mar. 16, 1919	17.8	10,100
	Apr. 22, 1919	14.6	5,580
	May 4, 1919	17.8	10,100
	June 4, 1919	18.8	12,500
	Sept. 30, 1919	14.2	5,260
1920	Nov. 11, 1919	15.2	6,100
	Mar. 24, 1920	16.9	8,350
	Mar. 26, 1920	16.0	7,000
	Apr. 2, 1920	15.2	6,100
	Apr. 21, 1920	16.4	7,600
	Apr. 27, 1920	13.7	4,890
	May 13, 1920	16.9	8,350
1921	May 11, 1921	14.5	5,500
	June 2, 1921	15.1	5,280
1922	May 23, 1922	15.0	5,200
	July 18, 1922	19.9	13,200
	July 30, 1922	15.5	5,600
	Sept. 1, 1922	17.6	8,040
1923	Nov. 13, 1922	17.4	7,760

06898000 Thompson River at Davis City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1924	Mar. 1, 1924	14.4	4,720
	June 26, 1924	19.0	10,200
1925	June 3, 1925	13.1	3,860
	(Gage discontinued July 2, 1925.)		
1926	Sept. 9, 1926	[i]19.1	10,800
	(Gage reactivated July 14, 1941, using wire-weight gage.)		
1941	Sept. 17, 1941	9.4	4,440
1942	Oct. 9, 1941	12.0	6,700
	Nov. 2, 1941	12.2	6,900
	(February 25, 1942, gage changed to graphic water-stage recorder.)		
	June 20, 1942	13.5	8,380
	June 26, 1942	12.0	6,700
1943	May 15, 1943	11.5	6,420
	June 13, 1943	12.1	6,910
1944	Apr. 23, 1944	14.2	8,810
	May 3, 1944	11.7	6,590
	May 21, 1944	9.7	4,960
1945	Mar. 17, 1945	11.5	6,620
	Apr. 17, 1945	13.9	8,700
	May 15, 1945	12.9	7,750
1946	Jan. 6, 1946	15.2	11,500
	May 3, 1946	10.0	6,400
	June 19, 1946	11.1	7,610
1947	Apr. 5, 1947	11.7	8,200
	Apr. 12, 1947	11.6	8,100
	May 30, 1947	8.9	5,300
	June 6, 1947	19.3	19,500
	June 14, 1947	20.14	[h]21,300
	June 23, 1947	12.6	9,320
1948	Mar. 20, 1948	8.6	4,860
1949	June 26, 1949	7.8	4,190
1950	May 10, 1950	11.8	12,000
	June 19, 1950	11.4	11,300
1951	Mar. 29, 1951	6.98	5,100
	May 2, 1951	13.75	15,200
	May 12, 1951	6.98	5,100
	May 27, 1951	9.82	8,900
	July 5, 1951	7.26	5,490
1952	Nov. 13, 1951	6.61	4,620
	Mar. 13, 1952	7.79	6,140
1953	Mar. 30, 1953	5.86	3,890
1954	June 15, 1954	4.56	2,520
1955	Mar. 3, 1955	4.81	2,760
1956	Aug. 9, 1956	4.70	2,670

06898000 Thompson River at Davis City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1957	Apr. 3, 1957	7.54	5,250
1958	July 15, 1958	9.22	7,400
	July 27, 1958	8.19	5,850
1959	Mar. 26, 1959	7.67	5,430
	Apr. 20, 1959	9.18	6,900
	May 11, 1959	10.25	7,900
	May 31, 1959	10.60	8,300
	July 1, 1959	8.04	5,700
	Aug. 6, 1959	18.42	17,500
	Sept. 27, 1959	10.35	8,100
1960	Jan. 14, 1960	11.92	9,690
	Mar. 30, 1960	16.63	15,200
	Apr. 17, 1960	6.97	4,800
	July 1, 1960	9.89	7,600
1961	Feb. 18, 1961	[e]6.63	[b]4,600
	Mar. 14, 1961	6.78	5,230
	Sept. 13, 1961	8.22	6,820
1962	Nov. 3, 1961	6.61	5,050
	Nov. 16, 1961	8.86	7,200
	Mar. 20, 1962	7.56	5,970
	May 31, 1962	6.18	4,690
	June 10, 1962	6.27	4,780
1963	Mar. 4, 1963	6.00	4,510
1964	June 21, 1964	7.05	5,410
	Sept. 8, 1964	9.14	7,400
	Sept. 23, 1964	7.74	6,060
1965	Mar. 17, 1965	9.08	9,120
	Apr. 8, 1965	9.35	9,520
	May 8, 1965	9.10	9,150
	July 1, 1965	5.69	4,760
	Sept. 21, 1965	8.87	8,820
1966	May 17, 1966	5.82	4,900
	June 13, 1966	5.70	4,770
	July 28, 1966	7.80	6,820
(February 9, 1967, gage changed to digital water-stage recorder, at present site at new datum.)			
1967	June 14, 1967	11.96	10,400
	June 23, 1967	11.65	9,980
1968	Apr. 23, 1968	8.58	5,650
1969	Apr. 28, 1969	7.87	4,830
	May 9, 1969	7.71	4,700
	June 13, 1969	9.69	7,190
	July 9, 1969	12.01	10,500
	July 19, 1969	11.39	9,460
1970	May 14, 1970	7.99	4,940

06898000 Thompson River at Davis City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1971	Feb. 20, 1971	[e]8.40	[b]5,200
1972	May 7, 1972	9.63	7,160
	Sept. 12, 1972	10.82	8,470
	Sept. 16, 1972	12.45	10,600
1973	Dec. 30, 1972	10.15	7,850
	Feb. 3, 1973	11.28	9,420
	Mar. 11, 1973	8.29	5,510
	Mar. 14, 1973	8.89	6,230
	Mar. 25, 1973	9.05	6,420
	Mar. 31, 1973	11.27	9,400
	Apr. 16, 1973	10.71	8,590
	May 2, 1973	8.10	5,280
	May 8, 1973	8.36	5,590
	Sept. 26, 1973	9.21	6,610
1974	Oct. 11, 1973	14.21	14,200
	Apr. 21, 1974	8.27	5,530
	May 30, 1974	8.49	5,750
	June 10, 1974	19.43	[j]24,300
1975	Mar. 18, 1975	7.38	4,420
1976	Nov. 30, 1975	8.09	5,270
	Apr. 20, 1976	9.93	7,520
	Apr. 26, 1976	13.26	12,500
1977	Sept. 3, 1977	6.12	3,120
1978	Oct. 24, 1977	9.07	6,500
	Mar. 22, 1978	9.16	6,880
	Apr. 10, 1978	7.61	5,020
	Apr. 19, 1978	11.37	9,960
	May 7, 1978	10.46	8,510
	July 22, 1978	7.59	4,880
	Sept. 20, 1978	11.68	10,200
1979	Mar. 19, 1979	7.84	5,090
	Mar. 23, 1979	10.34	8,220
1980	June 2, 1980	12.94	12,400
	June 5, 1980	8.99	6,610
	Aug. 31, 1980	8.25	5,660
	Sept. 1, 1980	8.06	5,440
1981	Apr. 14, 1981	8.06	5,420
	July 5, 1981	7.99	5,340
1982	Mar. 19, 1982	11.84	10,600
	Apr. 17, 1982	7.57	4,840
	May 6, 1982	10.72	8,940
	May 15, 1982	7.93	5,260
	May 22, 1982	9.22	6,880
	July 7, 1982	7.34	4,580

06898000 Thompson River at Davis City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1983	Dec. 6, 1982	7.47	4,720
	Dec. 28, 1982	9.06	6,710
	Apr. 3, 1983	8.08	5,530
	May 27, 1983	8.46	6,000
1984	Apr. 22, 1984	8.05	5,470
	Apr. 30, 1984	8.15	5,590
	May 20, 1984	7.57	4,910
	May 26, 1984	7.50	4,830
	June 9, 1984	9.23	6,950
	June 12, 1984	7.27	4,570
	June 18, 1984	7.98	5,390
1985	Feb. 21, 1985	[e]7.43	--
	Feb. 23, 1985	6.66	4,020
1986	Oct. 9, 1985	8.24	5,930
	Apr. 4, 1986	9.52	7,550
	May 1, 1986	7.58	5,100
	May 17, 1986	10.55	8,990
	Aug. 13, 1986	9.78	7,910
	Sept. 19, 1986	9.70	7,800
	Sept. 24, 1986	8.35	6,030
1987	Oct. 12, 1986	7.50	5,250
	Apr. 15, 1987	7.35	5,040
	June 1, 1987	7.49	5,240
	July 7, 1987	9.72	8,650
	July 8, 1987	9.55	8,380
	July 9, 1987	12.10	12,100
	July 12, 1987	12.96	13,300
	Aug. 15, 1987	7.42	5,140
	Aug. 28, 1987	13.81	14,600
1988	Nov. 29, 1987	5.37	2,640
	Feb. 20, 1988	[e]5.45	--
1989	Sept. 9, 1989	9.76	8,720
1990	Mar. 15, 1990	7.08	4,680
	May 25, 1990	11.70	13,600
	June 18, 1990	12.55	12,700
	June 20, 1990	7.32	5,000
	July 20, 1990	13.30	13,800
1991	Apr. 14, 1991	9.50	8,310
	Apr. 19, 1991	11.95	11,800
	Apr. 27, 1991	8.34	6,480
	May 5, 1991	8.93	7,400
	June 16, 1991	8.25	6,340

06898000 Thompson River at Davis City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1992	Feb. 18, 1992	7.66	5,360
	Apr. 21, 1992	8.57	6,730
	July 30, 1992	10.19	9,200
	Sept. 2, 1992	8.94	7,280
	Sept. 16, 1992	24.29	57,000
1993	Nov. 21, 1992	9.28	8,040
	Dec. 14, 1992	11.04	10,500
	Mar. 5, 1993	7.55	5,850
	Mar. 31, 1993	6.43	4,530
	May 8, 1993	7.44	5,720
	June 20, 1993	7.17	5,390
	July 1, 1993	13.33	13,800
	July 5, 1993	20.53	30,300
	July 10, 1993	11.69	11,400
	July 11, 1993	11.29	10,800
	July 13, 1993	9.87	8,830
	July 22, 1993	11.69	11,400
	July 24, 1993	14.74	16,000
	Aug. 21, 1993	11.32	10,900
	Sept. 26, 1993	7.76	6,110
1994	June 2, 1994	7.64	5,960
1995	Apr. 11, 1995	6.49	4,600
	Apr. 27, 1995	6.59	4,720
	May 8, 1995	8.29	6,770
	May 13, 1995	10.16	9,230
	May 23, 1995	11.83	11,600
	May 28, 1995	7.42	5,690
	July 5, 1995	6.61	4,740

[b]Approximate.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.
[g]High-water mark cut in the brickwork of a mill structure located about 1,000 ft downstream of gage. Discharge for the 1885 flood was estimated; other historic flood discharges could not be estimated. Stage-discharge relation is subject to large shifts (Schwob, 1953, p. 168). Datum in use prior to February 9, 1967.
[h]Discharge determined from rating curve extended above 15,000 ft^3/s on basis of velocity-area study.
[i]Following discontinuance of gage July 2, 1925, a few gage-height reading were collected in 1926.
[j]Discharge determined from rating curve extended above 17,000 ft^3/s on basis of velocity-area study.

06898400 Weldon River near Leon, Iowa

(Discontinued September 30, 1991)

Location.--Lat 40°41'45", long 93°38'07", in NE1/4 NE1/4 sec. 17, T.68 N., R.24 W., Decatur County, Hydrologic Unit 10280102, on left bank 10 ft downstream from bridge on County Road J46, 200 ft upstream from Unnamed Creek, 1.3 mi downstream from Brush Creek, and 6.5 mi southeast of post office at Leon.

Drainage area.--104 mi^2.

Gage.--Water-stage recorder. Datum of gage is 906.26 ft above sea level.

Stage-discharge relation.--Defined by current-meter measurements and above 5,600 ft^3/s by indirect measurements.

