DEPARTMENT OF THE INTERIOR
Hubert Work, Secretary

U. S. GEOLOGICAL SURVEY
George Otis Smith, Director

WATER-SUPPLY PAPER 567

SURFACE WATER SUPPLY OF THE UNITED STATES

1923

PART VII. LOWER MISSISSIPPI RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
E. L. WILLIAMS, H. C. BECKMAN, ROBERT FOLLANSBEE and H. B. KINNISON, District Engineers

Prepared in cooperation with the States of MISSOURI, COLORADO, and KANSAS

WASHINGTON
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1926

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AUTHORIZATION AND SCOPE OF WORK

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1923.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

Provided, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1923

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000
1918	175,000
1919	148,244
1920	175,000
1921 to 1923, inclusive	180,000
1924	170,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 5.

Measurements of stream flow have been made at about 5,600 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1923, 1,590 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, and run-off in inches and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained on the assumption that the run-off is distributed uniformly both as regards time and area.

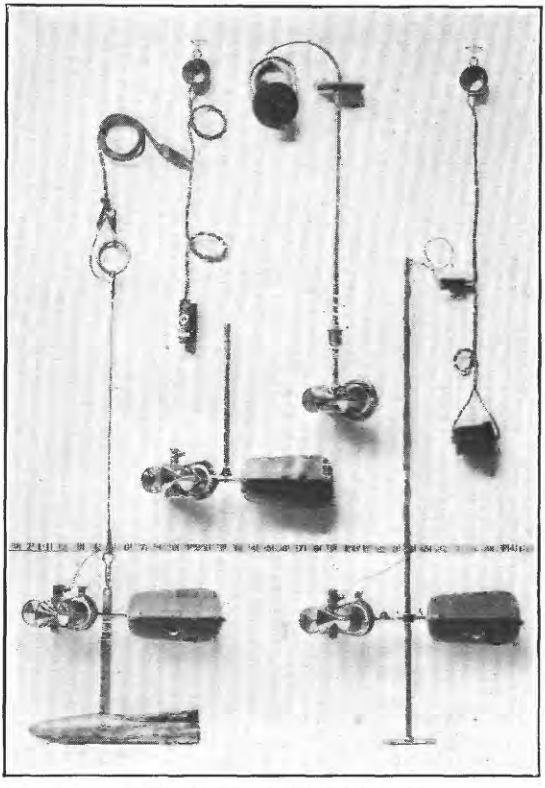
"Run-off in inches" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of a foot. The term is commonly used in connection with storage for irrigation.

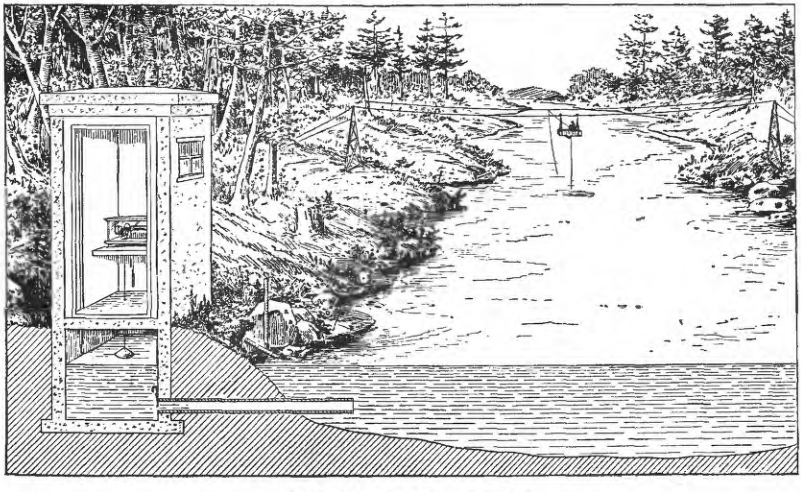
The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

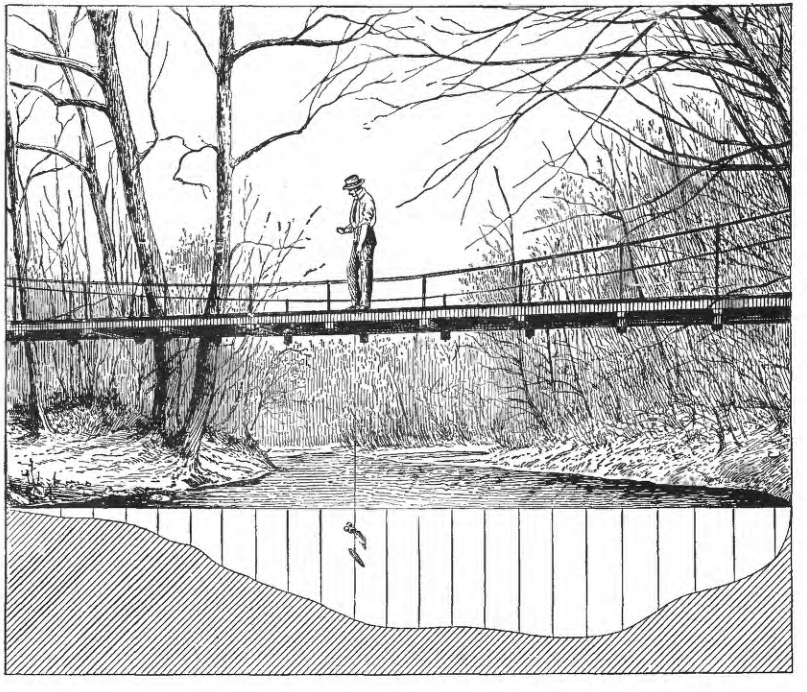


A. PRICE CURRENT METERS



B. TYPICAL GAGING STATION

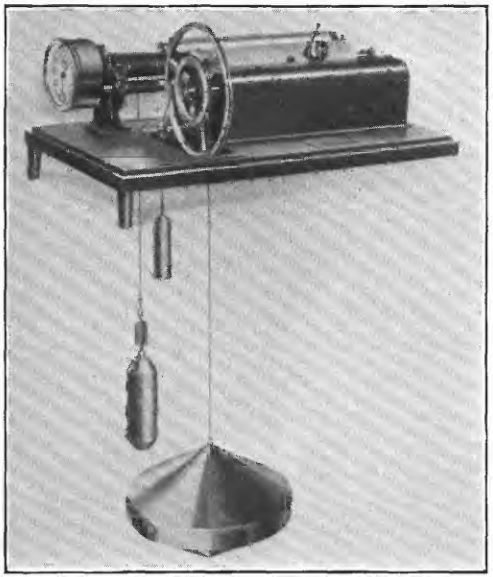
A



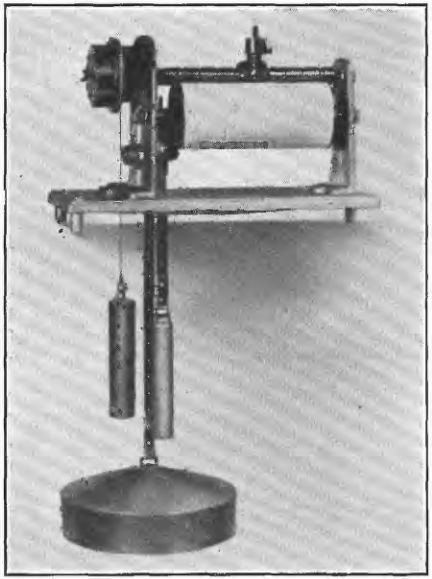
B

TYPICAL GAGING STATIONS

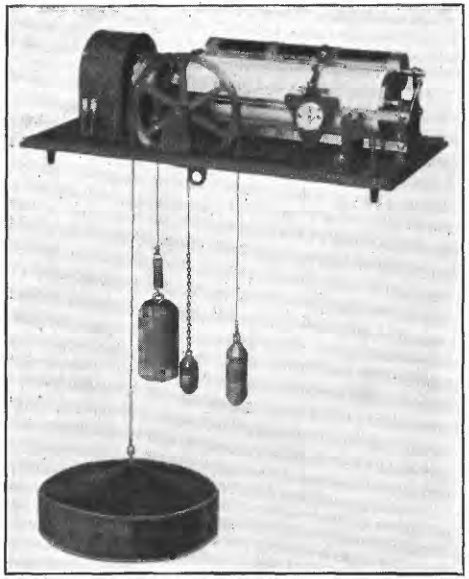
A, For wading measurement; *B*, for bridge measurement



A



B



C

WATER-STAGE RECORDERS

A, Au; *B*, Gurley; *C*, Stevens

The "point of zero flow" for a gaging station is that point on the gage—the gage height—at which water ceases to flow over the control.

EXPLANATION OF DATA

The data presented in this report cover the year begining October 1, 1922, and ending September 30, 1923. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or chain gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I–III.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage. The application of the daily gage heights to these rating tables gives the discharge from which the monthly and yearly mean discharge is determined.

The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the permanence of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each

day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 2, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

The accuracy of stream-flow data depends primarily (1) on the permanence of the stage-discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information con-

[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C., Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53–59, 1916.

cerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off in inches" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off in inches" published by the Survey in earlier reports should be used with caution because of possible inherent but unknown sources of error.

Many gaging stations on streams in the irrigated sections of the United States are located above most of the diversions from those streams, and the discharge recorded does not show the water supply available for further development, as prior appropriations below the stations must first be satisfied. To give an idea of the amount of prior appropriations, a paragraph on diversions is presented in each station description. Where figures are given these can not be considered exact but represent the best information available.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION

In Missouri the work was done in cooperation with the State Geological Survey, through H. A. Buehler, State geologist. Financial assistance has also been rendered by the United States Weather Bureau, Little River Drainage District, Western Tie & Timber Co., Ozark Power & Water Co., and Dixie Power Co.

In Arkansas the station on White River at Beaver, Ark., was maintained in cooperation with the Ozark Power & Water Co., and the stations on Ouachita River near Hot Springs and Malvern, Ark., were maintained in cooperation with the Arkansas Light & Power Co.

In Kansas the work was done in cooperation with the Kansas Water Commission, Governor Jonathan M. Davis, Chairman; H. A. Rice, Secretary; and H. B. Walker. Financial assistance was also rendered by G. S. Knapp, State irrigation commissioner; Finney County, Ben Allen, county engineer; Pawnee Power & Water Co.; city of Wichita, P. L. Brockway, city engineer; and Kansas Gas & Electric Co.

The station on Bayou Cocodrie near Meeker, La., was maintained in cooperation with the Louisiana Gravity Canal Co.

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DIVISION OF WORK

Data for stations in Missouri and Arkansas were collected and prepared for publication under the direction of E. L. Williams, district engineer until May 31, 1923, and H. C. Beckman, district engineer after that date, assisted by V. L. Austin, W. R. Denison, W. S. Frame, and H. E. Zoller.

Data for stations in Colorado were collected and prepared for publication under the direction of Robert Follansbee, district engineer, assisted by P. V. Hodges, M. B. Arthur, T. J. Watkins, J. W. Mangan, and Miss Florence M. Hall.

Data for stations in Kansas were collected and prepared for publication under the direction of E. L. Williams, district engineer until May 31, 1923, and H. B. Kinnison, district engineer after that date, assisted by G. H. Barger and C. P. Heartburg.

Data for the station in Lousiana were collected and prepared for publication under the direction of C. E. Ellsworth, district engineer.

The manuscript was reviewed by B. J. Peterson.

GAGING STATION RECORDS

MERAMEC RIVER BASIN

MERAMEC RIVER NEAR STEELVILLE, MO.

LOCATION.—In NE. ¼ sec. 21, T. 38 N., R. 4 W., at highway bridge on Steelville-Cuba road, 400 feet below St. Louis-San Francisco Railway bridge, half a mile above Wittenberg Creek, 2 miles below Perigee Spring, and 2½ miles north of Steelville, Crawford County.

DRAINAGE AREA.—Approximately 830 square miles (measured on topographic and soil survey maps); somewhat indefinite on account of large tributary springs.

RECORDS AVAILABLE.—December 21, 1922, to September 30, 1923. The United States Weather Bureau has obtained records of stage 1 mile upstream since October 1, 1916.

GAGE.—Chain gage on downstream side of bridge; read by William Weis and William Diehl.

DISCHARGE MEASUREMENTS.—Made from highway or railroad bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean coarse gravel. Left bank high and rocky. Right bank thinly wooded; subject to overflow at high stages. Control is gravel bar extending 200 feet downstream from bridge; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of records, 12.26 feet at 5 p. m. June 16 (discharge, 11,800 second-feet); minimun stage, 0.61 foot at 8 a. m. August 16 (discharge, 140 second-feet).

Maximun stage of 26.5 feet (determined from records of United States Weather Bureau) occurred August 20, 1915.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Natural regulation by large springs.

ACCURACY.—Stage-discharge relation changed slightly during period. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used December 21 to June 15. Records good.

Discharge measurements of Meramec River near Steelville, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	W. R. Denison	0.80	178	May 8	Frame and Beckman	1.23	403
Jan. 19	V. L. Austin	1.04	237	June 16	W. S. Frame	12.03	11.400
Apr. 14	E. L. Williams	4.24	2,660	July 2	V. L. Austin	1.34	412
16	V. L. Austin	2.17	896	Aug. 16	H. C. Beckman	.65	154

Daily discharge, in second-feet, of Meramec River near Steelville, Mo., for the year ending Sept. 30, 1923

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		1,330	1,330	245	308	355	775	455	380	160
2		735	2,030	228	330	330	535	405	228	355
3		562	2,430	228	330	330	2,630	330	185	355
4		455	1,330	245	330	330	2,060	308	185	245
5		380	735	330	405	355	1,580	308	172	245
6		308	535	430	508	405	895	245	185	228
7		285	508	1,170	455	430	705	245	160	210
8		265	430	895	430	430	618	245	160	198
9		245	405	705	405	405	562	228	150	198
10		228	380	618	355	380	508	228	160	198
11		210	330	1,940	330	355	480	210	160	185
12		210	330	5,950	330	330	455	210	160	265
13		210	480	3,330	765	330	380	185	150	198
14		210	562	1,330	3,430	330	380	185	150	172
15		228	480	1,170	1,850	455	535	185	150	172
16		265	380	7,160	960	5,290	9,720	198	150	160
17		285	355	3,130	765	4,850	4,630	455	172	160
18		245	330	1,940	705	2,230	1,670	455	405	160
19		228	285	1,100	562	1,850	1,030	245	308	160
20		210	265	895	535	1,330	765	210	228	185
21	150	228	265	895	535	895	618	198	210	210
22	150	330	228	765	508	798	535	185	185	198
23	150	355	228	618	480	705	480	185	185	185
24	150	355	210	535	645	645	430	172	172	172
25	150	330	228	535	590	590	405	185	172	172
26	150	330	228	455	535	562	355	172	160	172
27	210	355	245	430	480	618	330	160	160	160
28	1,410	508	245	430	430	590	380	150	160	160
29	1,250	562		430	405	535	1,170	150	160	160
30	705	508		380	380	508	618	198	160	160
31	798	455		330		895		285	160	

NOTE.—Discharge estimated Mar. 10, 11, and June 4; gage not read.

Monthly discharge of Meramec River near Steelville, Mo., for the year ending Sept. 30, 1923

[Drainage area, 830 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
December 21-31	1,410	150	479	0.577	0.24
January	1,330	210	368	.443	.51
February	2,430	210	564	.680	.71
March	7,160	228	1,250	1.51	1.74
April	3,430	308	636	.766	.85
May	5,290	330	917	1.10	1.27
June	9,720	330	1,200	1.45	1.62
July	455	150	244	.294	.34
August	405	150	190	.229	.26
September	355	160	199	.240	.27

MERAMEC RIVER NEAR SULLIVAN, MO.

LOCATION.—In N. ½ SW. ¼ sec. 35, T. 40 N., R. 2 W., at Sappington highway bridge, 3½ miles below Brazil Creek, 4½ miles below Thickety Creek, and 6 miles southeast of Sullivan, Franklin County.

DRAINAGE AREA.—1,550 square miles (measured on topographic and soil survey maps).

RECORDS AVAILABLE.—September 9, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to upstream side of bridge; read by John V. Sappington.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, gravel, and rock; clean and fairly permanent. Right bank high, rocky, and not subject to overflow. Left bank is wooded and is overflowed at stage of about 20 feet. Control is a bar of gravel and boulders 400 feet below gage; fairly permanent. Small trees and brush grow on high parts of bar.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.15 feet at 6 p. m. March 16 (discharge, 11,200 second-feet); minimum stage, 1.72 feet October 20 and September 1 (discharge, 304 second-feet).

1921–1923: Maximum stage recorded, 16.80 feet April 17, 1922 (discharge, 14,800 second-feet); minimum stage, 1.58 feet August 14, 1922 (discharge, 273 second-feet).

The flood of August, 1915, reached a stage of about 30.7 feet, determined by levels to somewhat indefinite flood marks.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Natural regulation by large springs.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Meramec River near Sullivan, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 9	Denison and Austin	3.11	867	Apr. 28	V. L. Austin	3.32	1,020
Nov. 14	W. R. Denison	2.18	474	Aug. 11	W. S. Frame	1.90	360
Feb. 16	do	3.58	1,120				

Daily discharge, in second-feet, of Meramec River near Sullivan, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	330	426	426	3,400	3,160	630	720	770	1,980	920	360	317
2	330	462	585	2,220	4,580	630	720	720	1,380	770	585	392
3	317	462	630	1,620	5,000	630	720	720	2,780	675	426	540
4	330	462	585	1,320	3,400	720	770	675	4,800	630	392	500
5	317	426	585	1,080	2,160	820	920	770	3,640	585	376	426
6	426	426	540	970	1,740	1,200	1,020	920	2,360	540	392	426
7	1,740	426	540	820	1,500	2,290	970	920	1,620	500	376	426
8	720	426	540	770	1,260	2,360	920	920	1,380	500	360	392
9	970	426	540	720	1,140	1,860	820	820	1,260	462	345	392
10	630	392	540	630	1,020	1,620	770	770	1,080	462	345	376
11	540	392	500	630	970	2,360	720	720	1,200	462	345	360
12	462	392	500	585	970	9,030	720	720	1,260	462	345	360
13	426	426	462	540	1,440	8,910	2,920	675	1,080	426	330	345
14	392	462	462	630	1,500	3,960	6,400	675	970	426	330	345
15	392	500	426	675	1,320	3,560	4,040	1,620	1,020	426	330	345
16	392	540	392	720	1,140	10,100	2,640	8,310	6,180	462	330	330
17	376	540	426	720	1,020	8,070	1,980	7,830	9,870	1,020	330	330
18	376	540	392	675	920	3,880	1,680	4,440	3,800	820	360	330
19	360	500	392	630	820	2,850	1,440	4,040	2,290	585	500	330
20	317	500	392	630	770	2,220	1,260	3,160	1,740	462	462	345
21	330	462	392	720	720	2,040	1,200	2,360	1,380	426	870	360
22	360	462	392	820	675	1,740	1,140	1,860	1,200	392	1,080	376
23	360	426	376	500	630	1,500	1,140	1,620	1,020	392	426	360
24	345	426	376	500	630	1,320	1,200	1,440	920	376	392	345
25	360	426	376	630	630	1,200	1,500	1,560	920	376	392	345
26	360	392	376	970	630	1,080	1,200	1,800	870	360	360	330
27	345	392	970	1,200	675	1,020	1,140	1,680	920	360	345	330
28	345	392	3,720	1,680	630	920	970	1,560	1,020	376	345	330
29	345	392	3,080	1,920	------	870	920	1,740	1,620	360	345	317
30	360	392	2,100	1,560	------	820	870	2,500	1,320	345	345	330
31	360	------	2,920	1,500	------	770	------	2,780	------	345	330	------

Monthly discharge of Meramec River near Sullivan, Mo., for the year ending Sept. 30, 1923

[Drainage area, 1,550 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,740	317	452	0.292	0.34
November	540	392	443	.286	.32
December	3,720	376	804	.519	.60
January	3,400	500	1,030	.665	.77
February	5,000	630	1,460	.942	.98
March	10,100	630	2,610	1.68	1.94
April	6,400	720	1,450	.935	1.04
May	8,310	675	1,970	1.27	1.46
June	9,870	870	2,090	1.35	1.51
July	1,020	345	507	.327	.38
August	1,080	330	414	.267	.31
September	540	317	368	.237	.26
The year	10,100	317	1,130	.729	9.91

MERAMEC RIVER NEAR EUREKA, MO.

LOCATION.—In SE. ¼ sec. 32, T. 44 N., R. 4 E., at Votaw Ford highway bridge on Eureka-Valley Park road, one-fourth mile below Antire Creek, 1½ miles above St. Louis-San Francisco Railway bridge, 2 miles east of Eureka, St. Louis County, and 3 miles below Big River.

DRAINAGE AREA.—3,800 square miles (measured on topographic and soil survey maps).

RECORDS AVAILABLE.—August 26, 1903, to July 21, 1906, and October 6, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to handrail on downstream side of bridge; read by J. W. Paul. Datum of present gage not some as that used 1903 to 1906.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading. Flood measurements are made from railroad bridge 1½ miles below gage.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and boulders. Right bank high, rocky, and wooded. Left bank wooded at edge and cultivated beyond; becomes overflowed at stage of about 27 feet. Control is a short section of river channel of rock and gravel just below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 16.95 feet at 5 p. m. March 17 (discharge, 24,800 second-feet); minimum stage, 0.72 foot October 5–6 (discharge, 365 second-feet).

1922–23: Maximum stage recorded, 24.45 feet April 19, 1922 (discharge, 38,600 second-feet); minimum stage, 0.60 foot September 28, 1922 (discharge, 320 second-feet).

The flood of August 22, 1915, reached a stage of 38.8 feet, and the flood of February 1, 1916, a stage of 35.6 feet, determined by levels to high-water marks.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Some natural regulation caused by springs.

ACCURACY.—Stage-discharge relation changed during high water in May. Rating curves used before and after the change well defined between 600 and 30,000 second-feet; extended beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except those below 500 second-feet.

Discharge measurements of Meramec River near Eureka, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 8	Austin and Denison	4.95	4,000	June 12	H. C. Beckman	6.86	7,460
Nov. 15	W. R. Denison	1.36	710	17	W. S. Frame	9.13	11,600
Dec. 8	V. L. Austin	1.73	967	18	do	11.36	15,800
Feb. 15	W. R. Denison	4.96	4,410	Aug. 10	do	1.53	1,010
Mar. 15	V. L. Austin	9.58	11,000	31	Frame and Beckman	1.11	687

Daily discharge, in second-feet, of Meramec River near Eureka, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	410	550	610	7,140	8,120	1,380	1,860	1,760	6,680	1,440	740	680
2	410	580	640	5,440	11,400	1,470	1,470	1,560	5,100	1,620	740	680
3	388	610	840	4,440	13,400	1,560	1,470	1,560	5,250	1,530	1,010	905
4	388	730	960	2,790	9,900	1,660	1,470	1,660	8,120	1,350	1,720	1,170
5	365	730	920	2,360	6,870	1,760	1,760	1,860	8,960	1,260	1,350	1,530
6	365	700	960	2,160	4,560	2,900	1,960	2,160	5,720	1,350	2,680	1,260
7	1,380	700	1,120	1,760	3,480	4,320	2,360	1,960	4,810	1,260	1,260	1,170
8	4,200	670	1,200	1,660	2,900	6,220	2,570	1,760	4,070	1,170	1,090	905
9	1,660	640	1,000	1,380	2,680	5,440	2,160	1,560	3,230	1,170	1,170	870
10	1,760	610	1,080	1,300	2,360	4,080	1,760	1,470	2,680	1,090	1,010	870
11	1,290	550	1,040	1,230	2,060	5,310	1,560	1,470	3,470	1,010	1,010	835
12	1,000	525	880	1,150	1,960	17,200	1,470	1,380	7,160	905	870	740
13	840	670	800	1,080	5,050	22,000	3,840	1,290	4,810	870	770	740
14	800	700	765	1,080	5,180	20,600	14,500	1,380	4,070	835	770	710
15	700	700	730	1,120	4,440	15,700	14,500	1,470	4,550	835	710	710
16	670	765	730	1,380	3,480	19,300	8,400	10,600	4,810	940	1,090	710
17	640	840	730	1,380	2,680	24,200	5,700	18,100	8,440	1,090	10,000	620
18	580	920	730	1,290	2,260	22,500	4,320	18,500	16,500	1,010	1,620	620
19	550	840	840	1,160	2,060	11,600	3,480	13,300	11,100	905	800	620
20	525	840	730	1,120	1,760	6,480	2,900	11,100	5,720	835	740	680
21	550	840	640	1,960	1,760	4,920	2,680	9,860	3,590	905	2,790	680
22	525	765	580	1,660	1,470	4,320	2,360	4,950	3,010	870	2,460	650
23	500	670	525	1,860	1,470	3,720	2,260	3,710	2,570	770	1,440	650
24	550	610	580	1,860	1,380	3,120	2,060	3,230	2,130	770	1,440	650
25	550	670	580	1,760	1,290	2,900	2,060	3,120	1,920	740	1,440	620
26	500	670	525	1,860	1,290	2,570	2,260	3,950	1,720	740	1,090	620
27	500	670	1,290	2,060	1,290	2,260	2,060	6,680	1,720	740	940	590
28	500	610	6,090	3,010	1,380	2,160	2,060	6,520	1,620	740	905	560
29	478	580	9,900	3,480	-------	1,960	1,960	5,250	1,530	740	835	535
30	478	610	6,740	3,600	-------	1,760	1,860	5,100	1,440	740	835	1,350
31	478	-------	5,700	3,960	-------	1,760	-------	6,040	-------	740	1,530	-------

NOTE.—Discharge, Jan. 10–12, interpolated. Large discharge, Aug. 17, caused by heavy rain near Eureka.

Monthly discharge of Meramec River near Eureka, Mo., for the year ending Sept. 30, 1923

[Drainage area, 3,800 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	4,200	365	791	0.208	0.24
November	920	525	686	.181	.20
December	9,900	525	1,630	.429	.49
January	7,140	1,080	2,240	.589	.68
February	13,400	1,290	3,850	1.01	1.05
March	24,200	1,380	7,330	1.93	2.22
April	14,500	1,470	3,370	.887	.99
May	18,500	1,290	4,980	1.31	1.51
June	16,500	1,440	4,880	1.28	1.43
July	1,620	740	999	.263	.30
August	10,000	710	1,510	.397	.46
September	1,530	535	798	.210	.23
The year	24,200	365	2,750	.724	9.80

MERAMEC SPRING NEAR ST. JAMES, MO.

LOCATION.—In SE. ¼ sec. 1, T. 37 N., R. 6 W., 30 feet above log bridge, 600 feet below outlet of spring, 1 mile above mouth of spring branch, and 6 miles southeast of St. James, Phelps County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 1, 1903, to July 21, 1906,[2] and November 11, 1921, to September 30, 1923.

GAGE.—Vertical staff gage in two sections fastened to overhanging oak tree on right bank about 100 feet downstream from gage used 1903 to 1906 and set at different datum; read by F. E. Beezley.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; small growth of aquatic plants in channel. Control is a coarse gravel bar 200 feet below gage; clean and practically permanent. Stage-discharge relation affected by backwater from Meramec River during high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3 feet June 16 (affected by backwater from Meramec River); maximum discharge, 420 second-feet March 17; minimum stage, 1.12 feet November 28–29 and December 18–26 (discharge, 79 second-feet).

1903–1906: Maximum discharge uncertain owing to backwater from Meramec River; minimum discharge, 73 second-feet, during periods in January and February, 1904.

1922–23: Maximum discharge, 420 second-feet March 17, 1923; minimum discharge, 79 second-feet November 28–29 and December 18–26, 1923.

ACCURACY.—Stage-discharge relation permanent, except as affected by backwater from Meramec River whenever river is more than about 6 feet above low-water stage; not affected by ice. Rating curve well defined. Gage read to hundredths once daily except Sundays. Daily discharge ascertained by applying daily gage height to rating table. Records fair for April to June and good for remainder of year.

Discharge measurements of Meramec Spring near St. James, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 10	Austin and Denison	1.25	107	Apr. 16	V. L. Austin	1.62	208
Nov. 7	W. R. Denison	1.15	84	19	Austin and Williams	1.39	178
Jan. 20	V. L. Austin	1.20	102	July 2	Austin and Frame	1.33	129
Apr 6	E. L. Williams	1.34	158	Aug. 14	H. C. Beckman	1.17	94
14	do	1.94	311				

[1] Published as "Meramec Spring near Meramec, Mo.," in Water-Supply Papers 99, 131, 173, and 209. High discharges given in those reports are probably much too large, as no allowance was made in determining discharge from gage heights for backwater from Meramec River.

Daily discharge, in second-feet, of Meramec Spring near St. James, Mo., for the year ending Sept. 30, 1923

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	a 85	83	81	162	299	100	a 108	120	122	a 137	110	90
2	85	83	81	144	264	100	107	120	120	132	107	a 91
3	85	83	90	130	233	100	102	114	a 134	127	104	a 91
4	87	83	a 100	120	a 196	a 111	100	110	147	a 124	104	92
5	85	a 84	95	117	160	122	130	110	150	122	a 100	114
6	87	85	95	110	144	194	134	a 110	142	117	95	92
7	140	87	95	a 107	134	282	130	110	134	114	95	90
8	a 132	87	92	104	127	233	a 122	110	130	a 112	92	90
9	a 124	87	90	102	122	203	114	107	124	a 111	90	a 90
10	a 116	85	a 88	100	117	170	107	107	a 123	a 110	90	90
11	107	85	87	97	a 114	b 247	102	104	122	a 108	90	92
12	100	a 85	85	95	112	b 325	100	104	117	a 106	a 88	95
13	97	85	83	95	173	402	200	a 102	114	a 105	87	92
14	95	a 84	83	a 100	160	316	316	100	117	a 104	87	90
15	a 92	a 84	83	104	140	264	a 267	134	b 173	a 102	90	85
16	90	83	81	102	127	b 342	218	b 264	b 334	100	87	a 85
17	87	83	a 80	100	120	420	182	282	b 334	137	122	85
18	87	85	79	100	a 115	a 351	160	264	334	a 126	122	85
19	87	a 84	79	97	110	282	144	282	264	114	b 110	83
20	87	83	79	97	104	233	140	a 241	218	a 112	b 97	87
21	87	88	79	a 96	100	194	140	200	194	a 109	b 147	87
22	a 86	81	79	95	a 98	179	a 134	173	182	a 107	b 122	90
23	85	81	79	120	97	162	127	160	164	104	b 110	a 88
24	85	81	a 79	114	95	152	144	147	a 158	104	b 97	87
25	83	81	79	110	a 98	a 144	160	142	152	102	90	85
26	83	a 81	b 79	110	100	137	144	137	147	100	a 90	a 85
27	83	81	b 203	122	100	127	140	a 134	142	97	90	a 84
28	83	79	b 173	a 128	100	124	134	130	140	104	87	a 84
29	a 82	79	b 160	134	-------	122	a 129	127	152	a 102	85	a 84
30	81	a 80	b 203	124	-------	120	124	a 127	142	100	85	a 83
31	81	-------	b 173	122	-------	110	-------	127	-------	112	85	-------

a Gage not read; discharge interpolated.
b Discharge estimated.

NOTE.—Stage-discharge relation affected by backwater from Meramec River Mar. 12 and 16, May 16, and June 16.

Monthly discharge, in second-feet, of Meramec Spring near St. James, Mo., for the year ending Sept. 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October	140	81	92.7	May	282	100	148
November	87	79	83.2	June	334	114	168
December	203	79	100	July	137	97	112
January	162	95	112	August	147	85	98.5
February	299	95	138	September	114	83	88.9
March	420	100	205				
April	316	100	145	The year	420	79	124

BOURBEUSE RIVER AT UNION, MO.

LOCATION.—In SW. ¼ sec. 26, T. 43 N., R. 1 W., at highway bridge on St. Clair-Union road, 800 feet above Flat Creek, 1 mile east of Union, Franklin County, 4 miles below Hamilton Creek, and 7 miles above Birch Creek.

DRAINAGE AREA.—767 square miles (measured on topographic maps and base map of Missouri).

RECORDS AVAILABLE.—June 7, 1921, to September 30, 1923. The United States Weather Bureau has records of stage since October 19, 1916.

GAGE.—Chain gage on downstream side of highway bridge; read by William J. Keller. Prior to September 24, 1921, a vertical staff gage on left bank 150 feet above bridge, set to same datum. Sea-level elevation of zero of gage, 491.9 feet as reported by the United States Weather Bureau.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clay and coarse gravel. Control is bar of clean, coarse gravel 800 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.10 feet at 6 p. m. March 17 (discharge, 8,930 second-feet); minimum stage, 0.80 foot October 5 and 6 (discharge, 40 second-feet).

1921–1923: Maximum stage recorded, 14.70 feet April 2, 1922 (discharge, 14,600 second-feet); minimum stage, 0.80 foot October 5 and 6, 1922 (discharge, 40 second-feet).

Maximum stage recorded by United States Weather Bureau, 27.3 feet at 3 p. m. August 22, 1915. Flood of 1897 reached a stage of 26.0 feet (exact date unknown).

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water February 2 and again on August 17; not affected by ice during year. Rating curve used October 1 to February 1 well defined; curve used February 2 to August 17 well defined above 200 second-feet; curve used August 18 to September 30 fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Bourbeuse River at Union, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 9	V. L. Austin	2.69	488	Feb. 16	W. R. Denison	2.97	717
Nov. 14	W. R. Denison	1.17	60	Apr. 23	V. L. Austin	2.01	286
Dec. 8	do	1.10	60	Aug. 10	W. S. Frame	1.86	236
8	do	1.11	59	30	do	1.53	98

Daily discharge, in second-feet, of Bourbeuse River at Union, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	42	51	55	500	2,590	280	205	385	190	108	65	65
2	42	54	55	475	4,440	280	205	310	405	99	128	84
3	42	57	54	360	2,140	280	190	280	822	108	328	88
4	41	57	57	265	1,380	295	190	235	1,720	98	205	65
5	40	55	54	220	855	448	220	220	648	100	156	69
6	42	52	54	180	570	730	495	190	425	99	295	67
7	55	50	58	155	425	1,290	990	172	295	89	190	84
8	53	51	58	136	365	1,720	675	163	235	122	144	94
9	425	64	58	123	328	1,290	470	154	185	99	220	110
10	220	66	61	107	295	822	365	144	220	83	345	90
11	141	62	60	100	263	990	295	138	328	80	120	76
12	100	58	58	91	448	3,440	263	130	405	82	142	73
13	81	61	57	86	855	6,540	702	117	855	99	165	68
14	68	64	57	97	1,460	4,440	1,980	119	855	93	119	63
15	65	64	57	91	1,140	2,410	3,140	154	855	83	115	54
16	59	72	55	82	675	4,970	1,290	365	990	80	190	56
17	56	70	56	82	448	8,280	760	310	6,540	175	760	52
18	52	70	55	83	345	5,080	545	990	1,720	149	310	55
19	52	81	52	83	280	1,380	448	760	822	99	175	140
20	49	76	54	86	250	920	365	730	545	115	118	82
21	49	73	54	94	220	702	328	595	405	93	94	62
22	49	70	52	96	205	570	295	405	310	80	106	54
23	47	64	51	113	180	495	280	310	263	83	84	50
24	46	63	51	170	170	425	280	250	220	85	400	50
25	45	61	51	185	160	385	385	235	188	79	296	48
26	45	60	50	182	172	345	280	328	165	74	204	47
27	44	58	425	205	178	310	310	328	185	72	158	46
28	44	57	1,890	360	205	280	310	263	138	70	124	45
29	44	55	2,680	775	-------	263	328	280	126	67	102	42
30	43	54	1,120	610	-------	250	345	263	115	66	81	44
31	44	-------	580	810	-------	235	-------	220	-------	66	71	-------

Monthly discharge of Bourbeuse River at Union, Mo., for the year ending Sept. 30, 1923

[Drainage area, 767 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	425	40	71.8	0.094	0.11
November	81	50	61.7	.080	.09
December	2,680	50	262	.342	.39
January	810	82	226	.295	.34
February	4,440	160	752	.980	1.02
March	8,280	235	1,620	2.11	2.43
April	3,140	190	564	.735	.82
May	990	117	308	.402	.46
June	6,540	115	706	.920	1.03
July	175	66	93.4	.122	.14
August	760	65	194	.253	.29
September	110	42	67.4	.088	.10
The year	8,280	40	411	.536	7.22

BIG RIVER AT BYRNESVILLE, MO.

