DEPARTMENT OF THE INTERIOR
Hubert Work, Secretary

U. S. GEOLOGICAL SURVEY
George Otis Smith, Director

Water-Supply Paper 568

SURFACE WATER SUPPLY OF THE UNITED STATES

1923

PART VIII. WESTERN GULF OF MEXICO BASINS

NATHAN C. GROVER, Chief Hydraulic Engineer
C. E. ELLSWORTH, District Engineer

Prepared in cooperation with the
STATE OF TEXAS

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1927

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
30 CENTS PER COPY

CONTENTS

ILLUSTRATIONS

SURFACE WATER SUPPLY OF WESTERN GULF OF MEXICO BASINS, 1923

AUTHORIZATION AND SCOPE OF WORK

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

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

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 of water supply for irrigation. Since the fiscal year ending June 30, 1895, successive appropriation bills passed by Congress have carried the following item:

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, 1895–1924

1895	$12,500.00
1896	20,000.00
1897 to 1900, inclusive	50,000.00
1901 to 1902, inclusive	100,000.00
1903 to 1906, inclusive	200,000.00
1907	150,000.00
1908 to 1910, inclusive	100,000.00
1911 to 1917, inclusive	150,000.00
1918	175,000.00
1919	148,244.10
1920	175,000.00
1921 to 1923, inclusive	180,000.00
1924	170,000.00

In this work many private and State organizations have cooperated, either by furnishing records or by assisting in their collection. 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 4,800 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 were 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 the 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 work of a certain class. 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, 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.

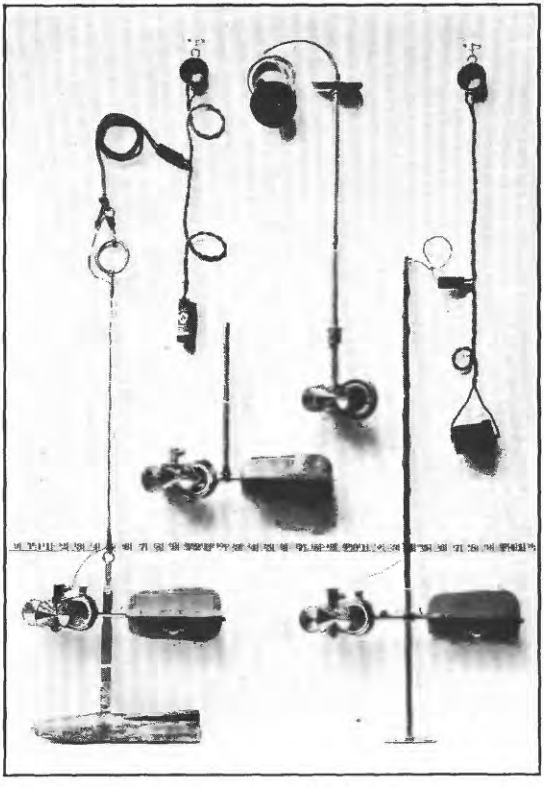
"Run-off in inches" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

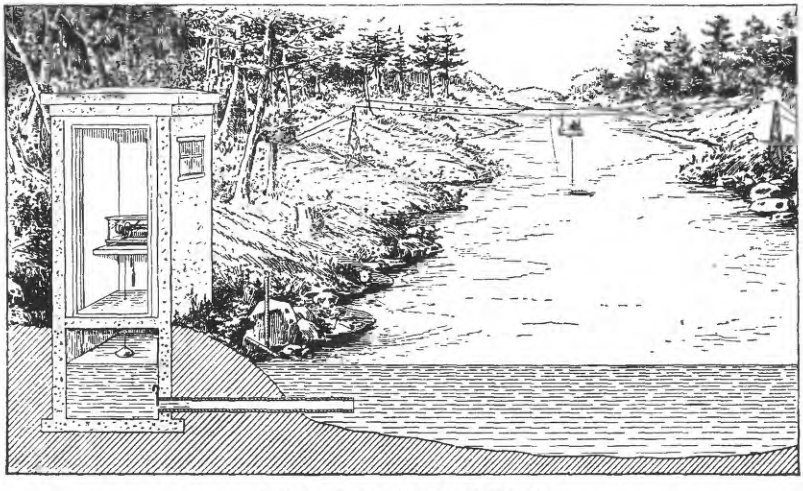
The following terms not in common use are here defined:

"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

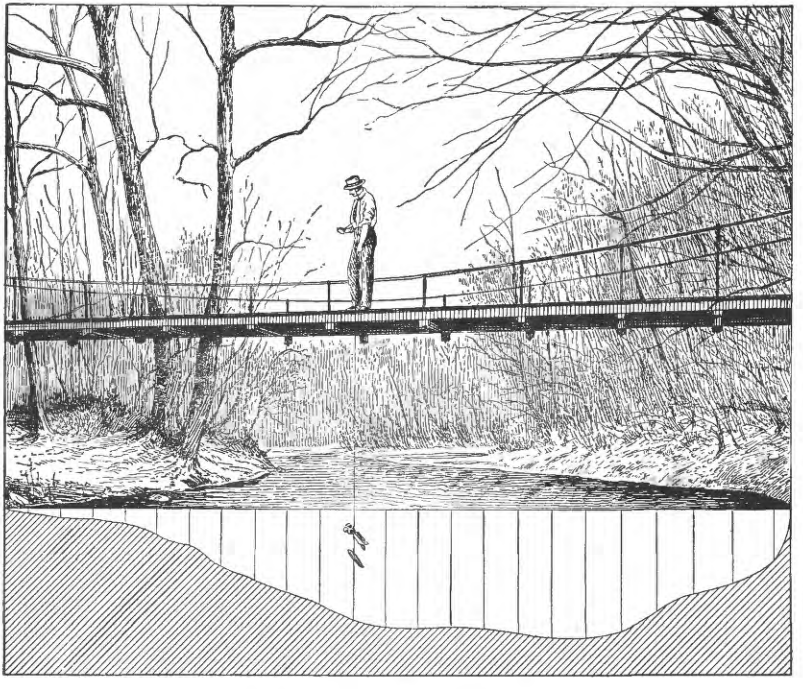


A. PRICE CURRENT METERS



B. TYPICAL GAGING STATION

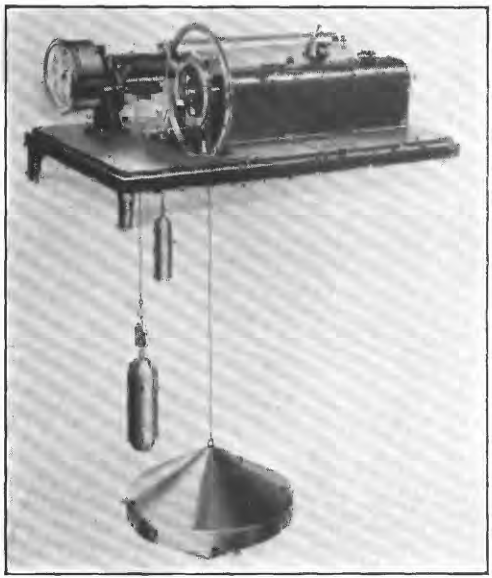
A



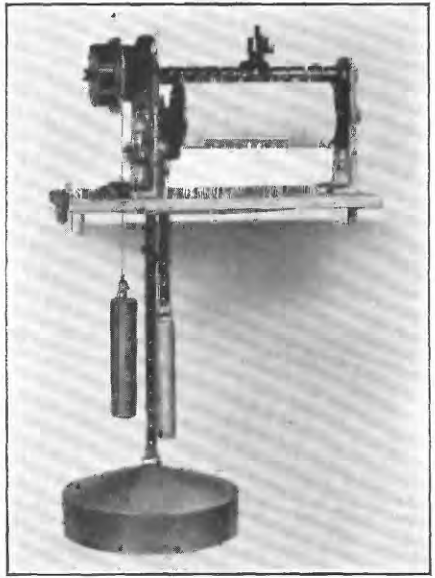
B

TYPICAL GAGING STATIONS

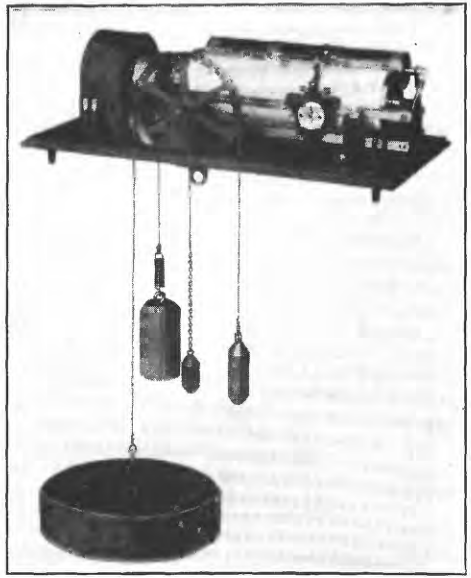
A, For wading measurement; *B*, for bridge measurement



A



B



C

WATER-STAGE RECORDERS

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

at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given 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 ending September 30, 1923. At the first 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 from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter by the general methods outlined in standard textbooks on the measurement of river discharge. (See Pls. I–III.)