Remarks.--Base for partial-duration series, 4,500 ft^3/s.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1959	Nov. 17, 1958	17.87	7,410
	Apr. 20, 1959	17.32	6,870
	May 21, 1959	19.16	8,740
	May 29, 1959	16.74	6,330
	May 30, 1959	15.37	5,220
	Aug. 6, 1959	[k]25.27	[f,k]48,600
1960	Oct. 5, 1959	16.00	5,700
	Mar. 29, 1960	18.12	7,220
	Apr. 16, 1960	19.72	9,210
	May 16, 1960	15.88	4,910
1961	Feb. 18, 1961	16.00	5,000
	Mar. 5, 1961	19.85	8,020
	July 15, 1961	21.62	10,000
	Sept. 13, 1961	22.14	11,600
	Sept. 30, 1961	15.91	4,930
1962	Nov. 2, 1961	15.62	4,720
	Nov. 16, 1961	17.25	5,860
	May 29, 1962	15.96	5,000
	June 10, 1962	21.63	10,000
1963	Mar. 4, 1963	[e]13.95	--
	Mar. 18, 1963	13.22	3,150
1964	Sept. 6, 1964	19.48	7,750
1965	Apr. 8, 1965	15.45	4,760
	Sept. 21, 1965	19.10	7,570
1966	June 13, 1966	10.65	1,840
1967	June 12, 1967	15.48	4,640
	June 14, 1967	15.80	4,860
1968	Apr. 22, 1968	20.12	8,310
1969	Apr. 26, 1969	17.97	6,480
1970	May 14, 1970	20.11	8,300
	Sept. 17, 1970	15.63	4,740

06898400 Weldon River near Leon, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1971	Oct. 9, 1970	14.90	4,230
1972	Sept. 12, 1972	17.19	5,850
	Sept. 14, 1972	17.20	5,980
1973	Feb. 1, 1973	15.60	4,720
	Mar. 31, 1973	18.95	7,260
	Apr. 16, 1973	16.54	5,480
1974	Oct. 11, 1973	[l]21.45	9,710
	Apr. 21, 1974	15.61	4,770
	May 30, 1974	16.65	5,460
	June 9, 1974	17.30	6,100
1975	Apr. 23, 1975	12.52	2,660
1976	Apr. 18, 1976	15.60	4,720
	Apr. 24, 1976	16.70	5,490
1977	Aug. 9, 1977	10.84	1,460
1978	Oct. 24, 1977	18.68	7,130
	Apr. 17, 1978	15.89	4,990
	May 7, 1978	16.88	5,690
	Sept. 20, 1978	15.79	4,950
1979	Mar. 23, 1979	16.05	5,180
1980	June 2, 1980	21.61	10,000
	June 4, 1980	18.80	7,140
	Sept. 1, 1980	17.90	6,420
1981	July 4, 1981	20.17	8,700
1982	Mar. 19, 1982	19.37	7,990
	May 6, 1982	17.63	6,600
1983	Oct. 9, 1982	14.37	4,060
1984	June 9, 1984	14.16	3,940
1985	Sept. 29, 1985	12.28	2,840
1986	Sept. 19, 1986	16.36	6,040
1987	Aug. 15, 1987	17.09	6,020
1988	Nov. 28, 1987	10.90	2,100
1989	Sept. 9, 1989	18.45	7,130
1990	May 25, 1990	17.96	6,720
	July 20, 1990	18.71	7,350
1991	Apr. 18, 1991	16.70	5,480
	(Gage discontinued September 30, 1991.)		
1992	Sept. 15, 1992	[l,m]28.69	[n]76,200

[b]Approximate.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.
[k]Greatest since at least 1919.
[l]Gage height determined from floodmarks.
[m]Gage height affected by backwater.
[n]Discharge estimated by drainage-area ratio transfer of discharge computed from indirect measurement of September 15, 1992, flood at State Highway 2 bridge crossing Weldon River.

06903400 Chariton River near Chariton, Iowa

Location.--Lat 40°57'12", long 93°15'37", in SW1/4 NE1/4 sec. 15, T.71 N., R.21 W., Lucas County, Hydrologic Unit 10280201, on right bank 15 ft downstream from bridge on County Road S43, 0.4 mi downstream from Wolf Creek, and 5.0 mi southeast of Chariton.

Drainage area.--182 mi^2.

Gage.--Water-stage recorder. Datum of gage is 917.90 ft above sea level (U.S. Army Corps of Engineers bench mark).

Stage-discharge relation.--Defined by current-meter and indirect measurements.

Flood stage.--15 ft.

Remarks.--Base for partial-duration series, 1,600 ft^3/s. Prior to Oct. 1, 1981, base for partial-duration series was 1,200 ft^3/s.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1947	June 5, 1947	[1]21.65	11,000
1960	March 1960	[b]23.0	[b]15,000
	(Systematic operation of gage began October 1, 1965.)		
1966	Feb. 9, 1966	15.90	1,360
1967	June 10, 1967	16.82	1,670
	June 14, 1967	18.08	2,820
	June 21, 1967	19.53	4,930
1968	Apr. 23, 1968	19.90	5,660
1969	Apr. 27, 1969	16.26	1,360
	July 10, 1969	16.21	1,340
	July 13, 1969	16.77	1,640
	July 21, 1969	16.32	1,390
1970	Apr. 19, 1970	16.61	1,550
	May 15, 1970	17.44	2,120
	Aug. 8, 1970	20.15	6,320
	Sept. 17, 1970	18.29	3,230
1971	Oct. 9, 1970	17.28	2,080
	Feb. 19, 1971	[e]17.60	--
1972	May 8, 1972	16.32	1,390
	Sept. 13, 1972	17.29	1,990
	Sept. 14, 1972	18.08	2,820

06903400 Chariton River near Chariton, Iowa

Peak stage and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1973	Feb. 2, 1973	17.63	2,290
	Mar. 7, 1973	16.20	1,330
	Mar. 11, 1973	16.49	1,470
	Mar. 26, 1973	16.89	1,710
	Apr. 1, 1973	17.22	1,940
	Apr. 16, 1973	18.02	2,740
	May 2, 1973	17.01	1,790
	May 7, 1973	16.44	1,470
	May 27, 1973	17.30	2,080
	June 19, 1973	17.58	2,240
	July 4, 1973	16.12	1,290
	Aug. 12, 1973	16.46	1,460
	Sept. 25, 1973	16.81	1,670
	Sept. 28, 1973	16.03	1,250
1974	Oct. 3, 1973	15.98	1,230
	Oct. 12, 1973	20.20	6,300
	Dec. 5, 1973	15.95	1,220
	Jan. 27, 1974	17.55	2,220
	Apr. 21, 1974	16.85	1,750
	May 18, 1974	16.03	1,250
	June 9, 1974	17.89	2,590
	June 13, 1974	16.82	1,770
1975	Mar. 18, 1975	16.27	1,360
	June 28, 1975	16.82	1,670
1976	Apr. 21, 1976	17.17	1,430
	Apr. 25, 1976	18.59	2,490
	June 14, 1976	20.35	5,460
1977	Aug. 27, 1977	17.27	1,490
1978	Oct. 24, 1977	19.34	3,520
	Oct. 31, 1977	17.28	1,500
	Mar. 22, 1978	17.48	1,300
	Apr. 10, 1978	18.22	3,340
	Apr. 18, 1978	17.66	1,730
	May 7, 1978	17.51	1,830
	May 13, 1978	17.43	1,770
	Sept. 21, 1978	19.79	3,660
1979	Mar. 4, 1979	[e]18.24	1,600
	Mar. 24, 1979	17.75	1,890
	May 3, 1979	17.09	1,540
1980	June 2, 1980	20.84	7,000
	June 4, 1980	20.31	5,380
	Sept. 1, 1980	16.70	1,210

06903400 Chariton River near Chariton, Iowa

Peak stage and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1981	Apr. 14, 1981	16.86	1,580
	June 8, 1981	18.47	2,800
	June 15, 1981	19.36	3,890
	July 4, 1981	23.14	16,600
(October 1, 1981, base for partial-duration series changed from 1,200 ft^3/s to 1,600 ft^3/s.)			
1982	Mar. 19, 1982	18.54	2,880
	Apr. 17, 1982	17.83	2,220
	May 7, 1982	17.55	2,020
	May 21, 1982	17.55	2,020
	May 29, 1982	17.33	1,900
	July 3, 1982	18.97	3,360
	July 16, 1982	19.85	4,650
	Aug. 30, 1982	18.02	2,370
1983	Oct. 9, 1982	20.74	6,530
	Dec. 6, 1982	17.55	2,010
	Dec. 28, 1982	16.82	1,630
	Apr. 2, 1983	17.73	2,420
1984	Apr. 12, 1984	16.34	1,630
	Apr. 22, 1984	16.58	1,740
	Apr. 30, 1984	17.07	1,970
	June 8, 1984	17.17	1,780
	June 10, 1984	17.16	1,730
	June 15, 1984	16.73	1,620
1985	Mar. 4, 1985	16.67	1,730
	July 31, 1985	19.01	5,120
1986	Oct. 10, 1985	17.40	2,030
	May 11, 1986	16.71	1,720
	May 17, 1986	19.04	3,460
	Aug. 16, 1986	16.38	1,610
	Sept. 19, 1986	18.23	2,590
	Sept. 29, 1986	16.70	1,720
1987	Oct. 12, 1986	16.95	2,250
	Apr. 15, 1987	16.55	2,020
	May 4, 1987	16.14	1,700
	July 12, 1987	16.30	1,780
	Aug. 26, 1987	19.62	6,720
	Sept. 17, 1987	16.60	1,970
1988	Nov. 29, 1987	16.40	1,840
1989	Sept. 9, 1989	15.01	1,200
1990	Apr. 28, 1990	16.35	1,890
	May 5, 1990	16.35	1,890
	May 25, 1990	18.31	3,730
	June 17, 1990	16.75	2,120
	July 22, 1990	17.84	3,080

06903400 Chariton River near Chariton, Iowa

Peak stage and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1991	Apr. 14, 1991	17.21	2,360
	Apr. 19, 1991	19.07	6,010
	Apr. 27, 1991	17.33	3,320
	Apr. 29, 1991	18.04	4,180
	May 5, 1991	17.29	3,280
1992	Apr. 19, 1992	17.64	2,960
	July 26, 1992	16.99	2,280
	July 31, 1992	17.00	2,290
	Aug. 1, 1992	16.26	1,760
	Sept. 15, 1992	[l]29.32	[f]37,700
1993	Nov. 20, 1992	16.73	2,070
	Dec. 15, 1992	16.92	2,220
	Mar. 3, 1993	17.49	2,790
	Mar. 31, 1993	17.16	2,440
	May 7, 1993	17.09	2,380
	July 5, 1993	22.60	14,900
	July 11, 1993	18.08	3,500
	July 15, 1993	16.53	1,920
	July 24, 1993	17.72	3,050
	Aug. 19, 1993	16.67	2,030
	Sept. 26, 1993	16.19	1,710
1994	Mar. 5, 1994	16.10	1,660
1995	Apr. 11, 1995	16.07	1,880
	May 8, 1995	18.22	4,120
	May 13, 1995	17.62	3,410
	May 24, 1995	17.37	3,100
	May 28, 1995	17.57	3,350
	June 29, 1995	16.14	1,920
	July 5, 1995	16.10	1,890

[b]Approximate.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.
[l]Gage height determined from floodmarks.

06903500 Honey Creek near Russell, Iowa

(Discontinued September 30, 1962)

Location.--Lat 40°55'25", long 93°07'55", in SW1/4 NW1/4 sec. 26, T.71 N., R.20 W., Lucas County, on left bank 15 ft downstream from county road bridge, 0.7 mi upstream from mouth, and 5.5 mi southeast of Russell.

Drainage area.--13.2 mi^2.

Gage.--Water-stage recorder. Datum of gage is 901.73 ft above sea level (levels by Soil Conservation Service).

Stage-discharge relation.--Defined by current meter measurements and above 640 ft^3/s by indirect measurements.

Remarks.--Base for partial-duration series, 250 ft^3/s.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
	(Systematic operation of gage began in June 1952.)		
1952	June 21, 1952	9.86	586
1953	Feb. 20, 1953	7.12	250
	Mar. 30, 1953	8.37	388
	June 10, 1953	7.32	265
1954	Apr. 26, 1954	7.10	245
1955	Feb. 19, 1955	6.27	170
1956	July 31, 1956	7.34	265
1957	Apr. 22, 1957	7.17	263
	May 21, 1957	7.11	254
1958	Feb. 24, 1958	7.20	273
	July 2, 1958	8.86	638
	July 4, 1958	8.32	418
	July 30, 1958	8.84	394
	Sept. 23, 1958	7.12	264
1959	Mar. 19, 1959	[e]8.19	[b]470
	Mar. 26, 1959	[e]7.97	[b]400
	Apr. 1, 1959	8.48	669
	Apr. 20, 1959	[m]8.40	[b]450
	Apr. 27, 1959	7.26	296
	May 21, 1959	11.26	[f]4,100
	May 30, 1959	8.89	645
	Sept. 27, 1959	7.06	270
1960	Dec. 28, 1959	[m]7.49	[b]260
	Jan. 12, 1960	8.51	669
	Mar. 28, 1960	9.16	1,080
	Apr. 16, 1960	8.92	900
	May 6, 1960	9.33	1,260
	May 16, 1960	[m]7.57	[b]1,000
	May 20, 1960	7.51	340
	May 24, 1960	7.28	303

06903500 Honey Creek near Russell, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1961	Feb. 18, 1961	[m]8.30	[b]450
	Mar. 6, 1961	9.51	1,390
	Mar. 13, 1961	[m]8.58	[b]450
	Mar. 27, 1961	7.97	448
	Sept. 13, 1961	[m]9.88	[b]1,000
	Sept. 30, 1961	[m]8.00	[b]400
1962	Nov. 2, 1961	[m]9.66	[b]1,000
	Nov. 13, 1961	7.68	382
	Nov. 16, 1961	9.55	[b]1,100
	May 29, 1962	[m]8.18	[b]300
	June 11, 1962	7.27	296

[b]Approximate.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.
[m]Gage height affected by backwater.

06903700 South Fork Chariton River near Promise City, Iowa

Location.--Lat 40°48'02", long 93°11'32", in SW1/4 SW1/4 sec. 5, T.69 N., R.20 W., Wayne County, Hydrologic Unit 10280201, on right bank 20 ft downstream from bridge on County Road S50, 1.3 mi downstream from Jordan Creek, and 4.3 mi northwest of Promise City.

Drainage area.--168 mi^2.

Gage.--Water-stage recorder. Datum of gage is 913.70 ft above sea level (U.S. Army Corps of Engineers bench mark).

Stage-discharge relation.--Defined by current-meter and indirect measurements.

Flood-stage.--18 ft.

Remarks.--Base for partial-duration series, 2,000 ft^3/s.