LOCATION.—In SE. ¼ sec. 12, T. 42 N., R. 3 E., at highway bridge in Brynesville, Jefferson County, 200 feet below dam and mill at Byrnesville, 4 miles above Heads Creek and Rockford dam, and 13 miles above mouth.

DRAINAGE AREA.—892 square miles (measured on topographic and United States soil survey maps).

RECORDS AVAILABLE.—May 10, 1922, to September 30, 1923.

GAGE.—Chain gage bolted to handrail on downstream side of bridge; read by Charles Steidle.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, gravel, and rock; clean and fairly permanently. Control is a bar of clean, coarse gravel 500 feet below gage; practically permanent. Brush grows on bar above low-water line.

EXTREMES OF STAGE.—Maximum stage recorded during year, 17.40 feet at 6 a. m. May 17; minimum stage, 2 feet at 6 p. m. October 1.

1922–1923: Maximum and minimum stages recorded same as given above.

REGULATION.—Slight diurnal fluctuation in the flow at low stages is caused by grist mills above.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice during year. Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of Big River at Byrnesville, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 8	Denison and Austin	7.15	1,820	June 18	W. S. Frame	6.38	1,380
Dec. 8	V. L. Austin	3.67	418	Aug. 30	do	3.08	189
Feb. 15	W. R. Denison	5.92	1,290	30	Beckman and Frame	3.01	230
Mar. 15	V. L. Austin	7.15	1,990	30	do	2.94	175
June 12	H. C. Beckman	8.84	3,070				

Daily gage height, in feet, of Big River at Byrnesville, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.05	2.72	2.76	9.85	8.68	4.25	3.98	4.00	6.70	3.48	2.81	2.64
2	2.25	2.98	3.48	7.28	10.86	4.15	3.92	3.88	7.02	3.42	2.85	2.65
3	2.64	3.01	3.36	5.75	12.36	4.12	3.88	3.72	7.32	3.40	4.09	4.60
4	2.37	3.16	3.28	5.14	8.23	4.28	3.92	3.80	9.52	3.48	4.65	4.32
5	2.28	3.08	3.16	4.75	6.36	5.15	4.42	4.00	6.82	3.50	4.48	4.58
6	2.30	2.97	3.89	4.45	5.53	5.75	4.88	5.80	7.42	4.05	4.25	4.02
7	3.21	2.78	3.68	4.28	5.30	7.75	4.72	5.10	6.68	4.00	3.65	3.55
8	3.36	3.05	3.62	4.09	5.06	7.32	4.45	4.58	6.62	3.52	3.62	3.40
9	4.94	3.07	3.97	3.96	4.89	6.18	4.12	4.35	5.40	3.28	3.60	3.40
10	4.10	2.88	3.93	3.83	4.79	5.55	3.95	4.18	5.02	3.14	3.15	3.40
11	3.63	2.83	3.59	3.66	4.63	6.58	4.02	4.08	5.62	3.05	3.30	3.36
12	3.32	2.80	3.41	3.61	5.46	14.10	3.90	3.95	8.25	3.19	3.36	3.08
13	3.14	2.81	3.26	3.48	6.90	16.72	8.30	3.80	6.25	3.13	3.08	2.89
14	3.05	2.89	3.28	3.62	6.98	8.62	13.48	4.32	5.25	3.07	2.94	2.71
15	2.95	2.96	3.25	3.92	5.74	9.70	9.62	7.60	5.22	3.09	2.83	2.70
16	2.88	3.22	3.15	4.42	5.14	14.18	6.98	15.25	6.98	3.44	2.83	2.67
17	2.89	3.24	3.13	4.23	4.82	17.02	5.80	17.38	6.60	3.98	4.70	2.62
18	2.89	3.31	3.07	4.18	4.72	8.48	5.48	9.32	7.08	4.58	3.24	2.62
19	2.72	3.06	2.97	3.85	4.35	6.88	5.18	13.55	6.82	3.92	2.96	2.61
20	2.72	3.23	2.87	3.72	4.20	6.18	4.88	7.88	6.02	3.45	3.16	2.81
21	2.71	3.17	2.84	4.79	4.15	5.75	4.70	6.50	5.15	3.21	4.00	2.88
22	2.53	3.02	2.87	5.21	4.05	5.42	4.65	5.82	4.72	3.10	6.52	2.82
23	2.58	3.02	2.86	5.25	3.88	5.18	4.55	5.40	4.52	3.05	4.85	2.75
24	2.75	2.92	2.89	4.76	3.82	5.08	4.38	5.15	4.25	2.93	4.50	2.95
25	2.58	2.88	2.83	4.54	3.70	4.90	4.30	5.62	4.10	2.80	3.80	2.79
26	2.50	2.75	2.89	4.49	3.75	4.60	4.25	7.02	3.90	2.73	3.42	2.69
27	2.58	2.87	3.51	4.96	4.00	4.48	4.15	8.55	3.88	2.64	3.26	2.57
28	2.52	2.82	10.25	6.68	4.38	4.42	4.22	9.02	3.75	2.78	3.08	2.52
29	2.55	2.83	9.90	6.48	-------	4.40	4.38	8.30	3.88	2.81	2.99	2.32
30	2.64	2.75	6.35	5.60	-------	4.28	4.12	7.82	3.80	2.76	2.89	2.55
31	2.67	-------	8.50	6.33	-------	4.15	-------	7.78	-------	2.78	2.76	-------

HEADWATER DIVERSION CHANNEL BASIN

CASTOR RIVER AT ZALMA, MO.

LOCATION.—In S. ½ sec. 29, T. 29 N., R. 9 E., at highway bridge in Zalma Bollinger County, 2 miles below Perkins Creek, 4 miles above Cato slough, and 7 miles above levee of headwater diversion channel of Little River Drainage District.

DRAINAGE AREA.—395 square miles (measured on topographic maps, soil survey maps, and base map of Missouri).

RECORDS AVAILABLE.—September 12, 1921, to September 30, 1923. The Little River Drainage District, Cape Girardeau, has records of stage since July 1, 1919.

GAGE.—Chain gage bolted to downstream side of bridge; read by Lowell King. Elevation of zero of gage above mean sea level, 300 feet.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, sand, and gravel; fairly permanent. No well-defined control. Banks are wooded and are overflowed at a stage of about 374 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 74.0 feet at 8 a. m. February 2 (discharge, 8,100 second-feet); minimum stage, 51.38 feet at 8.45 a. m. October 1 (discharge, 41 second-feet).

1921–1923: Maximum stage, 74.0 feet November 20, 1921, and February 2, 1923 (discharge, 8,100 second-feet); minimum stage, 51.31 feet August 21, 1922 (discharge, 36 second-feet).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—During extremely high stages river overflows neck of horseshoe bend, and the total flow does not pass bridge section. Records, however, show entire flow of stream. Entire flow is diverted 7 miles below gage into headwater diversion channel, which empties into Mississippi River 3½ miles south of Cape Girardeau.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined below 4,000 second-feet; extended above that stage. Gage read to hundredths twice daily; readings rather unreliable. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair for medium and high stages and poor for low stages.

Discharge measurements of Castor River at Zalma, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 3	Denison and Austin	51.40	43	Apr. 25	V. L. Austin	65.82	3,560
Jan. 17	W. R. Denison	52.97	190	Aug. 8	W. S. Frame	52.11	107

Daily discharge, in second-feet, of Castor River at Zalma, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	41	84	109	1,320	5,480	1,600	299	465	940	168	48	146
2	42	94	109	830	7,980	2,320	325	423	1,870	157	46	157
3	42	99	109	590	7,380	3,080	540	608	1,720	140	69	146
4	43	99	109	495	4,320	3,940	1,400	3,500	1,060	124	237	140
5	43	94	114	423	1,900	4,950	2,060	6,240	608	114	495	135
6	42	119	109	381	1,400	3,720	1,270	2,560	409	104	325	130
7	55	99	114	353	1,090	1,870	703	1,400	325	94	146	130
8	99	109	119	312	852	1,520	608	1,060	237	89	104	124
9	119	104	119	299	723	6,900	525	830	213	84	101	119
10	99	99	114	261	540	4,660	381	495	312	84	97	114
11	89	94	109	237	381	2,420	423	465	703	79	94	109
12	79	94	104	225	381	1,490	451	1,140	1,520	74	91	104
13	69	94	104	213	381	1,160	1,780	1,490	1,750	74	87	99
14	64	157	104	225	367	896	1,060	2,390	808	69	84	94
15	64	237	104	225	367	1,240	573	2,920	495	84	81	89
16	64	213	104	213	367	1,040	525	6,900	590	168	77	84
17	64	179	104	201	367	764	556	7,200	743	157	74	79
18	84	190	104	190	353	626	1,780	5,750	573	124	540	79
19	89	201	99	179	353	510	1,110	4,950	465	99	874	74
20	84	179	94	225	299	465	423	3,670	423	94	325	69
21	79	168	94	5,580	249	423	437	3,120	325	89	225	64
22	74	157	94	3,000	261	395	573	2,420	286	84	140	60
23	74	146	94	1,240	367	353	874	1,720	249	79	190	60
24	74	140	89	990	381	261	5,310	990	249	74	179	54
25	74	130	89	808	409	261	3,850	556	273	74	168	52
26	74	124	89	644	423	261	874	1,160	225	69	168	50
27	69	119	201	743	683	273	451	1,780	190	64	157	60
28	69	114	2,360	830	1,110	273	940	1,380	273	60	157	64
29	69	109	1,380	852	-------	273	703	990	299	55	157	60
30	69	109	663	1,140	-------	286	525	786	237	54	146	64
31	74	-------	1,040	2,250	-------	286	-------	608	-------	51	146	-------

NOTE.—Daily discharge estimated Feb. 25–28, Mar. 1–4, 10, 25–31, May 15–18, and Aug. 6–17 from records of rainfall and flow of near-by streams.

Monthly discharge of Castor River at Zalma, Mo., for the year ending Sept. 30, 1923

[Drainage area, 395 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	119	41	70.1	0.177	0.20
November	237	84	132	.334	.37
December	2,360	89	269	.681	.79
January	5,580	179	822	2.08	2.40
February	7,980	249	1,400	3.54	3.69
March	6,900	261	1,570	3.97	4.58
April	5,310	299	1,040	2.63	2.93
May	7,200	423	2,260	5.72	6.60
June	1,870	190	612	1.55	1.73
July	168	51	94.6	.239	.28
August	874	46	188	.476	.55
September	157	50	93.6	.237	.26
The year	7,980	41	713	1.81	24.38

WHITEWATER RIVER AT WHITEWATER, MO.

LOCATION.—In grant No. 2271, T. 30 N., R. 11 E., at Missouri Pacific Railway bridge 1,000 feet northwest of depot in Whitewater, Cape Girardeau County, 1 mile above Crooked Creek, 3 miles above headwater diversion channel, and 10 miles below Byrds Creek.

DRAINAGE AREA.—326 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—September 12, 1921, to September 30, 1923. The Little River Drainage District, Cape Girardeau, has records of stage from February to September, 1921.

GAGE.—Chain gage fastened to guardrail on upstream side of railroad bridge; read by William Fingerhut. Prior to November 30, 1921, a vertical staff gage in two sections, from 32 to 59 feet, fastened to downstream side of bridge piers. Zero of both gages 300 feet above mean sea level.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge 2,000 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and silt; shifting; obstructed at times by driftwood at railroad bridge. Control is a section of rocks and boulders just above highway bridge; practically permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 54.73 feet February 2; minimum stage stage, 31.27 feet October 2.

1921–1923: Maximum stage recorded, 55.5 feet November 20, 1922; minimum stage, 31.08 feet August 10, 1922.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice but affected by backwater from headwater diversion channel during high stages of the channel. Gage read to hundredths once daily. Daily discharge not determined.

Discharge measurements of Whitewater River at Whitewater, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 2	Denison and Austin	31.36	16	Apr. 25	V. L. Austin	*38.56	218
Jan. 16	W. R. Denison	32.69	116	Aug. 9	W. S. Frame	31.94	51

*Stage-discharge relation probably affected by backwater from headwater diversion channel.

Daily gage height, in feet, of Whitewater River at Whitewater Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	31.72	31.78	32.00	38.70	47.95	33.82	33.16	33.72	36.09	32.42	32.08	32.12
2	31.27	31.96	31.98	36.24	54.73	33.56	33.08	33.35	35.75	32.34	32.06	37.73
3	31.50	32.02	32.02	34.69	54.27	33.39	33.18	33.42	39.17	32.30	32.42	33.86
4	31.37	31.98	32.00	33.84	51.90	33.32	34.48	36.63	41.90	32.24	32.48	34.72
5	31.37	31.92	32.02	33.36	46.02	33.41	42.30	46.61	37.26	32.20	32.42	32.94
6	31.46	32.77	32.10	33.06	44.10	34.75	42.60	43.34	35.30	32.18	32.20	32.86
7	31.59	33.24	32.07	32.88	42.04	38.15	37.88	40.98	35.50	32.14	32.08	32.80
8	32.58	32.08	32.08	32.71	40.18	37.12	36.45	39.55	34.17	32.10	32.00	32.40
9	32.05	32.16	32.12	32.68	38.16	35.81	35.27	38.15	33.53	32.04	31.94	32.26
10	31.88	32.06	32.12	35.52	37.25	34.95	34.52	36.86	33.24	32.02	32.47	32.18
11	31.82	31.72	32.03	32.48	35.25	35.17	34.07	34.93	35.65	32.00	32.20	32.08
12	31.80	31.86	32.23	32.37	33.38	47.17	33.75	34.34	39.30	31.98	31.94	32.05
13	31.78	31.86	31.81	32.32	38.45	50.71	40.78	33.60	37.73	31.96	31.84	31.99
14	31.68	32.04	31.94	32.38	36.55	43.34	45.43	33.30	35.32	31.98	31.82	31.95
15	31.94	33.76	32.00	33.80	34.90	40.46	39.88	53.12	34.20	32.18	31.80	31.90
16	31.45	32.62	32.00	32.83	34.12	52.97	37.43	54.55	38.90	32.02	31.76	31.86
17	33.56	32.25	32.00	32.52	33.87	53.85	35.73	54.10	36.15	31.96	32.80	31.84
18	32.84	32.32	31.96	32.45	33.60	47.17	34.70	50.04	36.04	31.96	45.40	31.86
19	31.82	33.56	31.70	32.38	33.32	44.75	34.37	47.26	36.50	31.93	39.10	32.60
20	31.33	32.54	31.86	32.40	33.28	42.85	34.01	44.75	34.70	31.92	33.12	42.50
21	31.92	32.26	31.92	46.81	33.18	40.72	33.80	42.36	33.66	31.88	32.74	33.83
22	31.78	32.16	32.19	46.70	33.08	41.40	33.71	40.32	33.20	31.90	33.32	32.76
23	31.81	32.07	31.77	41.30	32.93	41.66	33.62	38.53	32.94	31.84	33.00	32.46
24	31.84	32.02	31.96	39.70	32.86	38.36	36.71	37.15	32.78	31.80	32.44	32.30
25	31.90	31.98	31.94	38.50	32.81	37.23	38.40	35.12	32.68	31.86	32.30	32.18
26	31.86	31.98	31.92	37.49	33.08	35.27	38.65	35.45	32.58	31.84	32.20	32.08
27	31.80	31.94	32.10	36.35	34.44	34.45	37.80	35.10	32.52	31.80	33.02	32.01
28	31.78	31.96	41.40	38.80	34.15	34.18	37.20	34.65	32.50	32.40	36.02	31.96
29	31.80	31.95	38.22	37.40	-------	33.80	36.20	34.77	32.48	34.35	32.74	31.94
30	31.80	31.94	35.90	36.30	-------	33.57	34.50	35.50	32.60	32.54	32.38	31.84
31	31.87	-------	35.16	41.20	-------	33.32	-------	37.25	-------	32.20	32.22	-------

NOTE.—Stage discharge relation affected by backwater from headwater diversion channel during high stages of the channel.

ST. FRANCIS RIVER BASIN

ST. FRANCIS RIVER NEAR PATTERSON, MO.

LOCATION.—In N. ½ sec. 16, T. 29 N., R. 5 E., at Black's highway bridge, 1½ miles above Clark's Creek, 4 miles below Big Creek, and 3 miles east of Patterson, Wayne County.

DRAINAGE AREA.—956 square miles (measured on topographic maps and base map of Missouri.

RECORDS AVAILABLE.—June 16, 1921, to September 30, 1923.

GAGE.—Chain gage fastened to upstream side of highway bridge; read by William Harris.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand and gravel; fairly permanent. Right bank high and rocky. Left bank sandy, thinly wooded, and subject to overflow at stage of 20 feet. Control is a heavy gravel bar 1,000 feet below gage; practically permanent.

EXTREMES OF DISCHARGE—Maximum stage recorded during year, 19.38 feet at noon March 16 (discharge, 34,600 second-feet); minimum stage, 2.12 feet at 5 p. m. October 3) discharge, 16 second-feet).

1921–1923: Maximum stage estimated from flood marks, 20 feet November 19, 1921 (discharge, 36,600 second-feet); minimum stage, 2.10 feet August 21, 1922 (discharge, 5 second-feet).

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation changed during high water on February 1. Rating curves well defined between 310 and 28,000 second-feet and fairly well defined beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of St. Francis River near Patterson, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 3	Austin and Denison	2.26	28	Feb. 3	W. R. Denison	10.32	9,410
Jan. 18	W. R. Denison	3.21	466	4	do	7.20	4,390
22	do	5.46	2,340	Apr. 27	V. L. Austin	4.10	1,160
Feb. 2	do	15.72	22,800	Aug. 3	W. S. Frame	2.47	108
3	do	11.91	12,600				

Daily discharge, in second-feet, of St. Francis River near Patterson, Mo., for the year ending Sept. 30 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	31	94	4,760	34,000	1,080	552	872	2,600	310	131	76
2	18	34	75	2,320	21,600	1,060	508	915	1,940	232	104	710
3	17	31	98	1,600	11,000	710	630	1,760	2,320	199	104	1,260
4	21	28	111	1,260	4,060	1,170	958	3,380	2,320	173	790	710
5	19	31	122	958	2,420	1,260	1,760	7,360	1,760	147	310	710
6	18	78	98	830	1,940	2,600	1,680	3,260	1,940	126	214	515
7	32	75	122	750	1,680	3,380	1,420	2,220	1,170	121	288	358
8	45	75	111	630	1,420	2,510	1,260	1,940	1,000	114	173	246
9	131	64	101	515	1,260	1,760	1,080	1,420	830	110	163	177
10	108	70	139	426	1,170	1,510	1,000	1,260	830	102	214	157
11	94	75	108	377	1,080	2,510	830	1,080	1,940	93	228	144
12	72	81	115	334	958	18,700	750	872	1,600	98	154	134
13	49	174	131	294	1,940	6,400	1,940	750	872	106	118	116
14	41	958	122	352	2,320	3,140	5,460	790	750	98	106	106
15	34	1,080	115	440	1,680	4,900	2,960	22,400	915	98	96	98
16	53	872	101	710	1,340	34,600	2,040	25,800	1,760	106	88	91
17	51	830	91	515	1,080	6,080	1,680	7,040	1,600	110	168	86
18	45	630	81	455	915	2,420	1,340	3,380	1,940	98	2,040	94
19	39	485	70	419	750	2,320	1,170	3,260	1,600	93	830	96
20	37	358	70	670	750	1,850	1,040	2,700	1,170	90	426	94
21	47	288	64	2,220	670	1,600	915	2,130	915	91	304	98
22	45	240	64	2,600	630	1,680	710	1,510	750	85	199	104
23	37	226	58	2,320	590	1,510	1,600	1,260	590	80	157	94
24	41	196	64	1,600	515	1,340	6,240	1,080	440	76	144	86
25	35	174	58	1,340	433	1,260	1,850	1,080	334	76	134	77
26	37	160	78	1,340	426	1,080	1,510	2,900	294	77	114	70
27	37	131	872	1,600	1,170	915	1,340	2,220	250	76	106	69
28	32	115	8,540	3,260	1,080	830	1,080	1,760	915	83	98	65
29	34	115	3,020	2,600	-------	750	1,000	3,140	552	76	91	62
30	30	104	1,760	2,420	-------	710	915	4,900	334	141	85	66
31	32	-------	5,600	7,200	-------	590	-------	2,700	-------	147	76	-------

Monthly discharge of St. Francis River near Patterson, Mo., for the year ending Sept. 30, 1923

[Drainage area, 956 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	131	17	43.5	0.046	0.05
November	1,080	28	260	.272	.30
December	8,540	58	718	.751	.87
January	7,200	294	1,520	1.59	1.83
February	34,000	426	3,560	3.72	3.87
March	34,600	590	3,620	3.79	4.37
April	6,240	508	1,590	1.66	1.85
May	25,800	750	3,780	3.95	4.55
June	2,600	250	1,160	1.21	1.35
July	310	76	117	.122	.14
August	2,040	76	264	.276	.32
September	1,260	62	226	.236	.26
The year	34,600	17	1,400	1.46	19.76

LITTLE RIVER DITCH NO. 1 AT KIRK, MO.

LOCATION.—In sec. 27, T. 19 N., R. 10 E., at St. Louis-San Francisco Railway Co.'s bridge at Kirk, Dunklin County, 9½ miles below ditch No. 63, nearest lateral, and 20 miles above Arkansas State line where ditch empties into Big Lake.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 13, 1921, to September 30, 1923. The Little River Drainage District, Cape Girardeau, Mo., has records of stage since May, 1920.

GAGE.—Chain gage bolted to downstream guardrail of railroad pile trestle; read by B. F. Brewer. Prior to December 2, 1921, a painted vertical staff gage fastened to pile trestle on downstream side. Zeros of both gages 200 feet above mean sea level.

CHANNEL AND CONTROL.—Bed composed of clean sand and small gravel; fairly permanent; occasional snags lodged in bed. No well-defined control.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge on Kennett-Hayti road, 1½ miles below gage, or by wading near highway bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 55.90 feet February 4 and May 20 (discharge, 5,620 second-feet); minimum stage, 44.80 feet October 1–5 (discharge, 112 second-feet).

1921–1923: Maximum stage recorded, 56.25 feet April 4, 1922 (discharge, 5,940 second-feet); minimum discharge, 110 second second-feet September 17 and 19–21, 1921.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Entire flow of Castor and Whitewater rivers, and other small streams formerly flowing into Little River, are now diverted into Mississippi River 70 miles north of the station. The drainage west and south of ditch No. 44, which enters 17 miles above, is diverted into ditch No. 81; and the drainage south of ditch No. 63, which enters 9½ miles above, is diverted into ditch No. 66. The three main ditches, Nos. 1, 66, and 81, run parallel from 9 miles above the station to the Arkansas State line, where the drainage district ends.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined. Gage read to half-tenths once daily; readings not entirely reliable. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Little River ditch No. 1 at Kirk, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 1	Austin and Denison	44.86	124	Apr. 24	V. L. Austin	48.10	1,160
Jan. 21	W. R. Denison	50.12	[a]2,200	Aug. 6	W. S. Frame	45.51	286
Mar. 20	William Mulholland [b]	55.50	5,260				

[a] Made during rapidly rising stage; computed discharge for constant stage, 2,030 second-feet.
[b] Engineer of Little River Drainage District.

Daily discharge, in second-feet, of Little River ditch No. 1 at Kirk, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	112	122	238	510	4,800	1,230	1,160	1,300	1,580	1,090	290	122
2	112	122	238	570	5,040	1,190	1,300	1,160	1,540	880	290	133
3	112	122	250	670	5,360	1,160	1,300	1,460	1,540	810	290	390
4	112	122	276	600	5,620	1,120	1,540	2,880	1,540	740	290	317
5	112	122	346	600	5,450	1,090	2,440	4,800	1,620	670	276	303
6	122	166	375	540	5,360	1,160	4,030	4,960	1,460	570	276	360
7	122	166	390	510	5,200	1,920	3,770	5,040	1,260	480	263	360
8	122	166	375	480	4,440	2,270	1,880	5,040	1,230	480	263	331
9	122	166	375	480	3,710	2,070	1,880	4,660	1,160	480	250	303
10	122	166	360	480	3,280	1,460	1,970	3,400	1,160	480	250	276
11	122	166	346	450	2,940	1,700	1,700	2,440	1,230	420	250	250
12	122	166	331	420	2,270	4,160	1,580	2,020	1,460	420	178	225
13	122	166	331	420	2,380	4,880	1,620	1,740	1,500	420	178	213
14	122	166	317	420	2,990	5,040	2,550	1,740	1,300	390	178	201
15	122	166	317	480	2,660	5,120	2,720	4,030	1,160	390	178	190
16	122	166	317	510	2,720	5,200	2,220	5,200	1,160	375	178	190
17	133	190	303	540	1,880	5,280	1,880	5,450	1,160	375	178	178
18	133	225	303	570	1,740	5,280	1,620	5,540	3,770	375	178	178
19	133	250	290	600	1,620	5,360	1,460	5,540	4,100	375	178	201
20	144	250	290	670	1,460	5,360	1,380	5,620	3,280	331	178	250
21	144	250	290	1,300	1,460	4,510	1,300	5,540	2,220	317	178	303
22	144	250	290	4,440	1,380	4,370	1,230	5,540	1,540	303	201	263
23	144	238	290	4,580	1,300	3,840	1,190	5,200	1,190	303	178	225
24	144	238	290	4,300	1,230	3,280	1,160	4,440	1,090	303	166	213
25	133	238	290	4,800	1,230	2,770	1,160	3,100	950	303	166	201
26	133	238	303	3,640	1,230	2,330	1,190	2,660	880	303	166	201
27	133	238	331	3,640	1,300	2,070	1,190	2,490	810	303	166	190
28	133	238	360	3,280	1,300	1,740	1,230	2,330	880	303	144	178
29	122	238	420	3,220	-------	1,700	1,700	1,970	1,300	303	133	166
30	122	238	480	2,770	-------	1,580	1,460	1,840	1,230	420	122	155
31	122	-------	480	3,520	-------	1,460	-------	1,790	-------	290	122	-------

Monthly discharge, in second-feet, of Little River ditch No. 1 at Kirk, Mo., for the year ending Sept. 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October	144	112	126	May	5,620	1,160	3,580
November	250	122	192	June	4,100	810	1,540
December	480	238	329	July	1,090	290	452
January	4,800	420	1,610	August	290	122	204
February	5,620	1,230	2,910	September	390	122	236
March	5,360	1,090	2,960				
April	4,030	1,160	1,760	The year	5,620	112	1,320

LITTLE RIVER DITCH NO. 81 AT KIRK, MO.

LOCATION.—In sec. 27, T. 19 N., R. 10 E., at St. Louis-San Francisco Railway Co.'s bridge at Kirk, Dunklin County, 1 mile below nearest lateral entering above, and 20 miles above outlet into Big Lake at Arkansas State line.

RECORDS AVAILABLE.—September 13, 1921, to September 30, 1923. The Little River Drainage District, Cape Girardeau, Mo., has collected records of stage since May, 1920.

GAGE.—Chain gage bolted to guard timber on downstream side of railroad pile bridge; read by B. F. Brewer. Prior to December 2, 1921, a painted vertical staff gage fastened to downstream side of pile bent of railroad bridge. Zeros of both gages 200 feet above mean sea level.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge on Kennett-Hayti road 5 miles east of Kennett and 1½ miles below gage, or by wading near highway bridge.

CHANNEL AND CONTROL.—Bed composed of clean sand and small gravel. Channel is artificial ditch section; fairly permanent. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 53.90 feet February 6–7 (discharge, 2,370 second-feet); minimum stage, 43.75 feet October 4–7 (discharge, 26 second-feet).

1921–1923: Maximum stage recorded, 54.05 feet April 4–5, 1922 (discharge 2,390 second-feet); minimum discharge, 20 second-feet August 11–20, 1922.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—This ditch drains all the area west and south of ditch No. 44 in Little River basin and diverts natural flow from ditch No. 1, which is now the main stream. (See Little River ditch No. 1 at Kirk, Mo.)

ACCURACY.—Stage-discharge relation changed during high water in January. Rating curve used until January 21 well defined; curve used after that date well defined between 90 and 2,200 second-feet and fairly well defined beyond these limits. Gage read to half-tenths once daily; readings not entirely reliable. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Little River ditch No. 81 at Kirk, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 1	Austin and Denison	43.89	39	Apr. 24	V. L. Austin	46.44	430
Jan. 21	W. R. Denison	51.22	1,560	Aug. 6	W. S. Frame	44.61	155
Mar. 21	William Mulholland[a]	52.48	1,900				

[a] Engineer of Little River Drainage District.

Daily discharge, in second-feet, of Little River ditch No. 81 at Kirk, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	42	36	67	257	2,190	520	802	460	710	424	173	50
2	36	36	67	273	2,220	424	540	424	754	340	160	62
3	31	36	102	289	2,280	486	540	500	644	308	146	153
4	26	36	116	273	2,310	442	874	898	580	292	180	160
5	26	36	226	257	2,220	424	1,730	1,920	540	264	173	180
6	26	42	226	257	2,370	520	1,980	1,890	500	236	160	194
7	26	42	226	226	2,370	922	1,610	1,920	480	236	153	194
8	42	42	226	211	2,250	826	948	1,670	460	236	140	194
9	42	42	211	196	1,810	802	974	1,210	460	222	127	166
10	42	42	196	188	1,210	778	754	802	460	208	127	127
11	36	48	181	181	1,160	710	666	666	644	201	127	114
12	36	48	174	174	1,100	2,040	710	600	850	194	127	101
13	36	54	166	166	1,260	2,070	732	540	802	194	120	101
14	36	54	158	166	1,390	2,130	1,050	540	666	187	114	101
15	36	54	151	188	1,210	2,130	850	2,130	580	180	108	101
16	36	54	151	196	1,080	2,220	710	2,280	622	173	101	101
17	36	60	137	226	1,000	2,220	622	2,280	666	173	101	101
18	36	81	130	257	898	2,250	580	2,340	802	173	94	101
19	36	123	123	273	688	2,100	540	2,340	1,050	173	101	101
20	36	109	123	289	666	2,040	500	2,340	974	166	101	173
21	36	109	123	1,050	622	1,610	500	2,310	802	153	101	208
22	36	95	123	1,980	560	1,530	480	2,070	644	146	108	173
23	36	81	123	1,890	540	1,530	460	1,530	540	140	101	140
24	36	67	123	1,390	500	1,670	424	1,180	442	140	94	127
25	36	67	123	1,750	500	1,640	424	1,000	356	140	94	114
26	36	67	137	1,160	520	1,590	424	1,000	308	140	82	108
27	36	67	151	974	580	1,450	424	974	292	140	75	101
28	36	67	174	1,160	560	1,080	442	948	44	140	75	94
29	36	67	196	1,100	------	974	622	802	580	140	62	88
30	36	67	226	948	------	898	540	732	500	187	56	88
31	36	------	257	1,890	------	850	------	710	------	180	50	------

Monthly discharge of Little River ditch No. 81 at Kirk, Mo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	42	26	35.3
November	123	36	61.0
December	257	67	158
January	1,980	166	640
February	2,370	500	1,290
March	2,250	424	1,320
April	1,980	424	748
May	2,340	424	1,320
June	1,050	292	604
July	424	140	201
August	180	50	114
September	208	50	127
The year	2,370	26	552

LITTLE RIVER DITCH NO. 66 AT KIRK, MO.

LOCATION.—In sec. 27, T. 19 N., R. 10 E., at St. Louis-San Francisco Railway Co.'s bridge at Kirk, Dunklin county, half a mile below ditch No. 72, half a mile above ditch No. 73, 8 miles below ditch No. 64, most northerly lateral, and 20 miles above outlet into Big Lake at Arkansas State line.

RECORDS AVAILABLE.—September 13, 1921, to September 30, 1923. The Little River Drainage District, Cape Girardeau, Mo., has collected records of stage since May, 1920.

GAGE.—Chain gage bolted to downstream guardrail of railroad pile bridge; read by B. F. Brewer. Prior to December 2, 1921, a painted vertical staff gage fastened to downstream side of pile trestle. Zeros of both gages 200 feet above mean sea level.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge on Kennett-Hayti road 1½ miles below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand and small gravel; artificial ditch section; fairly permanent. Some snags lodged in bed of stream. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 53.85 feet May 21 (discharge, 1,580 second-feet); minimum stage, 43.75 feet October 13 to November 9 (discharge, 3 second-feet).

1921–1923: Maximum stage, that of May 21, 1923; minimum stage, 43.2 feet October 30 to November 17, 1921 (discharge, 1 second-foot).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—This ditch drains the old Little River channel below ditch No. 51, the last diversion into ditch No. 1, and all the Little River basin south and east of ditch No. 63 (see Little River ditch No. 1 at Kirk, Mo.).

ACCURACY.—Stage-discharge relation changed during high water in January. Rating curves fairly well defined. Gage read to half-tenths once daily; readings not entirely reliable. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Little River ditch No. 66 at Kirk, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 1	Austin and Denison	43.90	6.3	Apr. 24	V. L. Austin	45.88	221
Jan. 21	W. R. Denison	50.76	1,040	Aug. 6	W. S. Frame	44.22	46
Mar. 21	William Mulholland [a]	49.55	760				

[a] Engineer of Little River Drainage District.

Daily discharge, in second-feet, of Little River ditch No. 66 at Kirk, Mo., for the year ending Sept. 30, 1923

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7	8	10	107	1,380	260	234	516	423	178	55	16
2	6	3	10	102	1,420	247	221	348	453	147	51	28
3	6	3	50	97	1,480	221	221	438	393	127	47	185
4	6	3	58	92	1,480	221	247	758	348	112	59	197
5	6	3	112	82	1,540	197	794	1,030	318	102	55	162
6	6	3	112	77	1,540	333	920	1,050	303	93	51	278
7	6	3	102	77	1,540	533	812	1,030	303	88	47	288
8	6	3	97	72	1,500	453	438	1,060	303	84	43	303
9	6	3	97	58	1,380	438	363	652	288	80	39	157
10	6	4	87	54	1,080	453	348	500	303	75	35	147
11	4	4	77	50	1,050	453	303	348	584	71	35	117
12	4	6	72	46	584	1,080	303	303	686	71	32	98
13	3	7	62	42	635	1,150	333	273	686	71	28	84
14	3	7	58	42	584	1,140	669	273	500	67	25	75
15	3	7	54	54	484	1,140	618	1,380	348	63	22	67
16	3	7	54	72	393	1,190	550	1,440	423	59	22	63
17	3	10	50	87	363	1,170	363	1,480	453	59	22	59
18	3	13	42	102	333	1,120	303	1,520	758	55	22	59
19	3	13	42	112	288	1,050	260	1,580	920	51	22	67
20	3	13	58	127	273	884	247	1,580	974	47	22	197
21	3	13	58	884	260	794	260	1,580	938	43	22	197
22	3	10	58	1,210	260	686	247	1,580	758	39	35	147
23	3	10	54	1,080	247	618	221	1,540	584	39	32	117
24	3	10	50	938	234	567	209	1,520	423	39	28	102
25	3	10	54	1,140	221	453	197	1,300	197	39	28	84
26	3	10	62	722	247	393	197	992	173	39	25	80
27	3	10	72	550	303	348	197	1,050	147	39	22	75
28	3	10	87	722	288	303	247	812	221	39	22	63
29	3	10	97	652	-------	273	686	635	221	39	19	55
30	3	10	107	601	-------	260	652	516	197	117	16	51
31	3	-------	107	1,190	-------	247	-------	393	-------	59	16	-------

Monthly discharge of Little River ditch No. 66 at Kirk Mo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	7	3	4.06
November	13	3	7.37
December	112	10	68.1
January	1,210	42	363
February	1,540	221	764
March	1,190	197	602
April	920	197	389
May	1,580	273	951
June	974	147	454
July	173	39	71.8
August	59	16	32.2
September	303	16	120
The year	1,580	3	319

WHITE RIVER BASIN

WHITE RIVER AT BEAVER, ARK.

LOCATION.—In sec. 20, T. 21 N., R. 26 W., at Missouri & North Arkansas Railroad bridge a quarter of a mile east of depot at Beaver, Carroll County, 3 miles above Leatherwood Creek, and 5 miles below Cedar Creek.

DRAINAGE AREA.—1,270 square miles (measured on topographic maps and base map of Arkansas).