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 daily discharge from which the monthly and yearly mean discharge are computed.

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, 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 channel, 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 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 [illegible]ed from the rating table and the mean daily gage heights [illegible]t be the true mean discharge for the day. If such stations [illegible]quipped with water-stage recorders, the mean daily discharge may be obtained by weighting discharge for parts of the day or by use of 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 that given in the 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" gives the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns which are defined on pages 2 and 3 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 observations of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station or footnotes added to the tables 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.

For the rating curves "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 depth of run-off in inches may be subject to gross errors, caused by including large noncontributing districts in the measured drainage area, by lack of information concerning 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, and 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" previously published by the Geological Survey should be used with caution because of possible inherent sources of error not known to the survey.

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. The figures given 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 records previously published.

COOPERATION

The work of measuring streams in Texas during the year ending September 30, 1923, was carried on in cooperation with the State through the Board of Water Engineers, consisting of John A. Norris, chairman, C. S. Clark, and A. H. Dunlap, to whom special acknowledgments are due for the efficient and cordial manner in which they represented the State in the cooperative investigations.

The following cities and companies have aided in the collection of records by furnishing funds or otherwise assisting: Corpus Christi, Dallas, Fort Worth, San Antonio, Louisiana Gravity Canal Co., Walker-Caldwell Water Co., Guadalupe Water Power Co., Medina Valley Irrigation Co., Planters & Merchants Mills, and Ward County Irrigation District No. 1.

Acknowledgment is made in the descriptions of gaging stations for records furnished by cooperating parties.

DIVISION OF WORK

Data for stations in Texas were collected and prepared for publication under the direction of C. E. Ellsworth, district engineer, assisted by Clarence E. McCashin, A. G. Fiedler, J. W. Bones, W. E. Armstrong, Donald S. Wallace, Trigg Twitchell, Robert G. West, H. Carr Pritchett, Thomas A. Slack, Ellis H. Morgan, John L.

Saunders, Seth D. Breeding, C. C. Crosnoe, E. A. Schlaudt, R. L. Pfau, O. S. L. Talbot, Kate Casparis, and Katherine E. Hickey.

The records were reviewed and manuscript assembled by B. J. Peterson.

GAGING-STATION RECORDS

CALCASIEU RIVER BASIN

CALCASIEU RIVER NEAR OBERLIN, LA.

LOCATION.—In NW. ¼ NW. ¼ sec. 7, T. 5 S., R. 4 W., at Oberlin-Mittie highway bridge, 3¼ miles west of Oberlin and 11 miles in air line above mouth of Whiskey Chitto Creek.

DRAINAGE AREA.—808 square miles (measured on project map of Louisiana Gravity Canal Co., scale 1:380,000, and post-route map).

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

GAGE.—Gurley eight-day water-stage recorder on downstream side of bridge near left bank.

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

CHANNEL AND CONTROL.—Channel curved. Banks composed of sand, medium in height, wooded, and subject to overflow. Bed composed of clean, fine sand; shifts. One channel at low stages, and several channels at high stages. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 18.48 feet at 6.55 a. m. April 7 (discharge, 34,700 second-feet, determined from extension of rating curve); minimum stage, 1.00 foot at 9 p. m. October 11 (discharge, 54 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 60 to 14,000 second-feet and extended above. Operation of water-stage recorder satisfactory, except as noted in footnote to daily discharge table. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily discharge table. Records good.

Discharge measurements of Calcasieu River near Oberlin, La., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 28	Joseph and Forrest	1.08	61.1	Mar. 9	Forrest and Roberts	10.34	2,330
Nov. 2	McCashin and Joseph	1.08	57.2	17	do	8.27	1,450
2	McCashin and Forrest	1.08	61.2	23–24	Forrest and Bradford	14.28	7,650
11	Bradford and Forrest	1.36	87.7	Mar. 31	do	15.41	13,300
17	Forrest and Creed	4.24	497	Apr. 1			
Dec. 2	do	1.44	93.9	6	Forrest and Osborne	15.09	13,800
13	do	3.95	497	14	Forrest and Marcantel	15.35	12,800
16	H. O. Creed	3.93	444	20	Forrest and Brian	12.66	4,150
30	Forrest and Marcantel	2.97	286	27	Forrest and Bradford	9.18	1,780
Jan. 5	do	6.12	963	June 8	Forrest and Marcantel	3.53	305
13	Creed and Marcantel	4.68	562	16	Forrest and Bradford	6.29	1,000
20	do	3.20	290	29	Forrest and Sharp	6.48	991
26	Forrest and Creed	9.54	1,920	30	do	6.65	1,000
Feb. 3	Forrest and Bradford	9.48	1,960	July 14	Forrest and Bradford	4.75	577
15–16	Forrest and Osborne	14.11	7,600	Aug. 4	do	6.91	1,190
23	Forrest and Bradford	8.87	1,570	Sept. 8	Forrest and Sharp	7.66	1,410
Mar. 2	do	9.52	2,040	28	do	2.39	211

Daily discharge, in second-feet, of Calcasieu River near Oberlin, La., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	70	61	99	1,230	2,950	1,980	13,000	1,730	748	794	1,170	204
2	68	61	94	1,010	2,430	1,980	8,720	3,020	642	662	1,380	388
3	68	60	93	889	1,980	2,490	6,560	5,030	582	525	1,460	525
4	66	59	92	913	2,370	5,390	5,590	4,200	496	396	1,200	602
5	67	59	92	937	5,200	5,390	4,870	3,180	468	322	1,060	632
6	67	68	92	961	7,400	4,200	13,000	2,370	458	276	1,060	748
7	70	107	91	985	7,700	3,440	28,500	1,780	379	248	1,200	865
8	64	104	92	1,010	9,090	2,880	17,600	1,830	314	248	1,460	1,350
9	58	97	662	1,010	11,600	2,370	9,090	2,370	314	255	1,350	1,260
10	56	90	1,290	985	10,700	1,880	6,300	2,670	354	241	794	985
11	56	89	985	889	10,300	1,460	5,030	2,370	413	388	516	913
12	73	88	622	748	12,600	1,170	5,030	1,830	449	478	413	937
13	115	275	506	563	18,100	1,040	8,360	1,490	602	622	346	1,060
14	141	672	449	431	13,500	985	12,600	1,110	865	544	306	1,530
15	137	985	468	338	8,360	937	21,400	1,110	961	458	269	2,130
16	114	771	431	276	6,050	1,140	18,700	1,490	937	449	241	2,250
17	97	525	422	248	4,580	1,420	10,700	1,610	726	413	228	2,080
18	85	370	478	234	3,740	1,530	7,400	1,610	841	362	220	1,690
19	76	299	544	241	3,260	1,490	5,810	2,810	1,060	322	220	1,170
20	72	276	572	284	2,880	1,350	4,580	3,260	1,320	284	213	662
21	70	248	534	330	2,490	1,140	3,640	3,350	1,650	234	234	458
22	68	209	458	642	2,130	3,960	2,950	2,880	1,980	203	306	396
23	66	185	370	1,530	1,780	7,110	2,490	2,490	2,370	179	299	370
24	65	154	314	2,190	1,420	8,360	1,930	2,130	1,980	165	262	346
25	63	141	276	2,430	1,110	7,110	1,650	2,080	1,350	154	228	299
26	62	131	248	2,080	913	5,590	1,690	2,030	1,140	174	198	269
27	61	123	241	1,880	1,380	5,030	1,780	1,780	1,060	440	184	241
28	61	112	248	1,730	1,780	5,030	1,980	1,690	1,010	771	183	215
29	61	106	255	2,030	-------	5,590	2,130	1,530	985	1,060	203	197
30	60	102	284	3,100	-------	8,360	1,980	1,230	985	1,320	203	183
31	61	-------	771	3,440	-------	13,500	-------	1,570	-------	1,170	186	-------

NOTE.—Owing to incomplete record, discharge partly estimated by comparison with record for the station at Kinder on May 15–18, June 16, 23, July 28, and August 4. Discharge June 17–22 and July 29 to August 3, determined from gage heights estimated by comparison with records for station at Kinder.

Monthly discharge of Calcasieu River near Oberlin, La., for the year ending September 30, 1923

[Drainage area, 808 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	141	56	74.8	0.093	0.11	4,600
November	985	59	221	.274	.31	13,100
December	1,290	91	393	.486	.56	24,100
January	3,440	234	1,150	1.42	1.64	70,500
February	18,100	913	5,640	6.98	7.27	313,000
March	13,500	937	3,720	4.60	5.30	229,000
April	28,500	1,650	7,840	9.70	10.82	467,000
May	5,030	1,110	2,250	2.78	3.20	138,000
June	2,370	314	915	1.13	1.26	54,400
July	1,320	154	457	.566	.65	28,100
August	1,460	183	568	.703	.81	34,900
September	2,250	183	832	1.03	1.15	49,500
The year	28,500	56	1,970	2.44	33.08	1,430,000

CALCASIEU RIVER NEAR KINDER, LA.