Peak stages and discharges

[Water year, October 1-September 30; ft, feet above gage datum; ft^3/s, cubic feet per second; --, not determined]

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1965	Sept. 21, 1965	[1]25.5	[b]18,000
1968	Apr. 20, 1968	14.60	2,710
	Apr. 23, 1968	20.96	6,950
1969	Jan. 16, 1969	[e]15.05	[b]1,900
	Apr. 27, 1969	14.29	2,600
	July 13, 1969	13.81	2,290
1970	Apr. 18, 1970	13.69	2,250
	May 14, 1970	19.12	4,280
	Aug. 8, 1970	21.32	7,660
	Sept. 17, 1970	20.44	6,160
	Sept. 22, 1970	18.61	4,420
	Sept. 24, 1970	14.53	2,690
1971	Oct. 9, 1970	20.98	6,970
	Feb. 18, 1971	[e]18.93	[b]3,300
	Feb. 26, 1971	[e]14.90	[b]2,300
	Mar. 11, 1971	12.38	2,010
1972	Sept. 14, 1972	17.68	3,930
1973	Dec. 29, 1972	--	[b]3,000
	Jan. 17, 1973	--	[b]2,600
	Feb. 2, 1973	18.73	4,500
	Mar. 7, 1973	14.60	2,710
	Mar. 11, 1973	13.97	2,490
	Mar. 25, 1973	18.41	4,300
	Mar. 31, 1973	19.14	4,810
	Apr. 12, 1973	14.82	2,800
	Apr. 16, 1973	19.21	4,870
	Apr. 21, 1973	12.78	2,130
	May 2, 1973	18.81	4,560
	May 7, 1973	14.82	2,790
	May 27, 1973	18.20	4,170
	June 18, 1973	13.25	2,280

06903700 South Fork Chariton River near Promise City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1974	Oct. 3, 1973	15.13	2,900
	Oct. 12, 1973	19.35	4,980
	Dec. 4, 1973	12.49	2,030
	Jan. 27, 1974	[e]17.72	[b]3,000
	May 31, 1974	15.43	3,000
	June 9, 1974	18.98	4,680
	June 13, 1974	14.34	2,620
	July 4, 1974	16.80	3,540
1975	Apr. 24, 1975	13.06	2,170
	June 28, 1975	20.85	6,580
1976	Mar. 5, 1976	17.88	4,030
	Apr. 24, 1976	20.27	5,930
	May 16, 1976	14.25	2,590
	June 14, 1976	20.29	5,960
1977	Aug. 26, 1977	18.75	4,520
	Sept. 13, 1977	15.27	2,940
1978	Oct. 24, 1977	19.72	5,300
	Oct. 31, 1977	17.08	3,660
	Apr. 10, 1978	21.92	9,700
	Apr. 18, 1978	18.74	4,510
	May 7, 1978	19.78	5,460
	May 13, 1978	18.32	4,250
	Sept. 20, 1978	17.73	3,970
1979	Mar. 4, 1979	[e]19.74	[b]2,900
	Mar. 13, 1979	14.73	2,710
	Mar. 24, 1979	19.18	4,910
	May 3, 1979	16.59	3,480
	June 8, 1979	12.59	2,100
	June 27, 1979	15.40	3,000
1980	June 3, 1980	22.92	11,200
	June 4, 1980	19.61	5,800
	Sept. 1, 1980	21.48	8,550
	Sept. 5, 1980	12.83	2,140
1981	Dec. 8, 1980	18.20	4,190
	Apr. 12, 1981	12.67	2,120
	Apr. 14, 1981	17.58	3,940
	June 8, 1981	16.18	3,290
	July 4, 1981	29.95	28,000
	July 15, 1981	17.38	3,790

06903700 South Fork Chariton River near Promise City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1982	Feb. 20, 1982	[e]--	[b]2,140
	Mar. 16, 1982	14.43	2,510
	Mar. 19, 1982	21.97	9,420
	Apr. 16, 1982	16.37	3,320
	May 6, 1982	14.25	2,450
	May 21, 1982	12.93	2,010
	May 29, 1982	20.27	6,680
	June 9, 1982	12.99	2,030
	July 16, 1982	22.32	10,000
	July 19, 1982	20.24	6,640
	July 21, 1982	17.84	4,050
	Sept. 17, 1982	15.24	2,850
1983	Oct. 9, 1982	[m]20.57	4,380
	Nov. 12, 1982	17.99	4,140
	Dec. 5, 1982	19.39	5,520
	Dec. 28, 1982	17.74	3,970
	Apr. 2, 1983	19.43	5,570
	Apr. 12, 1983	17.99	4,140
1984	Apr. 22, 1984	15.58	2,710
	Apr. 30, 1984	19.21	5,600
	May 20, 1984	16.88	3,290
	June 10, 1984	19.83	6,500
1985	Feb. 21, 1985	[e]18.06	--
	Mar. 4, 1985	16.36	3,040
	Sept. 30, 1985	14.86	2,490
1986	Oct. 10, 1985	20.36	6,850
	Oct. 19, 1985	17.48	3,640
	Apr. 30, 1986	13.24	2,010
	May 10, 1986	17.03	3,370
	May 17, 1986	20.95	7,710
	July 14, 1986	15.25	2,630
	Aug. 13, 1986	14.21	2,320
	Sept. 23, 1986	14.21	2,320
	Sept. 29, 1986	18.32	4,420
1987	Oct. 3, 1986	15.12	2,570
	Oct. 12, 1986	17.85	3,880
	May 3, 1987	13.61	2,130
	July 12, 1987	14.89	2,500
	Aug. 15, 1987	15.17	2,570
	Aug. 26, 1987	18.45	4,490
	Sept. 17, 1987	15.24	2,550
1988	Nov. 28, 1987	15.71	2,770
1989	Sept. 9, 1989	12.40	1,770

06903700 South Fork Chariton River near Promise City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1990	Apr. 28, 1990	16.06	2,800
	May 4, 1990	16.34	2,940
	May 25, 1990	19.51	5,720
	June 17, 1990	20.39	6,890
	June 20, 1990	15.84	2,700
	June 22, 1990	15.51	2,590
	July 20, 1990	19.06	5,130
	July 21, 1990	14.00	2,110
	July 29, 1990	16.42	2,970
1991	Apr. 13, 1991	13.76	2,050
	Apr. 14, 1991	18.19	3,820
	Apr. 19, 1991	20.49	6,470
	Apr. 27, 1991	17.12	3,210
	Apr. 29, 1991	20.70	6,760
	May 5, 1991	19.93	5,740
1992	Apr. 11, 1992	17.20	3,550
	Apr. 19, 1992	20.27	6,850
	Apr. 20, 1992	17.02	3,500
	July 16, 1992	13.44	2,140
	July 19, 1992	14.70	2,480
	July 30, 1992	18.30	4,320
	Sept. 15, 1992	[l]34.84	[f]70,600
	Sept. 18, 1992	17.34	4,150
1993	Nov. 20, 1992	17.01	3,780
	Mar. 2, 1993	17.15	3,440
	Mar. 31, 1993	18.30	4,310
	Apr. 8, 1993	14.12	2,280
	May 7, 1993	19.05	5,160
	June 8, 1993	18.21	4,200
	July 5, 1993	25.09	16,900
	July 8, 1993	15.94	2,870
	July 9, 1993	17.63	3,720
	July 11, 1993	20.76	7,430
	July 13, 1993	13.46	2,090
	July 14, 1993	17.64	3,730
	July 20, 1993	18.20	4,180
	July 22, 1993	18.20	4,180
	July 24, 1993	22.07	9,600
	Sept. 25, 1993	13.57	2,120
1994	Feb. 20, 1994	[e]14.00	--
	June 12, 1994	12.10	1,710

06903700 South Fork Chariton River near Promise City, Iowa

Peak stages and discharges--Continued

Water year	Date	Gage height (ft)	Discharge (ft^3/s)
1995	Apr. 11, 1995	17.52	4,370
	May 8, 1995	19.63	6,650
	May 13, 1995	18.07	4,900
	May 23, 1995	20.39	7,640
	May 28, 1995	19.87	6,960
	June 6, 1995	13.84	2,440
	June 8, 1995	12.77	2,070
	July 5, 1995	19.20	6,130
	July 8, 1995	13.84	2,440

[b]Approximate.
[e]Affected by ice.
[f]Discharge computed from indirect measurement.
[l]Gage height determined from floodmarks.
[m]Gage height affected by backwater.

APPENDIX B

WATER-SURFACE-ELEVATION PROFILES FOR THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

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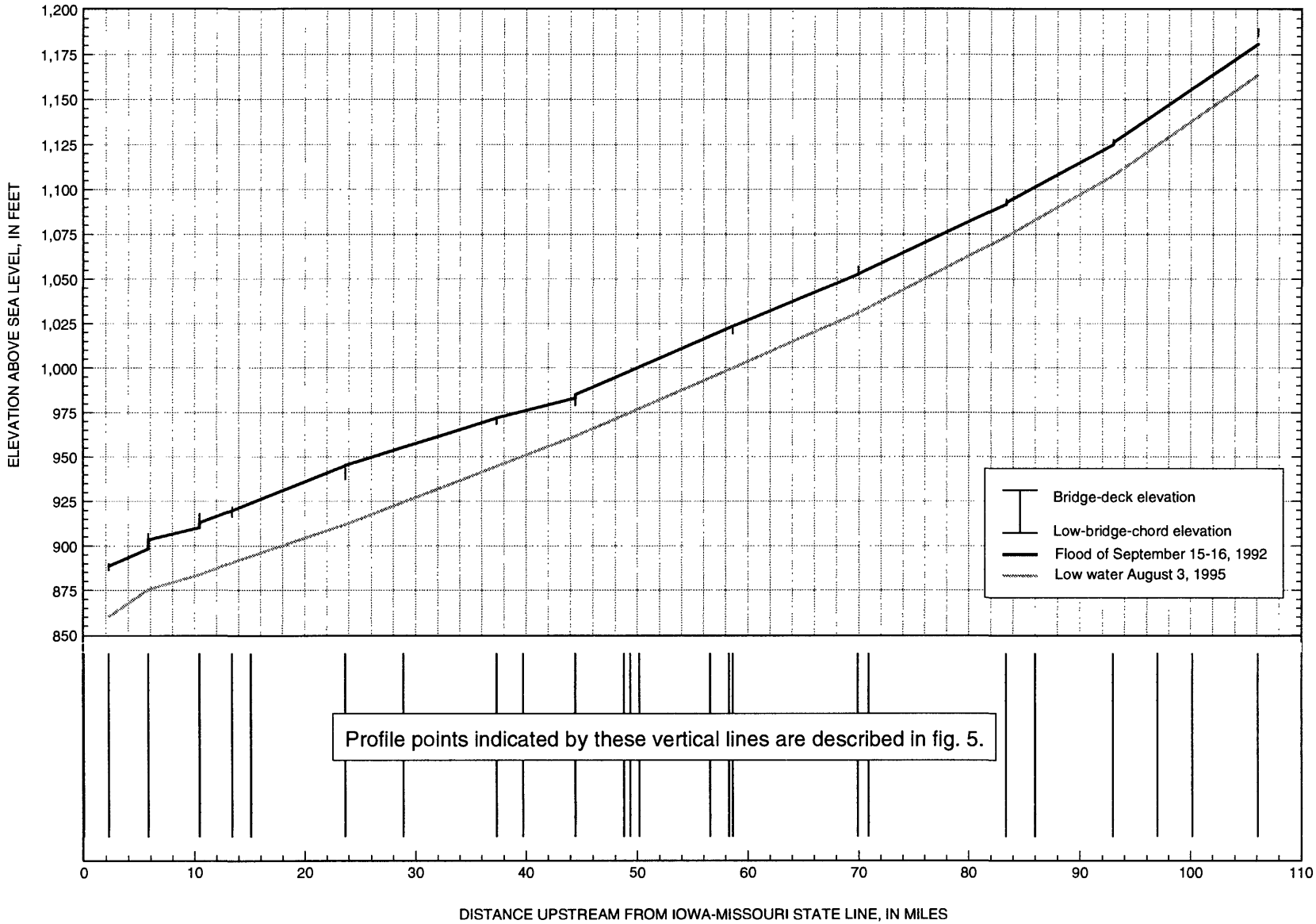

Figure 4. Water-surface-elevation profiles for the Thompson River, river miles 2.24-106.10.