RECORDS AVAILABLE.—July 17, 1909, to December 31, 1910, and May 16 to September 30, 1923.

GAGE.—Chain gage on upstream side of bridge; read during 1923 by Harvey Skelton. During 1909–10 a chain gage on upstream side of bridge with datum 1.5 feet lower than datum of present gage.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand and gravel; fairly permanent. Right bank high and rocky; Left bank thinly wooded and subject to overflow at extreme high stages. Control is a clean gravel bar half a mile below gage; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 17.43 feet at 3 p. m. May 16 (discharge, 21,500 second-feet); minimum stage, 2.15 feet August 25 and September 1 (discharge, 45 second-feet).

1909–10: Maximum stage recorded, 17.35 feet May 17, 1910 (discharge 21,500 second-feet); minimum stage, 1.55 feet October 1–8, 1909 (discharge, 42 second-feet). These gage heights refer to datum of gage installed in 1923.

ACCURACY.—Stage-discharge relation assumed permanent during 1909–10; was permanent during 1923, but changed during interval between those periods; not affected by ice. Rating curve used for 1909–10, fairly well defined above 300 second-feet; curve used for 1923 well defined above 110 second-feet. Gage read to half-tenths once daily during 1909–10 and to hundredths twice daily during 1923. Daily discharge ascertained by applying mean daily gage height to rating table. Records for 1909–10 fair for medium and high stages and poor for low stages. Records for 1923 good.

Discharge measurements of White River at Beaver, Ark., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Apr. 24	E. L. Williams	4.91	1,670	May 18	H. C. Beckman	9.20	7,460
May 16	H. C. Beckman	17.08	20,800	19	do	7.26	4,370
17	do	14.24	15,600	July 14	do	2.59	144
17	do	12.38	12,300	Sept. 13	V. L. Austin	2.53	114

Daily discharge, in second-feet, of White River at Beaver, Ark., for the periods July 17, 1909, to Dec. 31, 1910, and May 16 to Sept. 30, 1928

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1909				1909				1909			
1	-------	110	52	11	-------	76	52	21	180	57	45
2	-------	91	52	12	-------	76	52	22	180	52	48
3	-------	91	52	13	-------	69	52	23	155	52	45
4	-------	91	52	14	-------	69	52	24	155	52	45
5	-------	91	52	15	-------	62	52	25	132	52	45
6	-------	91	57	16	-------	62	48	26	132	52	45
7	-------	76	57	17	350	62	45	27	132	52	45
8	-------	76	57	18	275	62	45	28	132	52	45
9	-------	76	52	19	225	62	45	29	110	57	45
10	-------	76	52	20	210	62	45	30	110	57	45
								31	110	52	-------

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1909–10												
1	42	57	132	155	210	3,510	1,520	462	1,440	900	225	132
2	42	57	132	132	225	2,040	970	418	1,280	710	210	155
3	42	57	132	155	180	1,600	802	372	970	590	210	155
4	42	57	132	155	180	1,280	620	330	835	1,120	195	168
5	42	100	1,680	155	210	970	740	310	740	835	180	155
6	42	350	4,630	155	155	835	1,280	292	620	710	180	258
7	42	168	2,570	330	155	770	1,950	292	590	510	535	310
8	42	292	1,440	395	180	620	1,600	292	770	510	1,770	225
9	57	275	970	350	155	590	1,280	292	740	590	1,680	258
10	57	210	770	240	155	620	1,860	310	1,120	650	970	258
11	52	155	650	225	180	535	1,600	310	1,040	970	970	210
12	48	132	535	210	132	485	1,860	275	1,440	8,920	740	210
13	42	121	485	310	155	462	5,230	258	1,280	10,500	770	180
14	57	121	485	372	132	440	2,790	225	970	5,980	562	155
15	48	110	462	330	132	418	2,790	225	802	2,790	485	144
16	48	168	440	330	155	372	2,900	1,770	680	1,950	418	132
17	48	240	395	330	155	350	3,010	21,500	562	1,440	462	121
18	48	292	372	330	180	310	2,570	9,880	462	1,120	395	110
19	52	485	330	372	195	310	1,950	4,630	418	970	372	110
20	57	395	310	330	168	275	1,680	3,010	418	802	292	110
21	62	330	310	330	292	275	1,440	2,350	485	680	275	110
22	84	258	275	330	395	258	1,280	2,040	440	562	275	110
23	84	240	275	330	485	240	970	3,010	395	510	275	100
24	76	210	240	330	590	240	835	3,770	462	462	258	91
25	69	180	210	275	710	210	835	3,640	418	395	225	91
26	62	168	225	310	802	210	710	3,120	680	350	210	91
27	57	155	225	258	1,600	210	620	2,240	680	330	180	91
28	57	132	210	275	3,120	210	562	1,770	1,360	292	168	310
29	57	132	210	210	-------	195	535	1,440	1,950	258	155	275
30	57	132	292	240	-------	258	462	1,120	1,120	275	155	196
31	62	-------	180	210	-------	835	-------	970	-------	258	144	-------

Day	Oct.	Nov.	Dec.	Day	Oct.	Nov.	Dec.	Day	Oct.	Nov.	Dec.
1910				1910				1910			
1	155	110	91	11	155	110	91	21	180	91	91
2	132	110	91	12	155	91	91	22	155	91	76
3	144	110	91	13	225	91	91	23	155	91	76
4	155	110	110	14	350	91	91	24	155	91	76
5	258	110	100	15	395	91	91	25	155	91	76
6	350	110	91	16	258	91	91	26	144	91	76
7	292	110	91	17	225	91	91	27	132	110	76
8	258	110	91	18	195	91	91	28	132	110	91
9	210	110	91	19	180	91	91	29	132	110	91
10	180	110	91	20	180	91	91	30	132	91	91
								31	132	-------	91

Daily discharge, in second-feet, of White River at Beaver, Ark., for the periods July 17, 1909, to Dec. 31, 1910, and May 16 to Sept. 30, 1923—Continued.

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1923						1923					
1		3,640	650	116	46	16	21,500	1,210	530	53	224
2		2,240	502	110	56	17	13,700	1,210	251	50	195
3		1,740	420	147	52	18	6,730	1,210	270	50	246
4		1,470	365	134	50	19	4,480	1,380	305	49	238
5		1,210	310	108	48	20	3,640	980	215	48	338
6		1,130	280	98	47	21	3,010	805	199	47	840
7		3,120	242	83	59	22	2,350	650	158	45	429
8		2,900	228	79	65	23	4,030	560	134	49	420
9		2,040	211	75	88	24	5,080	530	128	52	338
10		1,470	187	71	275	25	12,600	475	125	56	275
11		1,210	172	67	175	26	9,720	448	113	59	238
12		1,050	161	64	134	27	8,920	448	108	62	203
13		980	150	62	168	28	5,680	740	108	58	175
14		980	140	59	233	29	3,900	740	98	50	158
15		1,740	980	56	134	30	3,010	770	448	50	144
						31	2,790		161	48	

Monthly discharge of White River at Beaver, Ark., for the periods July 17, 1909, to Dec. 31, 1910, and May 16 to Sept. 30, 1923

[Drainage area, 1,270 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
1909					
July 17–31	350	110	173	0.136	0.08
August	110	52	68.3	.054	.06
September	57	45	49.2	.039	.04
1909–10					
October	84	42	54.3	.043	.05
November	485	57	193	.152	.17
December	4,630	132	636	.501	.58
January	395	132	273	.215	.25
February	3,120	132	407	.320	.33
March	3,510	195	643	.506	.58
April	5,230	462	1,580	1.24	1.38
May	21,500	225	2,290	1.80	2.08
June	1,950	395	839	.661	.74
July	10,500	268	1,510	1.19	1.37
August	1,770	144	450	.354	.41
September	310	91	167	.131	.15
The year	21,500	42	757	.596	8.09
1910					
October	395	132	195	.154	.18
November	110	91	99.9	.079	.09
December	110	76	89.0	.070	.08
1923					
May 16–31	21,500	2,350	6,950	5.47	3.25
June	3,640	448	1,300	1.02	1.14
July	980	98	269	.212	.24
August	147	45	69.5	.055	.06
September	840	46	203	.160	.18

JAMES RIVER AT GALENA, MO.

LOCATION.—In NW. ¼ sec. 7, T. 24 N., R. 23 W., at highway bridge in Galena, Stone County, a quarter of a mile above Missouri Pacific Railway Co.'s bridge, half a mile above Railey Creek, and 8 miles below Crane Creek.

DRAINAGE AREA.—1,000 square miles (measured on topographic and soil survey maps).

RECORDS AVAILABLE.—October 28, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to upstream side of bridge; read by B. W. Stewart and M. H. Stewart.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and small boulders. Small trees and brush grow on gravel bars which are exposed at low stages. Low-water control is a heavy gravel riffle 100 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.95 feet at 4 p. m. March 12 (discharge, 9,940 second-feet); minimum stage, 0.74 foot at 7 a. m. October 17 (discharge, 77 second-feet).

1922–1923: Maximum and minimum stages same as given above.

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defincd. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records until July 31 poor on account of unreliable gage readings; good thereafter.

Discharge measurements of James River at Galena, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov 16	V. L. Austin	1.11	118	May 14	H. C. Beckman	1.88	376
Jan. 5	do	1.33	178	July 13	do	1.72	284
Mar. 28	do	2.68	808	Sept. 17	Frame and Austin	1.00	114

Daily discharge, in second-feet, of James River at Galena, Mo., for the year ending Sept. 30 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	84	97	104	242	3,240	485	660	1,060	825	825	276	120
2	90	104	139	212	4,780	485	635	1,000	1,060	770	242	129
3	84	104	139	197	3,600	462	610	825	3,990	660	226	120
4	84	97	139	184	3,000	485	560	825	4,780	610	212	112
5	78	90	149	184	2,320	635	510	715	4,780	560	197	104
6	84	90	149	171	1,730	770	485	635	4,510	535	197	160
7	104	78	149	160	1,730	1,180	462	610	4,120	510	184	129
8	120	78	139	149	1,640	1,560	462	585	3,730	510	184	129
9	129	84	149	139	1,640	1,480	462	585	3,120	462	160	149
10	120	97	149	129	1,480	1,480	440	535	2,540	418	160	160
11	112	97	139	129	1,400	1,400	440	510	2,320	374	160	160
12	104	90	139	120	1,400	8,140	440	440	2,540	332	160	139
13	97	104	139	120	1,320	7,180	440	396	2,760	293	184	112
14	97	171	129	139	1,180	6,550	440	374	2,540	2,320	160	104
15	90	149	120	212	1,000	4,120	418	825	2,020	1,060	149	112
16	84	129	112	242	940	4,380	396	2,120	1,730	880	149	112
17	78	149	120	242	880	3,730	418	2,430	1,640	940	149	104
18	78	171	112	258	825	3,360	418	2,020	1,560	1,060	139	112
19	84	171	104	212	770	3,360	485	1,640	1,480	770	139	112
20	84	160	97	184	635	3,120	535	1,250	1,320	560	129	120
21	84	139	104	770	610	2,760	560	1,250	1,180	462	129	112
22	78	120	104	1,920	560	1,320	585	1,320	1,120	374	129	104
23	84	120	97	1,480	585	1,060	1,640	2,020	1,000	353	120	104
24	84	112	97	1,120	610	1,060	2,220	2,020	635	332	112	112
25	78	104	90	940	610	1,060	1,560	1,920	880	332	112	104
26	84	97	120	770	585	1,060	1,400	1,250	940	293	139	104
27	84	97	171	660	535	1,000	1,250	1,060	1,000	258	139	104
28	84	90	226	585	510	860	1,180	940	1,060	242	120	120
29	84	97	293	535	-------	715	1,180	940	1,180	276	112	184
30	84	90	332	560	-------	715	1,250	880	880	276	112	171
31	84	-------	332	1,320	-------	635	-------	770	-------	293	120	-------

NOTE.—Records Oct. 1 to July 31 should be used with caution as they were computed from unreliable gage readings. Daily discharge estimated Nov. 15, 17, 18, May 12–14, and July 9–13.

Monthly discharge of James River at Galena, Mo., for the year ending Sept. 30, 1923

[Drainage area, 1,000 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	129	78	90.2	0.090	0.10
November	171	78	113	.113	.13
December	332	90	148	.148	.17
January	1,920	120	461	.461	.53
February	4,780	510	1,430	1.43	1.49
March	8,140	462	2,150	2.15	2.48
April	2,220	396	751	.751	.84
May	2,430	374	1,090	1.09	1.26
June	4,780	635	2,110	2.11	2.35
July	2,320	242	579	.579	.67
August	276	112	158	.158	.18
September	184	104	124	.124	.14
The year	8,140	78	767	.767	10.34

NORTH FORK OF WHITE RIVER AT TECUMSEH, MO.

LOCATION.—In sec. 16, T. 22 N., R. 12 W., at Hodos ferry at west edge of Tecumseh, Ozark County, half a mile below Bryants Creek, 3 miles above Lick Creek, and 8 miles above Missouri-Arkansas line.

DRAINAGE AREA.—1,180 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—October 24, 1921, to September 30, 1923.

GAGE.—Enameled vertical staff gage from 0.0 to 10.1 feet bolted to outcropping rocks on left bank 25 feet below landing for Hodos ferry; read by Edward Hodo.

DISCHARGE MEASUREMENTS.—Made from ferry boat at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and boulders; clean and fairly permanent. Control is a bar composed of outcropping rock and coarse gravel 400 feet below gage; clean and practically permanent.

EXTREMES OF STAGE.—Maximum stage during year estimated at 18.60 feet at 4 p. m. February 1; minimum stage, 0.38 foot October 1, 5, and December 26.

1922–23: Maximum stage, that of February 1, 1923; minimum stage, 0.38 foot September 26, 27, 29, 30, October 1, 5, and December 26, 1922.

REGULATION.—Natural regulation due to flow from large springs.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of North Fork of White River near Tecumseh, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 25	W. R. Denison	1.34	1,230	May 18	V. L. Austin	3.26	3,470
Mar. 27	V. L. Austin	1.52	1,340	July 26	W. S. Frame	.93	862

Daily gage height, in feet, of North Fork of White River at Tecumseh, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.38	0.44	0.46	1.46	15.70	1.00	1.27	1.93	2.94	1.29	0.95	0.76
2	.40	.44	.48	1.17	7.00	.98	1.24	1.79	2.34	1.29	.92	.70
3	.40	.43	.50	.98	5.35	1.01	1.31	1.71	4.85	1.24	.98	.75
4	.40	.42	.50	.86	3.55	1.10	1.69	1.71	3.80	1.19	.94	.74
5	.38	.42	.48	.79	2.85	1.10	2.10	1.67	2.95	1.18	.89	.70
6	.65	.44	.47	.71	2.45	1.72	1.74	1.63	2.57	1.14	.86	.67
7	.59	.44	.52	.68	2.18	1.84	1.61	1.60	2.49	1.10	.83	.67
8	.54	.44	.58	.62	1.98	1.72	1.53	1.55	2.18	1.09	.80	.68
9	.50	.44	.56	.59	1.83	1.59	1.43	1.45	2.02	1.07	.82	.65
10	.48	.42	.51	.57	1.63	1.52	1.37	1.37	3.55	1.06	.80	.64
11	.44	.42	.49	.54	1.56	2.52	1.32	1.34	5.10	1.03	.80	.60
12	.43	.42	.48	.52	1.55	4.75	1.29	1.33	3.75	1.00	.77	.60
13	.42	.48	.45	.50	1.56	3.40	1.41	1.28	3.10	1.67	.75	.58
14	.42	.51	.44	.55	1.48	2.70	1.48	1.64	2.67	1.36	.74	.58
15	.44	.50	.44	.59	1.36	3.90	1.45	4.50	2.40	1.17	.74	.56
16	.46	.49	.44	.60	1.32	7.00	1.40	7.45	2.25	1.10	.71	.58
17	.44	.46	.42	.58	1.29	3.95	1.39	4.30	2.27	1.41	.73	.59
18	.42	.50	.40	.58	1.23	3.20	1.35	3.30	2.33	1.22	.74	.60
19	.41	.50	.40	.58	1.20	2.65	1.30	2.74	2.16	1.07	.73	.70
20	.40	.49	.40	1.19	1.19	2.41	1.33	2.43	1.98	1.08	.70	.70
21	.41	.46	.40	3.95	1.15	2.24	1.67	2.20	1.84	1.04	.69	.63
22	.40	.44	.40	2.46	1.10	2.11	1.86	2.03	1.72	1.00	.70	.60
23	.42	.43	.41	1.82	1.06	1.93	1.79	1.91	1.63	.99	.70	.59
24	.42	.42	.40	1.55	1.03	1.78	1.87	2.11	1.58	.97	.69	.58
25	.42	.42	.40	1.37	1.02	1.69	1.76	5.20	1.52	.96	.69	.57
26	.42	.40	.38	1.24	1.07	1.63	1.67	4.40	1.47	.93	.65	.56
27	.41	.40	.68	1.28	1.05	1.53	1.62	3.65	1.43	.96	.64	.54
28	.42	.40	.89	1.36	1.01	1.48	2.12	3.14	1.59	1.02	.64	.53
29	.42	.40	.82	1.35	-------	1.42	2.32	2.74	1.45	1.00	.64	.52
30	.42	.40	1.03	1.29	-------	1.40	2.08	3.60	1.37	1.03	.64	.54
31	.42	-------	1.73	2.77	-------	1.31	-------	2.58	-------	1.02	.62	-------

BLACK RIVER AT LEEPER, MO.

LOCATION.—In SW. ¼ NE. ¼ sec. 27, T. 28 N., R. 3 E., on Missouri Southern Railway Co.'s bridge at Leeper, Wayne County, 1½ miles above Greenwood Valley Creek, 3 miles below McKenzie Creek, 5 miles below Deer Creek, and 8 miles above Brushy Creek.

DRAINAGE AREA.—957 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—June 15, 1921, to September 30, 1923.

GAGE.—Chain gage fastened to guard timber on downstream side of railroad bridge; read by Harry Record and Pearl Church. Elevation of zero of gage above mean Gulf level, 423.95 feet.

DISCHARGE MEASUREMENTS.—Made from downstream side of railroad or highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and sand. Control is a bar of coarse gravel and boulders 800 feet below gage; fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 12.80 feet at 4.45 p. m. March 16; minimum stage, 1.88 feet at 7 a. m. and 5.30 p. m. October 5.

1921–1923: Maximum stage recorded, 13.40 feet November 19, 1921; minimum stage, 1.84 feet August 30 and September 2, 1921.

The river reached a stage of 21.3 feet in August, 1915 (determined by levels to high-water marks by United States Weather Bureau).

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation changed during high water March 16. Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of Black River at Leeper, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 4	Austin and Denison	1.91	213	Apr. 26	V. L. Austin	3.64	991
Jan. 19	W. R. Denison	2.68	539	Aug. 3	W. S. Frame	2.54	362
Feb. 4	do	5.73	3,920				

Daily gage height, in feet, of Black River at Leeper, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.93	2.25	2.24	5.61	9.68	3.22	3.35	3.45	4.35	3.06	2.54	2.42
2	1.92	2.38	2.30	4.46	9.88	3.17	3.32	3.42	4.15	3.02	2.55	2.97
3	1.91	2.42	1.35	3.96	8.40	3.22	3.42	3.88	5.20	2.94	2.54	3.43
4	1.96	2.47	2.32	3.48	5.88	3.48	3.42	6.12	5.10	2.90	2.52	3.27
5	1.88	2.39	2.29	3.26	4.50	3.68	3.62	7.32	4.42	2.87	2.50	3.04
6	1.94	2.37	2.27	3.26	4.38	3.82	3.62	5.70	4.10	2.83	2.46	2.89
7	2.02	2.35	2.32	3.16	4.40	4.15	3.60	5.00	3.90	2.77	2.45	2.83
8	2.52	2.36	2.40	3.00	4.12	4.18	3.60	4.62	3.70	2.73	2.43	2.77
9	2.60	2.34	2.44	2.93	3.95	4.02	3.52	4.32	3.58	2.70	2.59	2.69
10	2.48	2.27	2.44	2.88	3.80	3.85	3.45	4.15	3.50	2.73	2.69	2.67
11	2.35	2.26	2.42	2.76	3.72	4.40	3.45	3.98	3.52	2.70	2.62	2.66
12	2.28	2.24	2.42	2.73	3.62	8.20	3.40	3.82	3.55	2.67	2.59	2.56
13	2.21	2.35	2.43	2.65	3.78	6.80	3.65	3.72	3.42	2.71	2.57	2.53
14	2.18	2.52	2.38	2.68	3.82	5.38	4.10	3.70	3.33	2.69	2.55	2.50
15	2.17	2.53	2.37	2.68	3.68	5.28	4.30	7.15	4.02	2.66	2.50	2.46
16	2.20	2.60	2.34	2.80	3.58	11.25	4.10	11.60	4.98	2.70	2.49	2.44
17	2.20	2.58	2.34	2.78	3.48	7.12	3.90	7.75	4.73	2.81	2.51	2.45
18	2.25	2.60	2.31	2.72	3.40	5.60	3.82	5.85	4.48	2.87	2.51	2.46
19	2.24	2.58	2.28	2.68	3.40	5.00	3.68	5.32	4.00	2.75	2.49	2.52
20	2.27	2.59	2.28	2.66	3.34	4.60	3.62	4.95	3.68	2.66	2.44	2.56
21	2.18	2.56	2.25	3.75	3.29	5.48	3.68	4.52	3.53	2.64	2.44	2.62
22	2.17	2.54	2.21	3.78	3.23	4.28	3.62	4.35	3.43	2.61	2.67	2.51
23	2.17	2.56	2.20	3.68	3.17	4.12	3.60	4.10	3.32	2.57	2.66	2.48
24	2.16	2.46	2.22	3.62	3.14	3.98	4.12	4.02	3.23	2.56	2.71	2.46
25	2.15	2.36	2.20	3.50	3.15	3.85	3.80	3.92	3.15	2.56	2.65	2.44
26	2.14	2.36	2.20	3.50	3.16	3.82	3.65	3.82	3.10	2.53	2.56	2.40
27	2.14	2.35	3.19	3.68	3.22	3.72	3.60	3.80	3.04	2.53	2.53	2.39
28	2.13	2.32	4.74	4.25	3.22	3.62	3.72	3.80	3.66	2.59	2.49	2.36
29	2.12	2.28	4.48	4.48	-------	3.52	3.62	3.82	3.28	2.56	2.47	2.38
30	2.13	2.24	3.98	4.08	-------	3.45	3.50	4.62	3.17	2.61	2.42	2.37
31	2.14	-------	5.11	4.80	-------	3.42	-------	4.70	-------	2.60	2.35	-------

CURRENT RIVER NEAR EMINENCE, MO.

LOCATION.—In SE. ¼ NW. ¼ sec. 15, T. 29 N., R. 3 W., at foot of Coot Mountain, 1 mile below Jacks Fork and 8 miles northeast of Eminence, Shannon County.

DRAINAGE AREA.—1,230 square miles (measured on United States soil survey maps); somewhat indefinite on account of several large tributary springs.

RECORDS AVAILABLE.—August 24, 1921, to September 30, 1923. The Western Tie & Timber Co., St. Louis, has records of stage from December, 1920, to August, 1921.

GAGE.—Vertical staff gage from 0 to 10 feet bolted to outcropping ledge on right bank, and another section from 10 to 26 feet fastened to near-by tree. Prior to October 19, 1921, a painted vertical staff gage at independent datum on right bank 1,200 feet above present gage; readings from this gage referred to present gage by use of curve based on simultaneous readings of the two gages.

DISCHARGE MEASUREMENTS.—Made from cable or by wading near gage.

CHANNEL AND CONTROL.—Bed composed of clean, coarse gravel; fairly permanent. Control is a coarse gravel bar below gage; clean and practically permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 13.50 feet at 3 p. m. March 16; minimum stage, 1.20 feet October 5 and 6.

1921–1923: Maximum stage recorded, 14.20 feet November 19, 1921; minimum stage, 1.20 feet October 5 and 6, 1922.

REGULATION.—Natural regulation through large tributary springs.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Gage read to hundredths once daily. Daily discharge not determined.

Discharge measurements of Current River near Eminence, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Mar. 24	V. L. Austin	3.31	2,130	June 5	W. S. Frame	5.62	5,500
May 19	W. S. Frame	5.08	4,600	July 28	do	1.72	904

Daily gage height, in feet, of Current River near Eminence, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.26	1.46	1.46	4.85	12.70	2.18	2.50	2.62	4.20	------	1.92	1.38
2	1.26	1.50	1.44	3.60	12.80	2.16	2.42	2.62	4.00	2.24	1.78	1.68
3	1.24	1.44	1.44	3.00	7.60	2.12	2.56	2.64	9.60	2.22	1.80	1.66
4	1.22	1.40	1.48	2.80	5.95	2.42	2.42	4.05	7.60	2.16	1.84	1.60
5	1.20	1.38	1.42	2.48	5.00	2.56	2.72	4.70	5.67	2.10	1.74	1.80
6	1.20	1.38	1.56	2.36	4.60	2.84	2.82	4.10	4.70	2.08	1.64	1.76
7	1.84	1.38	1.56	2.28	3.90	3.20	2.74	3.90	4.40	2.04	1.52	1.70
8	1.84	1.36	1.56	2.12	3.70	3.14	2.68	3.40	3.90	1.98	1.50	1.52
9	1.58	1.36	1.54	2.12	3.40	3.00	2.52	3.12	3.50	1.96	1.96	1.50
10	1.46	1.34	1.52	2.10	3.22	2.80	2.46	3.00	3.40	1.94	1.74	1.48
11	1.44	1.34	1.52	2.00	3.08	4.65	2.38	2.90	3.32	1.82	1.70	1.46
12	1.42	1.32	1.50	1.80	3.04	8.40	2.30	2.80	3.28	1.68	------	1.42
13	1.42	1.38	1.48	1.80	3.00	6.30	2.66	2.68	3.00	2.00	1.62	1.40
14	1.42	1.78	1.44	1.88	2.94	4.99	2.84	2.62	2.94	2.06	1.60	1.38
15	1.42	1.72	1.40	2.08	2.78	8.49	2.80	7.30	5.80	2.04	1.56	1.36
16	1.44	1.72	1.38	2.04	2.66	12.55	2.78	12.50	6.00	2.04	1.56	1.36
17	1.42	1.70	1.36	2.00	2.58	7.00	2.66	7.45	4.62	2.06	1.54	1.36
18	1.40	1.64	1.34	1.88	2.54	------	2.54	5.60	4.10	2.08	1.52	1.44
19	1.36	1.64	1.30	1.84	2.44	4.95	2.46	5.10	3.60	1.92	1.52	1.42
20	1.36	1.60	1.28	1.80	2.40	4.50	2.46	4.65	3.48	1.86	1.50	1.42
21	1.34	1.52	1.28	4.95	2.36	3.80	2.46	4.10	3.22	1.80	1.48	1.40
22	1.34	1.48	1.28	4.00	2.28	3.80	2.46	3.80	2.96	1.78	1.54	1.38
23	1.32	1.46	1.28	3.80	2.20	3.60	2.46	3.60	2.80	1.76	1.52	1.36
24	1.28	1.40	1.28	3.28	2.16	------	2.38	3.30	------	1.72	1.48	1.36
25	1.26	1.38	1.26	3.02	2.16	3.12	2.30	3.30	2.64	1.70	1.48	1.36
26	1.26	1.38	1.26	2.86	2.28	3.04	2.26	3.80	2.54	1.68	1.46	1.34
27	1.24	1.34	2.00	2.96	2.28	2.92	2.20	3.80	2.46	1.70	1.44	1.36
28	1.24	1.32	3.30	3.36	2.20	2.80	2.70	3.50	2.68	1.72	1.42	1.36
29	1.22	1.32	2.80	3.24	------	2.72	3.08	3.22	2.50	1.72	1.42	1.34
30	1.22	1.40	2.70	4.00	------	2.66	2.86	4.60	2.42	1.82	1.38	2.32
31	1.22	------	4.80	5.00	------	2.56	------	3.60	------	2.26	1.38	------

CURRENT RIVER AT VAN BUREN, MO.

LOCATION.—In NE. ¼ NW. ¼ sec. 25, T. 27 N., R. 1 W., at highway bridge in Van Buren, Carter County, half a mile below Davis Creek, 3 miles below Henpeck Creek, 3 miles above Carlos Creek, and 4 miles above Big Spring.

DRAINAGE AREA.—1,640 square miles (measured on United States soil survey maps). Somewhat indefinite on account of several large tributary springs.

RECORDS AVAILABLE.—June 18, 1921, to September 30, 1923. The Missouri Engineering Experiment Station has records at the same site from August 25, 1912, to July 30, 1921.[3]

GAGE.—Chain gage on downstream side of highway bridge; read by Z. Chilton and Bernice Rose.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; fairly permanent. No well-defined control; low-water control probably at constricted section of channel at former bridge site 800 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.24 feet at 3.30 p. m. February 2 (discharge, 21,800 second-feet); minimum stage, 1.06 feet October 3–6 and December 26 (discharge, 810 second-feet).

1921–1923: Maximum stage recorded, 10.25 feet November 20, 1921 (discharge, 22,100 second-feet); minimum discharge, 778 second-feet September 30, 1922.

The Missouri Engineering Experiment Station has published a maximum discharge of 125,000 second-feet on August 21, 1915, and a minimum discharge of 540 second-feet in September, 1913. On March 26, 1904, the river reached a stage about 5 feet higher than the flood of 1915.

REGULATION.—Natural regulation through large springs.

ACCURACY.—Stage-discharge relation changed during high water February 2; not affected by ice. Rating curves used before and after the change well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Current River at Van Buren, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 27	W. R. Denison	3.01	2,690	Mar. 22	V. L. Austin	4.09	3,600
Feb. 5	V. L. Austin	5.45	6,130	June 6	W. S. Frame	4.81	4,820

[3] See Missouri Univ. Eng. Exper. Sta. Bull., ser. 22, vol. 21, No. 35.

Daily discharge, in second-feet, of Current River at Van Buren, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	810	920	860	5,550	16,200	1,350	1,780	2,920	3,160	1,720	1,250	930
2	810	920	860	3,690	21,400	1,250	1,780	1,900	3,800	1,660	1,160	1,000
3	810	920	860	2,690	16,200	1,250	1,900	1,900	5,900	1,610	1,160	1,080
4	810	890	920	2,200	8,380	1,250	1,920	3,800	8,380	1,550	1,160	1,080
5	810	860	860	1,860	6,180	1,900	1,960	5,520	7,120	1,550	1,160	1,000
6	810	86 (	860	1,660	4,920	2,280	1,990	4,540	5,110	1,450	1,000	1,080
7	860	860	920	1,460	3,970	2,420	2,020	3,460	3,970	1,450	1,080	1,080
8	1,120	860	980	1,370	3,460	2,420	2,020	3,160	3,460	1,350	1,080	1,000
9	1,050	860	980	1,280	3,010	2,150	1,900	2,860	3,160	1,350	1,080	1,000
10	920	860	980	1,200	2,710	2,020	1,780	2,420	3,010	1,350	1,160	930
11	860	810	920	1,120	2,420	3,160	1,780	2,280	2,860	1,350	1,080	930
12	860	810	900	1,120	2,280	10,400	1,660	2,150	2,710	1,350	1,080	930
13	860	860	880	1,120	2,280	9,800	2,150	2,020	2,560	1,350	1,000	930
14	810	920	860	1,120	2,280	6,180	2,280	2,020	2,420	1,350	1,000	930
15	860	980	860	1,200	2,020	4,920	2,280	7,860	6,640	1,350	1,000	870
16	860	980	860	1,280	1,900	15,800	2,150	15,400	9,220	1,350	1,000	930
17	860	980	860	1,200	1,900	12,700	2,020	14,400	5,960	1,350	1,000	870
18	860	980	810	1,200	1,780	6,640	1,900	7,600	4,160	1,450	1,000	980
19	860	980	810	1,120	1,660	5,110	1,840	6,180	3,630	1,350	1,000	930
20	860	980	810	1,120	1,550	4,540	1,780	4,920	3,160	1,250	1,000	930
21	810	920	810	4,820	1,350	3,970	1,780	4,350	2,710	1,250	1,000	930
22	810	920	810	5,970	1,250	3,630	1,780	3,800	2,560	1,160	1,080	930
23	860	920	810	3,690	1,250	3,310	1,780	3,460	2,280	1,160	1,000	930
24	860	860	810	2,820	1,250	2,860	1,780	3,160	2,150	1,160	1,000	930
25	810	860	810	2,560	1,350	4,350	1,660	2,820	2,020	1,160	1,000	930
26	810	860	810	2,560	1,350	2,560	1,550	2,490	1,900	1,160	1,000	930
27	810	810	980	2,560	1,350	2,280	1,550	2,150	1,900	1,160	930	930
28	810	860	2,200	2,820	1,350	2,150	1,900	3,160	2,020	1,160	930	930
29	810	810	2,690	2,960	-------	2,020	2,150	2,860	1,900	1,160	930	930
30	810	810	2,440	2,690	-------	2,020	2,080	3,010	1,780	1,160	930	870
31	810	-------	4,480	3,390	-------	1,900	-------	3,630	-------	1,450	930	-------

NOTE.—Daily discharge interpolated Nov. 4, 7, Dec. 12, 13, Jan. 9, 26, Apr. 4–6, 19, 21, 30, May 25, 26, and July 1–3; estimated June 10–14. Gage not read on those days.

Monthly discharge of Current River at Van Buren, Mo., for the year ending Sept. 30, 1923

[Drainage area, 1,640 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,120	810	851	0.519	0.60
November	980	810	891	.543	.61
December	4,480	810	1,140	.695	.80
January	5,970	1,120	2,300	1.40	1.61
February	21,400	1,250	4,180	2.55	2.66
March	15,800	1,250	4,150	2.53	2.92
April	2,280	1,550	1,900	1.16	1.29
May	15,400	1,900	4,240	2.59	2.99
June	9,220	1,780	3,720	2.27	2.53
July	1,720	1,160	1,340	.817	.94
August	1,250	930	1,040	.634	.73
September	1,080	870	953	.581	.65
The year	21,400	810	2,230	1.36	18.33

CURRENT RIVER AT DONIPHAN, MO.

LOCATION.—In N. ½ sec. 27, T. 23 N., R. 2 E., at highway bridge three-quarters of a mile west of Doniphan, Ripley County, 2 miles above Briar Creek, and 12 miles below Buffalo Creek.

DRAINAGE AREA.—2,030 square miles (measured on United States soil survey maps); somewhat indefinite on account of numerous large tributary springs.

RECORDS AVAILABLE.—June 14, 1921, to September 30, 1923. The United States Engineer Office, Memphis, Tenn., has records of stage from August, 1918, to June, 1921.

GAGE.—Chain gage on upstream side of bridge; read by T. B. Swindel. Prior to May 10, 1922, a painted staff gage on bridge pier and auxiliary staff gage from 0 to 4 feet on right bank.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of clean, coarse gravel; practically permanent. No well-defined control.

EXTREMES OF STAGE.—Maximum stage recorded during year, 13 feet at 7 a. m. February 3; minimum stage, 0.54 foot December 25–26.

1921–1923: Maximum and minimum stages same as those for 1923, as given above.

The flood of August, 1915, reached a stage of 25.5 feet (determined by levels to flood marks by United States Engineer Corps).

REGULATION.—Natural regulation through numerous large springs.