LOCATION.—In sec. 31, T. 6 S., R. 5 W., at Gulf Coast Railroad bridge, three-fourths mile below mouth of Whiskey Chitto Creek and 4 miles west of Kinder.

DRAINAGE AREA.—1,760 square miles (measured on post-route map and project map of Louisiana Gravity Canal Co., scale 1:380,000).

RECORDS AVAILABLE.—August 23, 1922, to September 30, 1923.

GAGE.—Gurley eight-day water-stage recorder attached to downstream side of railroad bridge pier; inspected by J. L. Joseph or J. M. Forrest.

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

CHANNEL AND CONTROL.—Channel straight for 300 feet above and below station. Banks medium in height, composed of sand and clay, heavily wooded, and subject to overflow. Several channels at high stages. Bed composed of fine sand; clean; fairly permanent. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 19.23 feet at 5 p. m. April 14 (discharge, 46,500 second-feet, determined from extension of rating curve and subject to error); minimum stage, 1.01 feet from 12 to 2 p. m. October 25 (discharge, 370 second-feet).

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

DIVERSIONS.—Kinder Canal Co.'s pump diverts water 2 miles upstream and above mouth of Whiskey Chitto Creek. About 7,000 acres of rice were irrigated in 1922.

REGULATION.—Operation of Kinder Canal Co.'s pump affects flow at low stages.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory, except as noted in footnote to daily-discharge table. Daily discharge determined by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter, except as noted in footnote to daily discharge table. Records good.

Discharge measurements of Calcasieu River near Kinder, La., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 28	Joseph and Forrest	1.03	386	Mar. 9	Forrest and Roberts	9.68	4,020
Nov. 1	McCashin and Joseph	1.06	391	10	do	9.10	3,650
1	do	1.06	384	16	do	6.70	2,620
11	Bradford and Forrest	1.64	677	17	do	7.79	3,060
18	Forrest and Robinson	3.28	1,220	29–31	Forrest and Osborne	14.11	12,500
Dec. 2	Forrest and Creed	1.21	470	Apr. 7–8	do	17.78	31,700
13	Forrest and Robinson	4.92	1,750	15–16	do	17.92	38,100
15	H. O. Creed	3.70	1,360	21–22	Forrest and Brian	12.44	7,310
30	Forrest and Marcantel	2.76	989	28	Forrest and Hines	9.82	4,490
Jan. 6	do	5.36	2,010	June 9	Forrest and Marcantel	3.54	1,010
13	Creed and Marcantel	3.57	1,410	16	Forrest and Lee	6.99	2,500
20	do	2.34	823	30	Forrest and Sharp	7.08	2,780
27	Forrest and Creed	10.60	4,740	July 15	do	4.74	1,650
Feb. 2	Forrest and Roberts	8.82	3,710	Aug. 4	do	6.83	2,600
10–14	Forrest and Osborne	16.15	21,900	Sept. 8	do	10.79	5,780
24	Forrest and Marcantel	7.22	2,620	29	do	2.49	804
Mar. 3	do	11.21	5,960				

Daily discharge, in second-feet, of Calcasieu River near Kinder, La., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	423	390	481	2,480	3,850	4,200	18,400	6,780	2,120	2,590	2,500	1,380
2	416	387	470	2,520	3,720	4,200	17,400		1,880	2,500	2,590	1,300
3	407	397	464	2,520	3,360	5,670	13,600	9,080	1,770	1,960	2,780	1,770
4	413	416	460	2,570	3,780		10,900	14,400	1,650	1,880	2,540	2,460
5	420	433	460	2,300	7,330		9,950	13,600	1,800	1,490	2,080	3,180
6	420	470	464	1,980	13,600	5,400	9,360	11,200	1,650	1,230	1,840	3,660
7	430	641	470	1,840	18,900		17,400	8,530	1,490	1,120	2,000	4,420
8	433	676	470	1,790	20,600		35,100	5,670	1,380	1,100	2,280	5,240
9	436	712	1,080	1,730	19,500		23,600	4,270	1,300	1,150	2,320	5,450
10	474	748	3,420	1,690	21,100	3,780	15,200	4,200	1,270	1,100	2,280	4,940
11	467	676	4,130	1,670	20,600		9,950	4,200	1,340	1,270	1,800	4,200
12	443	610	2,780	1,570	20,000		8,530	3,920	1,690	1,690	1,380	3,080
13	443	857	1,790	1,380	23,600		14,000	4,200	2,280	1,610	1,120	2,320
14	467	1,230	1,420	1,190	26,300	2,300	41,100	6,620	2,680	1,770	986	2,120
15	491	1,880	1,400	1,040	20,600		39,300	5,340	2,880	1,730	894	2,280
16	484	1,960	1,440	912	14,400		35,100	5,560	2,640	1,460	838	2,540
17	491	1,610	1,280	894	9,360	3,080	27,000	5,910	2,200	1,270	802	2,730
18	498	1,230	1,250	950	6,460	3,180	18,900	5,450	2,120	1,150	766	2,780
19	508	968	1,280	857	5,240	3,240	14,000	7,130	2,360	1,060	784	2,680
20	450	838	1,280	827	4,420	3,130	10,900	10,300	2,590	1,000	950	2,320
21	403	766	1,250	820	3,850	2,880	8,530	8,530	3,130	931	1,020	1,800
22	387	712	1,100	1,440	4,130	4,850	6,170	6,950	3,780	894	1,150	1,460
23	384	658	986	3,720	3,130	9,950		5,910	4,270	894	1,040	1,120
24	374	606	876	5,450	2,830	14,400		4,760	4,060	838	876	1,230
25	374	571	802	5,910		15,600	4,900	3,920	3,360	784	820	1,120
26	407	543	748	5,560	2,700	14,400		3,990	2,730	838	894	1,040
27	390	522	730	4,940		12,900		3,990	2,410	1,690	894	1,000
28	377	508	802	4,130		13,200	4,340	3,780	2,120	2,500	968	931
29	374	498	894	3,180	-------	12,900	4,300	3,480	2,200	3,030	1,000	894
30	374	487	1,060	3,080	-------	12,200		2,980	2,640	3,130	1,230	857
31	380	-------	1,610	3,540	-------	13,600	-------	2,460	-------	2,830	1,380	-------

NOTE.—Owing to incomplete gage-height graph, discharge partly estimated Feb. 24, Apr. 12, 13, 18–21, and May 4. Discharge determined from one daily reading of staff gage Mar. 3, 10, Apr. 29, and May 3. Discharge estimated by comparison with records for station at Oberlin Feb. 25–28, Mar. 1, 2, 4–9, 11–16, Apr. 23–27, 29, 30, May 1 and 2. Braced figures show estimated mean discharge for periods indicated.

Monthly discharge of Calcasieu River near Kinder, La., for the year ending September 30, 1923

[Drainage area, 1,760 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	508	374	427	0.243	0.28	26,300
November	1,960	387	767	.436	.49	45,600
December	4,130	460	1,200	.682	.79	73,600
January	5,910	820	2,400	1.36	1.57	148,000
February	26,300	-------	10,400	5.91	6.15	578,000
March	15,600	-------	6,570	3.73	4.30	404,000
April	41,100	-------	14,700	8.35	9.32	876,000
May	14,400	2,460	6,250	3.55	4.09	385,000
June	4,270	1,270	2,330	1.32	1.47	138,000
July	3,130	784	1,560	.886	1.02	96,200
August	2,780	766	1,450	.824	.95	88,900
September	5,450	857	2,410	1.37	1.53	143,000
The year	41,100	374	4,150	2.36	31.96	3,000,000

TRINITY RIVER BASIN

WEST FORK OF TRINITY RIVER AT BRIDGEPORT, TEX.

LOCATION.—At suspension bridge on Balsora-Bridgeport road, half a mile southwest of center of Bridgeport, Wise County, a quarter of a mile above Chicago, Rock Island & Gulf Railway Co.'s pumping plant and 1 mile below mouth of Gentry Creek.

DRAINAGE AREA.—1,010 square miles (revised measurement on topographic maps and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—October 1, 1914, to September 30, 1923. Records of stage have been obtained by the United States Weather Bureau since August 12, 1908.

GAGE.—Weight and tape gage of the Mott type, on downstream side of bridge; read by Eugene Hembree.

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

CHANNEL AND CONTROL.—Bed composed of clay, gravel, and sand. Banks are high, slightly wooded, and are overflowed at a stage of 25 feet. Channel straight above and below station for 100 feet. Control is rock outcrop, three-quarters of a mile below station. A low dam was built on the control during the first week in November, 1922.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 25.7 feet at 6 p. m. April 25 (discharge, 14,700 second-feet, determined from extension of rating curve and subject to error); no flow October 1 to November 11 and December 9 to January 6.

1908–1923: Maximum stage recorded, 28.9 feet June 8, 1915 (discharge not determined); no flow during several periods.