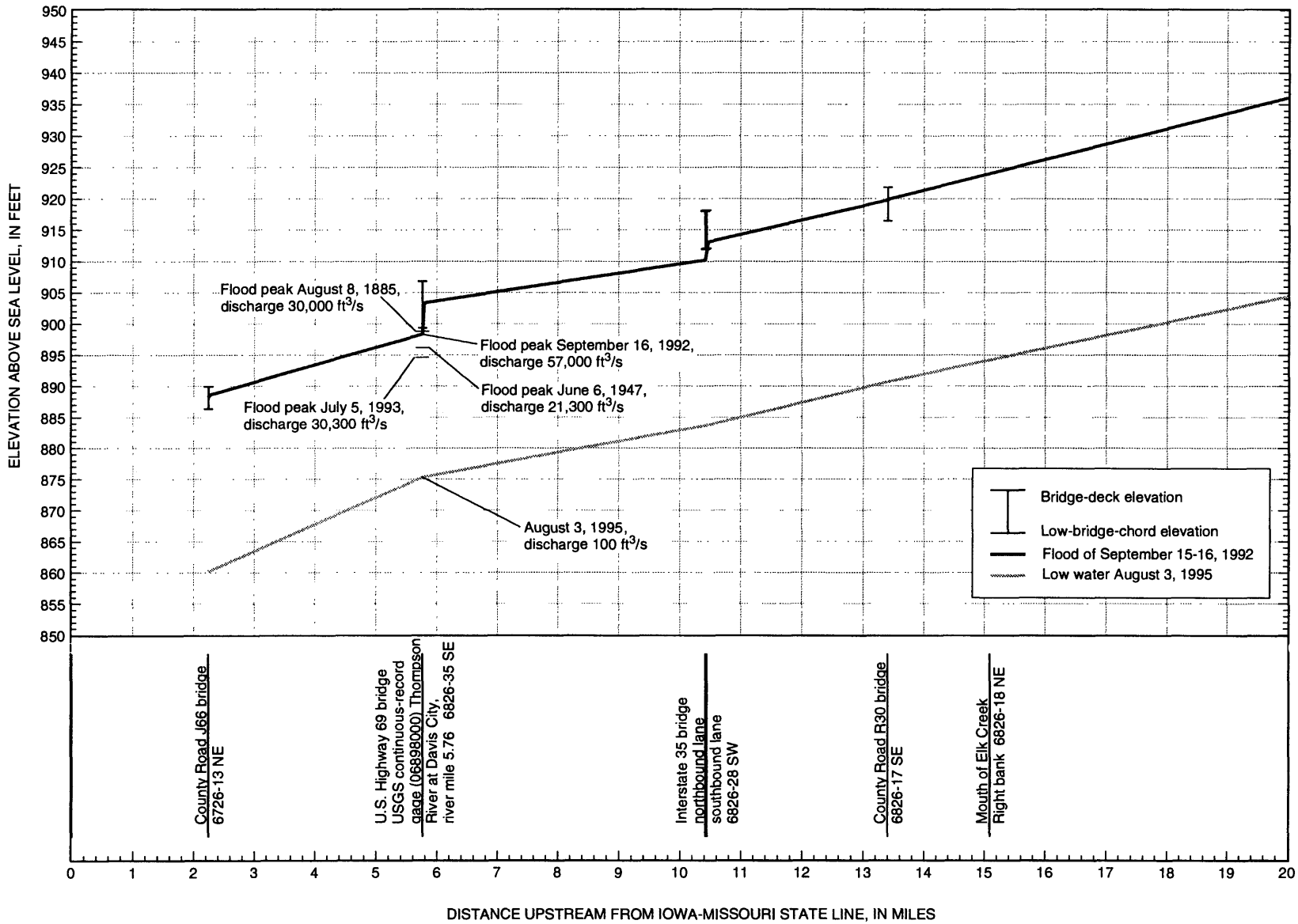

Figure 5A. Water-surface-elevation profiles for the Thompson River, river miles 2.24-20.

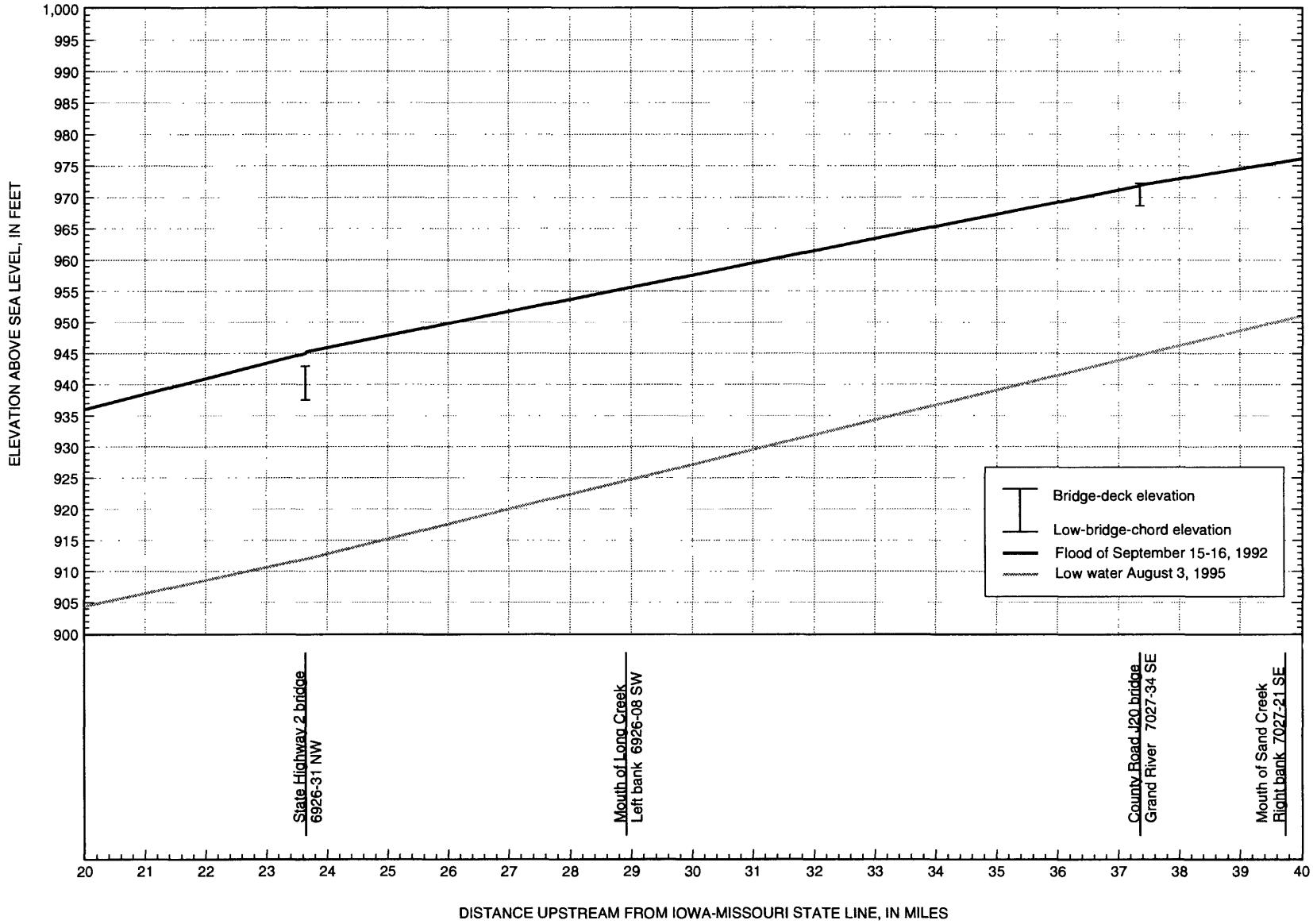

Figure 5B. Water-surface-elevation profiles for the Thompson River, river miles 20-40.

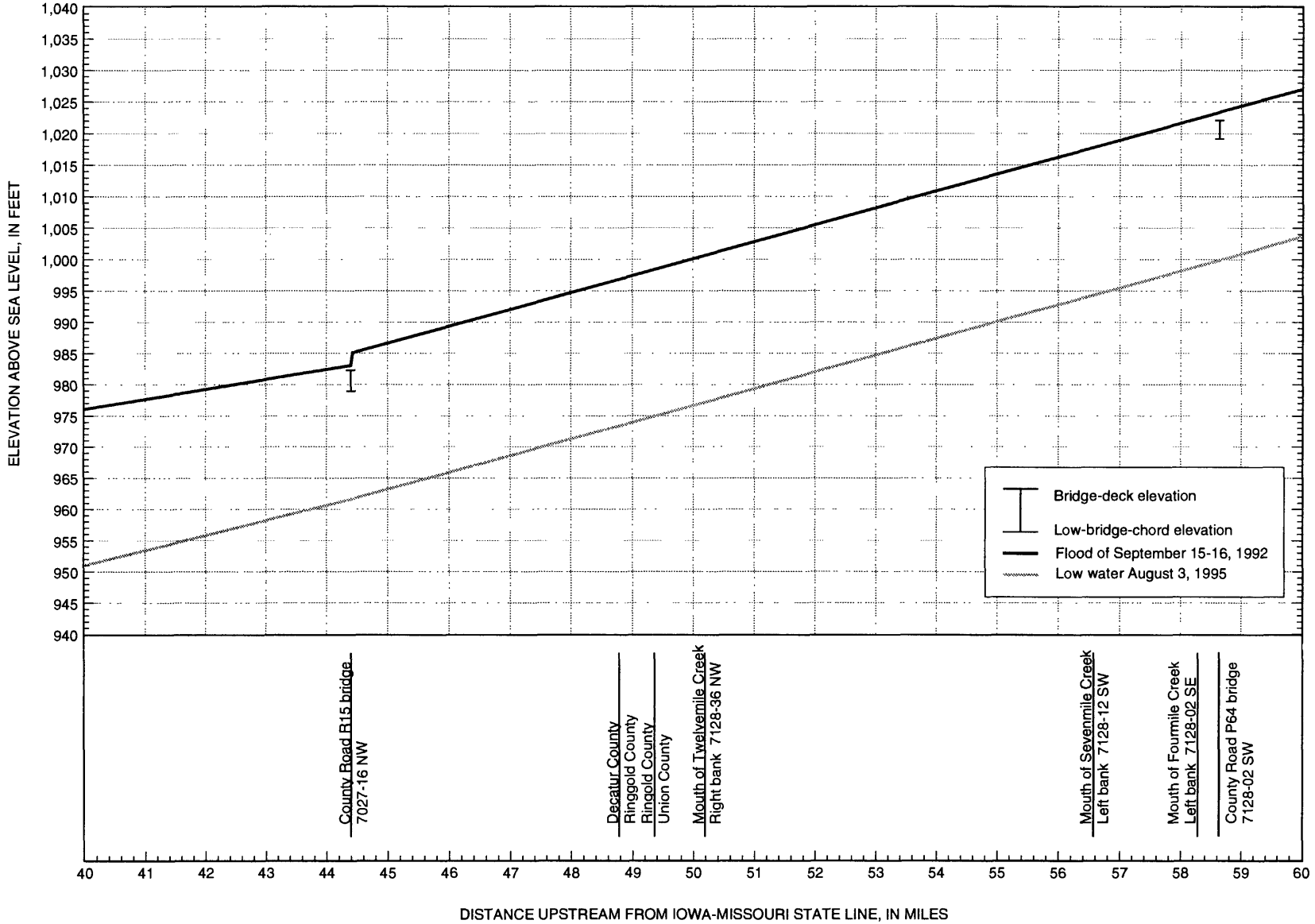

Figure 5C. Water-surface-elevation profiles for the Thompson River, river miles 40-60.

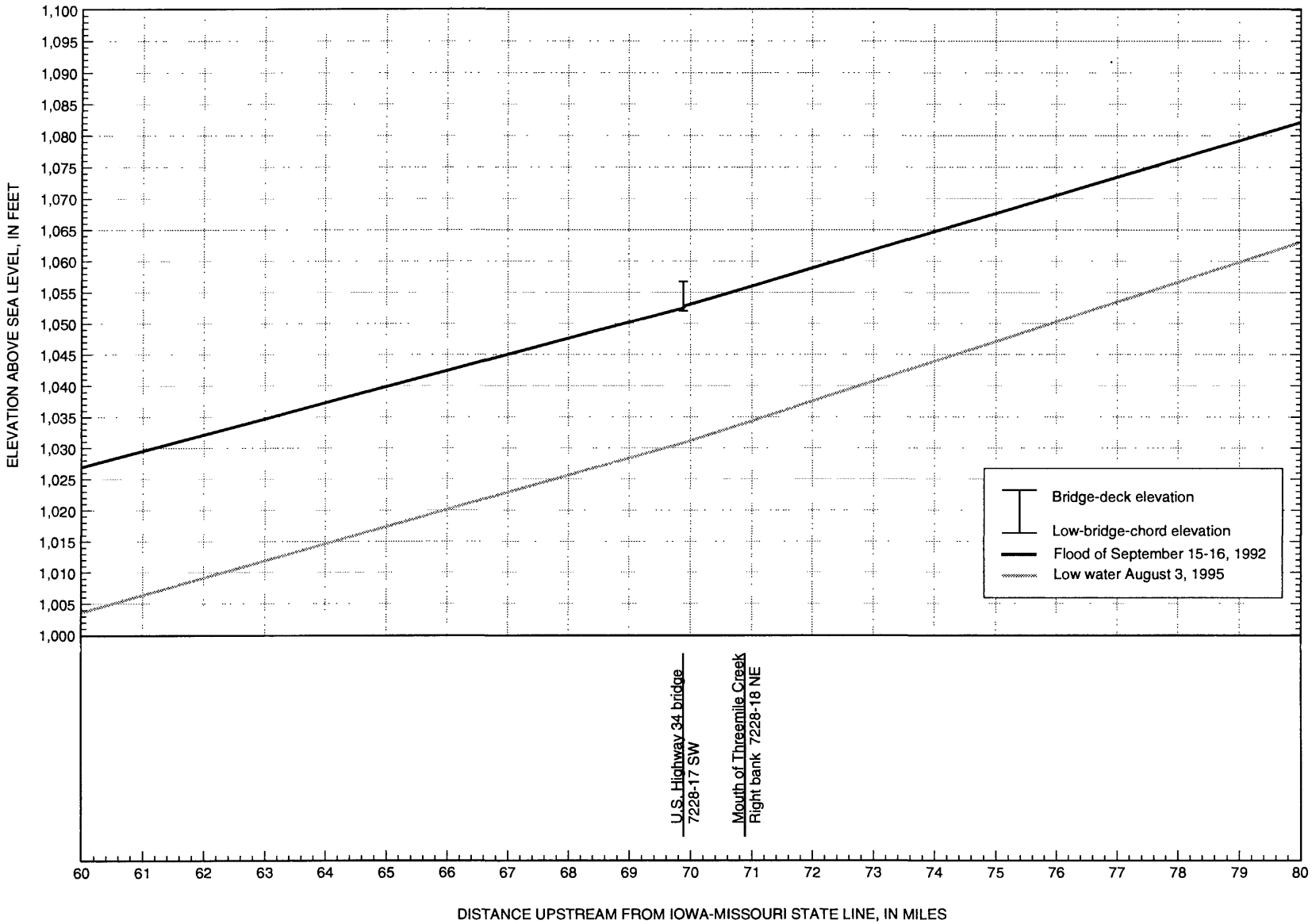

Figure 5D. Water-surface-elevation profiles for the Thompson River, river miles 60-80.