ACCURACY.—Stage-discharge relation fairly permanent; not affected by ice. Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of Current River at Doniphan, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 23	W. R. Denison	4.18	6,250	June 7	W. S. Frame	4.07	5,890
Mar. 21	V. L. Austin	4.31	6,220	Aug. 5	do	1.15	2,090

Daily gage height, in feet, of Current River at Doniphan, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.60	0.77	0.69	4.38	5.25	1.77	2.28	2.44	3.23	1.94	1.45	0.78
2	.58	.80	.72	4.03	11.15	1.73	2.20	2.27	3.08	1.82	1.32	.78
3	.58	.78	.71	2.93	13.00	1.70	2.22	2.29	3.28	1.75	1.23	.91
4	.58	.76	.76	2.40	9.45	1.83	2.37	3.43	5.83	1.69	1.16	.95
5	.58	.76	.72	2.02	5.60	1.91	2.79	5.18	4.88	1.63	1.13	.96
6	.58	.75	.73	1.84	4.75	2.72	2.69	5.28	4.13	1.58	1.09	.93
7	.64	.74	.78	1.56	4.20	2.90	2.64	4.38	4.04	1.54	1.05	.99
8	.64	.72	.82	1.49	3.70	3.01	2.58	3.83	3.35	1.49	1.04	1.00
9	.80	.72	.84	1.35	3.35	2.88	2.36	3.42	3.20	1.55	1.10	.96
10	.78	.72	.85	1.25	3.20	2.70	2.27	3.21	3.10	1.42	1.12	.87
11	.76	.72	.86	1.18	2.99	4.00	2.18	2.93	3.12	1.37	1.10	.83
12	.74	.70	.84	1.14	2.77	6.15	2.14	2.78	2.95	1.35	1.06	.81
13	.68	.68	.79	1.10	2.75	7.80	2.46	2.68	2.62	1.36	1.01	.77
14	.64	.88	.73	1.13	2.72	6.40	2.82	2.64	2.73	1.38	.99	.75
15	.64	.86	.70	1.12	2.55	5.00	2.95	8.33	5.10	1.47	.96	.74
16	.68	.84	.68	1.13	2.39	9.50	2.82	9.33	-------	1.45	.92	.73
17	.68	.84	.64	1.22	2.32	11.00	2.63	10.82	5.75	1.47	.90	.72
18	.67	.92	.60	1.18	2.27	8.45	2.42	8.61	4.35	1.57	.90	.80
19	.66	.92	.58	1.16	2.15	5.90	2.29	6.16	3.80	1.49	.89	.80
20	.64	.86	.58	1.16	2.04	4.90	2.26	5.23	3.40	1.43	.87	.83
21	.64	.86	.57	5.08	1.97	4.27	2.30	4.33	3.07	1.30	.86	.78
22	.64	.81	.56	4.48	1.89	4.02	2.30	3.93	2.85	1.27	.99	.76
23	.65	.76	.56	4.28	1.82	3.59	2.28	3.73	2.70	1.23	.96	.74
24	.62	.74	.56	3.41	1.70	3.59	2.23	3.48	2.58	1.19	.95	.72
25	.62	.72	.54	3.07	1.70	3.36	2.16	3.23	2.27	1.18	.94	.70
26	.62	.72	.54	2.90	1.76	2.96	2.08	3.12	2.15	1.17	.90	.68
27	.62	.69	.90	2.82	1.84	2.70	2.11	3.05	2.10	1.14	.89	.68
28	.62	.68	1.33	2.82	1.80	2.62	2.18	3.27	2.09	1.14	.86	.68
29	.62	.62	2.34	3.11	-------	2.51	3.03	3.15	2.04	1.14	.83	.68
30	.62	.61	2.44	3.09	-------	2.43	2.59	3.20	-------	1.12	.80	-------
31	.62	-------	2.72	3.24	-------	2.34	-------	3.40	-------	1.37	.78	-------

JACKS FORK AT EMINENCE, MO.

LOCATION.—In W. ½ sec. 26, T. 29 N., R. 4 W., at highway bridge half a mile north of Eminence, Shannon County, 1 mile below Mahans Creek, and 8 miles above mouth.

DRAINAGE AREA.—376 square miles (measured on United States soil survey maps); somewhat indefinite on account of large tributary springs.

RECORDS AVAILABLE.—October 18, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to handrail on upstream side of bridge; read by E. J. Ward.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and boulders; clean and fairly permanent. Control is a coarse gravel bar 300 feet below gage; fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 10.00 feet at noon February 1 (discharge, 12,200 second-feet); minimum discharge, 132 second-feet October 3.

1922–1923: Maximum and minimum discharge same as for year ending September 30, 1923, as given above.

REGULATION.—Natural regulation through flow from several large springs.

ACCURACY.—Stage-discharge relation changed during high water in February; not affected by ice. Rating curve used until January 31 fairly well defined below 2,900 second-feet; curve used after that date well defined below 3,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except those for stages above 5,000 second-feet.

Discharge measurements of Jacks Fork at Eminence, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 26	W. R. Denison	2.37	592	June 4	W. S. Frame	4.67	2,950
Mar. 23	V. L. Austin	2.34	754	July 28	do	1.25	236
24	do	2.22	644	30	do	1.27	244
May 18	W. S. Frame	3.51	1,660				

Daily discharge, in second-feet, of Jacks Fork at Eminence, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	138	167	161	1,160	10,900	438	460	630	1,450	350	238	170
2	135	155	167	695	6,780	438	460	580	1,630	330	227	173
3	132	155	180	540	4,590	460	482	580	4,590	310	227	179
4	138	155	192	445	2,130	555	482	1,040	3,650	310	255	182
5	138	158	183	405	1,630	605	580	1,540	1,830	290	241	241
6	138	155	183	365	1,360	710	605	1,280	1,280	290	224	272
7	180	149	205	325	1,120	900	555	970	1,040	290	213	255
8	186	149	250	285	970	830	530	830	830	272	213	213
9	199	149	268	268	900	710	505	770	770	272	310	196
10	180	149	218	250	830	678	482	655	678	272	252	188
11	170	149	208	250	710	1,200	460	630	710	272	227	179
12	155	149	180	234	710	4,910	438	605	678	272	224	173
13	149	167	180	234	710	2,250	530	555	630	310	213	170
14	149	180	174	234	678	1,450	655	555	580	370	210	167
15	152	199	167	250	630	2,610	630	3,510	770	350	206	167
16	155	199	161	305	580	6,600	580	6,430	1,040	310	202	167
17	155	192	161	285	555	2,370	555	2,730	1,040	330	199	167
18	149	196	155	268	555	1,730	505	1,730	830	330	199	173
19	149	192	149	250	530	1,280	482	1,360	678	290	192	173
20	149	199	149	365	505	1,120	460	1,040	605	272	185	179
21	149	192	149	3,200	505	970	482	900	555	272	185	173
22	155	183	149	1,490	482	830	505	770	505	255	206	167
23	149	167	143	950	460	770	505	710	460	255	199	167
24	149	161	143	725	460	678	505	678	438	248	192	167
25	149	158	143	640	438	655	460	678	415	241	185	161
26	146	155	143	590	460	605	438	770	415	234	185	161
27	146	152	212	590	460	555	438	830	392	244	182	161
28	149	149	405	695	460	530	555	710	392	234	179	158
29	149	149	425	668	------	505	770	630	370	227	176	158
30	149	143	615	590	------	505	710	900	350	255	173	155
31	146	------	1,860	1,090	------	482	------	830	------	255	173	------

Monthly discharge of Jacks Fork at Eminence, Mo., for the year ending Sept. 30, 1923

[Drainage area, 376 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	199	132	153	0.407	0.47
November	199	143	166	.441	.49
December	1,860	143	261	.694	.80
January	3,200	234	601	1.60	1.84
February	10,900	438	1,470	3.91	4.07
March	6,600	438	1,260	3.35	3.86
April	770	438	527	1.40	1.56
May	6,430	555	1,180	3.14	3.62
June	4,590	350	987	2.62	2.92
July	370	227	284	.755	.87
August	310	173	209	.556	.64
September	272	155	180	.479	.53
The year	10,900	132	600	1.60	21.67

BIG SPRING NEAR CHICOPEE, MO.

LOCATION.—In sec. 6, T. 26 N., R. 1 E., 150 feet below outlet of spring, 1,000 feet above junction of outlet channel and Current River, 4,000 feet below St. Louis-San Francisco Railway Co.'s bridge over Current River, and 3½ miles southeast of Chicopee, Carter County.

RECORDS AVAILABLE.—January 8 to June 30, 1922, and April 1 to September 30, 1923.

GAGE.—Vertical staff bolted to face of large rock on right bank of spring branch 150 feet below outlet of spring.

DISCHARGE MEASUREMENTS.—Made from temporary wagon bridge 500 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of heavy gravel and boulders; practically permanent; moss and weeds grow in bed of stream. Gravel ford across branch 400 feet below gage controls low flow to some extent. Stage-discharge relation is affected part of time by backwater from Current River.

EXTREMES OF DISCHARGE.—Maximum discharge during period, 840 second-feet May 27; minimum discharge, 344 second-feet August 31 and September 1–5 and 16–31.

1922–1923: Maximum discharge during periods of records, 840 second-feet May 27, 1923; minimum discharge, 341 second-feet (measured with current meter) September 27, 1922.

ICE.—Stage-discharge relation never affected by ice.

REGULATION.—Entire flow from the naturally regulated spring.

ACCURACY.—Stage-discharge relation probably permanent except for backwater from Current River whenever the river was above gage height 2.8 feet at Van Buren. Rating curve fairly well defined; constructed by subtracting from gage heights for discharge measurements the amount that Current River at Van Buren was above 2.8 feet. Gage read to hundredths two or three times a week. Daily discharge ascertained by applying to rating table gage height corrected by amount that Current River at Van Buren was above 2.8 feet, whenever that occurred, and interpolating discharge for days when gage was not read. Records rather poor.

Discharge measurements of Big Spring near Chicopee, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 28	W. R. Denison	[a] 1.87	499
July 31	W. S. Frame	1.10	402

[a] Backwater from Current River when measurement was made.

Daily discharge, in second-feet, of Big Spring near Chicopee, Mo., for the year ending Sept. 30, 1923

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1	534	424	404	472	380	344	16	486	454	404	404	358	344
2	523	434	401	472	376	344	17	500	448	404	404	358	344
3	512	444	398	459	372	344	18	507	442	404	404	358	344
4	500	452	394	446	372	344	19	514	436	404	404	358	344
5	493	462	391	446	372	344	20	520	430	404	404	358	344
6	486	472	388	446	372	347	21	527	424	414	400	358	344
7	479	507	388	442	372	350	22	534	435	424	396	358	344
8	472	543	388	437	372	352	23	523	446	431	392	358	344
9	486	578	388	433	372	355	24	512	490	439	388	358	344
10	500	552	388	428	372	358	25	500	534	446	388	358	344
11	500	525	388	424	372	358	26	481	578	446	388	358	344
12	500	498	393	424	372	358	27	462	840	446	388	358	344
13	491	472	399	424	372	358	28	443	717	459	388	358	344
14	481	466	404	417	367	353	29	424	595	472	388	358	344
15	472	460	404	411	363	349	30	424	472	472	388	351	344
							31	------	438	------	384	344	------

NOTE.—Stage-discharge relation affected by backwater from Current River, Apr. 1 to June 30.

Monthly discharge of Big Spring near Chicopee, Mo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
April	534	424	493	July	472	384	416
May	840	424	499	August	380	344	364
June	472	388	413	September	358	344	347

ELEVEN POINT RIVER NEAR BARDLEY, MO.

LOCATION.—In NW. ¼ sec. 20, T. 23 N., R. 2 W., at highway bridge on Alton-Doniphan road 7 miles southwest of Bardley, Oregon County, 7 miles above Fredericks Creek, and 12 miles above Missouri-Arkansas line.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 22, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to handrail on upstream side of bridge; read by J. S. Johnson.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and some outcropping rock; clean and fairly permanent. Low-water control is a contracted section of clean, coarse gravel 300 feet below gage; practically permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year 10.64 feet at 7.30 a. m. March 16; minimum stage, 1.42 feet December 20, 21, 25, and 26.

1922–1923: Maximum and minimum stages recorded same as given above.

REGULATION.—Natural regulation through flow from large springs.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of Eleven Point River near Bardley, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 24	W. R. Denison	2.96	969	June 7	W. S. Frame	3.40	1,350
Mar. 20	V. L. Austin	4.13	1,830	Aug. 4	do	2.24	638

Daily gage height, in feet, of Eleven Point River near Bardley, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.66	1.69	1.54	2.36	4.02	2.45	2.94	2.82	3.92	2.82	2.30	2.00
2	1.66	1.64	1.51	2.25	8.18	2.41	2.92	2.79	3.72	2.78	2.29	2.04
3	1.66	1.61	1.50	2.12	5.90	2.43	2.94	2.82	3.68	2.76	2.28	2.19
4	1.66	1.60	1.54	2.05	4.82	2.41	2.98	3.26	3.90	2.73	2.25	2.09
5	1.66	1.60	1.49	1.96	4.22	2.40	3.27	3.68	3.65	2.70	2.22	2.05
6	1.66	1.62	1.50	1.93	3.73	3.06	3.22	3.52	3.52	2.68	2.21	2.01
7	1.69	1.61	1.52	1.86	3.55	3.30	3.13	3.36	3.48	2.65	2.20	2.01
8	1.68	1.60	1.54	1.82	3.35	3.15	3.10	3.24	3.35	2.61	2.22	1.97
9	1.68	1.60	1.51	1.80	3.34	3.00	3.02	3.12	3.26	2.63	2.22	1.96
10	1.68	1.60	1.50	1.79	3.17	2.94	2.97	3.00	3.56	2.59	2.21	1.94
11	1.66	1.56	1.50	1.75	3.04	3.86	2.91	2.96	5.80	2.57	2.16	1.91
12	1.64	1.54	1.48	1.68	3.03	6.62	2.87	2.92	4.62	2.55	2.16	1.90
13	1.64	1.62	1.45	1.67	3.06	5.18	3.11	2.78	3.95	2.62	2.16	1.88
14	1.63	1.60	1.48	1.72	2.98	4.28	3.18	2.90	3.68	2.68	2.14	1.86
15	1.64	1.61	1.47	1.67	2.84	4.88	3.09	8.25	4.08	2.57	2.14	1.86
16	1.63	1.59	1.48	1.64	2.82	10.37	3.02	8.08	4.28	2.56	2.13	1.86
17	1.62	1.60	1.47	1.62	2.78	6.12	2.97	6.18	3.98	2.60	2.12	1.89
18	1.60	1.60	1.45	1.62	2.72	5.00	2.89	5.02	3.88	2.56	2.10	1.88
19	1.60	1.58	1.44	1.62	2.68	4.45	2.85	4.55	3.68	2.51	2.08	1.92
20	1.62	1.57	1.42	1.72	2.64	4.20	2.84	4.42	3.50	2.48	2.08	1.90
21	1.60	1.56	1.43	6.40	2.58	3.98	3.00	4.00	3.38	2.46	2.07	1.87
22	1.60	1.54	1.44	3.73	2.53	3.85	2.94	3.82	3.13	2.43	2.12	1.86
23	1.61	1.54	1.44	3.21	2.48	3.68	2.86	3.80	3.21	2.42	2.08	1.86
24	1.61	1.54	1.43	2.98	2.47	3.50	2.84	3.88	3.13	2.40	2.06	1.84
25	1.60	1.54	1.42	2.81	2.45	3.45	2.82	3.62	3.07	2.40	2.05	1.84
26	1.60	1.50	1.42	2.70	2.50	3.38	2.76	3.52	3.03	2.38	2.04	1.82
27	1.60	1.51	1.65	2.72	2.48	3.27	2.84	3.50	2.98	2.37	2.04	1.82
28	1.60	1.50	1.81	2.78	2.48	3.19	3.10	3.42	2.98	2.36	2.04	1.80
29	1.59	1.50	1.81	2.70	-------	3.12	2.96	3.32	2.90	2.35	2.02	1.80
30	1.60	1.51	1.75	2.68	-------	3.07	2.88	3.48	2.84	2.47	2.00	1.80
31	1.61	-------	2.13	2.80	-------	2.97	-------	4.05	-------	2.33	2.00	-------

GREER SPRING AT GREER, MO.

LOCATION.—In SE. ¼ SW. ¼ sec. 36, T. 25 N., R. 4 W., 250 feet below Greer Spring Milling Co.'s dam, 500 feet below second spring, 850 feet below first spring at mouth of cave, 1 mile north of Greer, Oregon County, and 1¼ miles above Eleven Point River.

RECORDS AVAILABLE.—August 10 to December 31, 1904, and November 18, 1921, to September 30, 1923.

GAGE.—Vertical staff fastened to large elm tree on right bank at same location as gage used in 1904. Gages not set to same datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and boulders. Control is a section of boulders and rocks below gage; fairly permanent. Stage at gage is never affected by backwater from Eleven Point River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.52 feet February 2 and 4 (discharge, 655 second-feet); minimum stage, 0.88 foot December 23–26 (discharge, 204 second-feet).

1922–1923: Maximum stage recorded, 1.68 feet April 11, 1922 (discharge, 835 second-feet); minimum stage, 0.88 foot December 23–26, 1922 (discharge, 204 second-feet).

ICE.—Stage-discharge relation never affected by ice.

REGULATION.—Dam 250 feet above gage does not utilize the entire flow and the effect is not noticeable.

ACCURACY.—Stage-discharge relation changed during high water in January. Rating curves well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Greer Spring at Greer, Mo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 24	W. R. Denison	1.25	420
Aug. 4	W. S. Frame	1.20	370

Daily discharge, in second-feet, of Greer Spring at Greer, Mo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	270	270	270	282	636	353	484	353	484	446	370	285
2	270	282	270	306	655	353	484	336	503	446	370	285
3	270	282	259	318	655	353	503	353	503	427	370	302
4	270	282	270	318	655	370	503	370	484	427	370	336
5	270	270	270	306	655	370	484	427	484	408	370	336
6	282	282	270	306	655	446	484	427	484	389	370	336
7	282	282	270	306	617	446	465	408	484	389	370	336
8	282	270	259	294	617	465	484	408	484	370	353	319
9	282	270	259	294	598	465	484	408	465	370	353	302
10	282	270	248	282	560	465	503	389	465	353	353	302
11	270	270	248	270	560	503	484	389	484	353	336	302
12	270	270	237	259	560	522	484	370	522	353	336	302
13	270	270	237	248	560	503	484	370	560	370	336	302
14	270	270	237	259	541	503	484	427	579	370	336	285
15	270	282	226	270	541	503	465	484	579	353	336	285
16	282	270	215	282	503	655	465	636	560	353	336	285
17	282	270	215	270	503	636	446	636	560	353	319	285
18	270	270	215	270	503	636	427	617	560	336	319	285
19	270	270	215	259	465	617	408	617	541	336	319	285
20	270	270	215	330	465	598	427	598	541	336	319	285
21	270	270	215	465	446	560	408	579	522	319	319	302
22	270	270	215	465	427	541	408	560	522	319	319	302
23	270	270	204	446	408	541	408	503	503	319	319	302
24	282	270	204	465	370	522	389	484	503	319	319	302
25	270	259	204	465	370	522	389	484	484	302	302	302
26	270	259	204	465	370	522	389	484	484	302	302	302
27	270	259	215	465	353	522	370	465	484	302	302	285
28	270	259	226	465	353	522	370	465	465	285	302	285
29	270	259	237	465	-------	503	370	465	465	285	302	285
30	270	259	248	484	-------	503	353	465	465	370	302	285
31	270	-------	248	522	-------	484	-------	484	-------	370	302	-------

Monthly discharge of Greer Spring at Greer, Mo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
October	282	270	273	May	636	336	466
November	282	259	270	June	579	465	507
December	270	204	236	July	446	285	356
January	522	248	352	August	370	302	333
February	655	353	521	September	336	285	300
March	655	353	500				
April	503	353	444	The year	655	204	380

ARKANSAS RIVER BASIN

EAST FORK OF ARKANSAS RIVER NEAR LEADVILLE, COLO.

LOCATION.—In sec. 16, T. 9 S., R. 80 W., at highway bridge 200 yards above mouth of Tennessee Fork and 3 miles northwest of Leadville, Lake County.

DRAINAGE AREA.—52 square miles (measured on topographic map).

RECORDS AVAILABLE.—April 25 to August 31, 1890; June 18 to October 11, 1903; June 5, 1911, to September 30, 1923.

GAGE.—Vertical staff on left bridge abutment, near upstream end; read by Jeanette Coquoz and forest ranger. No known relation between present gage and gages used prior to 1911.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control 30 feet downstream from gage; slightly shifting. Banks low, subject to overflow at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.60 feet at 11 a. m. June 21 (discharge, 460 second-feet); minimum stage recorded, 0.10 foot on several days during October (discharge, 4 second-feet).

1911–1923: Maximum stage recorded, 2.03 feet at 8.30 a. m. June 15, 1921 (discharge, 794 second-feet); minimum discharge, 4 second-feet several days in October, 1922.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—The Leadville Water Co. makes a continuous diversion of 2 second-feet from East Fork above station. During the winter this diversion may be increased to 3 second-feet.

REGULATION.—Diurnal fluctuation during spring from alternate melting and freezing of mountain snow. No artificial regulation.

ACCURACY.—Stage-discharge relation shifted slightly. Rating curves well defined below 300 second-feet. Gage read to hundredths twice daily from October 1 to 27 and from June 16 to September 3; at irregular intervals during remainder of year. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of East Fork of Arkansas River near Leadville, Colo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 21	M. B. Arthur	----------	10.1	June 27	Robert Follansbee	1.16	197
Mar. 10	T. V. Watkins	[a]1.02	13.4	July 29	P. S. Parker	.70	73
May 13	Robert Follansbee	.50	38.6	Sept. 27	Robert Follansbee	.41	23.2
June 1	do	1.24	236				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East Fork of Arkansas River near Leadville, Colo. for the year ending Sept. 30, 1923

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1	8	8	13	239	149	82	43
2	7	8	14	298	149	106	38
3	7	8	15	244	133	75	41
4	7	8	16	250	123	55	40
5	8	8	18	260	113	61	40
6	8	8	20	270	110	61	40
7	6	8	30	260	110	52	38
8	7	8	40	250	120	55	36
9	7	8	50	244	165	50	36
10	7	8	55	218	165	55	35
11	7	8	50	220	144	65	34
12	6	8	45	225	131	65	32
13	5	8	38	234	131	116	31
14	4	8	38	230	123	91	30
15	4	9	37	225	120	86	30
16	4	10	36	218	120	84	32
17	4	11	35	338	113	82	35
18	5	12	40	390	118	80	38
19	5	13	45	298	113	75	40
20	4	11	57	298	136	67	38
21	5	9	80	390	133	55	35
22	4	8	100	260	108	59	34
23	4	8	149	218	98	59	33
24	4	8	190	228	93	55	30
25	4	8	230	223	106	53	26
26	4	9	270	244	136	55	25
27	4	10	325	218	113	73	24
28	4	11	330	218	116	61	29
29	4	12	340	203	75	40	28
30	4	13	358	192	69	43	27
31	4	-------	300	-------	65	52	-------

NOTE.—Gage not read Oct. 28–31, Apr. 1–21, 23–30, May 2–11, 14–19, 21, 22, 24, 25, 28, 29, June 4, 5, 7, 8, 11, 12, 14, 15, Sept. 4–6, 9–14, 16–20, 22–26, 29, and 30; discharge estimated.

Monthly discharge of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	8	4	5.3	326	July	165	65	119	7,320
April	13	8	9.1	542	August	116	40	66.7	4,100
May	358	13	109	6,700	September	43	24	33.9	2,020
June	390	192	253	15,100					

ARKANSAS RIVER AT GRANITE, COLO.

LOCATION.—In sec. 31, T. 11 S., R. 79 W., at Granite, Lake County, below mouth of Lake Creek and above Lost Canyon and Clear creeks.

DRAINAGE AREA.—431 square miles.

RECORDS AVAILABLE.—May 1, 1897, to September 10, 1899; April 6, 1910, to September 30, 1923.

GAGE.—Bristol water-stage recorder of float type on right bank 200 feet below highway bridge at Granite. Prior to October 26, 1917, inclined gage on left bank half a mile upstream. Relation between gages not determined.

DISCHARGE MEASUREMENTS.—Made from highway bridge near railroad station or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control shifting. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.74 feet at 8 p. m. June 5 (discharge, 1,530 second-feet); minimum discharge, 60 second-feet on February 6 and March 12.

1910–1923: Maximum stage, 4.7 feet June 11, 1918 (discharge, 2,630 second-feet); minimum discharge recorded, 11 second-feet on March 15, 1918.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Water diverted from Arkansas River for irrigation of 1,800 acres between this station and junction of Tennessee and East forks.

REGULATION.—Discharge affected by operation of Twin Lakes reservoir, which has a storage decree for 54,450 acre-feet.

COOPERATION.—Complete records furnished by State engineer.

Daily discharge, in second-feet, of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	124	141	105	83	70	68	90	514	1,190	800	637	420
2	124	136	108	81	68	70	88	498	1,350	999	724	401
3	113	120	108	85	67	75	85	487	1,450	1,020	649	382
4	92	131	100	88	65	68	92	487	1,500	1,080	631	372
5	102	120	106	90	65	62	90	492	1,400	1,080	590	368
6	117	106	108	92	60	70	100	498	1,220	1,050	531	368
7	126	109	108	89	65	64	92	460	1,220	1,040	492	363
8	124	102	94	82	68	70	88	338	986	1,100	450	359
9	126	100	88	82	66	70	96	346	1,060	1,100	420	350
10	124	102	87	82	65	65	96	425	911	1,110	435	342
11	120	96	86	84	65	62	114	471	852	1,090	450	325
12	113	106	85	85	67	60	137	410	807	781	460	287
13	126	106	89	82	67	67	114	492	794	724	602	280
14	136	102	80	78	67	66	114	498	878	774	698	287
15	146	92	79	75	67	65	114	487	938	730	625	276
16	148	86	77	80	68	64	114	460	1,110	698	625	248
17	148	86	70	82	68	63	123	526	1,070	662	705	255
18	148	80	69	83	68	70	135	520	972	596	680	276
19	151	82	71	83	68	68	154	537	951	724	662	291
20	153	86	71	83	68	63	132	584	1,030	637	643	266
21	153	80	72	75	71	63	121	619	1,180	572	608	227
22	156	68	70	78	72	63	135	560	979	526	566	191
23	161	88	72	77	71	70	116	430	925	602	555	186
24	153	88	74	76	72	72	114	549	932	724	555	191
25	183	86	72	77	71	62	121	656	958	718	514	174
26	171	98	74	73	70	80	210	724	972	724	482	161
27	183	106	75	71	62	70	492	807	965	602	460	164
28	183	102	78	71	64	80	498	925	898	590	450	181
29	148	100	74	71	-------	80	526	986	833	619	460	184
30	143	104	72	75	-------	90	543	986	814	602	450	181
31	143	-------	80	70	-------	95	-------	1,010	-------	572	430	-------

NOTE.—Daily discharge Dec. 1 to Apr. 8 based on four current-meter measurements and comparison with records of flow of Arkansas River at Salida.

Monthly discharge of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	183	92	140	8,610	May	1,010	338	574	35,300
November	141	68	100	5,950	June	1,500	794	1,040	61,900
December	108	69	84	5,160	July	1,110	526	795	48,900
January	92	70	80	4,920	August	724	420	556	34,200
February	72	60	67	3,720	September	420	161	279	16,600
March	95	60	70	4,300					
April	543	85	168	10,000	The year	1,500	60	331	240,000

ARKANSAS RIVER AT SALIDA, COLO.

LOCATION.—In sec. 32, T. 50 N., R. 9 E., at Salida, Chaffee County, some distance above mouth of South Fork of Arkansas River, nearest important tributary.

DRAINAGE AREA.—1,210 square miles.

RECORDS AVAILABLE.—April 11, 1895, to October 31, 1903; November 3, 1909, to September 30, 1923.

GAGE.—Bristol water-stage recorder on right bank in City Park 400 feet below highway bridge; inspected by water commissioner. Datum lowered 1 foot January 1, 1922.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; shifts at intervals. No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.1 feet at 5 p. m. July 18 (discharge, 4,900 second-feet); minimum stage, 1.41 feet on February 28 (discharge, 210 second-feet).

1909–1923: Maximum stage recorded, that of July 18, 1923; minimum stage, 0.10 foot January 28, 1915 (discharge, 155 second-feet).

ICE.—Stage-discharge relation not affected by ice as river is kept open by springs.

DIVERSIONS.—Water diverted from Arkansas River between Granite and Salida for irrigation of 2,800 acres.

REGULATION.—Flow at station regulated to some extent by Twin Lakes and Clear Creek reservoirs which have storage decrees for 54,450 and 11,500 acre-feet, respectively.

COOPERATION.—Complete records furnished by State engineer.

Daily discharge, in second-feet, of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	290	290	271	251	227	220	297	630	1,920	2,000	1,180	768
2	281	304	284	230	225	227	284	774	2,050	2,150	1,280	858
3	271	300	293	232	222	235	262	744	2,170	2,100	1,270	846
4	268	310	293	237	218	240	248	798	2,230	2,200	1,300	822
5	256	300	287	237	210	232	259	828	2,110	2,200	1,300	804
6	271	281	300	246	218	213	246	834	2,170	2,140	1,200	792
7	287	307	314	256	213	232	271	822	2,190	2,170	1,130	780
8	287	314	317	246	220	225	254	695	1,790	2,310	1,110	762
9	284	321	284	235	225	232	240	652	1,680	2,170	1,160	733
10	278	324	259	235	222	237	235	646	1,610	2,220	967	641
11	278	324	268	237	218	227	246	756	1,490	2,240	668	608
12	284	290	268	243	220	218	248	738	1,580	2,170	738	592
13	287	290	268	246	220	213	259	706	1,580	1,950	896	541
14	281	307	284	243	222	220	246	798	1,860	1,920	1,060	566
15	290	307	265	230	220	220	246	756	2,250	1,820	1,000	576
16	290	300	268	225	218	220	232	700	2,600	1,770	1,100	531
17	284	297	262	240	220	220	259	733	2,290	1,650	1,240	517
18	284	307	243	240	218	220	274	744	2,100	1,720	1,320	566
19	271	307	240	243	218	232	342	733	2,130	1,800	1,370	598
20	271	293	246	243	218	232	290	780	2,200	1,790	1,270	679
21	281	293	248	232	220	220	324	858	2,550	1,830	1,200	679
22	297	290	246	227	225	220	290	846	2,310	1,800	1,140	641
23	293	290	240	235	227	220	265	576	2,150	1,500	1,080	619
24	290	321	248	232	225	232	254	792	2,210	1,560	1,070	646
25	307	324	251	237	225	246	259	1,000	2,250	1,430	1,060	630
26	331	290	243	235	230	220	259	1,300	2,290	1,500	1,030	614
27	328	297	246	227	232	262	498	1,580	2,510	1,460	916	598
28	328	293	251	220	210	237	603	1,690	2,300	1,320	780	603
29	317	300	256	222	-------	254	652	1,700	2,214	1,300	744	598
30	290	300	246	222	-------	259	668	1,670	2,060	1,230	744	592
31	284	-------	232	230	-------	284	-------	1,760	-------	1,230	716	-------

Monthly discharge of Arkansas River at Salida, Colo., for the year ending Sept. 30 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	331	256	288	17,700	May	1,760	576	924	56,800
November	324	281	302	18,000	June	2,600	1,490	2,090	124,000
December	317	232	265	16,300	July	2,310	1,230	1,830	112,000
January	256	220	236	14,500	August	1,370	668	1,070	65,500
February	232	210	221	12,300	September	858	517	660	39,200
March	284	213	231	14,200					
April	668	232	310	18,500	The year	2,600	210	702	509,000

ARKANSAS RIVER AT CANON CITY, COLO.

LOCATION.—Just below Hot Springs Hotel, at mouth of canyon, 1 mile above Canon City, Fremont County. Nearest important tributary, Grape Creek, enters some distance above.

DRAINAGE AREA.—3,090 square miles.

RECORDS AVAILABLE.—May 1, 1888, to September 30, 1923.

GAGE.—Bristol float-type water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from car and cable.

CHANNEL AND CONTROL.—Bed composed of gravel; very shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during year, 5.1 feet at 6.30 p. m. July 13 (discharge, 7,200 second-feet); minimum stage, 0.58 foot on April 17 (discharge, 242 second-feet).

1888–1923: Maximum stage recorded, 10.7 feet at 8 p. m. August 2, 1921 (discharge, 19,000 second-feet); minimum discharge, 108 second-feet on April 10, 1897.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Water diverted from Arkansas River between Salida and Canon City for irrigation of 3,000 acres.

REGULATION.—Flow regulated to slight extent by operation of reservoirs on headwaters.

COOPERATION.—Complete records furnished by State engineer.

Daily discharge, in second-feet, of Arkansas River at Canon City, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	291	291	371	295	272	272	625	601	2,100	2,300	980	862
2	280	285	353	286	272	286	454	625	2,300	2,360	1,180	872
3	274	285	389	295	250	290	406	658	2,460	2,410	1,220	862
4	274	280	383	300	264	286	362	682	2,620	2,480	1,200	832
5	274	302	324	305	246	320	345	754	2,590	2,540	1,270	812
6	291	280	319	310	246	310	345	822	2,460	2,530	1,160	782
7	302	307	347	340	264	325	394	736	2,500	2,520	948	772
8	302	359	371	310	264	356	362	727	2,280	2,620	904	736
9	291	359	363	310	264	300	305	609	1,830	2,640	904	691
10	264	335	319	286	270	305	277	625	1,930	2,720	959	658
11	258	330	335	254	270	315	264	691	1,640	3,090	1,120	666
12	269	365	365	264	265	300	272	718	1,750	3,130	926	709
13	269	359	359	259	270	290	282	633	1,820	2,530	1,190	633
14	258	383	359	259	280	315	286	782	1,960	2,900	1,300	625
15	291	383	377	254	280	325	250	862	2,380	2,360	1,340	682
16	302	365	347	246	285	330	259	822	2,770	2,350	1,310	666
17	274	359	335	282	285	320	242	782	2,860	2,180	1,530	666
18	269	389	307	305	290	310	264	812	2,470	2,180	2,240	980
19	274	371	307	295	290	286	305	763	2,400	2,130	2,460	992
20	280	353	313	300	277	320	320	754	2,480	2,170	2,110	1,170
21	269	353	324	282	290	330	290	894	2,780	2,410	1,920	915
22	324	353	319	268	300	315	282	958	2,780	1,990	1,920	812
23	307	335	324	268	286	290	295	812	2,420	1,720	1,950	802
24	274	395	324	277	286	282	250	691	2,420	1,740	1,610	842
25	280	401	319	295	272	282	246	980	2,580	1,790	1,490	872
26	319	365	330	286	290	325	264	1,300	2,590	1,780	1,380	852
27	347	389	319	277	286	310	259	1,600	2,800	1,920	1,270	822
28	330	395	335	250	277	330	500	1,830	2,720	1,450	1,110	792
29	341	389	319	250	-------	350	601	1,900	2,520	1,260	926	802
30	319	427	313	264	-------	362	594	1,880	2,380	1,160	883	782
31	285	-------	280	290	-------	579	-------	1,950	-------	1,000	883	-------

Monthly discharge of Arkansas River at Canon City, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	347	258	290	17,800	May	1,950	601	944	58,000
November	427	280	351	20,900	June	2,860	1,640	2,390	142,000
December	389	280	337	20,700	July	3,130	1,000	2,210	136,000
January	340	246	283	17,400	August	2,460	883	1,340	82,400
February	300	246	275	15,300	September	1,170	625	799	47,500
March	579	272	320	19,700					
April	625	242	340	20,200	The year	3,130	242	825	598,000

ARKANSAS RIVER AT PUEBLO, COLO.

LOCATION.—150 feet below Main Street Bridge in Pueblo, Pueblo County. Nearest tributary, Fountain Creek, enters 2 miles below.

DRAINAGE AREA.—4,820 square miles.

RECORDS AVAILABLE.—May 1, 1885, to September 30, 1886; September 19, 1894, to September 30, 1923. From June 1 to September 30, 1887, and May 1 to August 31, 1889, station maintained at point 9 miles above Pueblo.

GAGE.—Bristol float-type water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made from Main Street Bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 12.55 feet on July 12 (discharge, 25,600 second-feet); minimum discharge, 114 second-feet on October 7.

1894–1923: Maximum stage from high-water mark, 24.66 feet at midnight, June 3, 1921 (discharge estimated at 100,000 second-feet); minimum discharge, 25 second-feet on September 11, 1908.

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—Water diverted from Arkansas River between Canon City and Pueblo for irrigation of 23,000 acres.

COOPERATION.—Complete records furnished by State engineer.