DIVERSIONS.—Practically the only diversion above station is by city of Bridgeport, which diverts a small amount for municipal uses.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent, except for change caused by construction of a low dam below gage during period of no flow in November. Rating curves fairly well defined below 11,000 second-feet and extended above that point. Gage read to hundredths once daily, and oftener during floods. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of West Fork of Trinity River at Bridgeport, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 28	T. A. Slack	2.00	*0.1
June 14	Trigg Twichell	3.57	229

* Estimated.

Daily discharge, in second-feet, of West Fork of Trinity River at Bridgeport, Tex., for the year ending September 30, 1923

Day	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		13	0	624	26	4.8	372	37	32	37	152
2		11	0	1,740	94	4.8	255	37	32	37	32
3		17	0	832	37	17	191	348	32	37	8.8
4		17	0	300	67	17	143	324	32	37	8.8
5		13	0	233	191	13	117	255	32	37	8.8
6		8.8	0	126	191	13	109	222	32	32	8.8
7		6.4	4.8	60	152	13	73	372	32	26	420
8		3.2	4.8	32	126	13	60	420	32	17	162
9		0	4.8	32	94	13	48	1,250	26	13	126
10		0	4.8	26	80	11	48	12,000	21	13	126
11		0	4.8	26	80	8.8	37	6,470	17	13	126
12	117	0	4.8	23	73	34	37	2,100	17	13	43
13	117	0	4.8	21	64	23	32	832	17	13	13
14	26	0	4.8	17	54	21	29	244	17	13	13
15	26	0	4.8	14	43	21	26	94	17	13	13
16	348	0	4.8	13	32	21	26	57	17	13	13
17	372	0	4.8	13	26	17	21	45	17	13	17
18	420	0	4.8	13	26	17	20	40	45	13	17
19	650	0	4.8	13	23	14	17	37	17	13	17
20	495	0	4.8	11	20	14	2,000	34	17	13	13
21	372	0	13	8.8	20	13	1,140	32	17	13	13
22	255	0	67	8.8	17	13	162	29	17	13	13
23	134	0	21	17	13	13	143	29	17	13	13
24	78	0	13	43	13	6,470	126	26	17	13	17
25	60	0	13	67	17	12,300	109	26	17	13	17
26	54	0	4.8	470	34	13,800	101	23	17	13	80
27	45	0	143	372	32	13,800	94	23	17	17	48
28	40	0	101	117	21	10,800	86	21	17	13	26
29	32	0	54		17	4,000	67	21	17	13	26
30	20	0	54		13	858	60	21	17	13	21
31		0	109		13		43		37	13	

NOTE.—No flow Oct. 1 to Nov. 11.

Monthly discharge of West Fork of Trinity River at Bridgeport, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0	0	0	0
November	650	0	122	7,260
December	17	0	2.88	177
January	143	0	21.3	1,310
February	1,740	8.8	188	10,500
March	191	13	55.1	3,390
April	13,800	4.8	2,080	124,000
May	2,000	17	187	11,500
June	12,000	21	849	50,500
July	45	17	22.8	1,400
August	37	13	18.2	1,120
September	420	8.8	53.7	3,200
The year	13,800	0	296	214,000

WEST FORK OF TRINITY RIVER AT FORT WORTH, TEX.

LOCATION.—At old intake pump house of the Fort Worth Power & Light Co.'s plant, in Fort Worth, Tarrant County, one-fourth mile below mouth of Clear Fork of Trinity River and 150 feet above Paddock viaduct.

DRAINAGE AREA.—2,430 square miles (revised measurement on topographic maps and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—October 11, 1920, to September 30, 1923. Records of stage have been kept by United States Weather Bureau at Paddock viaduct since March 1, 1910.

GAGE.—Gurley graph water-stage recorder, located in the old pump house of Fort Worth Power & Light Co.; attended by employee of the city.

DISCHARGE MEASUREMENTS.—Made by wading from highway bridge 1,000 feet above, or from North Twelfth Street Bridge, 2 miles below gage.

CHANNEL AND CONTROL.—Channel straight for 500 feet above and 1,000 feet below gage. Right bank high, brushy, and not subject to overflow. Left bank low, with a protection levee, but subject to overflow at high stages. Bed composed of rock, gravel, and clay. Control is a concrete dam just below gage and is permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 16.25 feet at 11 a. m. June 11 (discharge, 16,300 second-feet); minimum stage, 0.87 foot at 11 p. m. August 17 and from 4 to 11 p. m. August 22 (discharge, 0.8 second-foot).

1910–1923: Maximum stage recorded, 23.95 feet at 12.20 p. m. April 25, 1922 (discharge, 85,000 second-feet); no flow during several periods.

DIVERSIONS.—The city of Fort Worth diverts for municipal use about 15 second-feet from storage reservoir on West Fork known as Lake Worth.

REGULATION.—Flow is partly regulated by storage at Lake Worth, which has a capacity of about 30,000 acre-feet.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 0 to 14,000 second-feet and extended above by use of one slope measurement at a stage of 23.95 feet (85,000 second-feet). Operation of water-stage recorder not satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection, by use of planimeter, or by averaging discharge for fractional parts of a day, except as noted in footnote to daily-discharge table. Records good, except those for low stages which are fair.

Discharge measurements of West Fork of Trinity River at Fort Worth, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 26	T. A. Slack	1.10	12.3	June 12	Trigg Twichell	8.88	8,360
Jan. 1	do	1.09	12.8	13	do	11.98	11,000
June 11	Trigg Twichell	15.13	13,700	14	do	10.38	9,320
12	do	9.22	8,580	Aug. 21	T. A. Slack	.91	*.5

* Estimated.

Daily discharge, in second-feet, of West Fork of Trinity River at Fort Worth, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5.2	167	12	14	60	236	40	9,480	58	38	7.2	2.0
2	7.2	167	14	15	58	198	36	6,310	100	36	5.2	1.8
3	7.2	4.4	17	15	82	190	357	3,540	179	31	3.6	1.6
4	6.0	5.2	12	15	604	86	313	1,420	148	29	4.4	46
5	6.0	6.0	12	17	1,140	74	93	692	210	29	4.4	42
6	4.4	7.2	14	17	850	137	45	437	210	27	4.4	6.0
7	4.4	7.2	14	17	517		42	333	179	24	4.4	5.2
8	5.2	7.2	14	17	348	186	42	254	240	42	3.6	3.6
9	5.2	7.2	14	15	297		38	186	509	38	4.4	4.4
10	5.2	6.0	14	15	210	236	31	148	5,560	24	8.4	5.2
11	3.6	6.0	15	14	152	301	524	123	13,400	20	8.4	5.2
12	4.4	7.2	14	14	119	188	508	141	9,170	15	7.2	6.0
13	4.4	8.4	15	15	112	99	290	102	10,700	14	7.2	5.2
14	4.4	7.2	17	15	80	60	134	106	8,810	15	3.6	4.4
15	4.4	12	15	15	66	175	119	186	5,490	18	2.0	7.2
16	4.4	36	17	14	50	110	96	86	3,470	18	1.2	17
17	4.4	117	17	12	45	38	90	69	1,530	14	1.0	14
18	4.4	258	17	14	45	108	83	66	716	14	12	11
19	4.4	62	17	14	40	58	74	130	426	14	6.0	9.6
20	4.4	29	17	14	42	29	96	1,070	292	12	1.8	9.6
21	4.4		17	114	36	29	126	502	215		1.2	8.4
22	4.4		19	99	33	33	74	229	175		.9	8.4
23	4.4	22	17	112	31	31	66	769	145		1.0	8.4
24	4.4		17	52	31	27	123	1,030	119	12	1.4	9.6
25	4.4	14	18	36	68	27	4,850	602	102		1.4	8.4
26	4.4	14	20	29	129	31	6,220	322	77		1.0	8.4
27	4.4	14	17	27	179	33	8,120	202	63		1.6	7.2
28	4.4	12	17	30	224	55	10,300	130	60	11	4.4	7.2
29	4.4	14	14	55	-------	42	13,700	99	50	8.4	2.8	7.2
30	4.4	12	14	38	-------	40	12,200	90	40	9.6	2.8	9.6
31	20	-------	12	40	-------	40	-------	66	-------	8.4	2.0	-------

NOTE.—Owing to incomplete record, discharge estimated Oct. 15 to Nov. 5, Nov. 21–24, Dec. 10, Mar. 7–9, and July 21–27. Discharge partly estimated Oct. 5, 7, 10, 14, Nov. 6, 13, 20, 25, Dec. 9, 11, and Mar. 10.

Monthly discharge of West Fork of Trinity River at Fort Worth, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	20	3.6	5.26	324
November	258	4.4	36.5	2,170
December	20	12	15.4	948
January	114	12	30	1,840
February	1,140	31	202	11,200
March	301	27	105	6,480
April	13,700	31	1,960	117,000
May	9,480	66	933	57,400
June	13,400	40	2,080	124,000
July	42	8.4	19.1	1,180
August	12	.9	3.90	240
September	46	1.6	9.66	575
The year	13,700	.9	446	323,000

TRINITY RIVER AT DALLAS, TEX.