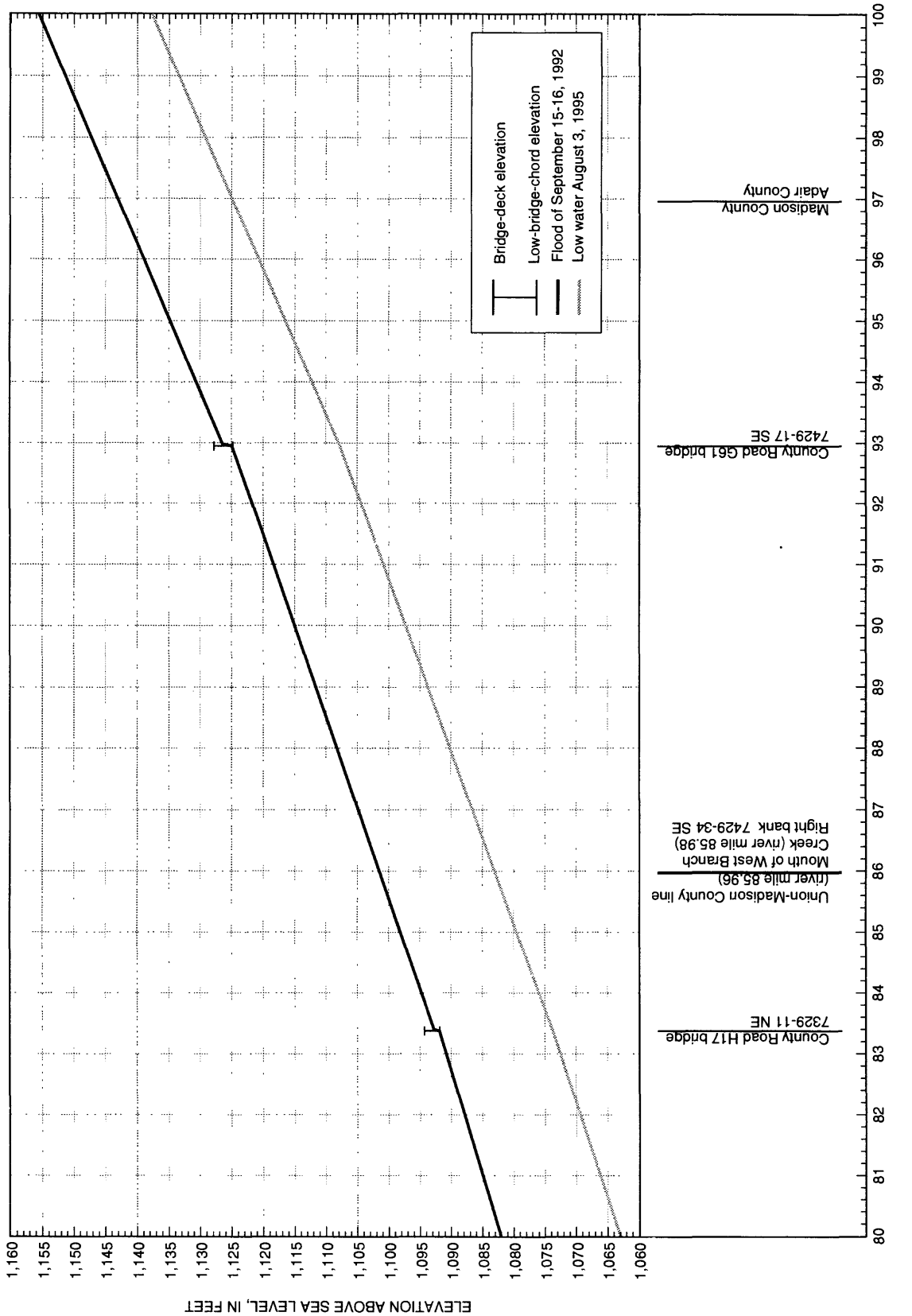

Figure 5E. Water-surface-elevation profiles for the Thompson River, river miles 80-100.

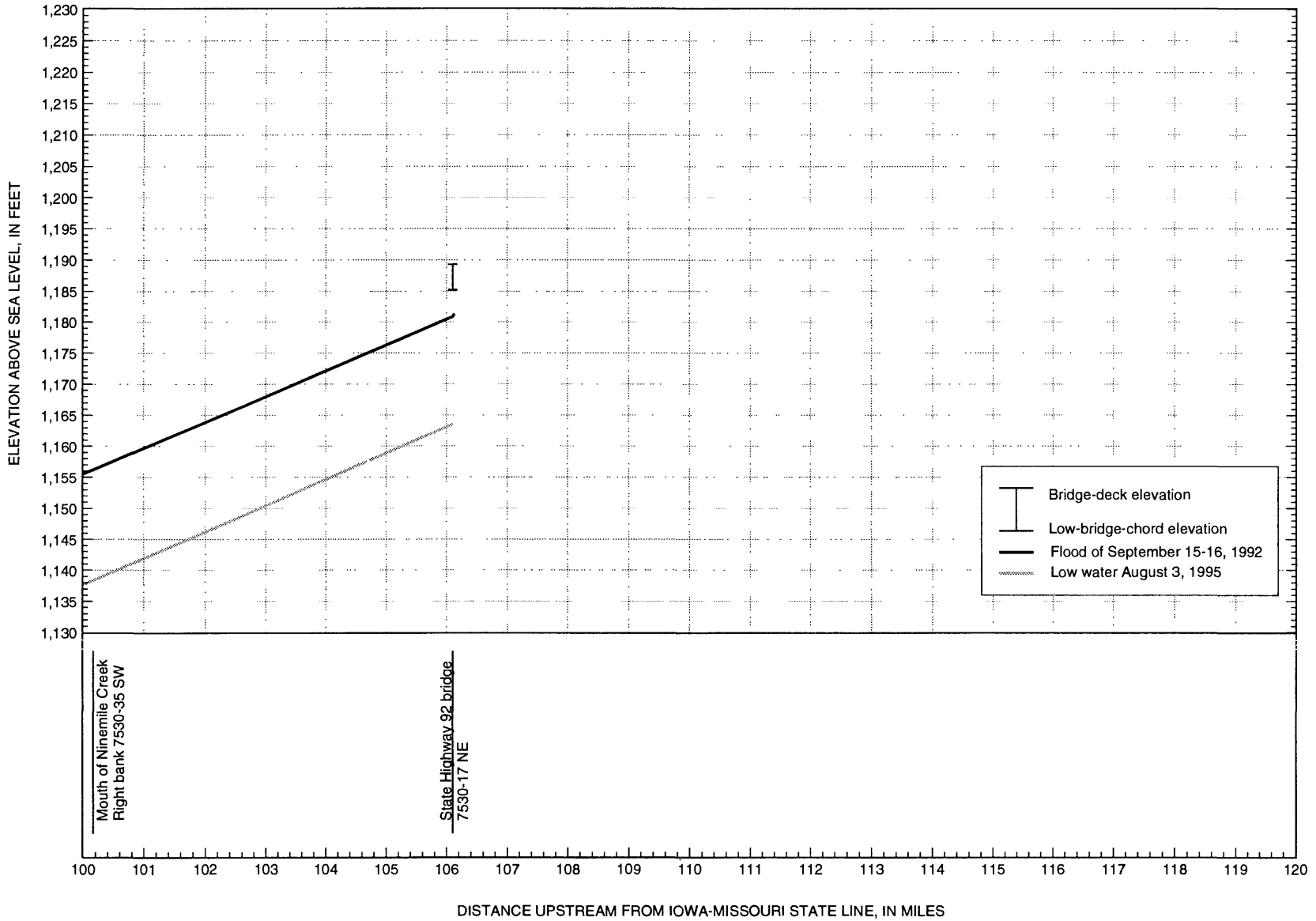

Figure 5F. Water-surface-elevation profiles for the Thompson River, river miles 100-106.10.

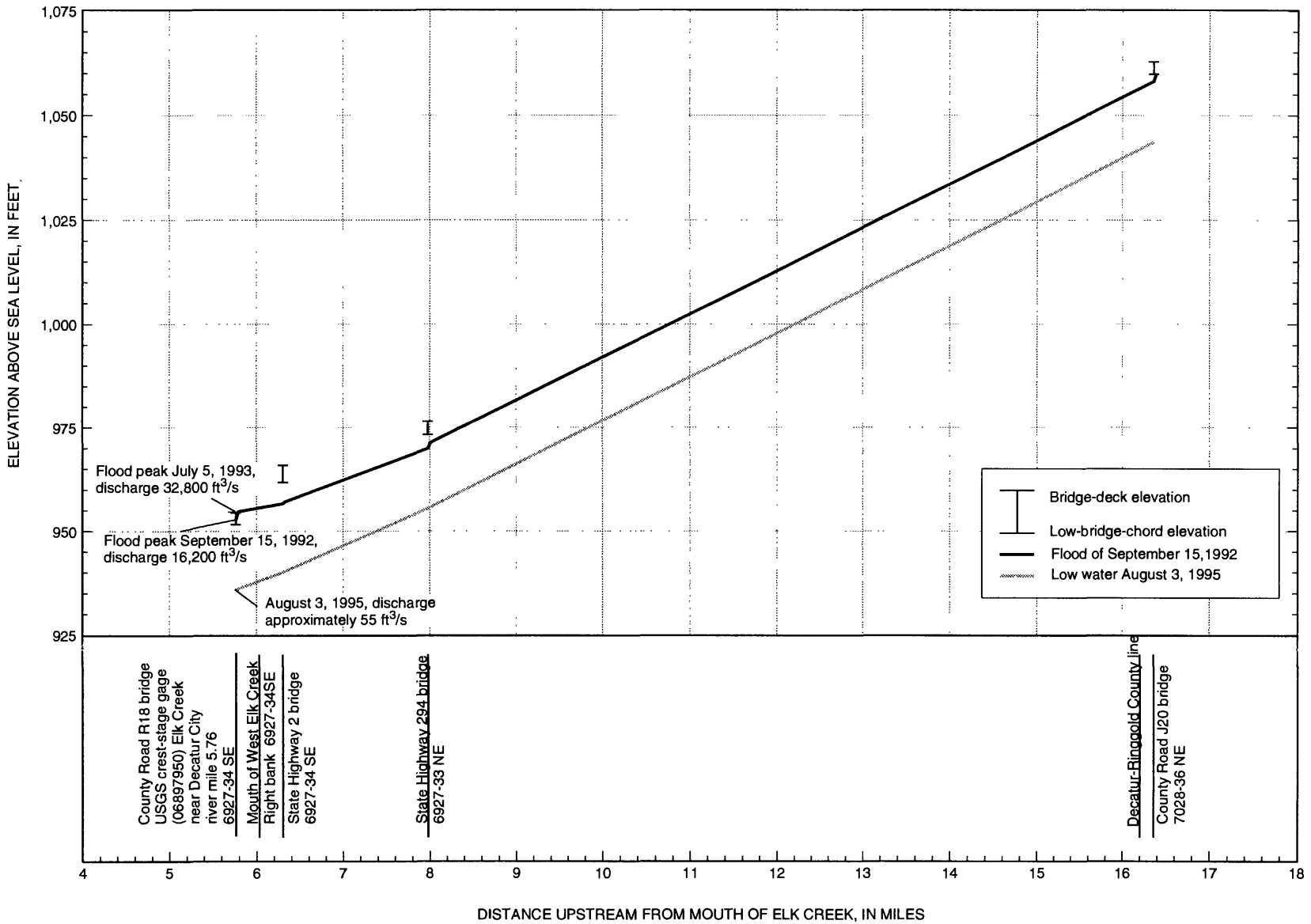

Figure 6. Water-surface-elevation profiles for Elk Creek, river miles 5.76-16.36.