Daily discharge, in second-feet, of Arkansas River at Pueblo, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	213	304	483	293	243	184	567	480	1,400	2,050	2,490	1,160
2	174	291	407	311	254	204	535	528	1,640	2,020	2,800	1,430
3	157	304	399	330	210	200	445	586	1,820	2,440	1,490	1,200
4	142	343	362	262	184	180	364	606	2,070	2,170	2,340	1,120
5	133	378	386	330	177	177	306	691	2,060	2,250	1,780	1,020
6	122	340	351	316	247	180	306	784	1,950	2,270	1,410	978
7	114	332	382	330	247	164	325	850	1,950	2,240	1,300	1,080
8	142	370	395	302	254	171	306	792	2,020	2,300	1,210	858
9	158	382	347	293	247	184	293	752	1,550	2,400	1,300	800
10	149	399	336	284	251	184	247	654	1,630	2,440	1,130	760
11	136	395	336	235	243	184	224	698	1,450	2,660	1,390	784
12	149	411	370	232	251	214	197	784	1,400	[a]6,120	1,460	2,220
13	205	399	370	235	251	150	204	776	1,520	2,320	1,860	858
14	205	407	362	224	228	152	197	884	1,550	2,470	1,260	752
15	228	374	399	221	224	177	200	987	1,810	3,220	1,310	2,240
16	228	399	386	224	204	171	197	1,010	2,210	4,340	1,350	1,020
17	248	411	386	239	228	161	174	1,040	2,640	[b]4,570	2,710	926
18	242	407	386	247	207	204	155	1,050	2,310	2,640	3,030	2,580
19	239	403	351	228	254	228	152	1,020	2,010	2,700	3,810	1,690
20	253	395	351	217	221	221	193	996	2,060	3,460	3,470	1,700
21	253	390	351	204	221	239	207	1,020	2,250	2,790	2,590	1,550
22	284	382	322	184	221	247	200	996	2,460	2,210	3,120	1,350
23	275	382	359	190	204	200	177	1,040	2,160	1,770	2,630	1,280
24	265	407	332	193	161	177	184	706	2,030	1,580	2,800	1,250
25	253	446	347	197	135	171	155	961	2,230	2,030	2,230	1,230
26	253	411	351	214	158	224	136	1,300	2,360	[c]3,200	2,070	1,100
27	275	455	304	197	174	235	171	1,230	2,430	2,640	1,930	969
28	287	507	301	171	168	221	210	1,360	2,510	1,780	2,780	833
29	287	478	311	174	-------	235	445	1,310	2,320	1,580	1,550	776
30	294	488	301	171	-------	266	510	1,610	2,140	1,390	1,440	706
31	297	-------	275	254	-------	401	-------	1,430	-------	1,260	1,250	-------

[a] Maximum discharge, 25,600 second-feet.
[b] Maximum discharge, 12,500 second-feet.
[c] Maximum discharge, 11,400 second-feet.

Monthly discharge of Arkansas River at Pueblo, Colo, for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	297	114	215	13,200	May	1,610	480	939	57,400
November	488	291	393	23,400	June	2,640	1,400	2,000	119,000
December	483	275	358	22,000	July	6,120	1,260	2,560	157,000
January	330	171	242	14,900	August	3,810	1,130	2,040	125,000
February	254	135	217	12,100	September	2,580	706	1,210	72,000
March	401	150	204	12,500					
April	567	136	266	15,800	The year	6,120	114	891	644,000

ARKANSAS RIVER AT HOLLY, COLO.

LOCATION.—Between secs. 14 and 15, T. 23 S., R. 42 W., at highway bridge half a mile south of Holly, Prowers County. Nearest tributary Wildhorse Creek, an intermittent tributary, enters 1 mile upstream.

DRAINAGE AREA.—About 25,000 square miles.

RECORDS AVAILABLE.—October 15, 1907, to September 30, 1923.

GAGE.—Bristol float-type water-stage recorder on upstream side of bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Bed comprised of sand and gravel; shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.05 feet on August 24 (discharge, 27,200 second-feet); minimum discharge, 3 second-feet on several days during October.

1907–1923: Maximum stage recorded, 11 feet at noon, October 20, 1908 (discharge determined from slope measurements, 136,000 second-feet); minimum discharge, river dry.

DIVERSIONS.—Water diverted from Arkansas River between Pueblo and Holly for irrigation of 300,000 acres.

COOPERATION.—Complete records furnished by State engineer.

Daily discharge, in second-feet, of Arkansas River at Holly, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4	6	56	118	62	73	37	31	132	80	314	2,000
2	3	6	55	106	64	73	35	31	104	64	275	1,660
3	3	5	53	106	78	71	35	30	87	45	5,520	1,420
4	4	6	66	80	66	66	41	32	85	40	2,900	1,700
5	4	7	74	78	75	82	41	30	80	51	1,150	1,310
6	4	9	78	82	109	84	30	27	87	53	2,840	960
7	4	10	83	78	129	73	28	23	69	35	1,840	912
8	3	11	86	82	147	66	31	23	[b]3,040	25	1,630	855
9	3	14	78	75	150	66	33	19	7,790	25	5,390	1,230
10	3	17	126	75	173	34	32	18	2,500	20	3,060	1,070
11	3	18	313	64	178	53	30	21	966	24	2,330	1,070
12	4	16	123	62	136	64	28	24	555	1,430	924	1,050
13	5	14	123	73	140	53	27	41	455	702	3,650	507
14	5	14	159	75	183	62	27	132	391	3,680	4,100	1,340
15	4	56	202	78	164	50	24	129	507	2,580	1,640	1,030
16	4	173	187	82	164	57	23	122	327	547	2,140	822
17	4	130	178	82	147	112	23	115	5,220	1,640	3,340	2,920
18	5	78	178	71	136	82	22	82	9,980	2,410	4,700	2,040
19	6	64	155	68	173	89	18	68	3,650	6,740	7,970	3,440
20	6	62	159	68	178	104	23	62	1,720	5,210	7,100	4,500
21	8	66	164	50	202	106	26	95	3,460	2,130	3,920	3,000
22	8	66	155	50	140	115	28	7,750	3,820	2,040	2,320	2,270
23	8	69	159	48	132	104	25	[a]8,470	2,600	720	18,000	1,640
24	7	74	168	48	78	89	14	1,900	1,480	188	[d]13,900	1,320
25	7	76	168	48	68	89	14	632	609	147	10,200	1,080
26	7	71	130	47	73	89	35	297	364	104	6,780	972
27	8	71	108	62	71	73	48	188	275	[c]5,090	4,320	984
28	6	60	123	68	68	59	112	171	259	2,760	3,920	822
29	6	66	136	71	-------	42	98	147	154	1,540	4,740	727
30	7	62	126	71	-------	38	61	205	110	844	3,890	650
31	6	-------	126	73	-------	37	-------	132	-------	447	2,440	-------

[a] Maximum discharge, 20,600 second-feet.
[b] Maximum discharge, 14,700 second-feet.
[c] Maximum discharge, 20,200 second-feet.
[d] Maximum discharge, 27,200 second-feet.

Monthly discharge of Arkansas River at Holly, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	8	3	5.13	315	May	8,470	18	679	41,800
November	173	5	46.6	2,770	June	9,980	69	1,700	101,000
December	313	53	132	8,120	July	6,740	20	1,340	82,400
January	118	48	72.2	4,440	August	18,000	275	4,430	272,000
February	202	62	124	6,890	September	4,500	507	1,510	89,800
March	115	34	72.7	4,470					
April	112	14	35.0	2,080	The year	18,000	3	850	616,000

ARKANSAS RIVER AT SYRACUSE, KANS.

LOCATION.—In NW. ¼ sec. 18, T. 24 S., R. 40 W., at highway bridge half a mile south of Syracuse, Hamilton County.

DRAINAGE AREA.—25,500 square miles (measured by State irrigation commissioner).

RECORDS AVAILABLE.—August 21, 1902, to November 30, 1905; April 1 to July 31, 1906; June 20, 1921, to September 30, 1923.

GAGE.—Gurley water-stage recorder on downstream side of bridge pier near center of channel. From 1902 to 1906 a vertical staff gage fastened to downstream pile of one of the bents of the bridge was used; not referred to same datum.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge of by wading.

CHANNEL AND CONTROL.—Bed composed of loose, clean sand; shifting. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 6.35 feet on August 23 (discharge, 18,000 second-feet); minimum stage from water-stage recorder, 0.93 foot on October 5 and 29 (discharge, 4 second-feet).

1921–1923: Maximum stage about 9.75 feet on June 6, 1921 (discharge, about 45,000 second-feet); minimum discharge, 4 second-feet during periods in August, September, and October, 1922.

1902–1906: Maximum stage recorded, 7.5 feet July 11, 1903 (discharge, 28,300 second-feet); minimum discharge, 3 second-feet in January, 1905.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Nearly all low-water flow during year is diverted for irrigation upstream.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined between 75 and 12,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying hourly gage height to rating table; shifting-control method used November 16 to December 5 and June 24 to September 29.

COOPERATION.—Complete records furnished by the Kansas Board of Agriculture through George S. Knapp, State irrigation commissioner.

Discharge measurements of Arkansas River at Syracuse, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 20	G. S. Knapp	1.43	85.3	July 9	V. W. Stambaugh	1.00	86
Dec. 7	Knapp and Schneider	1.50	83.2	16	do	2.12	1,290
Jan. 18	G. S. Knapp	1.62	125	21	do	3.16	3,190
May 23	do	4.01	6,420	Sept. 7	do	2.74	1,520
June 23	Knapp and Stambaugh	3.01	2,270				

Daily discharge, in second-feet, of Arkansas River at Syracuse, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4	5	71	107	100	91	34	38	205	132	1,480	2,840
2	4	5	71	97	94	91	34	26	172	117	1,300	2,400
3	4	5	78	76	91	94	16	9	146	121	1,620	1,900
4	4	6	84	78	99	84	9	6	142	107	3,550	1,880
5	4	5	84	100	99	88	7	6	124	100	3,000	1,980
6	4	5	84	114	99	84	6	5	110	97	2,450	1,550
7	4	5	84	110	99	78	6	5	89	91	2,200	1,420
8	4	5	71	110	99	76	5	5	94	91	1,930	1,260
9	4	5	61	104	99	76	5	5	5,900	84	1,950	1,420
0	4	5	66	104	107	73	5	5	4,040	66	2,200	1,600
11	4	6	78	100	164	84	5	5	2,280	59	1,930	1,280
12	4	9	97	88	181	91	5	5	1,690	181	1,020	1,260
13	4	13	98	81	186	91	5	5	1,180	983	1,040	925
14	4	7	97	71	193	104	5	21	854	1,670	3,590	1,100
15	5	8	98	88	193	66	5	110	735	3,380	2,340	1,440
16	5	159	117	73	193	100	5	84	702	1,580	1,320	1,080
17	5	155	166	61	200	97	5	66	871	570	2,250	1,710
18	5	135	166	110	200	121	5	54	9,700	1,980	6,770	2,080
19	5	100	166	100	200	121	5	40	4,220	3,300	8,110	2,450
20	5	84	166	100	190	121	7	32	2,250	4,220	7,090	4,130
21	5	84	166	84	215	97	5	34	4,440	3,130	5,760	3,130
22	5	84	166	78	210	100	5	386	3,380	2,630	3,100	2,600
23	4	84	215	66	124	121	5	7,420	2,630	2,340	9,000	2,170
24	4	81	195	48	107	97	5	3,380	1,460	1,690	12,000	1,810
25	4	78	195	52	97	94	5	1,640	905	964	9,140	1,580
26	4	81	205	104	97	81	7	983	495	495	7,740	1,280
27	4	84	139	110	94	76	7	570	279	1,880	5,530	1,060
28	4	71	135	91	91	64	6	363	205	3,520	4,310	888
29	4	66	164	88	-------	48	36	286	177	2,720	4,000	719
30	5	71	139	81	-------	38	44	266	139	2,060	4,490	702
31	5	-------	114	84	-------	38	-------	305	-------	1,710	3,440	-------

NOTE.—No gage-height record Dec. 12–15, 17–22, Feb. 4–9, and 14–16; discharge interpolated.

Monthly discharge of Arkansas River at Syracuse, Kans., for the year ending Sept. 30, 1923

[Drainage area, 25,500 square miles]

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	5	4	4.3	265	May	7,416	5	521	32,000
November	159	5	50.4	2,990	June	9,700	88	1,650	98,200
December	215	61	123	7,600	July	4,220	59	1,360	83,300
January	114	48	89.0	5,460	August	12,000	1,020	4,050	249,000
February	215	91	140	7,760	September	4,130	702	1,720	102,000
March	121	38	86.5	5,320					
April	44	5	10.1	602	The year	12,000	4	822	594,000

ARKANSAS RIVER AT GARDEN CITY, KANS.

LOCATION.—In NW. ¼ sec. 19, T. 24 S., R. 32 W., at highway bridge half a mile south of Garden City, Finney County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 21, 1922, to September 30, 1923.

GAGE.—Stevens water-stage recorder on downstream side of cylinder bridge pier near center of channel; inspected by Ben Allen, county engineer. Gage records height of underground water after surface flow ceases.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of loose, clean sand and gravel. No definite control. Surface flow ceases at gage height of 2.60 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.82 feet at 4 p. m. August 24 (discharge, 19,200 second-feet); no flow October 1–17, November 21–23, and December 8.

1922–23: Maximum stage that of August 24, 1923; no flow during numerous periods in 1922.

ICE.—Stage-discharge relation slightly affected by ice.

ACCURACY.—Stage-discharge relation not permanent; slightly affected by ice. One fairly well-defined rating curve used throughout year. Mean daily gage height determined to hundredths from recorder graph by inspection and planimeter. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used April 29 to August 24. Records fair.

Discharge measurements of Arkansas River at Garden City, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 22	G. S. Knapp	2.59	4.55	July 12	V. W. Stambaugh	2.16	23.5
Jan. 17	do	2.69	5.29	16	do	3.92	1,520
Apr. 26	do	3.00	30.3	20	do	5.42	5,580
May 24	do	5.02	3,100	Aug. 24	do	7.03	14,100
June 22	Knapp and Stambaugh	5.35	5,010	Sept. 19	do	4.72	2,430

Daily discharge, in second-feet, of Arkansas River at Garden City, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0	5.0	3.0	21	9.5	12	12	80	14	120	528	2,220
2	0	5.5	3.5	17	11	12	12	44	10	80	440	1,740
3	0	4.5	5.0	15	10	12	13	27	8.0	46	353	1,620
4	0	4.0	5.5	12	9.5	12	18	22	7.5	36	1,970	1,520
5	0	.5	6.0	11	10	14	18	20	5.5	85	1,520	1,410
6	0	3.5	3.0	12	14	14	14	19	8.0	36	1,150	1,320
7	0	5.0	1.0	13	12	12	12	18	7.5	25	1,200	1,180
8	0	5.5	0	10	12	12	12	18	32	22	1,320	1,060
9	0	6.0	1.5	8.5	11	10	12	17	260	23	4,710	928
10	0	4.0	4.0	8.5	12	10	12	17	4,960	24	4,710	824
11	0	5.5	4.5	8.5	14	11	12	16	2,090	25	1,220	992
12	0	7.0	5.5	8.5	18	10	12	16	838	24	1,850	944
13	0	5.5	5.5	8.5	14	10	13	17	420	17	1,220	852
14	0	4.0	6.0	8.0	10	10	12	55	253	110	2,520	852
15	0	3.0	6.0	7.5	11	13	12	246	140	353	3,180	838
16	0	2.0	6.0	8.5	15	14	12	90	100	1,220	1,850	1,180
17	0	3.0	6.0	9.0	18	23	12	48	34	838	1,410	1,130
18	1.0	1.5	6.5	8.0	20	16	12	40	4,710	380	5,200	2,220
19	.5	1.0	6.5	8.5	25	16	12	34	5,700	1,620	10,500	2,220
20	1.0	1.0	6.5	8.5	19	27	13	28	2,220	4,480	8,060	3,000
21	1.5	0	7.0	8.0	70	27	14	163	1,620	3,580	5,960	3,790
22	1.5	0	7.0	7.5	19	21	14	209	4,710	1,410	3,370	2,840
23	1.0	0	8.5	7.5	14	16	14	2,520	1,970	1,010	5,450	2,360
24	1.5	.5	12	8.0	12	14	14	4,240	2,090	880	15,500	2,090
25	2.5	1.0	13	13	13	14	15	1,850	1,130	726	8,580	1,970
26	4.0	1.0	14	16	14	14	25	824	880	516	8,060	1,850
27	4.0	2.0	18	14	13	14	36	266	670	362	5,960	1,620
28	4.0	4.0	44	14	12	13	27	140	470	2,090	4,020	1,410
29	4.5	3.5	40	16	-------	13	19	48	344	2,090	3,000	1,220
30	5.0	3.0	20	14	-------	12	17	25	209	912	4,020	1,130
31	5.0	-------	25	12	-------	12	-------	18	-------	642	3,580	-------

NOTE.—Stage-discharge relation affected by ice Dec. 9–20; discharge interpolated. Gage-height record uncertain June 27 to Aug. 1 and Aug. 28 to Sept. 30.

Monthly discharge of Arkansas River at Garden City, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	5.0	0	1.19	73.2	May	4,240	16	360	22,100
November	7.0	0	3.07	183	June	5,700	5.5	1,200	71,400
December	44	0	9.68	595	July	4,480	17	767	47,200
January	21	7.5	11.0	676	August	15,500	353	3,950	243,000
February	70	9.5	15.8	878	September	3,790	824	1,610	95,800
March	27	10	14.2	873					
April	36	12	15.1	898	The year	15,500	0	668	484,000

ARKANSAS RIVER AT LARNED, KANS.

LOCATION.—In NE. ¼ sec. 5, T. 22 S., R. 16 W., at highway bridge half a mile above Pawnee River and half a mile south of Larned, Pawnee County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 22, 1922, to September 30, 1923.

GAGE.—Stevens water-stage recorder on downstream side of cylinder bridge pier near center of channel. Gage records height of underground water after surface flow ceases.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of loose, clean sand and gravel. No definite control. Surface flow ceases at gage height of 2.7 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 9.5 feet at 2 p. m. August 25 (discharge, 14,300 second-feet); no flow during long periods.

1922–23: Maximum and minimum stages same as given above.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used June 30 to August 19. Records fair.

Discharge measurements of Arkansas River at Larned, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
June 4	G. S. Knapp	4.40	484	July 18	V. W. Stambaugh	3.64	235
25	Knapp and Stambaugh	5.71	1,900	19	do	4.60	887
26	do	6.05	2,520	Aug. 20	do	7.00	5,130
July 11	V. W. Stambaugh	3.42	103	20	do	8.39	9,740

Daily discharge, in second-feet, of Arkansas River at Larned, Kans., for the year ending Sept. 30, 1923

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		18	10	25	1,080	527	1,190	4,520
2		16	6.0	26	1,080	464	970	3,270
3		21	2.0	52	746	384	830	2,560
4		20	4.4	59	595	334	746	2,060
5		20	6.0	84	786	277	668	1,730
6		19	4.4	84	595	223	527	1,510
7		18	1.5	82	361	184	1,730	1,310
8		18	.3	70	494	145	1,310	1,440
9		17	.3	54	874	114	1,080	1,310
10		16		48	970	84	1,250	1,140
11		15		29	970	66	1,140	1,080
12		18		16	3,950	86	2,450	970
13		16		18	2,450	106	1,510	1,020
14		12		34	1,510	117	1,310	1,020
15		6.0		63	1,020	134	1,250	970
16		6.0		82	786	174	2,160	1,020
17		6.8		106	595	190	4,820	1,020
18		.9		120	527	244	1,440	1,080
19				125	1,730	830	2,060	1,310
20		.3	1.2	111	6,060	630	4,820	1,980
21		5.2	2.8	109	3,670	1,140	5,750	2,250
22	8.4	1.5	.3	136	2,660	3,950	3,950	3,950
23	8.4	16		48	3,540	2,660	3,140	3,020
24	12	18		46	3,400	1,730	3,140	2,450
25	15	21		1,730	2,350	1,440	12,200	2,060
26	22	21	13	2,250	2,350	1,440	8,010	1,890
27	26	21	17	1,580	1,440	970	7,670	1,730
28	22	24	24	1,080	922	830	6,060	1,580
29		17	32	706	706	706	4,520	1,440
30		12	31	630	630	1,380	3,670	1,360
31		10		668		1,810	3,020	

NOTE.—No surface flow on days for which no discharge is given. Gage height partly estimated June 30 to July 10 and Sept. 28–30.

Monthly discharge of Arkansas River at Larned, Kans., for the year ending Sept. 30 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	0	0	0	0	May	2,250	16	331	20,400
November	0	0	0	0	June	6,060	364	1,630	97,000
December	0	0	0	0	July	3,950	66	754	46,400
January	0	0	0	0	August	12,200	527	3,040	187,000
February	26	0	4.06	225	September	4,520	970	1,800	107,000
March	24	0	13.9	855					
April	32	0	5.21	310	The year	12,200	0	635	459,000

ARKANSAS RIVER NEAR WICHITA, KANS.

LOCATION.—Near center of line between secs. 7 and 18, T. 27 S., R. 1 E., at Thirteenth Avenue highway bridge, 1½ miles above mouth of Little Arkansas River and 2 miles northwest of Wichita, Sedgwick County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 11, 1921, to September 30, 1923.

GAGE.—Gurley water-stage recorder on downstream side of bridge pier. Prior to January 13, 1922, chain gage on upstream handrail of highway bridge; read by P. L. Brockway, city engineer.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Wide, flat bed of shifting sand. No definite control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 15.65 feet at 4.30 a. m. June 10 (discharge, 8,510 second-feet); no flow October 4–21.

1921–1923: Maximum discharge that of June 10, 1923; no flow September 22–26 and October 4–21, 1922.

ICE.—Stage-discharge relation occasionally slightly affected by ice.

DIVERSIONS.—Most of low-water flow during irrigation season is diverted for irrigation in western Kansas and eastern Colorado.

ACCURACY.—Stage-discharge relation not permanent; slightly affected by ice. Rating curve poorly defined. Mean daily gage height determined from recorder graph by inspection and planimeter. Daily discharge for the entire year ascertained by shifting-control method. Records fair.

Discharge measurements of Arkansas River near Wichita, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Mar. 9	G. H. Barger	10.33	100	June 12	Williams and Barger	14.65	5,890
Apr. 11	do	10.35	109	Aug. 24	H. B. Kinnison	12.68	3,520
June 10	do	14.77	6,460	Sept. 25	Kinnison and Barger	12.60	3,120

Daily discharge, in second-feet, of Arkansas River near Wichita, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10	72	139	133	98	100	86	112	1,770	1,530	685	2,850
2	7.8	76	139	130	98	106	90	106	2,850	1,360	1,140	2,850
3	3.0	66	139	130	90	112	142	103	4,080	1,240	1,190	3,000
4	0	64	136	127	86	103	305	115	4,560	1,090	990	2,560
5	0	64	130	130	84	103	212	136	4,080	990	855	2,160
6	0	68	130	157	90	112	172	124	3,600	900	765	1,990
7	0	72	136	151	72	112	148	118	3,000	810	685	1,650
8	0	78	133	136	70	109	127	145	2,700	685	615	1,410
9	0	80	133	130	72	103	109	450	6,500	650	1,360	1,300
10	0	82	106	127	70	100	100	360	6,910	580	1,410	1,190
11	0	80	115	124	64	109	103	360	5,750	545	1,190	1,190
12	0	200	96	118	66	121	106	272	5,930	510	1,140	990
13	0	260	94	118	60	124	109	244	5,750	545	1,300	945
14	0	310	94	118	46	121	94	240	6,110	510	1,990	945
15	0	290	92	106	38	127	92	244	5,750	510	1,650	900
16	0	360	118	103	40	121	94	240	4,720	510	1,470	945
17	0	390	121	103	40	124	92	216	3,600	545	1,470	990
18	0	276	115	103	44	80	92	216	2,850	545	2,030	1,190
19	0	236	103	96	66	80	92	224	2,420	480	2,160	1,300
20	0	212	98	94	100	100	96	224	2,160	450	1,770	1,300
21	0	196	100	94	103	112	124	244	2,420	450	2,560	1,470
22	6.0	192	112	92	106	109	124	360	3,760	480	4,240	1,650
23	9.6	184	127	92	103	112	115	580	3,150	580	3,920	3,000
24	11	164	154	94	96	112	106	900	3,300	1,580	3,450	3,450
25	11	160	157	94	98	98	100	1,140	3,920	1,770	3,450	2,850
26	11	154	151	96	98	88	100	1,410	3,150	1,470	4,240	2,290
27	9.6	151	136	96	98	88	106	1,990	2,560	1,300	5,390	1,990
28	6.0	145	133	96	100	84	121	3,000	2,560	1,140	5,570	1,770
29	3.0	145	136	96	-------	84	127	2,290	1,990	1,090	4,560	1,580
30	4.2	148	133	96	-------	80	118	2,030	1,770	900	3,760	1,470
31	33	-------	133	96	-------	82	-------	1,650	-------	810	3,150	-------

NOTE.—Gage heights partly estimated Nov. 12, Feb. 9, 10, Mar. 24–30, and June 21–23. Stage-discharge relation slightly affected by ice Dec. 19–24 and Feb. 7–19; discharge estimated from a study of gage-height graph and climatological data.

Monthly discharge of Arkansas River near Wichita, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	33	0	4.04	248	May	3,000	103	640	39,400
November	390	64	166	9,880	June	6,910	1,770	3,790	226,000
December	157	92	124	7,620	July	1,770	450	857	52,700
January	157	92	112	6,890	August	5,570	615	2,260	139,000
February	106	38	78.4	4,350	September	3,450	900	1,770	105,000
March	127	80	104	6,400					
April	305	86	120	7,140	The year	6,910	0	835	605,000

ARKANSAS RIVER AT ARKANSAS CITY, KANS.

LOCATION.—In NW. ¼ sec. 25, T. 34 S., R. 3 E., at Chestnut Avenue highway bridge, half a mile west of Arkansas City, Cowley County, 2 miles below diversion dam for Kansas Gas & Electric Co.'s canal, 5 miles above mouth of Walnut River, and 8 miles below mouth of Ninnescah River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 23, 1902, to July 31, 1906; September 10, 1921, to September 30, 1923.

GAGE.—Chain gage on upstream handrail of highway bridge, installed Sep- September 10, 1921; read by F. O. Burnett.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand. Control is contracted section and sand bar below gage; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 25.46 feet during afternoon of June 11 (discharge, 103,000 second-feet); minimum stage, 4.90 feet March 22, 23, 29–31, April 3 and 4 (discharge, 12 second-feet).

1921–1923; Maximum and minimum stages same as given above.

1902–1906: Maximum stage recorded, 15.2 feet July 10, 1904 (discharge 40,300 second-feet); minimum stage, 2.65 feet December 30 and 31, 1902 (discharge, 33 second-feet).

REGULATION AND DIVERSION.—Canal of Kansas Gas & Electric Co. with diversion dam across river 2 miles upstream diverts about 600 second-feet during high water and practically entire flow at low stages. Diversion in western Kansas and eastern Colorado for irrigation takes large part of low-water flow.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice. Rating curve poorly defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used November 23 to September 20. Records fair.

Discharge measurements of Arkansas River at Arkansas City, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 17	Kinnison and Barger	5.95	229	Aug. 23	H. B. Kinnison	10.49	4,260
Mar. 10	G. H. Barger	4.91	14.9	Sept. 25	Kinnison and Barger	10.56	3,090
Apr. 12	do	4.96	21.0	29	G. H. Barger	12.94	6,420
May 24	do	12.24	6,310	30	do	13.67	7,880
July 6	do	8.95	1,970				

Daily discharge, in second-feet, of Arkansas River at Arkansas City, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	380	885	627	483	40	25	16	129	6,580	2,760	1,530	3,560
2	324	1,960	601	461	37	24	16	170	6,420	2,540	1,530	3,330
3	290	1,060	601	461	30	24	13	240	8,330	2,340	1,460	3,330
4	256	679	601	439	196	24	13	101	7,800	2,240	1,870	3,450
5	256	575	601	125	37	24	196	57	5,800	2,040	1,620	2,990
6	256	575	575	125	30	30	601	110	4,890	1,960	1,460	2,760
7	256	575	575	82	44	30	290	211	7,100	1,960	1,460	2,440
8	256	505	575	73	44	27	182	182	7,450	1,870	1,390	2,240
9	256	505	575	64	30	24	88	125	19,700	1,790	1,320	2,040
10	240	461	549	64	30	18	52	118	53,900	1,700	1,390	1,870
11	226	417	549	55	44	25	27	380	67,600	1,620	1,870	1,700
12	226	705	505	55	44	90	25	273	41,500	1,620	1,700	1,700
13	226	5,180	417	55	37	71	25	226	30,700	1,530	1,620	1,700
14	226	4,620	483	55	78	38	23	211	23,900	1,530	1,700	1,700
15	226	3,220	439	52	37	80	362	211	19,000	1,620	1,870	1,530
16	240	2,440	439	48	37	73	33	182	27,700	1,620	2,040	1,530
17	226	2,040	417	48	30	59	28	211	24,800	1,530	1,870	1,460
18	240	1,620	362	33	24	196	25	211	17,400	1,530	1,870	1,620
19	273	1,390	362	33	30	40	25	170	12,800	1,530	1,790	2,040
20	290	1,120	417	40	24	40	29	147	9,730	1,460	2,540	2,540
21	240	1,000	527	37	21	15	28	129	8,500	1,460	2,240	2,340
22	240	945	505	37	52	12	25	1,000	7,100	1,390	2,240	2,040
23	240	885	483	36	42	12	49	1,320	7,100	1,390	4,490	1,870
24	240	825	527	33	33	40	86	5,030	5,180	1,390	3,950	2,540
25	240	765	575	33	30	21	78	8,500	5,030	1,530	3,680	3,100
26	240	765	627	33	29	15	66	6,420	5,180	2,140	3,100	2,760
27	240	705	601	33	28	16	55	5,180	5,650	2,040	4,490	2,340
28	240	679	505	33	27	13	306	3,330	3,560	1,870	5,800	2,140
29	240	679	380	33	-------	13	601	3,810	3,450	1,790	6,110	6,110
30	240	653	362	33	-------	13	182	3,680	3,100	1,790	4,890	7,630
31	306	-------	103	37	-------	13	-------	5,340	--------	1,700	4,220	-------

NOTE.—Gage not read Feb. 26 to Mar. 1; discharge interpolated. No gage height records June 9–12; gage height estimated.

Monthly discharge of Arkansas River at Arkansas City, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	380	226	254	15,600	May	8,500	57	1,530	94,100
November	5,180	417	1,280	76,200	June	67,600	3,100	15,200	904,000
December	627	103	499	30,700	July	2,760	1,390	1,780	109,000
January	483	33	104	6,400	August	6,110	1,320	2,550	157,000
February	196	21	41.6	2,310	September	7,630	1,460	2,610	155,000
March	196	12	37.0	2,280					
April	601	13	118	7,020	The year	67,600	12	2,160	1,560,000

TENNESSEE FORK NEAR LEADVILLE, COLO.

LOCATION.—In sec. 16, T. 9 S., R. 80 W., at highway bridge a few hundred yards above junction with East Fork and 3 miles northwest of Leadville, Lake County.

DRAINAGE AREA.—45 square miles (measured on topographic map).

RECORDS AVAILABLE.—May 10 to October 31, 1890; June 18 to October 16, 1903; February 8, 1911, to September 30, 1923.

GAGE.—Vertical staff on downstream side of left bridge abutment; datum lowered 0.40 foot October 6, 1914. Gage read by Jeanette Coquoz during summer and by forest ranger during winter. Relation between present gage and gages used in 1890 and 1903 not known.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed rough and composed of small boulders. Control a short distance below gage at rapids; slightly shifting at long intervals. Banks subject to overflow at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.9 feet at 7 a. m. June 21 (discharge, 399 second-feet); minimum stage recorded, 0.10 foot on several days during October (discharge, 2 second-feet).

1911–1923: Maximum stage recorded, that of June 21, 1923; minimum discharge, 1 second-foot October 26 to November 3, 1917.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Court decrees for diversions of 8 second-feet above the station; also a decree for diversions of 18.5 second-feet from the basin of Eagle River through Ewing ditch to that of Tennessee Fork above station.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 10 and 250 second-feet. Gage read to hundredths twice daily from October 1 to 28 and from June 16 to September 4; at irregular intervals during remainder of year. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Tennessee Fork near Leadville, Colo., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 21	M. B. Arthur	*0.48	12.2	June 27	Robert Follansbee	1.18	175
Mar. 10	T. J. Watkins	*.42	9.8	July 29	P. S. Parker	.80	56
May 13	Robert Follansbee	1.05	135	Sept. 27	Robert Follansbee	.50	19.6
June 1	do	1.71	338				

*Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4	10	16	70	340	148	45	29
2	2	10	16	75	260	148	51	28
3	2	10	16	80	260	120	49	29
4	2	10	16	90	265	104	34	27
5	2	10	16	100	270	86	36	28
6	2	10	16	120	275	120	29	28
7	2	10	16	130	265	120	31	29
8	3	10	16	150	255	101	28	20
9	3	10	16	175	244	160	29	20
10	2	10	16	190	275	176	31	21
11	2	10	16	185	278	136	33	22
12	3	10	16	182	281	120	30	23
13	2	10	20	136	284	114	20	24
14	2	10	29	130	290	123	101	25
15	3	10	25	120	300	111	67	25
16	3	10	23	110	306	98	58	26
17	3	10	20	100	244	89	64	27
18	3	11	18	110	213	98	64	28
19	2	11	18	125	182	98	58	29
20	2	12	16	139	188	129	44	27
21	2	12	16	160	306	104	40	25
22	2	13	16	200	182	86	39	24
23	2	13	16	228	182	77	39	23
24	2	13	18	240	182	61	39	22
25	2	13	20	250	182	83	37	21
26	2	13	25	260	185	129	29	21
27	2	13	30	228	179	114	29	20
28	2	14	40	228	170	114	29	25
29	2	14	50	228	151	58	23	25
30	2	15	60	228	148	44	24	25
31	2	16	------	290	------	31	30	------

NOTE.—Gage not read Oct. 29, 31, Mar. 1–9, 11–23, 25–31, Apr. 1–13, 15–22, 24–30, May 2–11, 14–19, 21, 22, 24, 25, 28, 29, 31, June 4, 5, 7, 8, 11, 12, 14, 15, Sept. 5, 6, 9–14, 16–20, 22–23, 29, and 30; discharge estimated.

Monthly discharge of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	4	2	2.3	141	June	340	148	238	14,200
March	16	10	11.4	701	July	176	31	106	6,520
April	60	16	21.7	1,290	August	101	23	42.3	2,600
May	290	70	163	10,000	September	29	20	24.9	1,480

COTTONWOOD CREEK BELOW HOT SPRINGS, NEAR BUENA VISTA, COLO.

LOCATION.—In sec. 22, T. 14 S., R. 79 W., at private bridge 6 miles west of Buena Vista, Chaffee County. Nearest tributary, North Cottonwood Creek, enters 2 miles downstream.

DRAINAGE AREA.—69 square miles (measured on Hayden atlas).

RECORDS AVAILABLE.—April 7, 1911, to September 30, 1923, when station was discontinued. From September 23, 1910, to September 13, 1911, station maintained in sec. 21, 1 mile above present site. Flow at two sites comparable.

GAGE.—Vertical staff; read by E. D. Masters. On February 19, 1915, gage was moved from side of left abutment to downstream end and reset to same datum. In present position water does not pile up on gage, especially during high water, and therefore for same discharge gage height is less.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders; very rough. Control short distance below gage; shifts at long intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.85 feet on June 16 and 21 (discharge, 372 second-feet); minimum stage, 0.28 foot at 6 a. m., April 8 (discharge, 19 second-feet);

1911–1923: Maximum discharge recorded, 495 second-feet June 21, 1921; minimum discharge, 10 second-feet April 9 and 19, 1914.

ICE.—Stage-discharge relation not affected by ice; hot springs keep creek open.

DIVERSIONS.—Court decrees for diversions of 148 second-feet from Cottonwood Creek, of which 28 second-feet are above gaging station.

ACCURACY.—Stage-discharge relation permanent; not affected by ice. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by Robert Follansbee: June 1, 1923: Gage height, 1.35 feet; discharge, 167 second-feet.