LOCATION.—At Commerce Street viaduct in Dallas, Dallas County, 800 feet below Texas & Pacific Railroad bridge and 5 miles by river below confluence of Elm and West Forks of Trinity River.

DRAINAGE AREA.—6,000 square miles (revised measurement on topographic maps and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—October 1, 1898, to December 31, 1899 (discharge not computed); July 1, 1903, to December 31, 1906; and October 1, 1920, to September 30, 1923. Gage readings by United States Weather Bureau available since 1903.

GAGE.—Chain gage attached to downstream handrail of Commerce Street viaduct; read by C. J. Anderson.

DISCHARGE MEASUREMENTS.—Made by wading, from upstream side of Commerce Street viaduct, or from "Miller's Ferry" bridge, about 6 miles downstream from gage.

CHANNEL AND CONTROL.—Channel practically straight for 1,000 feet above and 600 feet below station. Right bank medium in height, composed of clay and gravel, wooded, and subject to overflow. Left bank fairly clean and not subject to overflow, except at extremely high stages. Bed is composed of clay and gravel and is fairly permanent. Low-water control is a gravel and clay shoal about 300 feet below gage. High-water control is not known. A lock and dam, 13 miles below gage, will back water at station to a gage height of 11.65 feet when wickets are closed. This, however, rarely occurs.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 37.45 feet at 4.45 p. m. June 12 (discharge, 37,900 second-feet); minimum discharge, 8.8 second-feet at 4.50 p. m. November 29.

1898–1899; 1903–1906; 1920–1923: Maximum stage recorded, 42.35 feet at 5.15 a. m. April 27, 1922 (discharge, 75,100 second-feet); minimum discharge, that of November 29, 1922.

Maximum flood on record from United States Weather Bureau records, 52.6 feet at 6 p. m. May 26, 1908 (discharge not determined). During drought of 1917–1918 discharge was practically zero.

DIVERSIONS.—Only known diversions are for municipal uses. No irrigation of importance above.

REGULATION.—Low-water flow is partly regulated by municipal dams on West Fork, 40 miles above, and on Elm Fork, 6 miles above gage.

ACCURACY.—Stage-discharge relation changed November 20, 1922. Rating curves used before and after change well defined from 20 to 75,000 second-feet. Gage read to hundredths twice daily, except December 15–25 and April 19–21, when Weather Bureau gage heights of one reading daily were used. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for extremely low stages, for which they are fair.

The following discharge measurements were made by T. A. Slack:

December 27, 1922: Gage height, 4.86 feet; discharge, 33.6 second-feet.

August 16, 1923: Gage height, 4.71 feet; discharge, 26.1 second-feet.

Daily discharge, in second-feet, of Trinity River at Dallas, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	23	25	18	33	600	385	113	9,400	250	172	47	31
2	24	24	23	34	775	355	129	10,400	210	163	43	23
3	23	22	24	32	1,840	325	220	10,700	2,110	154	37	25
4	24	22	26	30	3,780	295	900	9,400	2,200	129	37	27
5	24	23	18	31	3,500	295	875	4,760	750	137	36	28
6	25	27	23	31	1,720	620	250	1,480	660	137	34	75
7	24	26	26	31	1,120	1,930	154	750	600	121	33	121
8	24	25	31	31	750	1,450	129	560	370	172	28	67
9	26	26	31	31	500	540	121	480	440	600	27	52
10	26	26	31	29	385	440	113	385	8,990	181	28	29
11	26	26	31	33	340	385	121	370	15,800	154	27	28
12	25	29	32	34	310	340	620	265	37,600	129	26	31
13	25	40	29	34	240	385	1,100	250	31,500	129	26	30
14	25	31	29	34	210	250	620	240	19,200	113	26	30
15	25	30	16	35	210	210	265	240	12,900	105	26	30
16	24	34	26	36	190	163	210	240	11,600	121	27	40
17	32	40	26	37	172	145	181	340	10,000	113	30	113
18	27	113	21	37	163	163	154	265	5,600	86	31	28
19	22	1,750	21	37	129	137	145	230	1,720	75	31	25
20	23	1,510	16	38	113	129	190	210	800	75	33	48
21	23	480	21	137	105	137	145	210	600	74	35	37
22	24	172	21	154	97	129	154	295	460	67	38	34
23	26	82	26	580	86	105	172	540	370	62	45	23
24	26	72	21	265	75	101	163	500	325	61	43	30
25	25	53	26	265	89	97	2,320	1,000	280	61	41	32
26	23	49	58	154	154	97	10,000	800	240	58	41	26
27	23	44	30	97	355	440	11,400	560	230	55	38	24
28	23	27	34	172	370	280	11,700	310	220	52	35	26
29	22	10	34	1,150	-------	181	11,800	370	190	54	34	26
30	22	10	34	1,220	-------	154	10,900	230	181	54	32	24
31	43	-------	34	600	-------	129	--------	240	--------	50	31	-------

Monthly discharge of Trinity River at Dallas, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	43	22	25.1	1,540
November	1,750	10	162	9,620
December	58	16	27.0	1,660
January	1,220	29	176	10,800
February	3,780	75	656	36,500
March	1,930	97	348	21,400
April	11,800	113	2,180	130,000
May	10,700	210	1,810	111,000
June	37,600	181	5,550	330,000
July	600	50	120	7,370
August	47	26	33.7	2,070
September	121	23	38.8	2,310
The year	37,600	10	917	664,000

ELM FORK OF TRINITY RIVER NEAR DALLAS, TEX.

LOCATION.—At city of Dallas pumping plant and dam (known as Record Crossing plant), 300 feet above Record Crossing highway bridge, 2,800 feet above Rock Island Railway bridge, 1.2 miles above confluence with West Fork, and 5 miles northwest of Dallas, Dallas County.

DRAINAGE AREA.—2,660 square miles (revised measurement on topographic maps and map of Texas, scale 1 : 500,000).

RECORDS AVAILABLE.—October 17, 1920, to September 30, 1923.

GAGE.—Vertical staff in three sections, attached to pump house; read by W. J. Selby.

DISCHARGE MEASUREMENTS.—Made from Record Crossing highway bridge, 200 feet below gage, from Rock Island Railway bridge half a mile below, or by wading just below gage.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifting. Control is concrete dam; permanent. Left bank high, wooded, and not subject to overflow, except at extremely high stages. Right bank medium in height, wooded, and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.05 feet at 8 a. m. April 29 (discharge not determined on account of backwater); a higher stage probably occurred some time in June, when gage was not read. No flow during several periods.

1920–1923: Maximum stage recorded, 20.20 feet at 10 a. m. April 27, 1922 (discharge not determined; backwater from Trinity River existed this day, which affected gage height). No flow during several periods.

DIVERSIONS.—No diversion except for municipal use, the largest being at the Record Crossing plant. The sum of all the diversions is believed to be but a small percentage of the total run-off during years of ordinary flow.

REGULATION.—During extremely low stages flow regulated by city of Dallas Reservoir at Carrolton.

ACCURACY.—Stage-discharge relation permanent, except during periods of backwater. Rating curve well defined below 1,100 second-feet and fairly well defined from 6,200 second-feet to 16,000 second-feet. No measurement between 1,100 and 6,200 second-feet, and this portion of the rating may be slightly in error. Gage read to hundredths twice daily and oftener during floods, except May 13 to July 8, when there were no readings. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Daily discharge, in second-feet, of Elm Fork of Trinity River near Dallas, Tex., for the year ending September 30, 1923

Day	Nov.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1			510	209	73				3.2
2			780	128	67				
3			1,890	120	85				
4			3,140	106	92				
5			2,290	102	82	395			
6			498	540	61	152			
7			160	1,810	61	120			
8			120	1,090	55	120			
9			106	351	55	120		29	
10			95	222	52	102		18	
11			85	168	55	99		17	
12			124	160	85	92		17	
13			116	128	79			25	
14			76	120	73			21	
15			64	128	73			14	
16			58	92	67			10	
17			42	85	55			10	
18	632		34	79	50			8.3	
19	1,570		29	92	45			8.3	
20	1,010		29	76	58			6.1	
21	254		25	61	55			4.4	
22	76		10	73	50			4.4	
23	42		10	67	45			4.4	
24	17		10	67	45			4.4	
25	17		15	61	290			3.2	
26	10		113	268				3.2	
27	10	25	395	245				3.2	
28		67	540	140				3.2	
29		1,330		113				8.3	
30		818		85				10	
31		300		76				6.1	

NOTE.—No flow Oct. 1 to Nov. 17, Nov. 28 to Jan. 26, and Aug. 2 to Sept. 30. Discharge not determined Apr. 26 to May 4 because of backwater. No record May 13 to July 8; flood stage probably existed during part of this time.