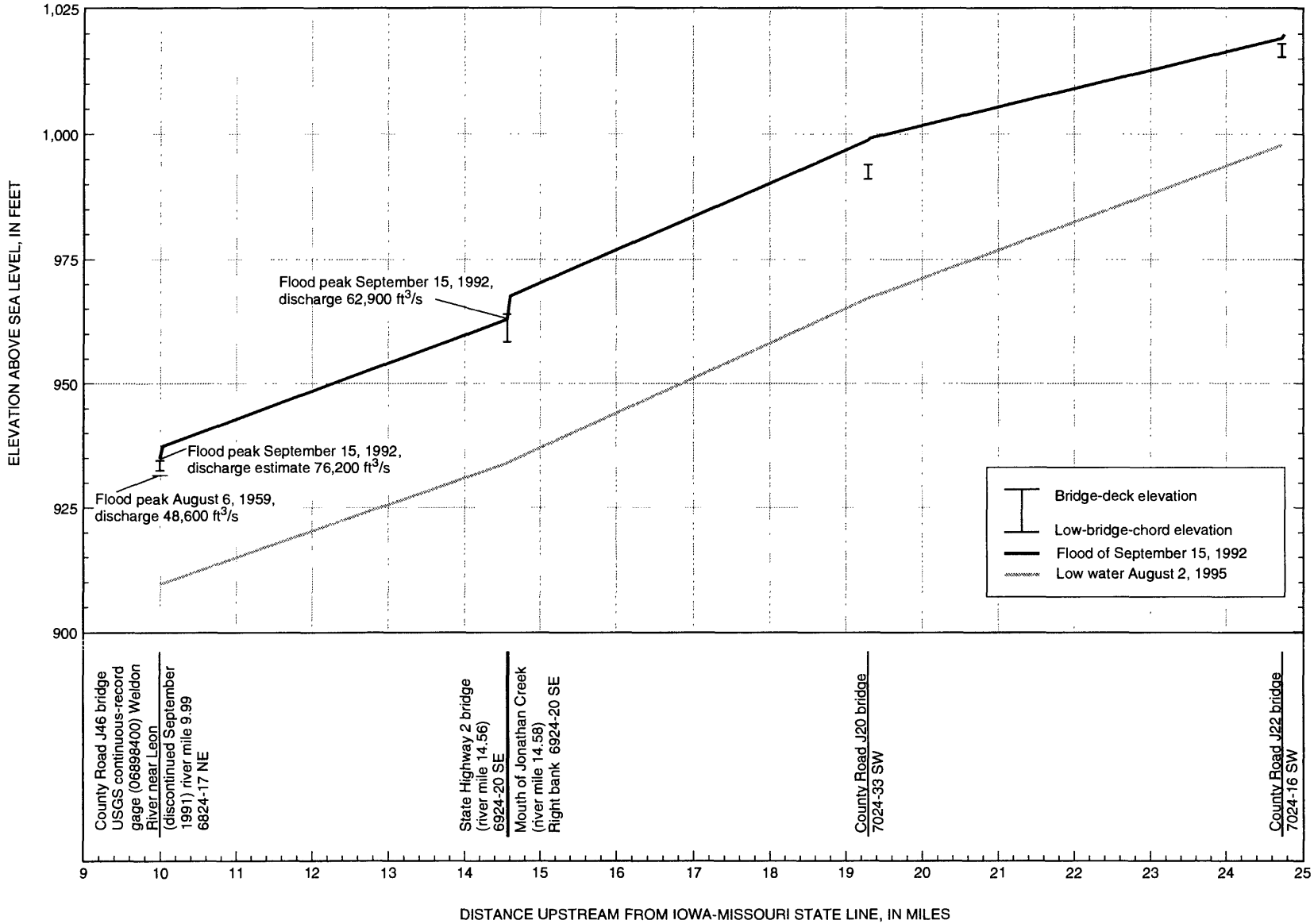

Figure 7. Water-surface-elevation profiles for the Weldon River, river miles 9.99-24.73.

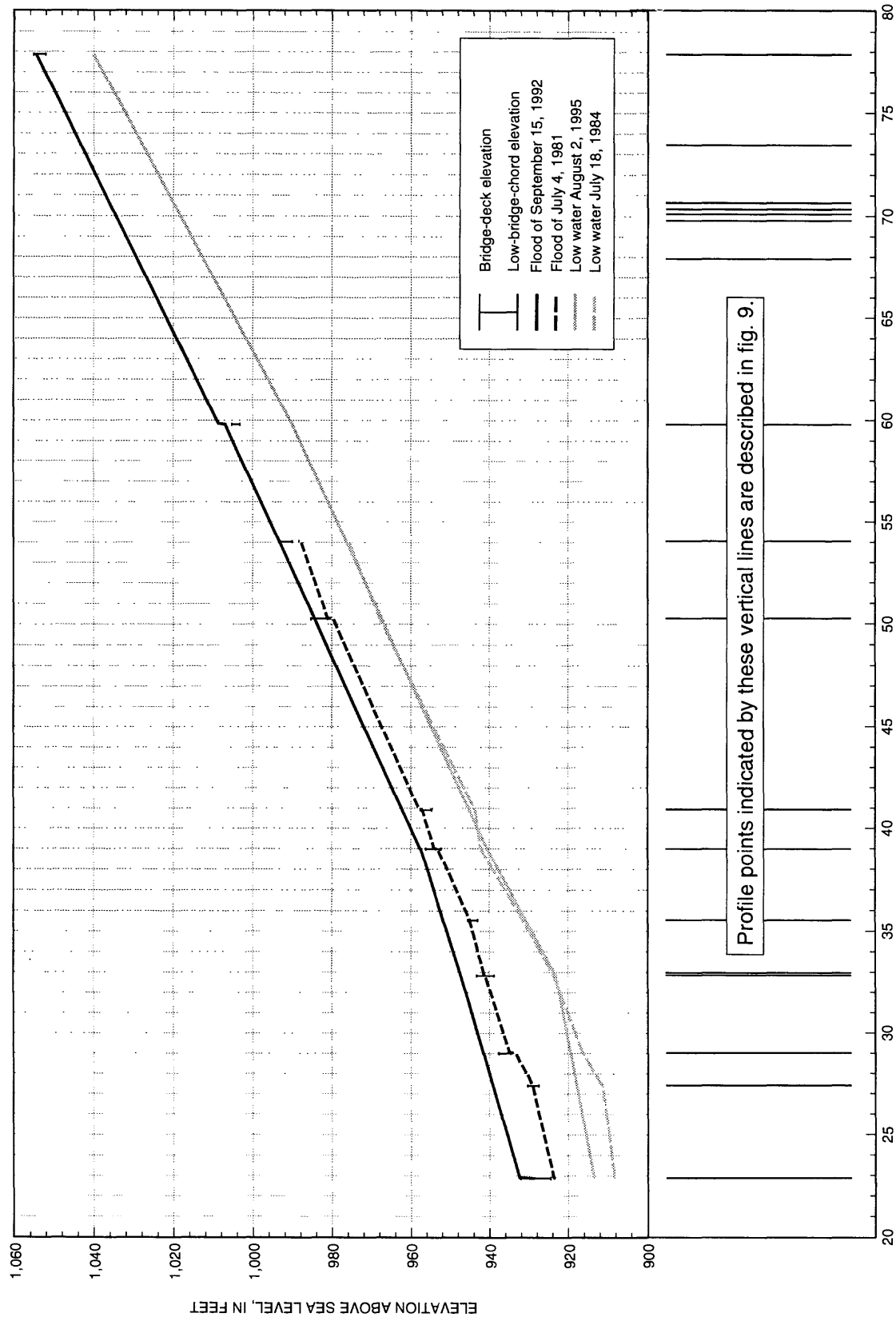

Figure 8. Water-surface-elevation profiles for the Chariton River, river miles 22.86-77.87.

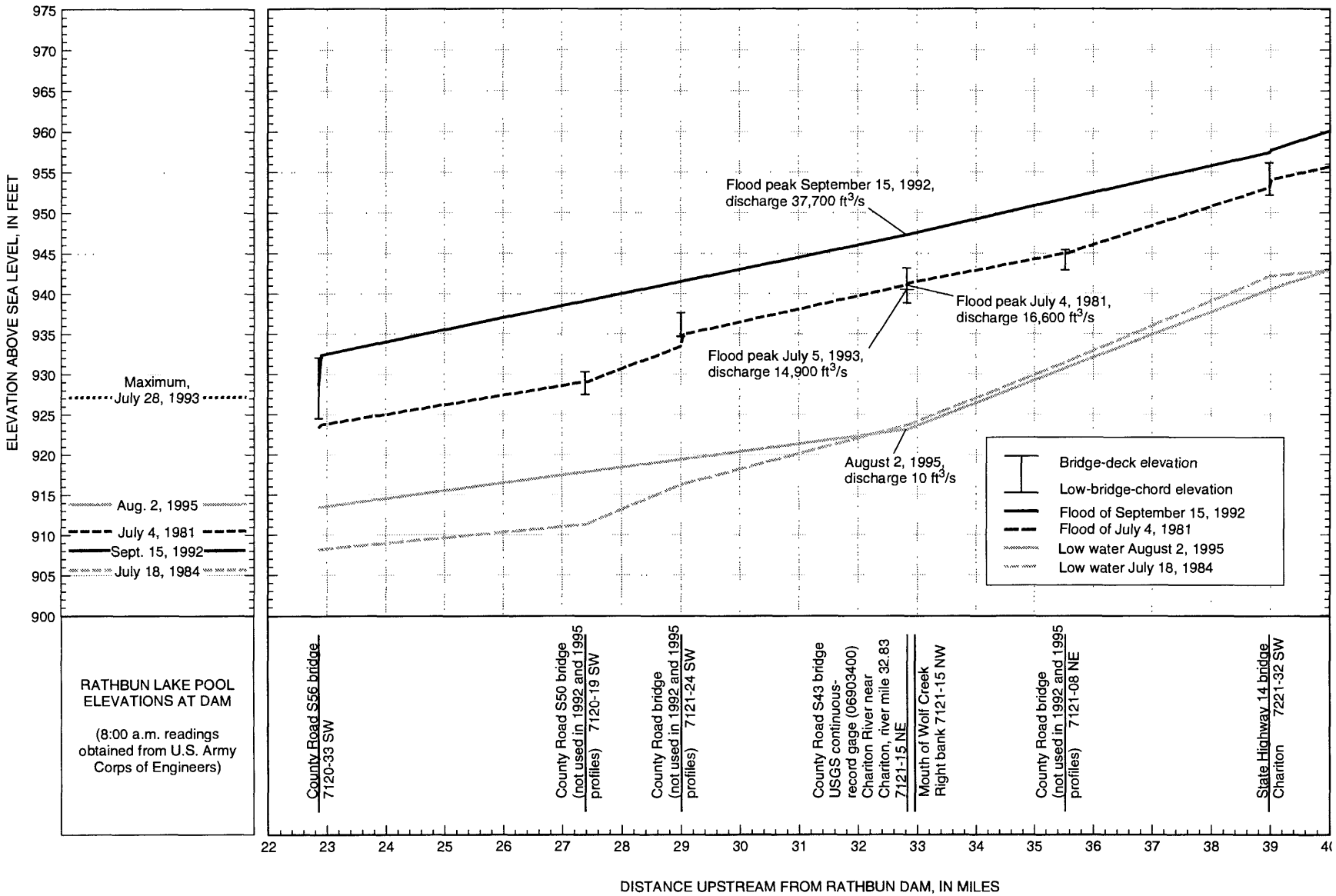

Figure 9A. Water-surface-elevation profiles for the Chariton River, river miles 22.86-40.

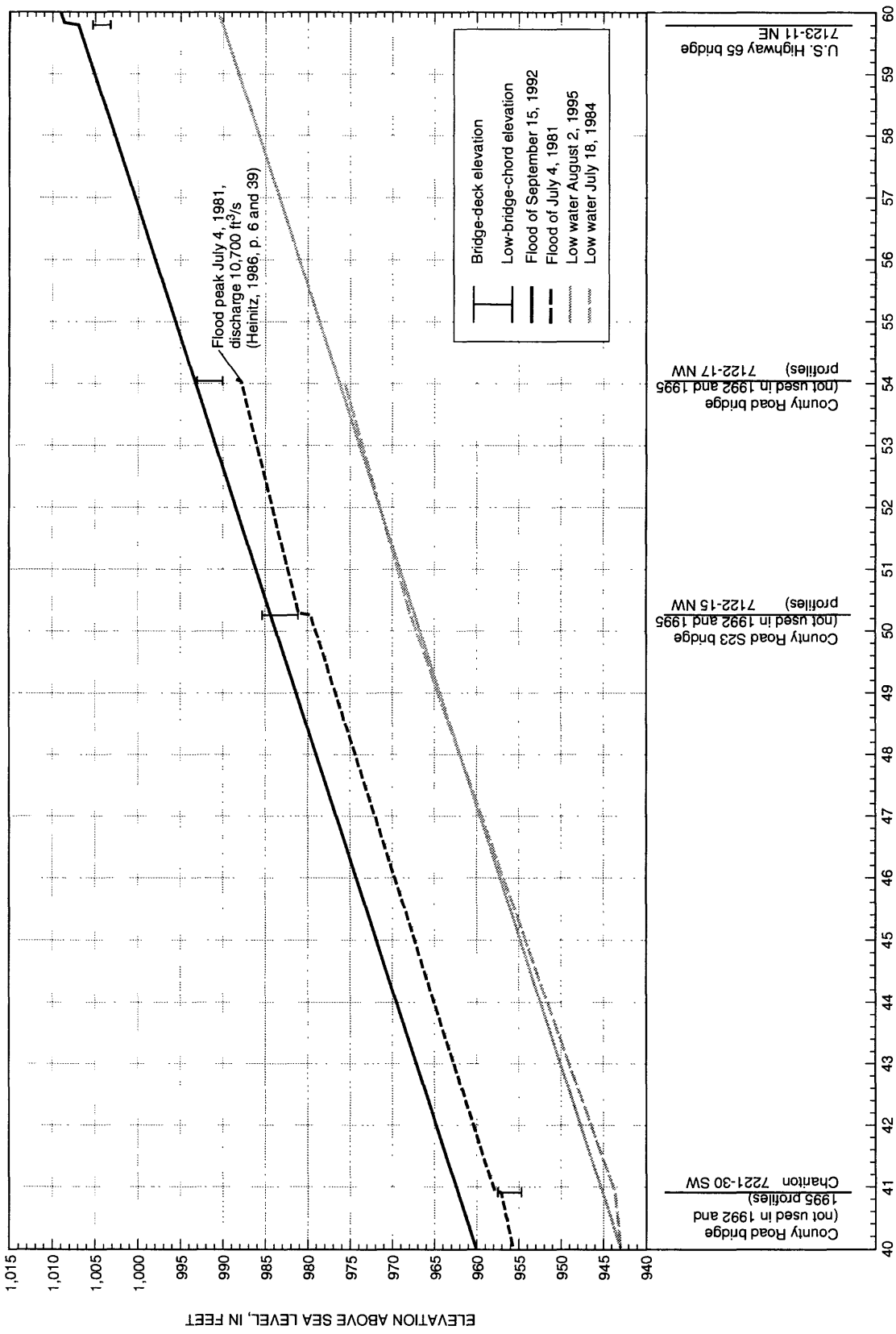

Figure 9B. Water-surface-elevation profiles for the Chariton River, river miles 40-60.