Daily discharge, in second-feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	24	22	24	23	21	20	21	24	202	252	114	76
2	24	23	26	24	21	20	21	26	252	252	112	71
3	24	22	26	24	20	20	20	28	260	228	99	68
4	23	23	26	24	21	21	20	32	240	213	99	68
5	23	23	26	24	21	21	20	43	213	202	99	65
6	23	23	26	24	21	20	21	53	202	191	88	64
7	22	26	26	24	20	20	21	60	213	220	84	61
8	22	25	26	23	20	20	20	60	213	198	76	57
9	22	27	25	23	20	20	20	67	202	188	71	54
10	22	28	26	23	21	20	20	71	140	188	81	52
11	22	26	25	23	21	20	21	68	178	188	81	52
12	22	27	26	22	21	20	21	65	240	178	76	52
13	22	27	26	22	21	20	21	61	296	168	99	49
14	22	3	26	22	21	20	21	57	314	178	114	49
15	22	27	24	22	21	20	21	44	350	178	103	52
16	22	27	25	22	21	20	20	40	359	162	114	49
17	22	28	25	22	21	20	21	38	314	165	112	52
18	22	28	24	22	20	20	22	42	314	153	112	61
19	22	27	25	22	21	20	25	47	314	153	112	68
20	22	26	25	21	21	20	24	62	314	153	103	67
21	22	27	25	21	20	20	21	67	341	178	101	62
22	22	27	26	21	20	20	22	68	305	153	101	62
23	21	26	26	22	20	21	20	65	296	142	88	65
24	22	27	25	22	20	21	21	78	305	140	84	68
25	21	26	25	22	20	21	21	114	305	137	84	65
26	21	26	26	21	21	20	20	168	328	131	78	62
27	22	26	25	21	19	20	21	159	341	126	78	62
28	22	26	25	22	20	20	22	178	305	121	78	60
29	22	26	25	21	-------	20	22	159	282	114	74	55
30	22	26	24	21	-------	21	24	159	269	112	74	53
31	22	-------	23	21	-------	21	-------	178	-------	99	70	-------

Monthly discharge of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	24	21	22.2	1,360	May	178	24	76.8	4,720
November	28	22	25.8	1,540	June	359	140	274	16,300
December	26	23	25.3	1,560	July	252	99	170	10,500
January	24	21	22.3	1,370	August	114	70	92.2	5,670
February	21	19	20.5	1,140	September	76	49	60.0	3,570
March	21	20	20.2	1,240					
April	25	20	21.2	1,260	The year	359	19	69.3	50,200

WEST BEAVER CREEK NEAR VICTOR, COLO.

LOCATION.—In sec. 30, T. 16 S., R. 68 W., at Skaguay power station of Southern Colorado Power Co., 7 miles southeast of Victor, Fremont County. Nearest tributary, East Beaver Creek, enters 2 miles downstream.

DRAINAGE AREA.—66 square miles.

RECORDS AVAILABLE.—January 1, 1905, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Water used through power house is brought by pipe line from reservoir 3½ miles upstream; quantity measured hourly by weir, and a quantity representing the gain or loss in the reservoir during the period is added or subtracted. To determine the natural flow of the stream the seepage through the dam is measured by weir and added to the total quantity thus obtained. This method takes no account of evaporation from the surface of the reservoir.

DIVERSIONS.—Above the power reservoir are three reservoirs from which the town of Victor obtains its municipal supply. In the upper basin are four reservoirs from which water is diverted through St. John tunnel into Lake Moraine, and thence by natural channels to Colorado Springs, where it is used as municipal supply. During 1923, 2,770 acre-feet were diverted through St. John tunnel. Below the power plant, adjudicated decrees for diversions of 126 second-feet from Beaver Creek, which is formed by East and West Beaver creeks. In addition there is an irrigation reservoir in operation which has a filing for 4,760 acre-feet.

COOPERATION.—Records are furnished through courtesy of Southern Colorado Power Co.

Monthly discharge of West Beaver Creek near Victor, Colo., for the year ending Sept. 30, 1923.

Month	Mean discharge in second-feet	Run-off in acre-feet	Month	Mean discharge in second-feet	Run-off in acre-feet
October	8.63	531	May	14.0	861
November	7.14	425	June	18.9	1,120
December	6.09	374	July	67.1	4,130
January	4.39	270	August	69.4	4,270
February	3.98	221	September	52.4	3,120
March	4.92	303			
April	14.7	875	The year	22.7	16,500

BOEHMER CREEK NEAR PIKES PEAK, COLO.

LOCATION.—In NW. ¼ sec. 32, T. 14 S., R. 68 W., 3½ miles south of Pikes Peak, El Paso County, above Little Beaver and Sackett creeks. Elevation of station, 11,000 feet.

DRAINAGE AREA.—7.2 square miles (measured on topographic map). About 75 per cent of this area is above timber line. To the natural drainage has been added that of West Beaver Creek above intake of Strickler tunnel.

RECORDS AVAILABLE.—October 1, 1909, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir, 60 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stage is measured by steel scale. Discharge is computed by Francis formula.

REGULATION.—Flow regulated by series of three reservoirs having an aggregating capacity of 1,400 acre-feet; reservoirs operated by Colorado Springs Water Department.

DIVERSIONS.—Water diverted above weir for use in Victor is measured and is added to flow over Boehmer Creek weir to show total run-off.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Boehmer Creek near Pikes Peak, Colo., for the year ending Sept. 30, 1923

[Drainage area, 72 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	11.7	1.13	2.48	0.344	0.40	152
November	1.58	1.58	1.58	.219	.24	94.0
December	1.58	1.35	1.42	.197	.23	87.3
January	1.35	.73	1.09	.151	.17	67.0
February	.73	.73	.73	.101	.11	40.5
March	.73	.64	.72	.100	.12	44.3
April	1.13	.82	.88	.122	.14	52.4
May	5.15	1.13	4.15	.576	.66	255
June	9.91	4.81	7.15	.993	1.11	425
July	34.0	8.69	21.9	3.04	3.50	1,350
August	28.7	14.9	19.7	2.74	3.16	1,210
September	26.5	2.07	3.88	.539	.60	231
The year	34.0	.64	5.51	.764	10.44	4,010

LITTLE BEAVER CREEK NEAR PIKES PEAK, COLO.

LOCATION.—In NW. ¼ NW. ¼ sec. 32, T. 14 S., R. 68 W., just above mouth of creek and 3½ miles south of Pikes Peak, El Paso County. Little Beave Creek enters Boehmer Creek from west 0.3 mile above reservoir No. 4. Elevation of station, 11,000 feet.

DRAINAGE AREA.—1.00 square mile (measured on topographic map). About 25 per cent of area above timber line; remainder sparsely timbered.

RECORDS AVAILABLE.—October 1, 1909, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir, 24 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Little Beaver Creek near Pikes Peak, Colo., for the year ending Sept. 30, 1923

[Drainage area, 1 square mile]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	0.36	0.20	0.30	0.30	0.35	18.4
November	.29	.29	.29	.29	.32	17.3
December	.29	.18	.25	.25	.29	15.4
January	.18	.16	.17	.17	.20	10.5
February	.16	.16	.16	.16	.17	8.9
March	.10	.10	.10	.10	.12	6.1
April	.29	.12	.15	.15	.17	8.9
May	1.40	.29	.85	.85	.98	52.3
June	2.50	1.28	2.21	2.21	2.47	132
July	1.78	1.11	1.35	1.35	1.56	83.0
August	1.65	1.40	1.52	1.52	1.75	93.5
September	1.40	1.04	1.13	1.13	1.26	67.2
The year	2.50	.10	.71	.71	9.64	514

SACKETT CREEK NEAR PIKES PEAK, COLO.

LOCATION.—In SE. ¼ NW. sec. 32, T. 14 S., R. 68 W., just above mouth of creek and 4 miles southeast of Pikes Peak, El Paso County. Sackett Creek enters Boehmer Creek from north a short distance above reservoir No. 4. Elevation of station, 11,000 feet.

DRAINAGE AREA.—0.65 square mile (measured on topographic map). About 30 per cent of area above timber line; remainder sparsely timbered.

RECORDS AVAILABLE.—October 1, 1909, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir 24 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Sackett Creek near Pikes Peak, Colo., for the year ending Sept. 30, 1923

[Drainage area, 0.65 square mile]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	0.16	0.04	0.12	0.185	0.21	7.4
November	.05	0	.02	.031	.03	1.2
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	.05	0	.01	.015	.02	.6
May	.93	.05	.68	1.05	1.21	41.8
June	1.53	.54	1.10	1.69	1.89	65.5
July	1.04	.54	.79	1.22	1.41	48.6
August	1.28	.63	.88	1.35	1.56	54.1
September	.93	.45	.64	.985	1.10	38.1
The year	1.53	0	.35	.544	7.43	257

LION CREEK NEAR HALFWAY, COLO.

LOCATION.—In NE. ¼ sec. 15, T. 14 S., R. 68 W., at mouth of creek, half a mile southwest of Halfway, El Paso County. Lion Creek enters Ruxton Creek from west. Elevation of station, 9,250 feet.

DRAINAGE AREA.—2 square miles (measured on topographic map). Includes all area above the Crater apparently tributary to Sheep Creek. About 30 per cent of area above timber line; remainder sparsely timbered.

RECORDS AVAILABLE.—April 1, 1908, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir 30 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Lion Creek near Halfway, Colo., for the year ending Sept. 30, 1923

[Drainage area, 2 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	1.60	1.30	1.42	0.710	0.82	87.3
November	1.24	.97	1.08	.540	.60	64.3
December	.91	.73	.79	.395	.46	48.6
January	.73	.56	.66	.330	.38	40.6
February	.61	.46	.55	.275	.29	30.5
March	.85	.46	.58	.290	.33	32.6
April	1.38	.56	.91	.455	.51	54.2
May	1.17	.73	.87	.435	.50	53.5
June	1.30	.61	.82	.410	.46	48.8
July	1.98	.51	1.06	.530	.61	65.2
August	2.10	1.30	1.77	.885	1.02	109
September	2.93	1.83	2.15	1.08	1.20	128
The year	2.93	.46	1.06	.528	7.16	762

SHEEP CREEK NEAR HALFWAY, COLO.

LOCATION.—In SW. ¼ sec. 11, T. 14 S., R. 68 W., a quarter of a mile west of Halfway, El Paso County. No tributary between station and mouth, a short distance below. Sheep Creek enters Ruxton Creek from west a short distance above Halfway. Elevation of station, 9,100 feet.

DRAINAGE AREA.—0.73 square mile (measured on topographic map). Does not include any area above the Crater as this is most probably tributary to Lion Creek. Practically all below timber line, but sparsely timbered.

RECORDS AVAILABLE.—April 1, 1908, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir 30 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

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Monthly discharge of Sheep Creek near Halfway, Colo., for the year ending Sept. 30, 1923

[Drainage area, 0.73 square mile]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	0.46	0.32	0.40	0.548	0.63	24.6
November	.32	.20	.25	.342	.38	14.9
December	.20	.20	.20	.274	.32	12.3
January	.20	.13	.15	.205	.24	9.2
February	.13	.05	.066	.090	.09	3.7
March	.20	.10	.14	.192	.22	8.6
April	.41	.13	.30	.411	.46	17.9
May	.51	.36	.41	.562	.65	25.2
June	.73	.23	.37	.507	.57	22.0
July	1.60	.23	.92	1.26	1.45	56.6
August	1.45	1.03	1.20	1.64	1.89	73.8
September	1.75	1.03	1.35	1.85	2.06	80.3
The year	1.75	.05	.48	.66	8.96	349

SOUTH RUXTON CREEK AT HALFWAY, COLO.

LOCATION.—In SW. ¼ sec. 11, T. 14 S., R. 68 W., just above hydroelectric intake at Halfway, El Paso County. No tributary between station and mouth, a short distance below. South Ruxton Creek enters Ruxton Creek from south at Halfway. Elevation of station, 9,000 feet.

DRAINAGE AREA.—3.95 square miles (measured on topographic map). Practically all below timber line and heavily timbered.

RECORDS AVAILABLE.—June 1, 1906, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by two sharp-crested weirs, with complete end contraction. Discharge is computed by Francis formula. Main wier is one-third mile above mouth of creek and a short distance above hydroelectric intake which has a capacity of 4.63 second-feet. Second weir is halfway between main weir and mouth of creek and measures inflow chiefly from springs below intake and small amount of seepage. At all times except during high water capacity of intake is sufficient to take entire flow passing main weir, and flow at two weirs is combined to give total run-off of the basin. During high water, excess passing intake and recorded at the lower weir does not represent increased flow between weirs, and is discarded. In its place is used a constant quantity based on inflow and seepage at other times.

DIVERSIONS.— None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of South Ruxton Creek at Halfway, Colo., for the year ending Sept. 30, 1923

[Drainage area, 3.95 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	2.10	1.60	1.75	0.443	0.51	108
November	1.63	1.17	1.37	.347	.39	81.5
December	1.30	1.03	1.16	.294	.34	71.3
January	1.03	.97	1.02	.258	.30	62.7
February	.97	.85	.90	.228	.24	50.0
March	.97	.79	.88	.223	.26	54.1
April	1.83	.91	1.19	.301	.34	70.8
May	2.75	1.63	2.10	.532	.61	129
June	4.21	2.38	3.42	.866	.97	204
July	5.85	2.49	3.89	.985	1.14	239
August	5.85	3.12	4.67	1.18	1.36	287
September	5.40	3.41	4.08	1.03	1.15	243
The year	5.85	.79	2.21	.560	7.61	1,600

CABIN CREEK NEAR HALFWAY, COLO.

LOCATION.—In SW. ¼ NW. ¼ sec. 11, T. 14 S., R. 68 W., just above hydroelectric intake, three-eighths of a mile north of Halfway, El Paso County. Cabin Creek enters Ruxton Creek half a mile below Halfway. Elevation of station, 9,000 feet.

DRAINAGE AREA.—2.4 square miles (measured on topographic map). About 15 per cent of area above timber line; remainder sparsely timbered.

RECORDS AVAILABLE.—October 1, 1906, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by two sharp-crested weirs with complete end contraction. Discharge computed by Francis formula. The main weir is about one-third of a mile above mouth of creek and just above hydroelectric intake. The second weir is 50 feet above mouth of creek and measures flow from springs and small tributaries entering below intake. Except during high water, measured flow at weirs is combined to give the run-off from basin. During high water, record from lower weir is discharged and inflow estimated. (See description of South Ruxton Creek at Halfway, Colo.).

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Cabin Creek near Halfway, Colo., for the year ending Sept. 30, 1923

[Drainage area, 2.4 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	1.63	1.38	1.57	0.654	0.75	96.5
November	1.38	.97	1.12	.467	.52	66.6
December	.91	.73	.82	.342	.39	50.4
January	.73	.46	.63	.262	.30	38.7
February	.41	.36	.39	.162	.17	21.7
March	.85	.41	.47	.196	.23	28.9
April	1.30	.73	1.07	.446	.50	63.7
May	2.07	1.17	1.62	.675	.78	99.6
June	2.93	1.60	1.88	.783	.87	112
July	5.85	1.75	3.80	1.58	1.82	234
August	5.17	3.50	4.03	1.67	1.92	248
September	7.29	3.50	4.18	1.74	1.94	249
The year	7.29	.36	1.81	.75	10.19	1,310

SUTHERLAND CREEK NEAR MANITOU, COLO.

LOCATION.—In SW. ¼ sec. 9, T. 14 S., R. 67 W., 1½ miles southeast of Manitou, El Paso County. No large tributary between station and mouth 1 mile below. Elevation of station, 6,600 feet.

DRAINAGE AREA.—4.4 square miles (measured on topographic map). Practically all below timber line.

RECORDS AVAILABLE.—January 1, 1918, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir, 30 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with creast of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Sutherland Creek near Manitou, Colo., for the year ending Sept. 30, 1923

[Drainage area, 4.4 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	0.91	0.56	0.68	0.155	0.18	41.8
November	.56	.56	.56	.127	.14	33.3
December	.56	.56	.56	.127	.15	34.4
January	.27	.27	.27	.061	.07	16.6
February	.36	.36	.36	.082	.09	20.0
March	.46	.46	.46	.105	.12	28.3
April	.67	.46	.56	.127	.14	33.3
May	1.30	1.30	1.30	.295	.34	79.9
June	1.03	.36	.84	.191	.21	50.0
July	2.07	.36	1.14	.259	.30	70.1
August	1.90	1.30	1.51	.348	.40	92.8
September	1.60	1.03	1.34	.305	.34	79.7
The year	2.07	.27	.80	.181	2.48	580

BEAR CREEK NEAR COLORADO SPRINGS, COLO.

LOCATION.—In NE. ¼ sec. 21, T. 14 S., R. 67 W., 3½ miles west of Colorado Springs. El Paso County. Nearest tributary, Hunters Run, enters a short distance above. Elevation of station, 6,615 feet.

DRAINAGE AREA.—6.9 square miles (measured on topographic map). Practically all below timber line.

RECORDS AVAILABLE.—March 1, 1918, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow measured by sharp-crested weir, 30 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir, depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

DIVERSIONS.—None.

REGULATION.—None.

COOPERATION.—Monthly discharge computed from records furnished by Colorado Springs Water Department.

Monthly discharge of Bear Creek near Colorado Springs, Colo., for the year ending Sept. 30, 1923

[Drainage area, 6.9 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	1.17	0.97	1.04	0.151	0.17	64.0
November	1.38	.91	1.05	.152	.17	62.5
December	1.24	.79	.88	.128	.15	54.1
January	1.10	.61	.74	.107	.12	45.5
February	.91	.51	.59	.086	.09	32.8
March	1.24	.67	.84	.122	.14	51.6
April	1.38	1.03	1.18	.171	.19	70.2
May	1.90	.79	1.05	.152	.18	64.6
June	1.52	.73	.98	.142	.16	58.3
July	15.3	.51	3.50	.507	.58	215
August	3.80	1.90	2.93	.425	.49	180
September	3.31	2.23	2.63	.381	.43	156
The year	15.3	.51	1.46	.211	2.87	1,050

AMAZON CANAL NEAR HARTLAND, KANS.

LOCATION.—In SW. ¼ sec. 8, T. 25 S., R. 37 W., 1 mile below head gates and 2 miles west of Hartland, Kearny County.

RECORDS AVAILABLE.—Irrigation seasons of 1921 to 1923.

GAGE.—Gurley water-stage recorder installed on north bank of canal 50 feet below highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed of canal is drifted sand. Banks and control permanent.

ACCURACY.—Stage-discharge relation permanent; rating curve well defined. Daily discharge ascertained by applying hourly gage heights to rating table. Records goods.

COOPERATION.—Complete records furnished by the Kansas State Board of Agriculture through George S. Knapp, State irrigation commissioner.

Water for the Amazon canal is diverted from the north bank of Arkansas River in NW. ¼ sec. 7, T. 25 S., R. 37 W., for irrigation. A waste gate 1 mile below gage is used only in case of floods.

Discharge measurements of Amazon canal near Hartland, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
May 24	G. S. Knapp	4.95	249
June 30	V. W. Stambaugh	3.85	160

Daily discharge, in second-feet, of Amazon canal near Hartland, Kans., for the year ending Sept. 30, 1923

Day	Mar.	May	June	July	Aug.	Sept.	Day	Mar.	May	June	July	Aug.	Sept.
1		11	112	136	231	150	16		120	189	177	63	140
2			89	88	209	154	17		111	144	134	75	73
3		10		64	217	145	18		83	68	103	43	
4		17		58	223	124	19		68	124	104	41	
5		10		52	200	122	20		50	65	101	94	
6		10		48	199	115	21		124		99	122	
7		7			187	116	22		148		98	107	
8					151	126	23		262		95	63	
9			5		121	121	24	109	258		95	90	
10			211		91	157	25	90	254	23	146	118	
11			232		83	120	26	34	232	100	211	151	
12			231		83	127	27		230	129	202	147	
13			230		67	131	28		188	140		122	
14		61	232	99	62	129	29		134	135		120	
15		90	220	211	59	144	30		118	158	237	135	
							31		137		242	140	

NOTE.—No flow in months and on days for which no discharge is given.

Monthly discharge of Amazon canal near Hartland, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
March (3 days)	109	34	77.7	461	August	231	41	123	7,550
May (24 days)	262	7	114	5,410	September (17 days)	157	73	129	4,340
June (20 days)	232	5	142	5,620					
July (22 days)	242	48	127	5,540	The year				28,900

SOUTH SIDE DITCH NEAR HARTLAND, KANS.

LOCATION.—In SW. ¼ sec. 15, T. 25 S., R. 37 W., half a mile south of Hartland, Kearney County, and 1 mile below head gates.

RECORDS AVAILABLE.—Irrigation seasons of 1921 to 1923.

GAGE.—Gurley water-stage recorder installed on south bank of canal 100 feet above highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed is drifted with loose sand; banks and control practically permanent.

ACCURACY.—Stage-discharge relation changes slightly. Rating curve fairly well defined throughout. Daily discharge ascertained by applying hourly gage height to rating table; shifting-control method used July 23 to September 30. Records good.

COOPERATION.—Complete records furnished by the Kansas State Board of Agriculture through George S. Knapp, State irrigation commissioner.

Water for the South Side ditch is diverted from the south bank of Arkansas River in SW. ¼ sec. 16, T. 25 S., R. 37 W., for irrigation. A waste gate is located 200 feet below gage.

Discharge measurements of South Side ditch near Hartland, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
May 23	G. S. Knapp	2.55	173	July 21	V. W. Stambaugh	1.70	77.6
July 14	V. W. Stambaugh	.79	9.4	Sept. 22	do	1.65	20.1

Daily discharge, in second-feet, of South Side ditch near Hartland, Kans., for th year ending Sept. 30, 1923

Day	Nov.	Apr.	May	June	July	Aug.	Sept.
1			12		89		28
2			24		121		20
3					106		17
4					101	103	13
5					79	81	14
6					120	97	13
7				47	122	16	7
8				60	124		
9				26	81		
10					65		
11					79		
12					93		
13					159		
14							
15					78	49	
16					135	104	
17					107	202	
18				21	73	149	37
19				52	92	90	33
20				37	78	73	50
21				53	73	78	30
22	42			59	109	80	18
23	43		16	55		72	9
24	44		144			67	5
25	44		98			83	
26	46		97			92	
27	14	113	65			79	
28		21			135	65	
29				85	151	52	
30				86	158	60	
31						37	

NOTE.—No flow in months and on days for which discharge is not given.

Monthly discharge of South Side ditch near Hartland, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
November (6 days)	46	14	38.8	461	August (21 days)	202	16	82.3	3,420
April (2 days)	113	21	67.0	265	September (14 days)	50	5	21.0	582
May (7 days)	144	12	65.1	903					
June (11 days)	86	21	52.8	1,150	The year				11,800
July (24 days)	159	65	105	5,010					

GREAT EASTERN CANAL NEAR HARTLAND, KANS.

LOCATION.—In NW. ¼ sec. 15, T. 25 S., R. 37 W., half a mile south of Hartland, Kearney County, and 1 mile below head gates.

RECORDS AVAILABLE.—Irrigation seasons of 1921 to 1923.

GAGE.—Gurley water-stage recorder installed on south bank of canal 150 feet above highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed of canal sandy; banks permanent. Control shifting.

ACCURACY.—Stage-discharge relation not permanent; rating curve poorly defined. Daily discharge ascertained by applying hourly gage height to rating table. Records fair.

COOPERATION.—Complete records furnished by the Kansas State Board of Agriculture through George S. Knapp, State irrigation commissioner.

Water from the Great Eastern canal is diverted from the north bank of Arkansas River in NW. ¼ sec. 16, T. 25 S., R. 37 W., for irrigation. A spillway seldom used during irrigation season is located 1 mile below gage.

Discharge measurements of Great Eastern canal near Hartland, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharg
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 20	G. S. Knapp	1.37	51.0	July 14	V. W. Stambaugh	3.22	375
May 23	do	3.86	430	Sept. 29	do	1.58	49.1

Daily discharge, in second-feet, of Great Eastern canal near Hartland, Kans., for the year ending Sept. 30, 1923

Day	Nov.	Dec.	Mar.	May	June	July	Aug.	Sept.
1		47			50		164	
2		44			51		174	
3		53			112		207	
4		59	12		100		374	30
5		61	81		104		530	55
6		60	87		100		289	49
7		61	57				443	35
8		47					448	27
9		23			451		297	25
10		44	50		582		231	36
11		46	50		482		195	23
12			50		395		153	12
13			49		294	299	107	12
14			50		369	372		4
15			38		277	413		35
16			31		322	304		25
17			40		256	112	101	21
18	55				183		164	18
19	59						92	12
20	48					181	65	
21	22					148	67	
22						251	61	
23				362		334	49	
24				372		207		
25				131				
26				201			16	
27				42			37	
28	51			32		319	51	
29	54			30		253	38	98
30	53			34		235	19	228
31				60		177		

NOTE.—No flow during periods for which discharge is not given except that about 20,000 acre-feet was diverted during the winter for storage in Lake McKinney for which no records are available.

Monthly discharge of Great Eastern canal near Hartland, Kans., for the year ending Sept. 30, 1923.

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
November (7 days)	59	22	49	677	July (14 days)	413	112	258	7,150
December (11 days)	61	23	50	1,080	August (25 days)	530	16	175	8,660
March (12 days)	87	12	50	1,180	September (18 days)	228	4	41	1,480
May (9 days)	372	30	140	2,500					
June (16 days)	582	50	258	8,170	The year				86,800

FARMERS DITCH NEAR GARDEN CITY, KANS.

LOCATION.—In NW. ¼ sec. 5, T. 24 S., R. 34 W., 1½ miles below head gates and 11 miles west of Garden City, Finney County.

RECORDS AVAILABLE.—Irrigation seasons of 1921 to 1923.

GAGE.—Gurley water-stage recorder installed on north bank of canal at down stream end of highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Slightly sandy bed; permanent banks and control.

ACCURACY.—Stage-discharge relation permanent. Rating curve well-defined. Daily discharge ascertained by applying hourly gage height to rating table. Records good.

COOPERATION.—Complete records furnished by the Kansas State Board of Agriculture through George S. Knapp, State irrigation commissioner.

Water for the Farmers ditch is diverted from north bank of Arkansas River in the SE. ¼ sec. 12, T. 24 S., R. 35 W., for irrigation. An unused waste gate is located half a mile below the gage.

No discharge measurements were made at this station during the year.

Daily discharge, in second-feet, of Farmers ditch near Garden City, Kans., for the year ending Sept. 30, 1923

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	------	33	63	37	82	47	84
2	------	16	57	28	67	28	87
3	80	------	36	27	57	------	101
4	65	16	33	32	41	------	90
5	30	26	26	23	54	------	83
6	58	------	24	25	33	66	78
7	57	------	19	25	22	81	69
8	57	------	------	13	17	86	61
9	56	------	------	------	------	87	59
10	57	------	------	------	------	34	68
11	64	------	------	------	------	64	75
12	64	------	------	------	------	75	63
13	58	------	------	------	------	76	58
14	54	------	------	------	103	65	51
15	23	------	59	------	84	44	60
16	21	------	39	------	79	50	61
17	23	------	27	------	116	84	20
18	18	------	20	------	------	------	------
19	16	------	------	------	------	------	------
20	12	------	------	------	------	------	------
21	11	------	43	------	62	31	------
22	16	------	37	------	96	71	------
23	20	------	52	------	110	42	------
24	------	------	52	------	133	------	------
25	------	------	72	------	148	------	------
26	------	90	99	------	141	------	------
27	12	63	93	------	156	63	------
28	53	42	51	33	------	94	------
29	56	27	60	106	61	76	------
30	46	18	49	104	83	42	------
31	36	------	47	------	72	65	------

NOTE.—No flow in months and on days for which no discharge is given.

Monthly discharge of Farmers ditch near Garden City, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
March (26 days)	80	11	40.9	2,100	August (22 days)	94	28	62.3	2,710
April (9 days)	90	16	36.8	655	September (17 days)	101	20	68.7	2,310
May (22 days)	99	19	48.1	2,100					
June (11 days)	106	13	41.2	897	The year	------	------	------	14,300
July (22 days)	156	17	80.3	3,500					

GARDEN CITY CANAL NEAR GARDEN CITY, KANS.

LOCATION.—In NW. ¼ sec. 4, T. 24 S., R. 34 W., half a mile below head gates and 10 miles west of Garden City, Finney County.

RECORDS AVAILABLE.—Irrigation seasons of 1921 to 1923.

GAGE.—Gurley water-stage recorder installed on south bank of canal 40 feet downstream from highway bridge.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage.

CHANNEL AND CONTROL.—Bed is loose, clean sand; control shifting. Banks permanent.

ACCURACY.—Stage-discharge relation affected by shifting sand in bottom of canal. Rating curve fairly well defined throughout. Daily discharge ascertained by applying hourly gage height to rating table; shifting-control method used July 18 to September 30. Records fair.

COOPERATION.—Complete records furnished by the Kansas State Board of Agriculture through George S. Knapp, State irrigation commissioner.

Water for the Garden City canal is diverted from the north bank of Arkansas River in the SE. ¼ sec. 5, T. 24. S., R. 34 W., for irrigation. No waste gate is provided.

The following discharge measurement was made by V. W. Stambaugh:

November 24, 1922: Gage height, 1.85 feet; discharge, 0.44 second-foot.

Daily discharge, in second-feet, of Garden City canal near Garden City, Kans., for the year ending Sept. 30, 1923.

Day	Apr.	May	June	July	Aug.	Day	Apr.	May	June	July	Aug.
1	------	4	23	------	------	16	6	------	------	------	10
2	13	16	20	------	------	17	6	------	------	16	11
3	12	32	15	------	------	18	5	------	14	9	7
4	------	16	10	------	17	19	5	------	11	6	2
5	------	11	10	------	16	20	6	------	------	28	13
6	------	6	17	------	17	21	10	------	------	38	21
7	9	5	12	------	21	22	10	------	------	25	23
8	9	4	11	------	19	23	7	------	------	31	35
9	8	3	10	------	20	24	6	------	------	34	13
10	8	3	14	------	12	25	14	------	------	33	------
11	8	5	9	------	14	26	14	40	------	32	------
12	6	------	7	------	21	27	18	39	------	32	------
13	7	------	5	------	21	28	12	35	------	39	------
14	7	------	4	------	13	29	7	35	------	25	------
15	7	------	------	------	9	30	5	31	------	21	------
						31	------	26	------	------	------

NOTE.—No flow in months and on days for which no discharge is given.

Monthly discharge of Garden City canal near Garden City, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
April (26 days)	18	5	8.7	446	August (21 days)	35	2	16.0	663
May (17 days)	40	3	18.3	616					
June (16 days)	23	4	12.0	380	The year	------	------	------	2,840
July (14 days)	39	6	26.4	731					

LITTLE ARKANSAS RIVER AT VALLEY CENTER, KANS.

LOCATION.—In SW. ¼ sec. 1, T. 26 S., R. 1 W., at highway bridge half a mile west of Goodrich station on Arkansas Valley Interurban Railroad, 1 mile south of Valley Center, Sedgwick County, and 14 miles above junction with Arkansas River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 11, 1922, to September 30, 1923.

GAGE.—Chain gage secured to upstream handrail of highway bridge; read by Clarence Carr.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed, sand and gravel; lodged snags and driftwood are frequent. Low-water control is sand and gravel bar under bridge; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.02 feet at night June 10 (discharge, 10,500 second-feet); minimum stage, 1.02 feet at 8.15 a. m. December 17 (discharge, 4 second-feet).

1922–23: Maximum and minimum stages same as given above.

ACCURACY.—Stage-discharge relation changes slightly. Rating curve well defined. Gage read to hundredths once daily except during rises when it was read twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used October 1 to May 7 and June 17 to September 26. Records good.

Discharge measurements of Little Arkansas River at Valley Center, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 16	Kinnison and Barger	1.23	22.9	June 13	Barger and Williams	14.05	5,630
Mar. 9	G. H. Barger	1.31	28.0	14	G. H. Barger	10.87	3,240
May 23	do	5.23	708	July 7	do	2.37	125
25	do	7.42	1,300	Sept. 24	H. B. Kinnison	1.42	47.7

Daily discharge, in second-feet, of Little Arkansas River at Valley Center, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	45	35	28	31	30	23	49	115	195	59	38
2	19	43	35	28	29	30	24	40	142	181	58	38
3	18	48	33	27	26	30	560	72	167	160	58	38
4	18	43	35	27	12	32	308	68	136	155	59	38
5	17	39	33	27	13	28	90	72	202	181	57	38
6	16	34	31	27	26	28	72	90	160	148	55	39
7	14	34	33	27	24	27	53	86	450	130	52	39
8	14	31	33	28	26	27	40	59	746	120	52	37
9	14	21	31	28	24	26	35	45	4,090	115	50	36
10	14	28	31	28	26	27	31	39	8,360	110	51	39
11	15	27	29	28	25	28	29	37	10,500	105	49	36
12	15	770	22	29	27	31	28	54	9,280	100	49	35
13	15	926	32	29	28	33	28	36	4,790	120	45	38
14	15	794	34	29	28	35	28	31	3,490	100	44	36
15	17	538	30	29	23	35	25	30	2,230	105	45	40
16	17	202	30	29	23	33	27	32	2,710	105	45	44
17	16	136	4	29	25	34	25	32	5,430	100	45	46
18	16	86	21	29	25	31	25	32	4,630	100	45	68
19	16	68	28	29	25	26	26	35	4,390	100	45	90
20	16	59	27	29	25	24	26	34	4,160	90	43	115
21	16	51	28	29	27	25	68	136	2,470	86	42	72
22	18	49	28	28	28	26	115	366	1,080	82	42	64
23	16	45	32	28	28	27	68	560	770	82	45	54
24	16	42	30	29	30	25	45	1,210	582	77	42	53
25	16	40	30	29	30	25	36	1,370	494	72	40	49
26	16	38	32	31	32	24	35	1,250	386	72	41	72
27	16	36	30	29	30	23	35	1,020	326	68	43	2,710
28	17	35	29	31	30	23	26	494	290	68	45	7,580
29	15	36	28	29	------	23	51	236	254	64	43	5,030
30	16	36	28	31	------	25	55	130	218	64	41	1,660
31	23	------	28	31	------	23	------	125	------	64	39	------

Monthly discharge of Little Arkansas River at Valley Center, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	23	14	16.3	1,000	May	1,370	30	254	15,600
November	926	21	146	8,690	June	10,500	115	2,430	145,000
December	35	4	29.4	1,810	July	195	64	107	6,580
January	31	27	28.7	1,760	August	59	39	47.4	2,910
February	32	12	25.9	1,440	September	7,580	35	609	36,200
March	35	23	27.9	1,720					
April	560	23	67.9	4,040	The year	10,500	4	313	227,000

DIVERSION CANAL FROM ARKANSAS RIVER AT ARKANSAS CITY, KANS.

LOCATION.—In SE. ¼ sec. 25, T. 34 S., R. 3 E., in Arkansas City, Cowley County, on right bank of canal, 135 feet below Chestnut Avenue canal bridge, 500 feet above St. Louis-San Francisco Railway Co.'s canal bridge, 2 miles below diversion dam across Arkansas River, and 2 miles above power house at lower end of canal on Walnut River.

RECORDS AVAILABLE.—September 10, 1921, to September 30, 1923. Gage height records have been obtained since July 27, 1919, by Kansas Gas & Electric Co.

GAGE.—Staff gage of 1½-inch iron pipe driven to bedrock; read by F. O. Burnett.

DISCHARGE MEASUREMENTS.—Made from upstream side of footbridge on B Street, 6,060 feet below gage or by wading at railroad trestle 500 feet below gage.

CHANNEL AND CONTROL.—Bed is sand and silt; permanent. Control is gravel and earth bar held by old sawed-off piling at trestle 500 feet below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.17 feet at 4.30 p. m. on June 5 (discharge, 541 second-feet); there was no discharge during a considerable portion of the year.

1921–1923: Maximum discharge, that of June 5, 1923.

REGULATION.—Flow is controlled by headgates 6,600 feet above gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined above 150 second-feet. Gage read to quarter inches twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Water for this canal is diverted from the left bank of Arkansas River in the SE. ¼ sec. 23, T. 34 S., R. 3 E., and is used for power. The canal discharges into Walnut River which flows into Arkansas River 3 miles below Arkansas City.