Monthly discharge of Elm Fork of Trinity River near Dallas, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0	0	0	0
November	1,570	0	121	7,220
December	0	0	0	0
January	1,330	0	81.9	5,040
February	3,140	10	406	22,500
March	1,810	61	228	14,000
April 1–25	290	45	72.3	3,590
May 5–12	395	92	150	2,380
July 9–31	29	3.2	10.4	473
August	3.2	0	.10	6.3
September	0	0	0	0

BRAZOS RIVER BASIN

BRAZOS RIVER AT WACO, TEX.

LOCATION.—At suspension bridge in Waco, McLennan County, 2½ miles below mouth of Bosque River, 4½ miles above mouth of Cottonwood Creek.

DRAINAGE AREA.—28,500 square miles, a large part of which is probably noncontributing (revised measurement on topographic maps and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—September 14, 1898, to December 31, 1911; October 1, 1914, to September 30, 1923. Record of stage have been obtained by United States Weather Bureau since August 9, 1900.

GAGE.—United States Weather Bureau chain gage on downstream side of suspension bridge used since May 5, 1922.

DISCHARGE MEASUREMENTS.—Made from upstream side of first one-span highway bridge above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifts. Banks are clay, medium in height, have been improved by the city, and are overflowed at extremely high tages. Channel straight above and below for several thousand feet. Location of control not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 24.6 feet at 7 a. m. April 27 (discharge, 66,900 second-feet); probably no flow during several days in latter part of August, when record was incomplete.

1898–1923: Maximum stage recorded, 39.7 feet December 3, 1913 (discharge not determined); no flow August 20–21, 1918, and probably several days in August, 1923.

DIVERSIONS.—Records of the Board of Water Engineers for the State of Texas show that numerous small diversions are made above station for mining, irrigation, and municipal uses, but total probably does not appreciably affect flow, except during low stages.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Standard rating curve fairly well defined. Gage read to tenths once daily, except as noted in footnote to daily-discharge table. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records fair.

COOPERATION.—Gage-height record furnished by the United States Weather Bureau.

Discharge measurements of Brazos River at Waco, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 5	Trigg Twichell	4.45	128	May 27	Edmund Taylor	5.62	670
27	C. E. Ellsworth	5.46	551	June 23	do	7.71	2,240
Jan. 5	do	4.15	86.2	July 16	T. A. Slack	4.91	158
Feb. 21	Ellsworth and Taylor	5.36	485	Aug. 14	do	4.27	5.9
Mar. 24	Edmund Taylor	4.33	96.7	Sept. 23	Edmund Taylor	5.47	325
May 5	do	8.98	3,900				

Daily discharge, in second-feet, of Brazos River at Waco, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	161	98	278	81	314	278	117	25,700	314	394		
2	161	98	278	98	278	278	117	20,300	245	1,280		3.0
3	161	98	245	81	278	440	117	10,400	490	730		
4	161	117	245	81	875	394	117	5,300	2,450	394		
5	161	138	186	98	660	394	490	3,950	543	394		314
6	161	117	186	81	352	440	186	3,200	443	543		161
7	161	117	186	98	3,200	352	138	2,450	394	394	36	55
8	161	117	186	81	3,200	186	214	1,890	352	352		161
9	138	98	138	81	2,450	214	161	1,460	440	278		98
10	98	98	117	81	1,770	214	138	1,280	8,100	352		81
11	98	98	138	81	1,370	278	138	1,030	16,400	490		55
12	98	98	138	81	1,110	214	26,100	875	21,800	314		39
13	98	98	117	98	875	161	10,100	730	32,900	245		33
14	98	98	117	117	660	161	2,900	730	22,500	186	5.9	28
15	117	98	117	81	543	161	1,280	730	13,500	186		98
16	117	98	117	81	490	117	1,890	600	7,850	138		314
17	117	98	117	81	352	117	1,190	2,020	7,600	138		394
18	98	117	98	98	314	117	800	1,370	9,500	117		19,200
19	81	117	98	98	314	81	543	1,280	5,980	81		2,020
20	81	214	98	98	245	81	490	950	4,900	67		950
21	81	352	98	98	245	81	2,160	800	3,800			490
22	98	800	98	98	314	81	1,660	730	3,050			352
23	98	730	98	98	245	81	1,190	600	2,300		3.0	314
24	81	490	98	98	214	81	950	543	1,770			245
25	98	314	98	161	278	81	1,560	600	1,370			214
26	98	245	117	245	245	81	8,100	543	1,110	36		186
27	98	490	98	490	214	81	66,900	660	875			214
28	81	440	81	490	214	117	29,400	543	660			186
29	98	352	98	394	-------	117	26,500	490	543			161
30	81	352	98	314	-------	98	22,900	352	440			161
31	81	-------	98	278	-------	98	--------	352	--------			--------

NOTE.—Gage readings doubtful and mean discharge estimated July 21–31, Aug. 1–13, 15–31, and Sept. 1–4.

Monthly discharge of Brazos River at Waco, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	161	81	114	6,980
November	800	98	226	13,500
December	278	81	138	8,490
January	490	81	146	9,000
February	3,200	214	772	42,900
March	440	81	183	11,300
April	66,900	117	6,950	414,000
May	25,700	352	2,980	183,000
June	32,900	245	5,750	342,000
July	1,280	----------	241	14,800
August	----------	----------	16.9	1,040
September	19,200	----------	885	52,600
The year	66,900	----------	1,520	1,100,000

BRAZOS RIVER NEAR COLLEGE STATION, TEX.

LOCATION.—At Jones Bridge, 4 miles below Munson Shoals, 6 miles southwest of College Station, Brazos County, and 19 miles above mouth of Yegua River.

DRAINAGE AREA.—38,500 square miles (revised measurement on topographic maps; map of Texas, scale 1:500,000; and progressive military maps of United States Army).

RECORDS AVAILABLE.—February 23, 1918, to September 30, 1923.

GAGE.—Chain gage on upstream handrail of bridge installed April 18, 1922; read by Lamar McRae.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of sand and mud; shifting. Location of control not known. Banks high and free from vegetation. Right bank subject to overflow at extremely high stages (about 40 feet).

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 33.2 feet at 6 p. m. April 13 (discharge, 56,300 second-feet); minimum stage, 3.5 feet 7 a. m. August 23 to 7 a. m. August 26 (discharge, 112 second-feet).

1918–1923: Maximum stage recorded, 53.0 feet 1 to 3 a. m. September 12, 1921 (discharge not determined); minimum discharge, 92 second-feet September 4, 1918.

DIVERSIONS.—No important diversions above or below station.

REGULATION.—None. A lock and dam is being constructed by the War Department about 25 miles upstream, which may eventually regulate the flow during extremely low stages.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 40,000 second-feet and poorly defined from 40,000 to 114,000 second-feet. Gage read to tenths twice daily. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Brazos River near College Station, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 18	J. T. L. McNew		345	Apr. 1	J. T. L. McNew	7.76	2,470
Nov. 22	do	5.1	570	22	do	11.0	7,070
Dec. 14	do	4.9	704	May 16	do	7.81	2,010
Jan. 30	do	5.2	661	July 15	T. A. Slack	5.48	851
Mar. 7	do	6.2	1,220	Sept. 6	J. T. L. McNew	4.8	496

Daily discharge, in second-feet, of Brazos River near College Station, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	440	460	945	440	825	1,630	2,380	22,500	1,080	1,350	245	127
2	400	420	915	440	715	1,140	1,920	21,900	1,010	1,490	260	146
3	400	460	945	440	825	885	1,490	21,100	855	1,210	275	166
4	400	505	885	380	885	1,010	1,350	18,800	798	1,490	245	945
5	400	505	855	380	945	1,210	945	16,900	742	1,490	245	825
6	400	505	855	460	885	1,210	855	12,100	742	1,210	290	482
7	400	742	770	420	1,350	1,210	855	10,600	742	1,210	290	440
8	400	742	825	380	1,350	1,350	945	9,920	742	1,350	290	660
9	400	528	770	400	3,140	1,490	855	8,840	742	1,210	275	1,350
10	380	528	688	440	2,700	1,280	855	8,480	798	1,080	230	1,080
11	380	528	578	440	2,540	770	915	7,340	798	945	202	825
12	380	360	660	440	2,380	885	15,300	7,180	15,500	770	184	578
13	380	1,080	605	400	2,080	770	52,800	7,020	16,900	715	164	528
14	380	798	660	380	1,630	715	40,300	4,310	20,600	660	164	420
15	380	632	605	380	1,490	715	31,000	2,150	15,700	798	164	482
16	380	688	605	380	1,490	715	20,800	2,080	10,600	825	164	482
17	380	632	605	340	1,350	605	15,100	2,150	8,480	688	164	420
18	340	578	605	340	1,210	605	13,000	2,460	9,740	1,210	144	1,080
19	340	688	605	340	1,080	550	10,600	2,460	9,560	505	126	5,480
20	340	632	578	380	915	550	9,740	2,300	7,660	440	126	6,860
21	340	632	578	380	915	505	9,560	1,920	5,750	885	127	6,700
22	340	632	578	688	945	460	7,340	1,630	4,870	360	127	23,200
23	340	578	578	632	1,630	420	11,900	1,560	4,000	400	112	4,100
24	340	578	578	632	2,080	420	5,480	1,460	3,140	400	112	3,230
25	340	945	550	605	1,920	460	4,750	1,350	2,700	440	112	1,490
26	380	1,140	550	340	2,460	605	4,640	1,080	2,300	380	120	945
27	340	1,210	550	420	1,420	825	19,400	825	2,080	305	166	440
28	340	945	550	420	1,560	13,200	41,600	825	2,150	260	186	360
29	380	885	550	420	-------	12,600	31,300	885	1,920	260	186	770
30	380	945	528	605	-------	9,740	25,100	945	1,780	275	166	688
31	420	-------	528	825	-------	3,800	---------	945	--------	260	136	-------

NOTE.—Discharge estimated Oct. 19–23, when no gage-height records were obtained, and May 24, because of doubtful gage readings.