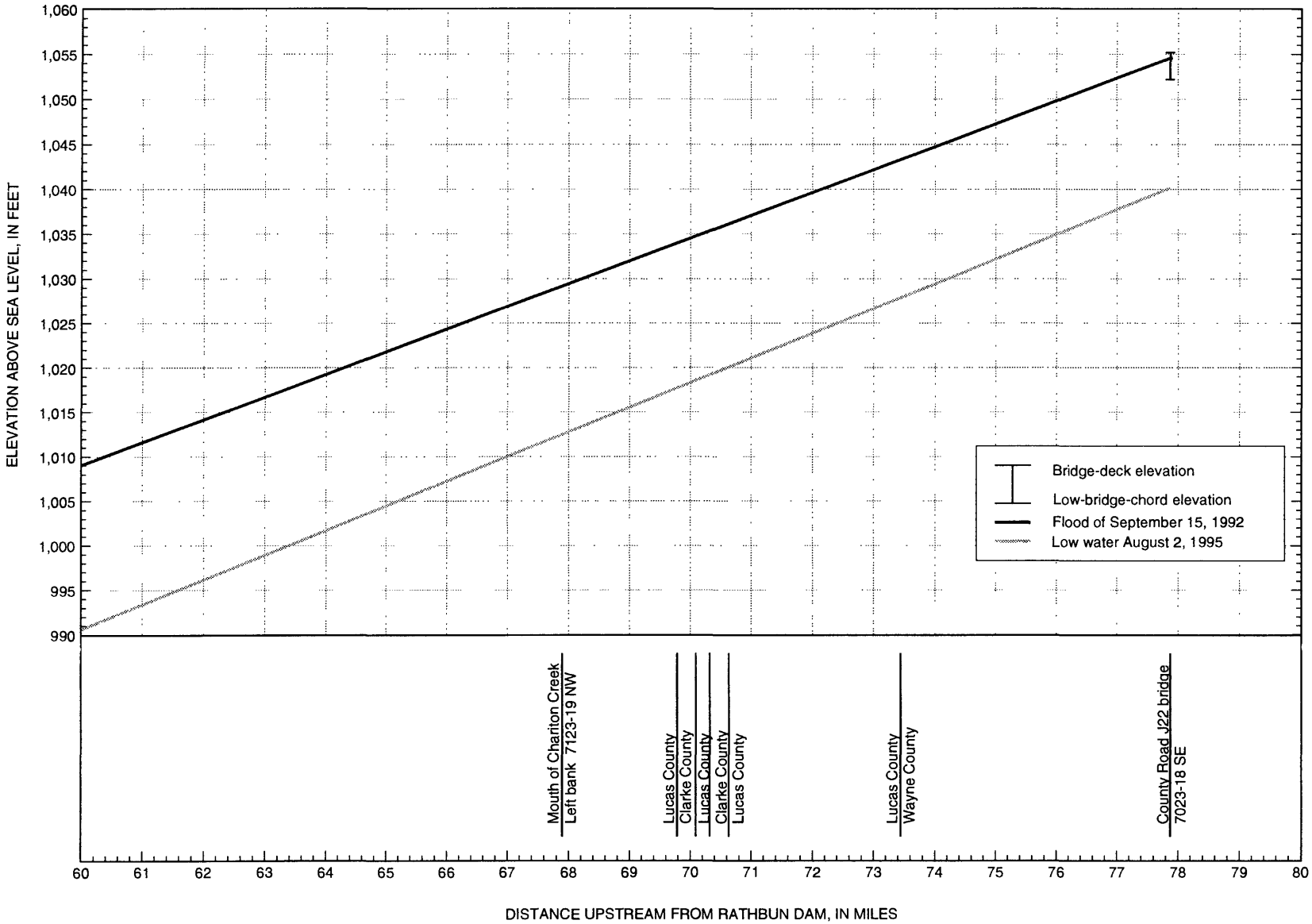

Figure 9C. Water-surface-elevation profiles for the Chariton River, river miles 60-77.87.

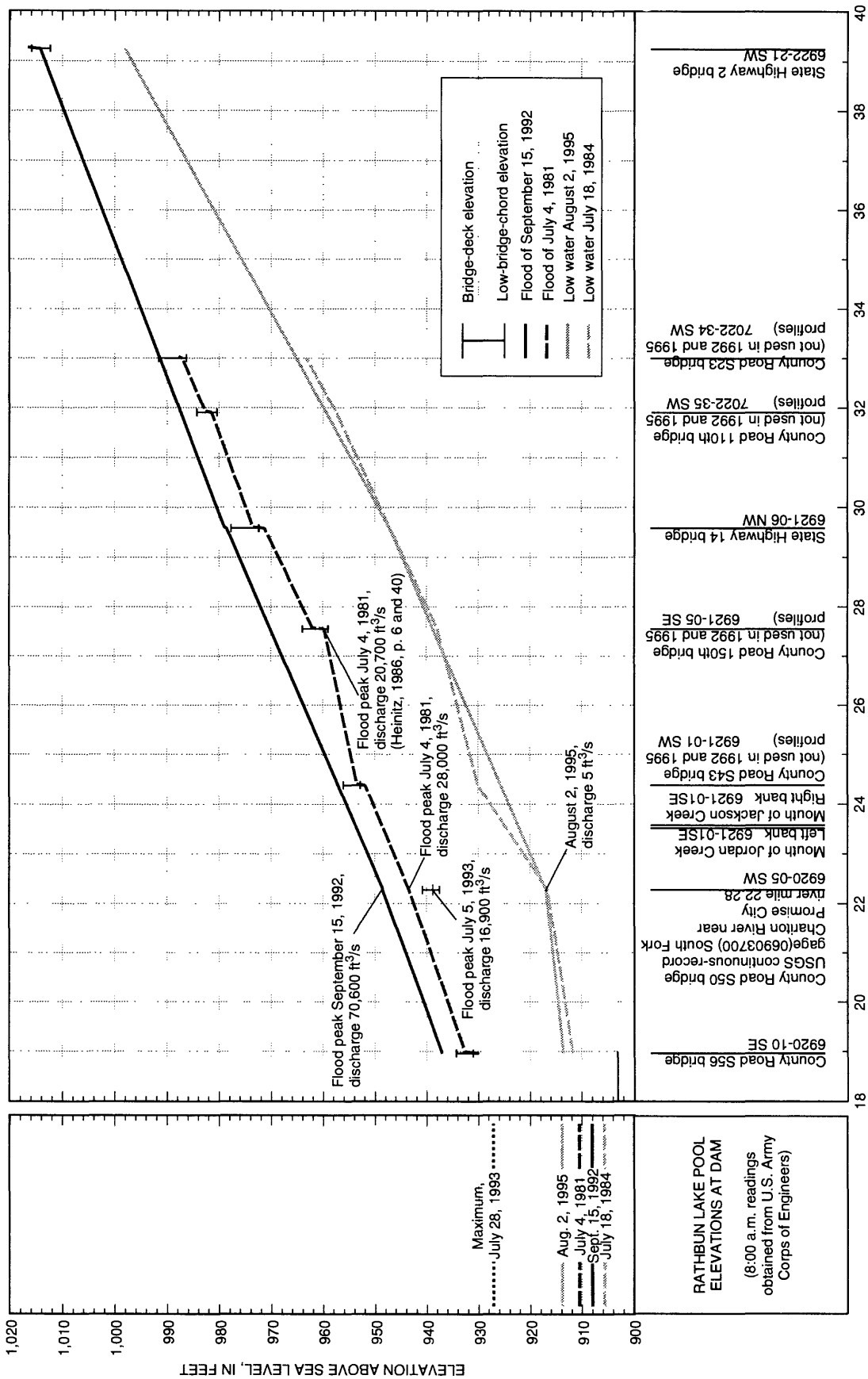

Figure 10. Water-surface-elevation profiles for the South Fork Chariton River, river miles 18.96-39.25.

APPENDIX C

TEMPORARY BENCH MARKS AND REFERENCE POINTS IN THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

To facilitate measuring and referencing the high-water marks used in the flood profiles to a common datum, temporary bench marks (BM) and reference points (RP) were established by the USGS at many of the bridges along the profiled river reaches. All BM and RP elevations listed in this tabulation are referenced to sea level. BMs and RPs are listed only for those bridge sites used in the September 15-16, 1992, flood profiles. The BMs and RPs were established in the Thompson and Weldon River Basins during 1994-95, and in the Chariton River Basin during 1983-84 and 1994-95. BM and RP elevations were determined from differential leveling. Level lines to establish the third-order accuracy of the BMs and RPs shown herein were surveyed from bench marks established and adjusted by the National Mapping Division of the USGS and the National Geodetic Survey. Errors of closure in the USGS level work were adjusted along the level lines to balance the BM and RP elevations. BMs and RPs established by other agencies are noted in the bench-mark descriptions where they occur.

The BMs and RPs are designated by an index number derived from their respective locations using Public Land Survey System coordinates (township, range, section). Within the section, the quarter in which the BM or RP is located is designated by NE, SE, SW, or NW. For example, 6726-13 NE refers to a location in Township 67 North, Range 26 West, northeast quarter of section 13. A number in parentheses following the quarter-section designation indicates the number of the BM or RP in that particular quarter section. The index number serves to describe the landline location of the BM or RP without further reference in the body of the description.

Standard BMs and RPs such as chiseled squares, arrows, or crosses on concrete; filed arrows or marks on steel; or existing bolts on bridges were used. Existing BMs or RPs were used wherever available, and the agency responsible for the mark, when known, is indicated in the description. RPs are distinguished from BMs in this tabulation by the notation "(REFERENCE POINT)" following the index number. RPs were established to permit water-surface elevations to be determined by use of a tape and weight. The terms "right" and "left" in the descriptions are determined as viewed while facing in the downstream direction.

The user is cautioned that the BMs and RPs listed herein might have been disturbed, destroyed, or moved since the surveys were made. It is the responsibility of the user to determine the condition and the suitability of the BM or RP.

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TEMPORARY BENCH MARKS AND REFERENCE POINTS IN THE THOMPSON, WELDON, AND CHARITON RIVER BASINS, SOUTH-CENTRAL IOWA

6726-13 NE (1)--Approximately 2.2 mi southeast of Davis City, on County Road J66 bridge over Thompson River, on right downstream wingwall; top of 3/4-in. bolt.

Elevation 892.08 ft.

6726-13 NE (2)--Approximately 2.2 mi southeast of Davis City, on County Road J66 bridge over Thompson River, on right upstream wingwall; top of 3/4-in. bolt.

Elevation 891.98 ft.

6726-13 NE (3)--(REFERENCE POINT) Approximately 2.2 mi southeast of Davis City, on County Road J66 bridge over Thompson River, on 22nd guardrail post from right downstream end of bridge; two filed marks.

Elevation 892.77 ft.

6826-17 SE (1)--Approximately 4.1 mi northwest of Davis City, on County Road R30 bridge over Thompson River, on left downstream wingwall; Iowa Highway Commission bench mark.

Elevation 924.38 ft.

6826-17 SE (2)--Approximately 4.1 mi northwest of Davis City, on County Road R30 bridge over Thompson River, on right downstream wingwall; chiseled square.

Elevation 925.12 ft.

6826-17 SE (3)--(REFERENCE POINT) Approximately 4.1 mi northwest of Davis City, on County Road R30 bridge over Thompson River, on 23rd guardrail post from left downstream end of bridge; chiseled arrow.

Elevation 924.52 ft.

6826-28 SW (1)--Approximately 2.5 mi northwest of Davis City, on southbound lane of Interstate 35 bridge over Thompson River (upstream bridge), on right downstream wingwall; Iowa Highway Commission bench mark.

Elevation 929.46 ft.

6826-28 SW (2)--Approximately 2.5 mi northwest of Davis City, on northbound lane of Interstate 35 bridge over Thompson River (downstream bridge), on left upstream wingwall; Iowa Highway Commission bench mark.

Elevation 920.31 ft.

6826-28 SW (3)--Approximately 2.5 mi northwest of Davis City, on southbound lane of Interstate 35 bridge over Thompson River (upstream bridge), on left upstream wingwall; chiseled square.

Elevation 920.34 ft.

6826-28 SW (4)--(REFERENCE POINT) Approximately 2.5 mi northwest of Davis City, on southbound lane of Interstate 35 bridge over Thompson River (upstream bridge), on downstream guardrail and 154 ft from left end of bridge; chiseled arrow.

Elevation 921.69 ft.

6826-35 SE (1)--At Davis City, on U.S. Highway 69 bridge over Thompson River, on upstream landward corner of capstone of right upstream concrete pier; U.S. Geological Survey bronze bench mark.

Elevation 901.70 ft.

6826-35 SE (2)--At Davis City, on U.S. Highway 69 bridge over Thompson River, on right downstream concrete pier at end of approach walkway to gage house; U.S. Geological Survey bronze bench mark.

Elevation 901.22 ft.

6920-05 SW (1)--Approximately 4.3 mi northwest of Promise City, near County Road S50 bridge over South Fork Chariton River, set in ground 10 ft north of right downstream abutment, with sign marking location, U.S. Army Corps of Engineers brass bench mark.

Elevation 934.86 ft.

6920-05 SW (2)--Approximately 4.3 mi northwest of Promise City, on County Road S50 bridge over South Fork Chariton River, on streamward side of right downstream wingwall; chiseled square (U.S. Army Corps of Engineers).