Discharge measurements of diversion canal from Arkansas River at Arkansas City, Kans, during the year ending Sept. 30, 1923

[Made by G. H. Barger]

Date	Gage height	Discharge
	Feet	*Sec.-ft*
Mar. 10	9.38	427
Apr. 12	9.69	452

Daily discharge, in second-feet, of diversion canal from Arkansas River at Arkansas City, Kans., for the year ending Sept. 30, 1923

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1			429	429	367	493	352
2			429	429	352	493	352
3			292	429	367	509	382
4			136	429	382	493	477
5		367	307	413	445	509	525
6		367	352	413	477	541	509
7		413	367	413	477	541	509
8		397	367	429	493	525	493
9		413	352	429	493	509	461
10		429	382	413	493	525	
11		429	367	445	461	525	
12		429	367	477	461	525	
13		429	397	477	461	541	
14		445	413	493	445	509	
15		429	292	509	38	509	
16		429	382	509	413	525	
17		413	337	493	429	525	
18		413	262	307	413	525	
19		429	337	277	397	525	
20		429	352	413	397	525	
21		429	382	382	429	525	
22		413	429	382	429	525	
23		413	429	461	461	525	
24		429	429	461	477	525	
25		413	429	461	477	509	
26		429	429	429	461	493	
27		429	429	429	461	461	
28	56	429	429	397	493	493	
29	136	429		397	493	509	
30	136	413		397	493	429	
31	461	429		382		367	

NOTE.—Gage not read Feb. 26 to Mar. 1; discharge interpolated. No flow on days for which discharge is not given.

Monthly discharge of diversion canal from Arkansas River at Arkansas City, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
December	461	0	25.5	1,570	May	541	367	508	31,200
January	445	0	365	22,400	June	525	0	135	8,030
February	429	136	368	20,400					
March	509	277	426	26,200	The year				135,000
April	493	38	431	25,600					

WALNUT RIVER AT WINFIELD, KANS.

LOCATION.—In NE. ¼ sec. 33, T. 32 S., R. 4 E., at concrete highway bridge 1 mile south of Winfield, Cowley County, 1 mile above Black Creek, and 3 miles below Timber Creek.

DRAINAGE AREA.—1,680 square miles (measured on topographic map).

RECORDS AVAILABLE.—November 14, 1921, to September 30, 1923.

GAGE.—Chain gage on upstream handrail of highway bridge; read by William Mason.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading on control.

CHANNEL AND CONTROL.—Bed composed of silt, sand, and rock. Control is gravel bar 500 feet below gage; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 38.7 feet at 6 p. m. June 10 (discharge, 30,500 second-feet); minimum discharge 1 second-foot at 6 a. m. August 24.

1921–1923: Maximum and minimum discharge same as given above.

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice. Rating curve fairly well defined below 15,000 second-feet; extended above that point. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used November 10 to April 10 and June 10 to September 30. Records good October to May; poor June to September.

Discharge measurements of Walnut River at Winfield, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 17	Kinnison and Barger	3.30	20.9	May 25	G. H. Barger	23.68	13,200
Mar. 10	G. H. Barger	3.42	47.0	June 16	do	17.41	8,010
Apr. 11	do	3.88	131				

Daily discharge, in second-feet, of Walnut River at Winfield, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	50	1,340	149	90	54	74	18	350	840	491	132	132
2	74	2,140	116	96	57	78	126	534	990	491	132	110
3	74	648	121	121	68	96	54	534	1,790	491	106	20
4	50	312	177	74	18	52	63	369	744	1,390	110	49
5	49	294	88	100	88	39	792	369	512	2,640	100	59
6	44	276	106	108	50	74	350	240	1,540	1,540	137	22
7	66	211	204	57	106	50	312	264	6,370	840	86	59
8	44	211	106	59	57	57	158	170	4,210	602	78	63
9	39	146	98	66	57	66	164	129	19,300	491	66	14
10	28	86	113	64	63	50	88	140	26,400	428	106	106
11	31	70	140	63	23	90	78	140	26,000	388	110	32
12	31	1,000	88	59	82	294	72	129	22,600	369	106	54
13	28	4,500	82	78	63	491	78	140	15,400	350	100	86
14	31	4,920	76	21	64	388	78	215	3,440	312	100	63
15	13	1,190	76	135	59	312	47	187	3,140	648	106	35
16	24	491	76	64	57	276	140	137	7,810	579	110	57
17	31	369	28	52	64	294	68	167	13,400	890	66	54
18	28	331	98	70	24	258	72	155	15,700	1,140	106	61
19	30	276	76	64	90	258	61	155	4,920	1,240	93	124
20	28	258	82	84	55	190	78	132	1,240	648	82	449
21	31	215	76	20	59	158	84	229	1,040	350	63	312
22	13	190	72	124	64	152	59	1,240	940	276	93	211
23	30	180	82	54	70	124	146	1,240	792	350	46	103
24	36	167	20	54	70	110	126	7,490	744	258	7	110
25	33	149	140	61	22	74	155	12,700	696	236	22	70
26	31	121	152	76	96	149	126	9,890	648	222	39	39
27	33	180	72	72	66	72	126	1,340	602	229	86	32
28	33	129	66	40	78	64	696	940	556	177	106	30
29	15	110	78	98	------	70	648	744	534	222	100	1,840
30	28	103	70	88	------	57	512	2,190	534	194	100	648
31	35	------	84	124	------	76	------	1,640	------	100	118	------

Monthly discharge of Walnut River at Winfield, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	74	13	35.8	2,200	May	12,700	129	1,430	87,900
November	4,920	70	690	41,100	June	26,400	512	6,110	364,000
December	204	20	97.2	5,980	July	2,640	100	606	37,300
January	135	20	75.4	4,640	August	137	7	90.7	5,580
February	106	18	61.6	3,420	September	1,840	14	168	10,000
March	491	39	148	9,100					
April	792	18	186	11,100	The year	26,400	7	804	582,000

VERDIGRIS RIVER AT INDEPENDENCE, KANS.

LOCATION.—In NE. ¼ sec. 31, T. 32 S., R. 16 E., at highway bridge half a mile east of Independence, Montgomery County, 2½ miles below Elk River and 4½ miles above Drum Creek.

DRAINAGE AREA.—2,800 square miles.

RECORDS AVAILABLE.—November 14, 1921, to September 30, 1923. Intermittent records of stage were obtained April 24 to September 24, 1904.

GAGE.—Chain gage fastened to upstream vertical members of highway bridge; read by Ben Wainscott. During 1904 a chain gage was fastened to upstream guardrail near south end of bridge; not referred to present datum.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge or by wading at control.

CHANNEL AND CONTROL.—Bed is composed of silt and rock. Control is rock riffle just below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 44.11 feet at 3.20 p. m. June 12 (discharge, 35,900 second-feet); minimum stage recorded, 1.02 feet on October 24, 25, 27, and August 23 (discharge, 10 second-feet).

1921–1923: Maximum and minimum stages same as given above.

1904: Maximum stage, 46.7 feet on July 8, referred to present datum.

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 30,000 second-feet. Gage read to hundredths once daily, more frequently during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Verdigris River at Independence, Kans., during the year ending Sept. 30, 1924

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 18	Kinnison and Barger	1.18	14	Apr. 13	G. H. Barger	1.87	77
Mar. 12	G. H. Barger	2.16	130	July 6	do	6.07	2,070

Daily discharge, in second-feet, of Verdigris River at Independence, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	33	14	60	42	67	43	102	648	3,880	376	82	25
2	26	14	55	44	50	33	95	616	2,980	345	77	72
3	31	22	48	34	30	37	92	424	2,660	376	72	552
4	52	29	65	50	34	45	102	360	3,880	360	60	151
5	71	37	48	44	32	49	87	315	1,470	360	60	110
6	59	44	53	34	39	43	72	270	2,720	2,140	58	87
7	52	27	50	38	37	41	84	270	8,570	3,670	55	60
8	45	42	53	32	39	37	77	240	4,440	856	56	82
9	29	60	60	32	39	35	87	186	15,800	584	48	72
10	23	58	62	30	39	37	72	165	28,600	424	36	46
11	27	55	48	42	41	43	82	151	29,500	360	42	32
12	33	62	46	38	47	124	74	134	35,700	315	44	36
13	24	84	44	32	43	750	79	132	32,400	285	27	34
14	23	682	48	46	41	936	77	128	24,400	270	26	24
15	23	488	42	38	39	682	82	153	11,500	360	27	24
16	16	330	44	30	39	2,850	87	124	17,500	976	20	60
17	14	240	42	38	41	1,830	98	112	21,200	616	16	79
18	12	186	42	50	43	750	285	140	29,600	858	12	84
19	13	134	42	34	47	488	255	136	25,100	488	20	138
20	14	118	38	36	33	360	226	376	4,720	345	12	5,210
21	14	110	40	40	27	285	300	648	1,830	330	17	1,140
22	14	92	38	36	37	270	520	1,060	1,520	199	13	376
23	14	90	38	34	37	240	682	1,470	1,140	176	10	199
24	10	87	40	32	41	212	616	5,490	936	160	15	114
25	10	77	46	28	39	186	520	15,500	822	151	15	92
26	11	79	42	34	37	170	408	16,400	682	134	22	84
27	10	84	27	32	37	151	345	16,700	648	110	14	151
28	13	77	36	34	37	134	376	2,330	520	102	12	212
29	13	72	34	36	------	118	2,010	1,380	456	98	13	192
30	11	67	40	36	------	106	1,140	1,230	424	84	12	72
31	14	------	42	46	------	98	------	5,490	------	84	32	------

NOTE.—Gage not read Nov. 3–5; discharge interpolated.

Monthly discharge of Verdigris River at Independence, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	71	10	24.3	1,490	May	16,400	112	2,150	132,000
November	682	14	119	7,080	June	35,700	424	10,500	625,000
December	65	27	45.6	2,800	July	3,670	84	516	31,700
January	50	28	37.2	2,290	August	82	16	33.2	2,040
February	67	27	39.7	2,200	September	5,210	24	317	18,900
March	2,850	33	361	22,200					
April	2,010	72	304	18,100	The year	35,700	10	1,200	868,000

NEOSHO RIVER NEAR IOLA, KANS.

LOCATION.—In NE. ¼ sec. 9, T. 25 S., R. 18 E., 2½ miles south and 1½ miles west of Iola, Allen County, 1 mile below Elm Creek and 8 miles above Owl Creek.

DRAINAGE AREA.—3,800 square miles (revised).

RECORDS AVAILABLE.—October 12, 1917, to September 30, 1923; August 1, 1895, to November 30, 1903, at city water and power dam about 4 miles upstream

GAGE.—Stevens continuous water-stage recorder on left bank, three-fourths mile above Pipe Line ford; inspected by J. E. Ensminger.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and silt. Control is a long shale riffle half a mile below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 27.33 feet at 4 a. m. June 15 (discharge, 31,400 second-feet); minimum stage from water-stage recorder, 2.58 feet at 3 p. m. October 27, (discharge, 10 second-feet).

1917–1923: Maximum stage recorded, that of June 15, 1923; minimum stage recorded, 1.9 feet on June 23, 1920 (discharge 1 second-foot).

1895–1903: Maximum stage recorded, 22.0 feet on June 3, 1903 (discharge, 39,100 second-feet); no flow on several days in September and October, 1897.

A stage of 24 feet on July 10, 1904, referred to datum of old gage, was determined by levels from high-water marks (discharge estimated, 74,600 second-feet).

ICE.—Stage-discharge relation seldom affected by ice.

REGULATION.—Low-water flow regulated by dams upstream.

ACCURACY.—Stage-discharge relation permanent; not affected by ice. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Rating curve well defined below 25,000 second-feet. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or by planimeter, or by averaging hourly discharge. Records good.

The following discharge measurement was made by Kinnison and Barger: September 27, 1923: Gage height, 3.27 feet; discharge, 143 second-feet.

Daily discharge, in second-feet, of Neosho River near Iola, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	64	42	256	123	106	70	106	171	920	1,440	388	112
2	72	34	227	118	109	68	109	160	730	1,360	365	112
3	66	30	212	123	112	66	106	153	790	1,360	320	112
4	59	34	196	133	112	59	95	153	790	1,360	320	109
5	57	46	200	140	104	70	112	153	730	4,120	298	104
6	59	235	200	143	88	82	115	160	670	10,600	298	106
7	51	342	204	143	77	88	112	171	642	14,000	276	106
8	37	235	196	140	85	88	106	174	1,200	15,500	298	109
9	37	174	185	126	88	77	106	185	17,400	7,020	298	109
10	34	150	182	115	88	66	101	174	24,400	2,600	276	112
11	37	118	174	118	95	77	109	146	26,000	2,020	276	109
12	42	140	171	112	101	615	118	133	27,000	1,930	256	106
13	39	223	167	109	85	642	133	129	27,900	2,500	256	104
14	33	4,720	171	112	75	298	160	123	30,600	2,930	256	106
15	31	9,520	167	109	70	615	178	126	31,200	3,520	227	104
16	30	8,190	153	85	53	1,930	182	118	29,800	7,020	227	109
17	28	1,840	146	85	51	615	153	109	27,600	4,600	216	112
18	28	850	167	106	64	342	171	93	18,100	2,400	227	115
19	24	642	146	115	66	256	182	118	13,000	1,760	235	143
20	19	535	146	106	66	200	185	182	10,100	1,520	212	200
21	16	485	136	95	68	189	235	850	4,600	1,200	216	153
22	15	435	140	106	68	185	256	1,600	2,400	850	200	185
23	15	388	143	85	66	182	256	2,300	1,930	670	160	235
24	39	342	140	93	68	160	298	8,840	1,680	642	126	223
25	18	320	129	104	72	140	219	13,700	1,440	588	129	200
26	10	298	118	95	77	129	200	14,300	1,440	560	120	178
27	19	276	123	88	70	126	298	11,900	1,440	510	118	146
28	62	256	133	88	66	118	342	4,480	1,360	485	118	157
29	51	256	129	80	-------	123	256	1,680	1,280	460	118	160
30	46	256	129	66	-------	109	200	1,280	1,440	435	120	1,200
31	41	-------	129	90	-------	112	-------	1,060	--------	410	118	-------

NOTE.—Water-stage recorder not operating May 28, 29, June 18–20, and July 21–28; daily gage height estimated from records at station 4 miles above.

Monthly discharge of Neosho River near Iola, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	72	10	38.0	2,340	May	14,300	93	2,090	129,000
November	9,520	30	1,050	62,500	June	31,200	642	10,300	613,000
December	256	118	165	10,100	July	15,500	410	3,110	191,000
January	143	66	108	6,640	August	388	118	228	14,000
February	112	51	80.4	4,470	September	1,200	104	171	10,200
March	1,930	59	255	15,700					
April	342	95	173	10,300	The year	31,200	10	1,480	1,070,000

NEOSHO RIVER NEAR PARSONS, KANS.

LOCATION.—In NW. ¼ sec. 22, T. 31 S., R. 21 E., at bridge on Parsons-Pittsburg highway 500 feet above St. Louis-San Francisco Railway Co.'s bridge, 800 feet below Hickory Creek and 10 miles east of Parsons, Labette County.

DRAINAGE AREA.—4,860 square miles.

RECORDS AVAILABLE.—October 18, 1921, to September 30, 1923.

GAGE.—Chain gage bolted to upstream truss of bridge; read by Mrs. W. C. Slane.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of solid flat outcropping shale rock. No well-defined control. Bank-full stage, 24 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 24.50 feet all day June 18 (discharge, 27,600 second-feet); minimum stage, 1.14 feet at 7.40 a. m. November 11 (discharge, 19 second-feet).

1921–1923: Maximum stage recorded, 24.90 feet at 5.50 p. m. April 13 and 7 a. m. April 14, 1922 (discharge, 28,400 second-feet); minimum stage recorded, 1.12 feet at 5.10 p. m. December 3, 1921, (discharge, 18 second-feet).

ICE.—Stage-discharge relation probably never seriously affected by ice.

REGULATION.—Flow apparently not affected by dams upstream.

ACCURACY.—Stage-discharge relation permanent; not affected by ice during the year. Rating curve fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Neosho River near Parsons, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 18	Kinnison and Barger	1.42	49.5	Apr. 13	G. H. Barger	1.86	114
Mar. 13	G. H. Barger	5.26	1,820	July 5	do	3.55	790

Daily discharge, in second-feet, of Neosho River near Parsons, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	74	54	234	126	99	92	144	401	1,880	1,080	401	133
2	74	166	234	122	90	83	135	302	1,440	1,080	447	139
3	83	146	234	128	102	84	130	284	2,940	964	359	124
4	72	86	218	130	106	79	135	234	1,950	852	338	137
5	75	104	202	108	108	92	130	202	1,380	852	338	130
6	75	177	194	130	120	114	130	194	1,640	2,230	320	120
7	66	133	196	126	101	92	124	185	2,020	8,030	302	122
8	64	72	199	128	110	101	120	194	1,570	11,100	302	101
9	59	250	188	124	90	118	122	196	9,230	12,800	284	110
10	56	250	182	116	84	116	120	194	20,700	8,270	302	104
11	60	43	171	124	84	380	122	284	23,400	2,380	266	112
12	59	158	169	108	104	2,780	112	284	24,000	1,700	250	114
13	43	1,020	144	102	102	1,950	124	199	24,800	3,260	250	108
14	42	1,260	144	112	108	1,570	135	202	25,800	4,800	234	97
15	37	2,460	144	108	102	1,200	151	266	26,600	3,420	202	95
16	42	7,390	151	110	93	4,800	164	234	27,000	3,420	202	106
17	50	7,390	161	108	84	3,990	191	188	27,200	5,610	196	139
18	49	2,860	124	104	90	1,570	194	171	27,600	4,170	196	148
19	45	1,320	114	95	74	796	185	250	27,400	2,160	194	151
20	44	964	146	97	66	522	194	338	27,200	1,640	191	218
21	42	684	130	108	60	422	684	320	23,600	1,260	191	234
22	38	549	130	110	86	359	630	302	10,100	1,080	177	266
23	44	497	135	108	84	359	447	2,700	3,740	908	177	194
24	41	401	122	97	75	302	2,020	6,890	2,780	796	153	401
25	33	359	133	90	83	284	3,180	11,100	2,090	684	164	234
26	32	320	133	95	84	250	684	13,100	1,820	630	130	266
27	46	320	139	93	83	234	472	13,900	1,570	576	126	603
28	56	302	130	102	81	188	630	12,800	1,380	522	144	684
29	56	266	130	90	------	185	964	5,890	1,260	472	141	284
30	44	250	124	92	------	177	603	2,230	1,080	422	144	185
31	41	------	128	106	------	141	------	2,090	--------	422	139	-------

Monthly discharge of Neosho River near Parsons, Kans., for the year ending Sept. 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	83	32	53.0	3,260	May	13,900	171	2,460	151,000
November	7,390	43	1,010	59,500	June	27,600	1,080	11,800	702,000
December	234	114	161	9,900	July	12,800	422	2,830	174,000
January	130	90	110	6,760	August	447	126	234	14,400
February	120	60	91.2	5,060	September	684	95	195	11,600
March	4,800	79	756	46,500					
April	3,180	112	439	26,100	The year	27,600	32	1,680	1,210,000

COTTONWOOD RIVER AT ELMDALE, KANS.

LOCATION.—In NW ¼ sec. 26, T. 19 S., R. 7 E., at highway bridge one fourth mile above Middle Creek, 1 mile east of Elmdale, Chase County, and 2 miles above Diamond Creek.

DRAINAGE AREA.—1,040 square miles (measured on topographic map).

RECORDS AVAILABLE.—May 9, 1922, to September 30, 1923.

GAGE.—Chain gage fastened to upstream handrail of highway bridge; read by Miss Rowena Starkey.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed, clean coarse sand, gravel, and rock; permanent. Control is long gravel and rock riffle extending from 200 feet above to 100 feet below gage; permanent. Dam at Cottonwood Falls may affect stage-discharge relation at medium and high stages. Bank-full stage, 32 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 35.50 feet at 4 p. m. June 11 (discharge, 20,000 second-feet); minimum stage recorded 3.43 feet at 8.30 a. m. October 16 (discharge, 18 second-feet).

1922-1923: Maximum stage recorded, that of June 11, 1923; minimum stage, 3.33 feet on September 9 and 12, 1922 (discharge, 10 second-feet).

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; not affected by ice. Rating curve well defined below 400 second-feet and fairly well defined from 400 to 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Cottonwood River at Elmdale, Kans., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 16	Kinnison and Barger	3.43	19.3	Apr. 10	G. H. Barger	3.74	65.3
Mar. 8	G. H. Barger	3.64	42.7	July 8	do	4.67	360

Daily discharge, in second-feet, of Cottonwood River at Elmdale, Kans., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	677	80	61	51	51	54	63	208	204	141	48
2	28	677	78	58	44	54	58	76	191	233	135	46
3	28	340	82	58	48	59	63	82	182	2,020	127	44
4	28	113	82	61	51	54	72	92	168	5,530	124	51
5	28	72	82	61	51	51	82	105	164	1,610	120	49
6	28	56	80	56	51	51	72	105	322	548	117	51
7	24	41	78	61	49	51	63	72	717	340	113	44
8	20	44	80	56	48	63	63	68	967	305	113	51
9	20	38	82	58	44	72	41	54	17,500	258	108	48
10	24	26	88	59	51	68	54	46	19,600	233	100	43
11	26	41	97	59	51	51	63	46	20,000	233	97	36
12	24	4,500	102	59	51	63	61	38	15,000	225	84	36
13	20	4,150	105	58	51	72	56	38	5,700	208	68	36
14	20	2,240	110	61	51	72	54	38	1,140	913	70	41
15	24	677	118	58	51	82	58	38	504	657	63	48
16	19	430	118	49	46	82	58	38	5,310	305	61	135
17	26	258	113	51	43	84	54	68	8,110	266	59	147
18	30	164	118	67	36	54	54	82	1,860	237	59	141
19	26	154	124	54	36	54	54	97	1,160	225	59	118
20	26	132	88	54	36	54	68	592	636	216	59	95
21	36	118	54	51	36	54	70	730	570	182	61	72
22	31	108	56	51	36	54	63	867	504	161	63	61
23	24	105	54	51	36	54	61	1,860	450	141	54	59
24	28	97	54	51	36	54	61	4,970	395	124	51	56
25	28	92	56	51	43	54	54	1,730	341	105	52	48
26	24	82	65	51	40	54	54	757	286	132	51	48
27	24	76	63	51	46	54	54	340	286	154	59	757
28	26	82	63	51	49	54	58	266	286	138	68	2,870
29	28	82	63	51	------	54	65	225	233	132	59	1,670
30	28	80	63	52	------	54	72	233	204	141	59	697
31	24	------	63	54	------	54	------	208	------	147	59	------

NOTE.—Gage not read May 21, June 23–25, Aug. 4–6, and 30; discharge interpolated.

Monthly discharge of Cottonwood River at Elmdale, Kans., for the year ending Sept. 30, 1923

[Drainage area, 1,040 square miles]

Month	Discharge in second-feet			Run-off in acre-feet	Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean			Maximum	Minimum	Mean	
October	36	19	25.5	1,570	May	4,970	38	452	27,800
November	4,500	26	525	31,200	June	20,000	164	3,430	204,000
December	124	54	82.5	5,070	July	5,530	105	527	32,400
January	67	49	55.6	3,420	August	141	51	81	4,980
February	51	36	45.1	2,500	September	2,870	36	255	15,200
March	84	51	59.2	3,640					
April	82	41	60.5	3,600	The year	20,000	19	464	335,000

RED RIVER BASIN

OUACHITA RIVER NEAR HOT SPRINGS, ARK.

LOCATION.—In SW. ¼ sec. 29, T. 3 S., R. 19 W., at Smith Ferry highway bridge, half a mile below Fourche a Loup Creek, 1 mile above Hot Springs Creek, 3 miles above dam site of Arkansas Light & Power Co., 3½ miles below Little Mazarn Creek, and 5 miles south of Hot Springs, Garland County.

DRAINAGE AREA.—1,420 square miles (measured on base map of Arkansas; scale, 1 : 500,000)

RECORDS AVAILABLE.—June 27, 1922, to September 30, 1923.

GAGE.—Chain gage bolted to downstream side of bridge; read by E. Q. Boone and J. E. Woodward.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock and small gravel and boulders. Channel is obstructed by outcropping rock dikes on which small trees grow. Control is a series of outcropping rock dikes 400, 1,000, and 1,500 feet below gage; the upper dike forms the low-water control, and lower dike the high-water control; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year determined by levels to flood marks, 43.9 feet about 1 a. m. May 15 (discharge determined by extending rating curve for main channel and computing overflow by Kutter formula, 101,000 second-feet); minimum stage, 5.21 feet at 4.45 p. m. September 1 (discharge, 43 second-feet).

1922–23: Maximum stage that of May 15, 1923; minimum discharge, 42 second-feet, several periods in September, 1922.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 3,000 and 10,000 second-feet and fairly well defined below 3,000 second-feet; extended to flood height by extending curve for main channel and computing overflow by Kutter formula. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for high stages, which may be considerably in error.

Discharge measurements of Ouachita River near Hot Springs, Ark., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 27	E. L. Williams	5.50	69	May 26	V. L. Austin	12.60	9,150
Jan. 23	V. L. Austin	10.75	5,240	31	do	7.92	1,930
25	do	9.28	3,370	Aug. 29	do	5.31	54

Daily discharge, in second-feet, of Ouachita River near Hot Springs, Ark., for the year ending Sept. 30, 1923.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	54	78	163	2,800	19,100	4,580	622	4,170	1,520	585	478	44
2	54	130	163	2,140	18,600	3,390	765	3,780	2,470	146	860	46
3	54	82	171	1,340	34,800	3,030	3,150	3,030	2,250	137	808	45
4	54	72	195	998	17,500	2,360	6,880	2,140	3,780	133	718	44
5	54	71	290	955	7,440	2,690	8,960	1,820	4,040	130	622	808
6	54	69	392	860	6,520	18,200	2,580	1,920	13,500	112	622	622
7	105	59	440	675	4,170	20,400	2,140	1,720	14,100	93	462	675
8	85	54	568	517	2,030	13,500	3,520	1,430	4,170	89	150	568
9	95	61	860	412	2,690	5,190	3,150	1,190	2,360	82	87	324
10	195	69	675	348	3,390	3,390	2,140	998	8,200	79	195	203
11	203	75	675	312	4,580	3,030	2,250	500	11,800	79	160	120
12	137	101	622	342	3,030	2,920	2,470	360	8,720	82	115	130
13	125	275	585	290	3,150	2,860	2,690	622	5,650	105	89	255
14	163	412	517	306	2,360	2,580	2,360	6,520	2,580	137	82	128
15	125	765	425	290	2,580	4,730	2,140	87,800	2,140	156	79	101
16	82	1,140	360	373	2,140	22,800	1,920	29,300	1,920	171	54	97
17	95	1,090	348	386	1,920	15,900	1,520	8,770	1,520	217	78	955
18	93	765	260	348	2,470	5,670	1,430	8,010	1,340	280	231	1,340
19	82	399	241	440	955	4,300	1,280	7,630	1,140	324	231	2,910
20	71	718	260	399	1,280	3,150	1,090	6,000	808	336	163	2,580
21	95	500	212	9,530	1,190	2,800	1,050	2,690	622	290	91	6,880
22	71	622	203	10,900	998	2,030	1,340	2,690	526	270	63	2,800
23	69	386	171	5,030	955	2,140	2,690	3,520	425	250	52	1,620
24	89	336	171	3,390	808	1,820	4,580	8,390	386	212	55	1,140
25	78	290	167	2,910	902	1,620	8,010	7,250	373	171	52	808
26	78	250	163	2,910	20,000	1,280	6,520	9,150	348	150	64	622
27	74	203	373	2,910	11,800	998	5,030	5,510	300	130	58	462
28	78	163	860	5,670	7,440	902	8,390	3,390	270	105	54	354
29	74	133	1,050	6,700	-------	962	8,770	2,580	241	120	53	260
30	78	163	765	27,300	-------	955	4,580	2,150	187	250	51	241
31	78	------	2,470	15,900	-------	860	-------	1,720	-------	207	47	------

NOTE.—Discharge, Oct. 1–5, estimated from records of discharge at Malvern, and Dec. 25, Mar. 12 May 30, June 11 and 12, interpolated; gage not read.

Monthly discharge of Ouachita River near Hot Springs, Ark., for the year ending Sept. 30, 1923

[Drainage area, 1,420 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	203	54	91.7	0.065	0.07
November	1,140	54	318	.224	.25
December	2,470	163	478	.337	.39
January	27,300	290	3,470	2.44	2.81
February	34,800	808	6,600	4.65	4.84
March	22,800	860	5,190	3.66	4.22
April	8,960	622	3,470	2.44	2.72
May	87,800	360	7,310	5.15	5.94
June	14,100	187	3,260	2.30	2.57
July	585	79	182	.128	.15
August	860	47	223	.157	.18
September	6,880	44	906	.638	.71
The year	87,800	44	2,620	1.83	24.85

OUACHITA RIVER NEAR MALVERN, ARK.

LOCATION.—In NW. ¼ sec. 16, T. 4 S., R. 17 W., at Rockport highway bridge, 100 feet above old timber crib and rock-filled dam and 1¾ miles northwest of Malvern, Hot Springs County.

DRAINAGE AREA.—1,570 square miles (measured on base map of Arkansas; scale 1 : 500,000).

RECORDS AVAILABLE.—March 3, 1903, to April 30, 1905, and June 29, 1922, to September 30, 1923.

GAGE.—Chain gage on upstream side of highway bridge; before May 15, 1923, bolted to eyebar of lower chord; after May 25, attached to wooden beam between vertical members; read by Whit Halton. Gage used 1903 to 1905 was a vertical staff fastened to web between cylindrical piers of the bridge; datum 2 feet above that of present gage.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rock with outcropping dikes. Small trees grow on the rocks projecting above low water. Control is a rock outcrop and the remains of an old timber crib and rock filled dam, 100 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year determined by levels to flood marks, 30.3 feet May 15 (discharge determined by extending rating curve, 60,100 second-feet); minimum stage, 1.28 feet October 1 and 3 (discharge, 61 second-feet).

1903–1905: Maximum stage recorded, 20 feet March 11, 1903, referred to old gage datum (discharge, 36,900 second-feet); minimum stage, 0 foot December 18–20, 1904 (discharge, 40 second-feet).

ICE.—Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation changed during high water in May and September. Rating curves well defined between 3,000 and 14,000 second-feet and fairly well defined between 1,000 and 3,000 second-feet. Gage read to hundredths twice daily; readings fairly reliable. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair for medium stages and poor for others.

Discharge measurements of Ouachita River near Malvern, Ark., during the year ending Sept. 30, 1923

Date	Made by —	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 28	E. L. Williams	1.62	92	May 27	V. L. Austin	10.16	7,680
Jan. 24	V. L. Austin	8.95	5,530	29	do	6.74	3,340
26	do	6.95	3,520	Aug. 30	do	1.69	82
May 25	do	12.72	13,100				

Daily discharge, in second-feet, of Ouachita River near Malvern, Ark., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	63	92	217	3,460	12,600	6,010	1,210	6,170	1,480	220	------	79
2	63	98	217	2,650	10,900	4,450	760	4,550	910	196	------	86
3	63	92	217	1,840	32,500	3,370	2,650	4,050	2,830	174	------	102
4	63	92	262	1,750	24,500	2,920	8,270	3,100	2,650	163	------	102
5	63	98	306	1,410	8,830	2,830	5,570	2,560	2,740	152	------	126
6	77	92	478	1,070	5,570	19,300	4,790	2,020	17,500	134	------	790
7	158	98	478	730	4,250	24,200	3,750	1,750	21,700	134	------	670
8	126	98	478	615	4,690	12,800	3,010	1,570	16,700	134	------	478
9	126	92	615	565	5,130	5,850	2,920	1,390	9,400	126	------	420
10	240	92	------	499	5,570	4,790	------	1,210	5,290	126	------	274
11	306	98	------	438	6,010	3,950	------	910	17,100	145	------	196
12	228	694	------	402	4,450	3,650	------	910	10,200	126	------	163
13	186	1,390	------	386	3,850	3,370	------	850	4,350	126	------	152
14	150	458	------	370	3,550	3,010	------	3,550	3,550	118	------	196
15	142	420	------	370	3,190	3,100	------	------	2,650	126	------	170
16	142	945	------	354	2,740	21,200	------	------	1,570	134	------	145
17	134	945	------	438	2,110	18,900	------	------	1,390	642	------	118
18	134	790	------	565	1,750	8,270	------	------	1,210	760	------	219
19	134	670	------	520	1,570	6,170	------	------	980	642	------	320
20	126	730	------	478	1,210	4,350	1,210	------	730	402	------	3,190
21	112	790	------	4,790	980	3,460	1,300	------	615	320	------	7,370
22	104	565	------	15,100	910	2,830	1,390	------	499	220	------	6,020
23	104	478	------	8,450	850	2,740	1,210	------	438	185	------	4,670
24	98	420	240	5,570	820	2,020	------	------	402	145	------	3,370
25	98	338	228	5,030	820	1,750	------	13,400	420	145	------	2,350
26	98	322	228	3,460	25,600	1,300	------	14,700	438	163	------	1,330
27	95	287	240	3,370	23,700	1,130	------	7,190	402	145	------	690
28	92	252	1,390	5,290	10,900	980	------	4,350	352	126	------	615
29	92	228	1,130	6,830	------	910	------	3,190	274	134	------	448
30	92	217	760	24,200	------	850	------	2,650	246	144	72	408
31	92	------	2,290	22,900	------	850	------	2,110	------	154	72	------

NOTE.—Gage-height record incomplete. Daily discharge interpolated for Oct. 27, Nov. 20, and 27, Dec. 4, Jan. 5, 6, Feb. 8–10, June 17, 25, July 4, 15, 30, 31, Sept. 1, 15, 18, 22, and 25; estimated for Nov. 12.

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Monthly discharge of Ouachita River near Malvern, Ark., for the year ending Sept. 30, 1923

[Drainage area, 1,570 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	306	63	123	0.078	0.09
November	1,390	92	399	.254	.28
January	24,200	354	4,000	2.55	2.94
February	32,500	820	7,480	4.76	4.96
March	24,200	850	5,850	3.73	4.30
June	21,700	246	4,300	2.74	3.06
July	760	118	215	.137	.16
September	7,370	79	1,180	.752	.84

BAYOU COCODRIE NEAR MEEKER, LA.

LOCATION.—On line between secs. 4 and 5, T. 1 S., R. 1 E., at Meeker-Meridian highway bridge, three-eighths mile east of Rock Island Railroad crossing, three-fourths mile below Lake Cocodrie, 20 miles above mouth of Bayou Chicot, and 4 miles southwest of Meeker.

DRAINAGE AREA.—278 square miles (measured on post-route map and project map of Lousiana Gravity Canal Co.; scale, 1 : 380,000).

RECORDS AVAILABLE.—May 12, 1922 to September 30, 1923.

GAGE.—Vertical staff, attached to downstream pile bent of bridge; read by Ernest or Hart Johnson.

DISCHARGE MEASUREMENTS.—Made from bridge at gage.

CHANNEL AND CONTROL.—Channel curved at station and general course is very crooked. Bed composed of leaves, twigs, sinkers, and mud, and subject to shift. Right bank composed of clay and is not subject to overflow. Left bank clay, low, wooded, and subject to overflow above a gage height of about 12.5 feet. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.7 feet at 6 a. m. April 14 (discharge, 1,790 second-feet); negative discharge November 13–15, when direction of current was reversed.

1922–1923: Maximum and minimum stages same as given above.

ICE.—None during year.

DIVERSIONS.—None.

REGULATION.—Flow regulated by swampy areas and Lake Cocodrie, about three-fourths mile above station.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined for all stages. Gage read to nearest half-tenth twice a day. Daily discharge determined by indirect method for shifting control, except November 13–15 when the direction of the curve was reversed and discharge estimated as zero; discharge for November 16 estimated as the mean of zero and the discharge for the stage on November 16. Records poor.