Monthly discharge of Brazos River near College Station, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	440	340	375	23,100
November	1,210	360	683	40,700
December	945	528	667	41,000
January	825	340	451	27,700
February	3,140	715	1,530	84,700
March	13,200	420	2,010	124,000
April	52,800	855	12,800	760,000
May	22,500	825	6,580	405,000
June	20,600	742	5,150	306,000
July	1,490	260	802	49,300
August	290	112	187	11,500
September	23,200	127	2,180	130,000
The year	52,800	112	2,770	2,000,000

BRAZOS RIVER AT ROSENBERG, TEX.

LOCATION.—On Rosenberg-Richmond highway bridge at Rosenberg, Fort Bend County, 3 miles above mouth of Jones Creek.

DRAINAGE AREA.—44,000 square miles (measured on topographic maps, map of Texas, scale 1:500,000, and progressive military maps of United States Army).

RECORDS AVAILABLE.—October 1, 1922, to September 30, 1923. Records of stage have been obtained by the United States Weather Bureau since July 1, 1914.

GAGE.—United States Weather Bureau's chain gage attached to downstream handrail of the bridge; read by G. W. Nelson.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge to which gage is attached.

CHANNEL AND CONTROL.—Bed of stream consists of sand; shifts. Channel straight 400 feet above and 700 feet below station. Right bank clean, high, of sand and clay. Left bank above bridge is medium in height and wooded, and below bridge is clean and high and subject to overflow at extremely high stages. Control is a stretch of the channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 29.4 feet April 15 (discharge 54,900 second-feet, determined from slight extension of curve and subject to slight error); minimum stage, 1.03 feet August 27–29 (discharge, 530 second-feet, determined from extension of rating curve and subject to slight error).

The United States Weather Bureau reports a stage of 56.4 feet, present gage datum, at 11 p. m. December 9, 1913.

DIVERSIONS.—No important diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 325 to 44,000 second-feet and extended above to cover the range of stage for the year. Gage read to tenths once daily. Daily discharge determined by shifting-control method. Records fair.

COOPERATION.—Gage-height record furnished by the United States Weather Bureau.

Discharge measurements of Brazos River at Rosenberg, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 5	C. E. McCashin	7.05	5,450	May 14	Bebeau and McCashin	6.58	4,560
Aug. 21	Trigg Twichell	3.03	1,220	July 9	C. E. Ellsworth	4.17	2,350
Sept. 27	Slack and McCashin	2.19	848	Aug. 10	Trigg Twichell	1.35	666
Jan. 31	C. E. McCashin	3.20	1,500	Sept. 13	Twichell and Breeding	2.65	1,470

Daily discharge, in second-feet, of Brazos River at Rosenberg, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	765	685	1,330	845	1,330	14,200	27,800	36,700	2,640	2,840	885	3,450
2	765	1,750	1,330	845	1,120	11,900	20,200	31,400	2,560	2,560	845	1,560
3	765	1,620	1,220	845	975	10,200	16,700	29,000	2,160	2,380	845	1,560
4	765	1,500	1,120	845	930	8,160	16,500	26,700	1,950	2,300	765	1,620
5	685	805	1,220	845	1,880	6,380	11,800	23,500	1,750	2,160	765	1,680
6	685	845	1,120	805	4,600	4,840	10,700	18,600	1,820	1,750	765	1,880
7	685	805	930	805	3,780	4,240	8,000	16,100	1,680	2,300	765	1,750
8	1,120	765	1,220	805	3,560	3,560	8,160	12,900	1,560	2,300	765	1,680
9	1,120	765	1,120	805	3,670	2,930	7,390	10,700	2,090	2,380	765	1,560
10	1,120	805	1,120	805	3,340	2,740	7,090	8,000	2,470	2,160	685	1,380
11	1,060	845	1,120	805	2,470	2,470	8,320	6,800	2,090	2,020	685	1,280
12	1,060	975	1,020	805	1,950	2,380	24,900	5,860	1,820	1,820	685	1,220
13	1,060	1,060	1,020	765	5,470	2,230	37,200	5,210	11,800	1,680	685	1,500
14	1,020	3,340	1,020	765	5,210	2,230	46,900	4,600	13,600	1,680	685	1,380
15	1,020	10,200	1,020	765	4,840	1,950	54,900	4,240	18,200	1,680	685	1,500
16	1,120	6,660	1,020	765	4,480	1,880	52,800	3,890	23,500	1,440	605	1,220
17	1,120	3,560	1,020	765	4,000	1,820	47,400	3,130	19,100	1,560	565	1,220
18	1,060	2,230	1,020	765	4,000	1,820	33,800	5,210	14,400	1,500	565	1,120
19	1,020	1,950	930	765	3,670	1,750	30,900	5,470	10,700	1,380	565	1,280
20	930	1,880	845	765	3,240	1,500	28,500	6,800	6,940	1,280	565	6,380
21	885	1,680	845	765	2,740	1,440	25,300	6,250	10,700	1,160	565	6,800
22	765	1,680	845	845	2,640	1,380	21,300	5,730	9,990	1,060	565	10,700
23	765	1,620	930	1,330	2,470	1,280	20,000	4,960	7,840	1,020	565	9,480
24	765	1,560	930	3,890	2,470	1,280	17,800	4,600	6,380	1,020	565	6,940
25	725	1,280	930	3,450	2,380	1,220	14,400	4,360	5,860	975	565	5,990
26	765	1,120	930	3,340	3,780	1,220	14,800	4,000	5,470	930	565	5,600
27	765	1,220	930	2,930	9,990	4,000	14,400	3,670	4,840	930	530	4,960
28	765	1,330	1,020	2,380	20,200	20,000	11,000	3,450	4,120	930	530	3,890
29	765	1,680	1,020	2,090	-------	34,100	26,700	2,930	3,560	930	530	3,030
30	805	1,330	930	1,680	-------	33,800	41,700	2,840	3,240	930	685	2,300
31	805	-------	930	1,440	-------	30,500	-------	2,740	-------	885	3,130	-------

Monthly discharge of Brazos River at Rosenberg, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,120	685	888	54,600
November	10,200	685	1,920	114,000
December	1,330	845	1,030	63,500
January	3,890	765	1,290	79,600
February	20,200	930	3,970	221,000
March	34,100	1,220	7,080	435,000
April	54,900	7,090	23,600	1,400,000
May	36,700	2,740	10,000	616,000
June	23,500	1,560	6,830	406,000
July	2,840	885	1,610	99,100
August	3,130	530	740	45,500
September	10,700	1,120	3,200	190,000
The year	54,900	530	5,150	3,720,000

CLEAR FORK OF BRAZOS RIVER AT CRYSTAL FALLS, TEX.

LOCATION.—At Walker-Caldwell Water Co.'s pumping plant, one-fourth mile north of Crystal Falls, Stephens County, 1 mile above mouth of Hubbard Creek, and 10 miles north of Breckenridge.

DRAINAGE AREA.—4,320 square miles (measured on topographic maps and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—November 12, 1921, to September 30, 1923.

GAGE.—Vertical staff on right bank, opposite pumping plant; read by pump man.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge, 500 feet below gage.

CHANNEL AND CONTROL.—Right bank high and fairly clean; left bank wooded and is overflowed during extremely high stages. Control is formed by concrete dam about 800 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage during year, 14.10 feet at 6 a. m. April 26 (discharge not determined). No flow for long periods.

1921–1923: Maximum stage, 18.25 feet at 10.30 p. m. April 30, 1922 (discharge not determined). No flow for several periods each year.

DIVERSIONS.—Large part of ordinary flow diverted for municipal use and mining purposes.