Elevation 943.70 ft.

6920-10 SE (1)--Approximately 2.5 mi north of Promise City, on County Road S56 bridge over South Fork Chariton River, on top of first guardrail post from left downstream end of bridge; two filed marks.

Elevation 936.73 ft.

6920-10 SE (2)--Approximately 2.5 mi north of Promise City, on County Road S56 bridge over South Fork Chariton River, on right downstream wingwall; chiseled square.

Elevation 936.78 ft.

6920-10 SE (3)--(REFERENCE POINT) Approximately 2.5 mi north of Promise City, on County Road S56 bridge over South Fork Chariton River, on 20th guardrail post from right downstream end of bridge; filed arrow.

Elevation 936.97 ft.

6921-06 NW (1)--Approximately 3.3 mi north of Corydon, on State Highway 14 bridge over South Fork Chariton River, on left upstream wingwall; top of bolt.

Elevation 979.79 ft.

6921-06 NW (2)--(REFERENCE POINT) Approximately 3.3 mi north of Corydon, on State Highway 14 bridge over South Fork Chariton River, on downstream curb and 81 ft from left end of bridge; chiseled arrow.

Elevation 978.34 ft.

6922-21 SW (1)--Approximately 3.6 mi west of Corydon, on State Highway 2 bridge over South Fork Chariton River, on curb near left upstream wingwall; Iowa Highway Commission bench mark.

Elevation 1017.16 ft.

6922-21 SW (2)--Approximately 3.6 mi west of Corydon, on State Highway 2 bridge over South Fork Chariton River, on corner of right downstream wingwall; chiseled square.

Elevation 1019.06 ft.

6922-21 SW (3)--(REFERENCE POINT) Approximately 3.6 mi west of Corydon, on State Highway 2 bridge over South Fork Chariton River, 1 ft left of 10th guardrail post or 74 ft from left downstream end of bridge; chiseled arrow.

Elevation 1016.98 ft.

6924-20 SE (1)--Approximately 5.5 mi east of Leon, on State Highway 2 bridge over Weldon River, on top of right downstream concrete guardrail; Iowa Highway Commission bench mark.

Elevation 966.37 ft.

6924-20 SE (2)--Approximately 5.5 mi east of Leon, on State Highway 2 bridge over Weldon River, on left downstream wingwall; chiseled square.

Elevation 966.35 ft.

6924-20 SE (3)--(REFERENCE POINT) Approximately 5.5 mi east of Leon, on State Highway 2 bridge over Weldon River, on downstream guardrail and 90 ft from left end of bridge; chiseled arrow.

Elevation 966.33 ft.

6926-31 NW (1)--Approximately 3.3 mi west of Decatur City, on State Highway 2 bridge over Thompson River, on right upstream wingwall; Iowa Highway Commission bench mark.

Elevation 945.38 ft.

6926-31 NW (2)--Approximately 3.3 mi west of Decatur City, on State Highway 2 bridge over Thompson River, on left upstream wingwall; chiseled square.

Elevation 946.02 ft.

6926-31 NW (3)--(REFERENCE POINT) Approximately 3.3 mi west of Decatur City, on State Highway 2 bridge over Thompson River, on top of downstream concrete guardrail and at 2nd bridge deck drain from right end of bridge; chiseled arrow.

Elevation 945.57 ft.

6927-33 NE (1)--Approximately 6.3 mi west of Decatur City, on State Highway 294 bridge over Elk Creek, on right upstream concrete curb, Iowa Highway Commission bench mark.

Elevation 982.91 ft.

6927-33 NE (2)--Approximately 6.3 mi west of Decatur City, on State Highway 294 bridge over Elk Creek, on left upstream wingwall; chiseled square.

Elevation 978.76 ft.

6927-33 NE (3)--(REFERENCE POINT) Approximately 6.3 mi west of Decatur City, on State Highway 294 bridge over Elk Creek, on downstream guardrail and 81 ft from left end of bridge; chiseled arrow.

Elevation 981.07 ft.

6927-34 SE (1)--Approximately 5.5 mi west of Decatur City, near right downstream side of County Road R18 bridge over Elk Creek, set at ground level and 4 ft landward of upstream landward side of gage house; U.S. Geological Survey brass bench mark.

Elevation 953.91 ft.

6927-34 SE (2)--Approximately 5.5 mi west of Decatur City, on County Road R18 bridge over Elk Creek, on right downstream wingwall; chiseled square.

Elevation 957.10 ft.

6927-34 SE (3)--Approximately 5.7 mi west of Decatur City, on State Highway 2 bridge over Elk Creek, on right upstream concrete guardrail; Iowa Highway Commission bench mark.

Elevation 971.47 ft.

6927-34 SE (4)--Approximately 5.7 mi west of Decatur City, on State Highway 2 bridge over Elk Creek, on left upstream wingwall; chiseled square.

Elevation 968.34 ft.

6927-34 SE (5)--(REFERENCE POINT) Approximately 5.7 mi west of Decatur City, on State Highway 2 bridge over Elk Creek, 90 ft from right downstream end of bridge; chiseled arrow.

Elevation 969.92 ft.

7023-18 SE (1)--Approximately 2.2 mi west of Humeston, on County Road J22 bridge over Chariton River, on right upstream wingwall; chiseled square.

Elevation 1056.02 ft.

7023-18 SE (2)--Approximately 2.2 mi west of Humeston, on County Road J22 bridge over Chariton River, on left upstream wingwall; chiseled cross.

Elevation 1056.03 ft.

7023-18 SE (3)--(REFERENCE POINT) Approximately 2.2 mi west of Humeston, on County Road J22 bridge over Chariton River, on fifth guardrail post from right upstream end of bridge; chiseled arrow.

Elevation 1057.63 ft.

7024-16 SW (1)--Approximately 2.4 mi northwest of Garden Grove, on County Road J22 bridge over Weldon River, on top of curb near left downstream wingwall; chiseled square.

Elevation 1018.73 ft.

7024-16 SW (2)--Approximately 2.4 mi northwest of Garden Grove, on County Road J22 bridge over Weldon River, on right downstream wingwall; chiseled square.

Elevation 1018.72 ft.

7024-16 SW (3)--(REFERENCE POINT) Approximately 2.4 mi northwest of Garden Grove, on County Road J22 bridge over Weldon River, on top of guardrail between 9th and 10th guardrail posts from right downstream end of bridge; filed mark.

Elevation 1021.01 ft.

7024-33 SW (1)--Approximately 1.7 mi southeast of Garden Grove, on County Road J20 bridge over Weldon River, on left downstream wingwall; chiseled square.

Elevation 994.57 ft.

7024-33 SW (2)--Approximately 1.7 mi southeast of Garden Grove, on County Road J20 bridge over Weldon River, on right upstream wingwall; chiseled square.

Elevation 994.57 ft.

7024-33 SW (3)--(REFERENCE POINT) Approximately 1.7 mi southeast of Garden Grove, on County Road J20 bridge over Weldon River, on top of guardrail between 14th and 15th guardrail posts from left downstream end of bridge; filed mark.

Elevation 996.65 ft.

7027-16 NW (1)--Approximately 3.2 mi north of Grand River, on County Road R15 bridge over Thompson River, on left downstream wingwall; chiseled cross.

Elevation 982.59 ft.

7027-16 NW (2)--Approximately 3.2 mi north of Grand River, on County Road R15 bridge over Thompson River, on downstream concrete curb at 22nd guardrail post from right end of bridge; chiseled square.

Elevation 985.29 ft.

7027-16 NW (3)--(REFERENCE POINT) Approximately 3.2 mi north of Grand River, on County Road R15 bridge over Thompson River, on 22nd guardrail post from right downstream end of bridge; filed mark.

Elevation 986.99 ft.

7027-34 SE (1)--Approximately 0.5 mi east of Grand River, on County Road J20 bridge over Thompson River, on right upstream wingwall; chiseled square.

Elevation 974.78 ft.

7027-34 SE (2)--Approximately 0.5 mi east of Grand River, on County Road J20 bridge over Thompson River, on curb at left downstream wingwall; chiseled cross.

Elevation 975.84 ft.

7027-34 SE (3)--(REFERENCE POINT) Approximately 0.5 mi east of Grand River, on County Road J20 bridge over Thompson River, on right side of 25th guardrail post from right downstream end of bridge; three chiseled marks.

Elevation 976.12 ft.

7028-36 NE (1)--Approximately 2.5 mi west of Grand River, on County Road J20 bridge over Elk Creek, on left downstream wingwall; chiseled square.

Elevation 1065.40 ft.

7028-36 NE (2)--(REFERENCE POINT) Approximately 2.5 mi west of Grand River, on County Road J20 bridge over Elk Creek, on downstream guardrail at 4th guardrail post from left end of bridge; filed mark.

Elevation 1065.60 ft.

7120-33 SW (1)--Approximately 5.3 mi south of Russell, on County Road S56 bridge over Chariton River, on upstream corner of right upstream wingwall; chiseled square.

Elevation 932.94 ft.

7120-33 SW (2)--(REFERENCE POINT) Approximately 5.3 mi south of Russell, on County Road S56 bridge over Chariton River, on guardrail between 21st and 22nd guardrail posts from right downstream end of bridge; chiseled arrow.

Elevation 934.96 ft.

7121-15 NE (1)--Approximately 5 mi southeast of Chariton, on County Road S43 bridge over Chariton River, on end of right downstream concrete wingwall; top of 1-in. bolt.

Elevation 945.09 ft.

7121-15 NE (2)--Approximately 5 mi southeast of Chariton, on County Road S43 bridge over Chariton River, on right downstream abutment; chiseled square (U.S. Army Corps of Engineers).

Elevation 938.03 ft.

7123-11 NE (1)--Approximately 2.1 mi north of Derby, on U.S. Highway 65 bridge over Chariton River, on right downstream wingwall; Iowa Highway Commission bench mark.

Elevation 1007.82 ft.

7123-11 NE (2)--Approximately 2.1 mi north of Derby, on U.S. Highway 65 bridge over Chariton River, on left downstream wingwall; chiseled square.

Elevation 1008.48 ft.

7123-11 NE (3)--(REFERENCE POINT) Approximately 2.1 mi north of Derby, on U.S. Highway 65 bridge over Chariton River, on downstream guardrail and 87 ft from left end of bridge; chiseled arrow.

Elevation 1008.22 ft.

7128-02 SW (1)--Approximately 3.7 mi south of Thayer, on County Road P64 bridge over Thompson River, on right downstream wingwall; chiseled square.

Elevation 1025.12 ft.

7128-02 SW (2)--Approximately 3.7 mi south of Thayer, on County Road P64 bridge over Thompson River, on left upstream wingwall; chiseled cross.

Elevation 1025.13 ft.

7128-02 SW (3)--(REFERENCE POINT) Approximately 3.7 mi south of Thayer, on County Road P64 bridge over Thompson River, on downstream guardrail and 92 ft from left end of bridge; two filed marks.

Elevation 1025.24 ft.

7221-32 SW (1)--Approximately 0.8 mi south of Chariton, on State Highway 14 bridge over Chariton River, on left downstream wingwall; Iowa Highway Commission bench mark.

Elevation 962.53 ft.

7221-32 SW (2)--Approximately 0.8 mi south of Chariton, on State Highway 14 bridge over Chariton River, on right downstream wingwall; chiseled square.

Elevation 962.40 ft.

7221-32 SW (3)--(REFERENCE POINT) Approximately 0.8 mi south of Chariton, on State Highway 14 bridge over Chariton River, on downstream guardrail and 150 ft from left end of bridge; chiseled arrow.

Elevation 962.82 ft.

7228-17 SW (1)--Approximately 2.6 mi west of Thayer, on U.S. Highway 34 bridge over Thompson River, on left downstream guardrail; Iowa Highway Commission bench mark.

Elevation 1059.32 ft.

7228-17 SW (2)--Approximately 2.6 mi west of Thayer, on U.S. Highway 34 bridge over Thompson River, on right upstream wingwall; chiseled square.

Elevation 1059.59 ft.

7228-17 SW (3)--(REFERENCE POINT) Approximately 2.6 mi west of Thayer, on U.S. Highway 34 bridge over Thompson River, 114 ft from left downstream end of bridge; chiseled arrow.

Elevation 1057.65 ft.

7429-17 SE (1)--Approximately 1.2 mi southwest of Macksburg, on County Road G61 bridge over Thompson River, on right upstream wingwall; top of bolt.

Elevation 1129.70 ft.

7429-17 SE (2)--Approximately 1.2 mi southwest of Macksburg, on County Road G61 bridge over Thompson River, on curb at left downstream wingwall; chiseled square.

Elevation 1128.53 ft.

7429-17 SE (3)--(REFERENCE POINT) Approximately 1.2 mi southwest of Macksburg, on County Road G61 bridge over Thompson River, on downstream guardrail and 75 ft from left end of bridge; three filed marks.

Elevation 1130.72 ft.

7530-17 NE (1)--Approximately 6.7 mi east of Greenfield, on State Highway 92 bridge over Thompson River, behind guardrail on right downstream wingwall; Iowa Highway Commission bench mark.

Elevation 1193.84 ft.

7530-17 NE (2)--Approximately 6.7 mi east of Greenfield, on State Highway 92 bridge over Thompson River, on left upstream wingwall and almost level with bridge deck; chiseled square.

Elevation 1189.42 ft.

7530-17 NE (3)--(REFERENCE POINT) Approximately 6.7 mi east of Greenfield, on State Highway 92 bridge over Thompson River, 132 ft from left upstream end of bridge; chiseled arrow.

Elevation 1191.10 ft.

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