Discharge measurements of Bayou Cocodrie near Meeker, La., during the year ending Sept. 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 30	Joseph and Forrest	1.24	114	Feb. 7	Forrest and Bradford	10.2	1,070
Nov. 2	McCashin and Joseph	1.37	116	Mar. 12	do	8.94	819
2	do	1.37	108	Apr. 9	Forrest and Fenn	12.52	1,490
3	Joseph and Robertson	1.36	121	19	Forrest and Brian	13.70	1,500
17	Forrest and Creed	8.65	612	June 19	Forrest and Lee	6.51	576
Dec. 19	do	5.50	427	Sept. 28	Forrest and Sharp	2.04	188
Jan. 15	Forrest and Bradford	4.86	362				

Daily discharge, in second-feet, of Bayou Cocodrie near Meeker, La., for the year ending Sept. 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	100	118	467	469	583	1,110	1,480	1,170	856	402	856	350
2	100	118	467	519	570	1,090	1,430	1,240	828	390	884	401
3	100	118	454	544	557	1,080	1,390	1,270	800	380	870	471
4	100	118	428	544	674	1,050	1,390	1,290	800	360	856	495
5	100	110	416	544	884	1,020	1,450	1,270	786	330	842	495
6	106	132	392	544	1,020	1,020	1,480	1,260	744	320	828	495
7	114	204	368	531	1,080	955	1,480	1,220	716	350	814	544
8	137	245	356	519	1,080	926	1,450	1,160	688	350	800	583
9	147	282	356	495	1,130	898	1,410	1,130	661	350	786	609
10	152	292	370	471	1,240	870	1,380	1,260	661	340	772	622
11	147	282	423	447	1,290	842	1,340	1,080	648	320	744	609
12	152	254	469	423	1,290	842	1,430	1,050	635	310	716	583
13	152	0	469	402	1,390	814	1,700	1,050	635	292	688	557
14	132	0	469	380	1,380	786	1,770	1,030	635	283	688	531
15	127	0	447	483	1,390	758	1,730	1,050	622	274	661	519
16	122	307	435	340	1,310	786	1,720	1,080	609	250	635	483
17	122	600	435	330	1,290	814	1,680	1,060	583	227	622	471
18	118	600	423	301	1,260	828	1,660	1,060	583	213	596	469
19	114	600	423	266	1,210	814	1,630	1,060	570	199	570	435
20	114	586	423	250	1,190	800	1,570	1,060	557	175	544	402
21	114	586	402	220	1,130	814	1,550	1,080	557	155	519	390
22	114	572	390	350	1,090	1,050	1,480	1,050	531	146	495	350
23	114	572	390	531	1,060	1,260	1,450	1,030	519	146	471	320
24	114	558	360	648	1,030	1,340	1,410	1,000	507	142	447	283
25	114	545	350	688	1,000	1,340	1,380	985	495	138	423	250
26	114	532	320	688	985	1,320	1,340	1,000	495	155	401	227
27	114	519	320	674	1,050	1,360	1,320	985	483	220	380	206
28	114	506	310	661	1,090	1,430	1,270	970	469	292	350	186
29	114	519	310	648	-------	1,520	1,240	940	447	370	320	175
30	114	493	310	648	-------	1,520	1,210	912	435	544	301	170
31	114	-------	401	609	-------	1,520	-------	884	-------	674	283	-------

Monthly discharge of Bayou Cocodrie near Meeker, La., for the year ending Sept. 30 1923

[Drainage area, 278 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	152	100	120	0.432	0.50
November	600	[a] 0	346	1.24	1.38
December	469	310	399	1.44	1.66
January	688	220	489	1.76	2.03
February	1,390	557	1,080	3.88	4.04
March	1,520	758	1,050	3.78	4.36
April	1,770	1,210	1,470	5.29	5.90
May	1,290	884	1,090	3.92	4.52
June	856	435	618	2.22	2.48
July	674	138	293	1.05	1.21
August	884	283	618	2.22	2.56
September	622	170	423	1.52	1.70
The year	1,770	0	663	2.38	32.34

[a] See accuracy.

MISCELLANEOUS MEASUREMENTS

Measurements of the flow of streams in the lower Mississippi River basin at points other than gaging stations are recorded in the following table:

Miscellaneous discharge measurements in lower Mississippi River basin during the year ending Sept. 30, 1923

Date	Stream	Tributary to—	Locality	Gage height	Discharge
				Feet	*Sec.-ft.*
May 12	White River	Mississippi River	Forsyth, Mo.	[a] 4.47	4,520
13	do	do	do	[a] 2.28	1,060
13	do	do	do	[a] 4.46	4,590
21	do	do	do	[a] 6.47	8,960
Sept. 21	do	do	Wild Cat Shoals, 3 miles northeast of Flippin, Ark.	[a] 5.48	1,270
21	do	do	do	[a] 5.50	1,280
July 15	Roaring River Spring	Roaring River	6 miles south of Cassville, Mo.		22
15	do	do	do		23
16	do	do	do		28
May 12	Swan Creek	White River	Forsyth, Mo.		76
Sept. 23	North Fork of White River	do	5 miles northeast of Norfork, Ark.	[a] 1.74	717
Oct. 4	Mill Spring	Black River	Mill Spring, Mo.		10
July 28	Round Spring	Current River	9 miles northwest of Eminence, Mo.		31
Aug. 1	Blue Spring	do	12 miles east of Eminence, Mo.		133
July 26	Spring River	Black River	Imboden, Ark.	[b] 1.62	776
Oct. 25	Illinois River	Arkansas River	Below Missouri Pacific Railroad bridge near Gore, Okla.		62
Aug. 29	Quitaque Creek	Pease River	Mrs. Merrell's ranch, 10 miles from Quitaque, Tex., and 6 miles from head springs.		7.9
June 28	Sulphur River	Red River	Ringo's Crossing near Hagansport, Tex., 1 mile below junction of North and South Forks	[c] 1.0	9.9
29	do	do	Finley, Tex.	[c] 1.45	31.0

[a] Staff gage of Dixie Power Co.
[b] Staff gage of Imboden Hydroelectric Power & Manufacturing Co.
[c] United States Weather Bureau gage.

INDEX

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART VII. LOWER MISSISSIPPI RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES

INTRODUCTION

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, annual reports, and monographs.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features, as indictaed below:

Part I. North Atlantic slope basins (St. Johns River to York River).
II. South Atlantic and eastern Gulf of Mexico basins (James River to the Mississippi).
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins; in three volumes:
A. Pacific slope basins in Washington and upper Columbia River basin.
B. Snake River basin.
C. Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

2. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

3. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Trenton, N. J., Statehouse.
Asheville, N. C., 316 Jackson Building.
Chattanooga, Tenn., 37 Municipal Building.
Columbus, Ohio, Brown Hall, Ohio State University.
Chicago, Ill., 940 Transportation Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Ames, Iowa, State Highway Commission Building.
Rolla, Mo., Rolla Building, School of Mines and Metallurgy.
Topeka, Kans., 23 Federal Building.
Helena, Mont., 45–46 Federal Building.
Denver, Colo., 403 Post Office Building.
Salt Lake City, Utah, 313 Federal Building.
Idaho Falls, Idaho, 228 Federal Building.
Boise, Idaho, Federal Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 600 Federal Building.
Tucson, Ariz., 210 Agricultural Building, University of Arizona.
Austin, Tex., State Capitol.
Honolulu, Hawaii, 25 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director, United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS

Stream-flow records have been obtained at about 5,600 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey

[A = Annual Report; B = Bulletin; W = Water-Supply Paper]

Report	Character of data	Year
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 to 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River, and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier ears)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.
W 451 to 464	do	1917.
W 471 to 484	do	1918.
W 501 to 514	do	1919–20.
W 521 to 534	do	1921.
W 541 to 554	do	1922.
W 561 to 574	do	1923.

NOTE.—No data regarding stream flow are given in the fifteenth and seventeenth annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1923. The data for any particular station will, in general, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Maine, 1903 to 1921, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, 451, 471, 501, and 521, which contain records for the New England streams from 1903 to 1921. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River, are given in four parts, as indicated on page 101, and the records for large lakes are taken up in order of streams around the rim of the lake.

Numbers of water-supply papers containing results of stream measurements, 1899—1923

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												A	B	C
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 78	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	176, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917	451	452	453	454	455	456	457	458	459	460	461	462	363	464
1918	471	472	473	474	475	476	477	478	479	480	481	482	483	484
1919–20	501	502	503	504	505	506	507	508	509	510	511	512	513	514
1921	521	522	523	524	525	526	527	528	529	530	531	532	533	534
1922	541	542	543	544	545	546	547	548	549	550	551	552	553	554
1923	561	562	563	564	565	566	567	568	569	570	571	572	573	574

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Monthly discharge for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Monthly discharge for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuykill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California, except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

PRINCIPAL STREAMS

The principal streams flowing into the Mississippi below the mouth of the Missouri on the west and the Ohio on the east, are Meramec, White, Arkansas (whose chief tributaries are Huerfano, Purgatory, Cimarron, Verdigris, Neosho, and Canadian rivers), Yazoo, Homochitto, and Red rivers. The streams drain wholly or in part the States of Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas.

GAGING STATIONS

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1923. Period after a date indicates discontinuance.

MERAMEC RIVER BASIN

Meramec River near Meramec, Mo., 1903–1906.
Meramec River near Steelville, Mo., 1922–
Meramec River near Sullivan, Mo., 1921–
Meramec River near Eureka, Mo., 1903–1906; 1921–
Meramec River (Station No. 1) at Fenton, Mo., 1903.
Meramec River (Station No. 2) below Fenton, Mo., 1903.
  Meramec Spring near St. James,[1] Mo., 1903–1906; 1921–.
  Dry Fork of Meramec River near St. James, Mo., 1903.
  Courtois Creek at Scotia, Mo., 1905–6.
  Bourbeuse River at Union, Mo., 1921–
  Big River at Byrnesville, Mo., 1922–

HEADWATER DIVERSION CANAL BASIN

Castor River at Zalma, Mo., 1921–
Whitewater River at Whitewater, Mo., 1921–

ST. FRANCIS RIVER BASIN

St. Francis River near Patterson, Mo., 1921–
  Little River:
    Little River ditch No. 1 at Kirk, Mo., 1921–
    Little River ditch No. 81 at Kirk, Mo., 1921–
    Little River ditch No. 66 at Kirk, Mo., 1921–

WHITE RIVER BASIN

White River at Beaver, Ark., 1909–10; 1923–
White River near Branson, Mo., 1909–10.
White River near Lead Hill, Ark., 1909–10.
White River near Cotter, Ark., 1909–10.
  James River at Galena, Mo., 1921–
  Buffalo River near Gilbert, Ark., 1909–10.
  North Fork of White River at Tecumseh, Mo., 1921–
  North Fork River near Henderson, Ark., 1909–10.
  Black River at Leeper, Mo., 1921–
    Current River near Eminence, Mo., 1921–
    Current River at Van Buren, Mo., 1921–
    Current River at Doniphan, Mo., 1921–
      Jacks Fork at Eminence, Mo., 1921–
      Big Spring near Chicopee, Mo., 1922–
    Spring River:
      Eleven Point River near Bardley, Mo., 1921–
        Greer Spring at Greer, Mo., 1904; 1921–
  Little Red River near Pangburn, Ark., 1909–10.

[1] Records, 1903–1906, published as "Meramec Spring near Meramec."

ARKANSAS RIVER BASIN

Arkansas River, East Fork (head of Arkansas River), near Leadville, Colo., 1890; 1911–
Arkansas River at Granite, Colo., 1897–1899; 1910–
Arkansas River at Salida, Colo., 1895–1903; 1909–
Arkansas River at Canon City, Colo., 1888–
Arkansas River near Rock Canyon, Colo., 1889.
Arkansas River at Pueblo, Colo., 1885–1889; 1894–
Arkansas River near Nepesta, Colo., 1897–1903; 1909–1913.
Arkansas River near Manzanola, Colo., 1898.
Arkansas River near Rocky Ford, Colo., 1897–1903.
Arkansas River at La Junta, Colo., 1889; 1894–95; 1901; 1903; 1908; 1912–13.
Arkansas River at Las Animas, Colo., 1898; 1909.
Arkansas River at New Fort Lyons, Colo., 1911.
Arkansas River near Prowers, Colo., 1903.
Arkansas River at Prowers, Colo., 1900–1901.
Arkansas River near Amity canal head gates, Colo., 1898–99; 1901.
Arkansas River near Lamar, Colo., 1913.
Arkansas River near Granada, Colo., 1898–1901; 1903.
Arkansas River near Holly (Barton or Byron), Colo., 1894; 1901–2; 1907–
Arkansas River near Coolidge, Kans., 1903.
Arkansas River at Syracuse, Kans., 1902–1906; 1921–
Arkansas River at Garden City, Kans., 1922–
Arkansas River at Dodge, Kans., 1903–1906.
Arkansas River at Larned, Kans., 1922–
Arkansas River near Hutchinson, Kans., 1895–1905.
Arkansas River near Wichita, Kans., 1921–
Arkansas River at Arkansas City, Kans., 1902–1906; 1921–
- Tennessee Fork near Leadville, Colo., 1890; 1903; 1911–
- Lake Fork of Arkansas River near Arkansas Junction, Colo., 1890; 1903.
- Half Moon Creek near Leadville, Colo., 1911–1914.
- Lake Creek near Twin Lakes, Colo., 1899–1900.
- Twin Lakes outlet near Twin Lakes, Colo., 1910.
- Clear Creek near Granite, Colo., 1890; 1910.
- Cottonwood Creek near Buena Vista, Colo., 1890.
- Cottonwood Creek at Hot Springs tunnel, near Buena Vista, Colo., 1910–11.
- Cottonwood Creek below Hot Springs, near Buena Vista, Colo., 1911–1923
  - South Fork of Cottonwood Creek near Buena Vista, Colo., 1890.
  - North Cottonwood Creek near Buena Vista, Colo., 1911–1914.
- Chalk Creek (upper station) near St. Elmo, Colo., 1913–1919.
- Chalk Creek near St. Elmo, Colo., 1911–1916.
- Chalk Creek near Buena Vista, Colo., 1910.
- South Fork of Arkansas River at Poncha, Colo., 1911–1918.
  - Poncha Creek at Poncha, Colo., 1911–1918.
- Grape Creek near Canon City, Colo., 1907–1909.
- Oil or Fourmile Creek near Canon City, Colo., 1910.
- West Beaver Creek (head of Beaver Creek) near Victor, Colo., 1905–
  - Boehmer Creek near Pikes Peak, Colo., 1909–
    - Little Beaver Creek near Pikes Peak, Colo., 1909–
    - Sackett Creek near Pikes Peak, Colo., 1909–
- Fountain Creek—
  - Lion Creek near Halfway, Colo., 1908–
  - Sheep Creek near Halfway, Colo., 1908–

Arkansas River—Continued.
Fountain Creek—Continued.
South Ruxton Creek near Halfway, Colo., 1906–
Cabin Creek near Halfway, Colo., 1906–
Sutherland Creek near Manitou, Colo., 1918–
Bear Creek near Colorado Springs, Colo., 1918–
Huerfano River at Badito, Colo., 1912.
Huerfano River near Undercliffe, Colo., 1908.
Cucharas River at Walsenburg, Colo., 1907–8.
Purgatory (Las Animas) River at Trinidad, Colo., 1896–1899; 1905–1912.
Purgatory River near canyon entrance (Alfalfa), Colo., 1905–1907.
Purgatory River at J. J. ranch, near La Junta, Colo., 1898.
Purgatory River near Las Animas, Colo., 1889 and 1909.
Big Sandy Creek at Hugo, Colo., 1910–1912.
Big Sandy Creek near Kit Carson, Colo., 1910–1912.
Big Spring Creek near Arena, Colo., 1910–1912.
Amazon canal near Hartland, Kans., 1921–
Southside ditch near Hartland, Kans., 1921–
Great Eastern canal near Hartland, Kans., 1921–
Farmers ditch near Garden City, Kans., 1921–
Garden City canal near Garden City, Kans., 1921–
Little Arkansas River at Valley Center, Kans., 1922–
Diversion canal from Arkansas River at Arkansas City, Kans., 1921–1923.
Walnut River at Winfield, Kans., 1921–
Walnut River near Arkansas City, Kans., 1902–3.
Salt Fork of Arkansas River near Alva, Okla., 1904–5.
Salt Fork of Arkansas River near Tonkawa, Okla., 1903–1905.
Medicine Lodge River near Kiowa, Kans., 1895–96.
Cimarron River near Kenton, Okla., 1904–5.
Cimarron River near Garrett, Okla., 1905–1907.
Cimarron River near Arkalon, Kans., 1895–96; 1903–1905.
Cimarron River near Waynoka, Okla., 1903–1905.
Verdigris River at Independence, Kans., 1904; 1921–
Verdigris River near Liberty, Kans., 1895–1903.
Verdigris River near Catoosa, Okla., 1903–1905.
Fall River at Fall River, Kans., 1904–5.
Neosho River near Neosho Rapids, Kans., 1904.
Neosho River near Iola, Kans., 1895–1903; 1917–
Neosho River near Humboldt, Kans., 1904.
Neosho River near Parsons, Kans., 1921–
Neosho River (or Grand River) near Fort Gibson, Okla., 1899; 1903–1905.
Cottonwood River at Elmdale, Kans., 1922–
Canadian River near Sanchez, N. Mex., 1912–1914.
Canadian River at Logan, N. Mex., 1904–5; 1908–1914.
Canadian River at Calvin, Okla., 1905–1908.
Chicorica Creek near Raton, N. Mex., 1910–1914.
Una del Gato Creek near Raton, N. Mex., 1910–1913.
Cimarron River at Ute Park, N. Mex., 1907–1914.
Cimarron River at Springer, N. Mex., 1907–1909.
Rayado River near Cimarron, N. Mex., 1911; 1913; 1914.
Rayado River above Abreu's ranch, near Cimarron, N. Mex., 1911–1914.
Rayado River at Abreu's ranch, near Cimarron, N. Mex., 1908–9.
Rayado River below Abreu's ranch, near Cimarron, N. Mex., 1912–13.

Arkansas River—Continued.
Canadian River—Continued.
Cimarron River—Continued.
Rayado River near Springer, N. Mex., 1907–1909.
Urraca Creek near Cimarron, N. Mex., 1912–1914.
East Fork of Ocate River at Ocate, N. Mex., 1914.
Ocate River at Ocate, N. Mex., 1914.
West Fork of Ocate River at Ocate, N. Mex., 1914.
Sweetwater Creek near Colmar, N. Mex., 1914.
Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1911
Mora River near Weber, N. Mex., 1903–4.
Mora River near Watrous, N. Mex., 1894–1896.
Mora River near Shoemaker, N. Mex., 1914.
Sapello River at Sapello, N. Mex., 1903–4.
Sapello Mill tailrace at Sapello, N. Mex., 1903–4.
Sapello River at Los Alamos, N. Mex., 1903–1911.
Manuelitos River near Sapello, N. Mex., 1903–4.
Pajarito Creek near Hanley, N. Mex., 1911–1913.
Pajarito Creek below Vigil Creek, near Hanley, N. Mex., 1912–13.
Ute Creek near Logan, N. Mex., 1904–1906; 1909–1914.
Beaver Creek (head of North Fork of Canadian River) at Beaver, Okla., 1904–5.
North Fork of Canadian River near Woodward, Okla., 1903–1906.
North Fork of Canadian River near El Reno, Okla., 1902–1908.
North Fork of Canadian River near Oklahoma, Okla., 1899.
North Fork of Canadian River near Eufaula, Okla., 1899.

ARKANSAS RIVER CANALS

Oxford Farmers canal near Nepesta, Colo., 1902–3.
Colorado-Kansas canal near Prowers, Colo., 1903.
Keese ditch near Prowers, Colo., 1903.

YAZOO RIVER BASIN

Tallahatchie River (head of Yazoo River) at Batesville, Miss., 1906–1912.
Tallahatchie River at Phillip, Miss., 1908–1913.
Yazoo River at Greenwood, Miss., 1908–1913.
Yazoo River at Yazoo City, Miss., 1900–1905.
Coldwater River at Savage, Miss., 1908–1912.
Yalobusha River at Grenada, Miss., 1906; 1908–1912.
Sunflower River near Ruleville, Miss., 1909–1912.
Sunflower River at Baird, Miss., 1908–1912.

HOMOCHITTO RIVER BASIN

Homochitto River at Rosetta, Miss., 1906.

RED RIVER BASIN

Red River at Arthur City, Tex., 1905–1911.
Salt Fork of Red River at Mangum, Okla., 1905–6.
Turkey Creek (Deep Red Run) at Olustee, Okla., 1905–1908.
North Fork of Red River near Granite, Okla., 1903–1908.
North Fork of Red River near Snyder, Okla., 1905.

Red River—Continued.
North Fork of Red River near Headrick, Okla., 1905–1908.
Elm Fork of Red River near Mangum, Okla., 1905–1908.
Elk Creek near Hobart, Okla., 1904–1908.
Otter Creek near Mountain Park, Okla., 1903–1908.
Horse Creek near Mountain Park, Okla., 1905–6.
Dry Fork of Otter Creek near Mountain Park, Okla., 1905–6.
Cache Creek:
Medicine Bluff Creek near Lawton, Okla., 1912–1919.
Evaporation station near Lawton, Okla., 1913–1918.
Little Medicine Bluff Creek near Lawton, Okla., 1912–1919.
Wichita River at Wichita Falls, Tex., 1910–11.
Washita River at Anadarko, Okla., 1902–1908.
Washita River near Pauls Valley, Okla., 1899.
Ouachita River near Hot Springs, Ark., 1922–
Ouachita River near Malvern, Ark., 1903–1905; 1922–
Ouachita River near Arkadelphia, Ark., 1905–6.

MISSISSIPPI RIVER DELTA

Bayou Cocodrie near Meeker, La., 1922–

REPORTS ON WATER RESOURCES OF THE LOWER MISSISSIPPI RIVER BASIN

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY

WATER-SUPPLY PAPERS

Water-supply papers may be purchased (at price quoted below) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. An asterisk (*) indicates that the report is out of print. Water-supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls.

Describes reservoirs for storm and pumped waters, ditching, methods of distributing water, cultivation and subirrigation, duty of water, and winter irrigation.

*6. Underground waters of southwestern Kansas, by Erasmus Haworth. 1897. 65 pp., 12 pls.

Describes physiography, drainage, geologic formations and water supply, and irrigation development in Meade, Dodge, and Garden quadrangles, including all of Meade County, nearly all of Seward, Haskell, and Gray counties, about one-third of Ford County, and one-fourth of Finney County; discusses waters of Dakota sandstone and of the Tertiary formations.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls.

Describes the location and construction of various types of canals for irrigation.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.)

*61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings, more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.).

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River divisions, drainage and irrigation, and gives records of stream flow.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

101. Underground waters of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping, and treats briefly of rice cultivation.

*102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904 522 pp.

Contains brief reports on springs and wells of Arkansas and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams, including Red and Canadian rivers.

107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Appendix contains gage heights, rating tables, estimates of monthly discharge of Yazoo River.

*110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls.

Contains a "Summary of the water supply of the Ozark region in northern Arkansas, by George I. Adams"; describes the drainage and some of the immense springs of the area, many of which have been developed as resorts.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls.

Contains brief reports as follows:
Mississippi, by L. C. Johnson.
Louisiana and southern Arkansas, by A. C. Veatch.
Northern Arkansas, by A. H. Purdue.
Each of these reports discusses the geologic formation as related to water supply, treats particularly of the mineral waters, and gives a list of the principal publications.

*145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains five short reports relating to areas draining to the lower Mississippi River:
Water resources of the Joplin district, Missouri-Kansas, by W. S. Tangier Smith. Describes topography, geology, streams, springs, and wells; gives analyses of waters.
Water resources of the Winslow quadrangle, Arkansas, by A. H. Purdue. Area includes a few square miles of Oklahoma, discusses water-bearing formations, and the quality of spring and well waters.
Notes on certain hot springs of the southern United States, by Walter Harvey Weed. Gives an account of the history, topography, geology, flow, temperature, and composition of the Hot Springs of Arkansas, including many analyses.
Notes on certain large springs of the Ozark region, Missouri and Arkansas, compiled by Myron L. Fuller. Treats briefly of the conditions under which the springs emerge, and of their flow, temperature, and quality.
Water resources of the contact region between the Paleozoic and Mississippi embayment deposits in northern Arkansas, by A. H. Purdue. Describes geology and water resources of a belt 12 to 15 miles wide extending along the western edge of the Mississippi embayment deposits from Arkansas River northward to the Missouri line. Considers source of water, amount, chemical character and use of water, prospects for flowing wells, etc.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Describes floods on Kansas, Neosho, Verdigris, Osage, Arkansas, Canadian, and Purgatory rivers, discussing the streams, precipitation, damages, prevention of future damages, etc.

*148. Geology and water resources of Oklahoma, by C. N. Gould. 1905. 178 pp., 22 pls.

Describes topography, geology, climate, streams, springs, deep wells (water and oil and gas), and artesian water, and discusses the water supply by counties; treats of irrigation from reservoirs, springs, and wells; gives analyses of well waters and table of well records.

149. Preliminary list of deep borings in the United States (second edition, with additions), by N. H. Darton. 1905. 175 pp. 10c.

Gives by State (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*153. The underflow in Arkansas Valley in western Kansas, by C. S. Slichter. 1906. 90 pp., 3 pls.

Discusses origin and extent of the underflow, fluctuations of ground-water level, the chemical composition of the waters (including analyses); gives results of measurements at various points and summaries and details of pumping tests.

*154. The geology and water resources of the eastern portion of the Panhandle of Texas, by C. N. Gould. 1906. 64 pp., 15 pls.

Discusses topography, geology, streams, springs, ground waters, and irrigation; gives details by counties.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 86 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters, artesian requisites, and special conditions in the Coastal Plain formation; gives notes on wells by counties, deep-well records, and selected records in detail; treats of sanitary aspect of wells and gives analyses.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Contains brief report entitled "Drainage of wet lands in Arkansas by wells," by A. F. Crider.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C Murphy and others. 1906. 105 pp., 4 pls.

Gives account of flood on Purgatory River, Colorado, and estimates of flood flow and discharge of Arkansas River at Pueblo, Colo.; contains also index to literature on flood flow in American streams.

164. Underground waters of Tennessee and Kentucky west of Tennessee River and of an adjacent area in Illinois, by L. C. Glenn. 1906. 173 pp., 7 pls. 25c.

Describes physical features, static level, and uses of waters, artesian conditions, source and properties of underground water; discusses topography, geology, and water resources by counties; gives logs of wells, analyses of waters, and bibliography of most important reports.

*191. The geology and water resources of the western portion of the Panhandle of Texas, by C. N. Gould. 1907. 70 pp., 7 pls.

Describes the topography and general geology of the area, the deep-seated waters, springs, and streams, and the use of the waters for irrigation; discusses details of topography, geology, and water supply by counties.

195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard, 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of water, and many well records.

*236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Mississippi, Arkansas, and Red rivers.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

*274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from Sapello River, Salt, North, and Elm forks of Red River, and Turkey Creek.

*276. Geology and underground waters of northeastern Texas, by C. H. Gordon. 1911. 78 pp., 2 pls.

Describes geography, physiography, and geology of area comprising Bowie, Red River Lamar, Delta, Hopkins, Franklin, Titus, Morris, Camp, and Cass counties; discusses the source and availability of underground waters, artesian waters of the various formations, and reviews the geographic relations, geology, and water resources by counties.

*317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls.

Describes the physiography, climate, surface and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

*(*a*) Preliminary report on ground water for irrigation in the vicinity of Wichita, Kans., by O. E. Meinzer, pp. 1–9.

(*b*) Ground water for irrigation in the vicinity of Enid, Okla., by A. T. Schwennesen, pp. 11-23, pl. 1, 5c.

*(*d*) Ground water for irrigation in the valley of North Fork of Canadian River near Oklahoma City, Okla., by A. T. Schwennessen, pp. 41-51.

*399. Geology and ground waters of northeastern Arkansas, by L. W. Stephenson and A. F. Crider, with a discussion of the chemical character of the waters by R. B. Dole. 1916. 315 pp., 11 pls.

Describes the physiography of Arkansas, the character and distribution of the geologic formations, the streams, lakes, ponds, and swamps, the source, disposal, quantity, and distribution of the ground waters and their economic uses; gives details by counties; discusses, under chemical character of the waters, standards of classification, methods of purification, and the quality of surface and ground water; contains bibliography and gives many geologic sections and analyses of waters.

421. Profile surveys in 1915 along the Rio Grande, Pecos River, and Mora River, N. Mex., prepared under the direction of W. H. Herron, acting chief geographer. 1916. 11 pp., 11 pls. 15c.

Gives the results of surveys made to determine the location of undeveloped water power on some of the rivers of the United States that are adapted to the development of power by low or medium heads of 20 to 100 feet.

487. The Arkansas River flood of June 3–5, 1921, by Robert Follansbee and E. E. Jones, 1922. 44 pp., 6 pls. 10c.

Describes topography of Arkansas River basin, gives cause of flood, areas of intense rainfall, progress of flood crest through Arkansas Valley, effect of reservoirs on floods, and flood flow on main streams and largest tributaries. Gives an account of previous floods in the basin.

*500. Contributions to the hydrology of the United States, 1921; N. C. Grover, chief hydraulic engineer. 1922. iv, 74 pp., 4 pls.

Issued also in separate chapters. The following paper contains information on ground water.

(b) Ground water for irrigation near Gage, Ellis County, Okla., by D. G. Thompson, pp. 33–63, pl. iv. 5c. Describes the surface features and geology of this region. Discusses source of water supply, quantity and quality of water available, and the feasibility of using it for irrigation.

ANNUAL REPORTS

Each of the papers contained in the annual reports was also issued in separate form. Annual reports may be purchased (at the price quoted below) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. An asterisk (*) indicates that the report is out of print.

Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp., 30 pls. and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Gives an account of the surveys in the Arkansas division.

*The arid lands, pp. 201–289. Includes a report on artesian irrigation on the Great Plains, a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in Colorado and New Mexico, and on reservoir sites.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp., 93 pls. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ended June 30, 1891, by A. H. Thompson, pp. 1–212, pls. 54–57. Describes reservoir sites in Chaffee, Custer, Fremont, Park, El Paso, Pueblo, Huerfano, Las Animas, Bent, Otero, Baca, Kiowa, and Lake counties, Colo.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow, classifies the drainage basins, and describes the rivers of the Arkansas River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351–427, pls. 147–182. Describes work at Twin Lakes reservoir and Twin Lakes dam, Colorado.

*Report upon the construction of topographic maps and the selection and survey of reservoir sites in the hydrographic basin of Arkansas River, Colo., by A. H. Thompson, pp. 429–444.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, pls. 35–39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands and private miscellaneous entries), lands reserved (Indian, forest, and military reservations) the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Seventeenth Annual Report of the United States Geological Survey, 1895–96 Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. Contains:

The underground water of the Arkansas Valley in eastern Colorado, by G. K. Gilbert, pp. 551–601, pls. 56–68. 20c. Describes the geology and topography of the district, the general conditions under which artesian water occurs, the gathering grounds, capacity, distribution, and quality of the water of the Dakota sandstone, the water of the upland sands, the terraces, and the dune sands, and the underflow of rivers and creeks.

*Twenty-first Annual Report of the United States Geological Survey, 1899–1900 Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. Pt. IV, Hydrography, 768 pp., 156 pls. $2.35. Contains:

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, pls. 113–156. Describes the area situated in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Republican, and Smokey Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, tempera ture, and other factors of climate, experiments with irrigation, and the use of mountain streams local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, pls. 51–65. ($2.20.)

*Pt. VII, Texas, 666 pp., 71 pls. Consists of:

Geography and geology of the Black and Granite prairies, Texas, with detailed descriptions of the Cretaceous formations and special reference to artesian waters, by Robert T. Hill. Describes an area in Texas and southern Indian [Oklahoma] Territory, comprising about 50,000 square miles; describes relief, drainage, and soils; gives a résumé of principles governing under ground water; describes the artesian well systems of Texas and gives details of artesian conditions in Black and Grand prairies by counties; treats briefly of the chemical qualities of the artesian waters and gives analyses.

*Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 690 pp., 65 pls. $2.20 Contains:

*The High Plains and their utilization (conclusion of paper in Twenty-first Ann. Rept., pt 4), by W. D. Johnson, pp. 631–669, pls. 51–65.

BULLETINS

Bulletins may be purchased (at price quoted below) from the SUPERINTENDENT OF DOCUMENTS WASHINGTON, D. C. An asterisk (*) indicates that the report is out of print. Bulletins are of octavo size.

238. Economic geology of the Iola quadrangle, Kans., by G. I. Adams, Erasmus Haworth, and W. R. Crane. 1904. 83 pp., 11 pls. 25c.

Contains (pp. 75–77) a brief discussion of the water supply.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Arkansas, Colorado, New Mexico, Oklahoma, Kansas, Missouri, Tennessee, and Texas; and detailed records of wells in Otero County, Colo.; Greenwood, Montgomery, and Neosho counties, Kans., and St. Louis County, Mo. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas; and detailed records of wells in Hempstead County, Ark.; Fremont and Pueblo counties, Colo.; Allen, Chase, Coffee, and McPherson counties, Kans.; Panola County, Miss.; Nowata, Washington, Tulsa, Murray, Okmulgee, and Pawnee counties, Okla., and Clay and Roberts counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS

Professional papers may be purchased (at price quoted below) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. An asterisk (*) indicates that the report is out of print. Professional papers are of quarto size.

*32. Preliminary report on the geology and underground-water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls.

Describes altitudes and slopes, climate, drainage, stratigraphic structure, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota, Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*46. Geology and underground-water resources of northern Louisiana and southern Arkansas, by A. C. Veatch. 1906. 422 pp., 51 pls.

Describes the historical geology and topographic development of a portion of the Coastal Plain; discusses the fundamental principles governing underground waters and their application to this region; contains account of methods and costs of well making, gives well predictions and a short discussion of the underground conditions in each county, and data in regard to wells arranged in tables by counties, followed by notes giving sections, analyses of waters, etc.; contains also a dictionary of altitudes, arranged by counties.

*52. Geology and underground waters of the Arkansas Valley in eastern Colorado, by N. H. Darton. 1906. 90 pp., 28 pls.

Describes the stratigraphic, structural, and historical geology of the Arkansas Valley and the relation of the geologic formations to the underground waters; discusses the source, depths, areas of flow, head, quantity, and quality of the waters of the "Dakota" sandstone, and the waters of the "Red Beds" and Morrison formations, the Laramie and associated formations, the later Tertiary deposits, and the dune sands "An extension of the preliminary examination of the region by G. K. Gilbert in 1894 and 1895." See Seventeenth Annual Report, part 2, 1896, pp 551–601.

135. The composition of the river and lake waters of the United States, by F. W. Clarke. 1924. iv, 199 pp. 50c.

Contains analyses of the water of the principal streams.

GEOLOGIC FOLIOS

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[2] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral

[2] Index maps showing areas in the lower Mississippi River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*36. Pueblo, Colorado.
*58. Elmoro, Colorado.
*68. Walsenburg, Colorado.
*71. Spanish Peaks, Colorado.
*122. Tahlequah, Oklahoma-Arkansas.
*132. Muskogee, Oklahoma.
*135. Nepesta, Colorado.
148. Joplin district, Missouri-Kansas. (Reprinted in 1914.) 50c.
*154. Winslow, Arkansas–Oklahoma (Ind. T.).
*159. Independence, Kansas.
186. Apishapa, Colorado. 50c.
198. Castle Rock, Colorado. 25c.
202. Eureka Springs-Harrison, Arkansas. 25c.
203. Colorado Springs, Colorado. 25c.
212. Syracuse-Lakin, Kansas. 25c.
214. Raton-Brilliant-Koehler, New Mexico-Colorado. 50c.
215. Hot Springs, Arkansas. 25c.

MISCELLANEOUS REPORTS

Other Federal bureaus, State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the lower Mississippi River drainage basin are the reports of the State

geologists of Kansas, Tennessee, Louisiana, and Texas, the Mississippi Agricultural Experiment Station, the Chief of Engineers, United States Army, the Mississippi River Commission, and the Tenth Census, volume 17. The following reports deserve special mention:

Special report on well waters in Kansas, by Erasmus Haworth, State geologist: Kansas Univ. Geol. Survey Bull. 1, 1913.

Report of the board of irrigation survey and experiment for 1895 and 1896 to the Legislature of Kansas, 1897.

Surface waters of Kansas, 1895–1919, by Kansas Water Commission. 1920.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others: Louisiana Geol. Survey Bull. 1, 1905.

Geology and underground water resources of northern Louisiana, with notes on adjoining districts, by A. C. Veatch: Louisiana Geol. Survey Bull. 4, 1906.

Report on water purification investigation and on plans proposed for sewerage waterworks systems: New Orleans Sewerage and Water Board, 1903.

Water powers of Arkansas: A preliminary report on White River and some of its tributaries, by W. N. Gladson. 1911.

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INDEX BY AREAS AND SUBJECTS

A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic Folio]

[3] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

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