REGULATION.—Low-water flow partly regulated by dam above gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined from 0 to 3,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except when stage was beyond limits of rating curve, as noted in footnote to daily-discharge table. Records for low and medium stage good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Clear Fork of Brazos River at Crystal Falls, Tex., for the year ending September 30, 1923

Day	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1				576	84	12	3,130	40	28	8	
2		16		3,130	76	12	2,210	40	28	8	60
3		12		2,210	60	22	1,080	46	28		40
4		12		1,530	60	28	690	40	28		276
5		25		300	60	28	666	382	28		332
6		28		158	60	28	576	224	28		252
7		28		60	60	28	382	576	28		238
8		28		60	52	28	300	472	28		217
9		28		60	46	22	1,080	472	22		99
10		25		60	40	22	2,040	2,830	22		40
11		25		60	40	28	1,380		22		22
12		25		60	28	690	940	3,130	22		16
13		25		52	28		690	2,590	28		12
14		16		52	28		554	2,210	28		12
15		8		46	28	3,130	300	2,380	22		12
16	10	8		46	28	678	158	1,870	16		14
17	12			46	22	2,830	114	576	16		43
18	8			52	22	1,380	60	300	16		40
19	8		8	52	22	690	60	224	12		28
20	6		19	52	16	348	60	158	22		16
21	8		28	52	16	300	52	104	22		6
22			28	60	16		46	60	22		
23			34	60	16	2,380	46	52	22		
24			28	60	16	1,080	60	46	22		
25			28	60	12		52	46	16		
26		8	22	60	28		52	40	16		
27	8	8	28	104	22		52	34	16	810	
28	8	8	16	104	16		46	34	16	28	
29	8	8	60		16		46	34	12	16	
30	8	8	60		14		46	34	8	8	
31			576		12		40		8	6	

NOTE.—Gage height, in feet, for days when stage was beyond limits of ratings curve and discharge not determined as follows: Apr. 13, 2.90; Apr. 14, 3.10; Apr. 22, 2.48; Apr. 25, 8.10; Apr. 26, 13.30; Apr. 27, 10.50; Apr. 28, 11.80; Apr. 29, 10.08; Apr. 30, 8.50; and June 11, 3.00. No flow: Oct. 1 to Nov. 15, Nov. 22–26, Dec. 1, 17–25, Dec. 31 to Jan. 18, Aug. 3–26, Sept. 1, and 21–30.

Monthly discharge of Clear Fork of Brazos River at Crystal Falls, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0	0	0	0
November	12	0	2.80	167
December	28	0	11.3	692
January	576	0	30.2	1,850
February	3,130	46	329	18,300
March	84	12	33.7	2,070
April		12		
May	3,130	40	549	33,700
June		34		
July	28	8	21.0	1,290
August	810	0	28.5	1,750
September	332	0	59.2	3,520

LITTLE RIVER AT CAMERON, TEX.

LOCATION.—At McCowan Bridge at Cameron-Rockdale highway crossing, 1 mile above Gulf, Colorado & Santa Fe Railroad bridge, 2 miles southeast of Cameron, and 6½ miles below mouth of San Gabriel River.

DRAINAGE AREA.—7,030 square miles (revised measurement on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military map of United States Army).

RECORDS AVAILABLE.—November 1, 1916, to September 30, 1923.

GAGE.—Chain gage attached to upstream handrail of bridge, installed September 30, 1922; prior to that date a vertical and inclined staff attached to trees on left bank 200 feet below city pumping plant. Gage read by Tracy Hobson. Relation between gages not known except at a 4-foot stage by new gage; old gage reads 2.0 feet less.

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

CHANNELL AND CONTROL.—Bed composed of rock, boulders, sand, gravel, and clay; fairly permanent. Right bank, rock, high and overflowed at extremely high stages. Left bank, clay and gravel, slightly wooded, and water flows through a draw at a stage of 27 feet and over the road at a stage of 31.5 feet. A rough rock and gravel shoal 20 feet below gage serves as control for low and medium stages; may shift. During extremely high stages on Brazos River backwater may reach gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 33.2 feet at 8.35 a. m. April 13 (discharge, 21,500 second-feet, determined by extension of rating curve and estimated flow in overflow channel and subject to error); minimum stage 3.22 feet, August 22 (discharge, 29 second-feet, determined from extension of rating curve and subject to error).

1917–1923: Maximum stage recorded, 49.5 feet at 2.30 p. m. September 10, 1921 (discharge, 647,000 second-feet, determined by slope method, using value of 0.035 for "n" in Kutter's formula); minimum discharge, 2.6 second-feet at 7 a. m. September 3, 5, and 7, 1918.

DIVERSIONS.—Numerous small diversions are made for irrigation and municipal uses, but such diversions have little effect on flow at station, except during extremely low stages. Records of the Board of Water Engineers for the State of Texas show that about 2,500 acres have been declared irrigated above station. No diversions of consequence below station. During time of low flow water pumped by Cameron Power & Light Co. affects flow at this station.

REGULATION.—Slight effect by pumping for city of Cameron.

ACCURACY.—Stage-discharge relation permanent, except that extremely high stages of Brazos River may cause backwater at this point. Rating curve well defined from 150 to 11,500 second-feet; extended below 150 second-feet by estimation and above 11,500 second-feet on basis of a slope measurement at gage height 49.5 feet (647,000 second-feet). Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage height to rating table, except as noted in footnote to daily discharge table. Records for medium stages good, and only fair for low and high stages.

Discharge measurements of Little River at Cameron, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.ft.*			*Feet*	*Sec.ft.*
Oct. 1	Slack and McCashin	4.08	167	Sept. 23	Armstrong and Saunders	12.29	3,150
Nov. 5	Trigg Twichell	4.13	176	23	do	11.76	2,990
28	C. E. Ellsworth	4.60	316	24	do	9.67	2,010
Apr. 2	J. J. Bebeau	4.46	a 319	24	do	8.58	1,660
July 14	T. A. Slack	4.25	197	25	J. L. Saunders	6.20	868
Sept. 21	Armstrong and Saunders	15.71	4,680	25	do	5.86	755
22	do	13.83	3,810	26	do	5.34	550
22	do	14.50	4,120	26	do	5.24	520

a Poor measurement.

Daily discharge, in second-feet, of Little River at Cameron, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	171	121	212	131	140	299	359	4,150	561	642	66	121
2	158	121	198	131	145	270	270	4,750	390	1,030	66	121
3	158	158	198	131	212	240	255	5,660	374	529	60	121
4	145	198	184	131	240	226	240	6,200	344	467	60	145
5	145	184	171	131	212	212	226	5,550	314	529	53	96
6	143	184	171	131	212	284	212	3,190	299	436	48	498
7	140	171	171	131	299	758	198	1,590	299	436	48	791
8	135	198	171	131	270	498	184	1,280	299	467	43	626
9	133	198	158	131	498	436	171	1,140	284	498	39	398
10	133	171	158	131	498	344	158	1,060	1,240	498	39	171
11	126	145	158	119	359	314	374	995	4,000	405	39	126
12	121	158	145	119	270	255	7,560	893	1,200	329	39	126
13	121	145	145	119	255	240	21,500	791	692	255	39	126
14	121	158	140	119	212	240	16,900	758	626	212	39	171
15	121	158	126	119	212	240	8,880	893	1,340		37	212
16	117	158	145	119	198	226	6,540	2,100	1,280		35	278
17	113	184	145	117	240	212	7,080	1,100	1,650		35	344
18	110	198	140	117	240	212	7,020	791	2,020		35	2,420
19	113	198	126	117	226	198	6,480	659	2,140		32	4,400
20	113	198	133	117	226	171	5,820	593	1,900		32	4,500
21	110	184	133	121	344	158	3,820	561	1,420		31	4,500
22	110	184	133	135	1,030	145	2,700	561	893	139	29	4,050
23	110	184	131	128	1,450	145	1,940	561	659		32	2,920
24	110	184	131	128	498	135	1,620	529	529		34	1,800
25	119	255	131	128	374	135	1,730	467	436		35	791
26	121	467	131	128	374	226	3,100	467	390		35	529
27	121	436	131	117	467	1,030	5,300	467	329		36	405
28	121	314	131	117	374	5,820	4,050	436	299		39	344
29	121	270	131	135	-------	5,200	4,700	405	270		37	284
30	121	226	131	145	-------	791	4,350	436	255	66	35	255
31	121	-------	131	140	-------	467	-------	692	-------	66	121	-------

NOTE.—Discharge interpolated June 17, July 1, 8, September 9, 16, 23, and 30; gage not read. Discharge Apr. 13 and 14 estimated upon basis of extension of rating curve and estimated flow in overflow channel. Discharge July 15–29 estimated by comparison with records for other stations, because gage was not read.

Monthly discharge of Little River at Cameron, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	171	110	127	7,780
November	467	121	204	12,100
December	212	126	150	9,200
January	145	117	126	7,760
February	1,450	140	360	20,000
March	5,820	135	649	39,900
April	21,500	158	4,120	245,000
May	6,200	405	1,600	98,600
June	4,000	255	891	53,000
July	1,030		289	17,800
August	121	29	43.5	2,670
September	4,500	96	1,060	62,800
The year	21,500	29	797	557,000

COLORADO RIVER BASIN

COLORADO RIVER AT BALLINGER, TEX.

LOCATION.—Half a mile below Hutchins Avenue highway bridge, two-thirds mile below Gulf, Colorado & Santa Fe Railroad bridge at Ballinger, Runnels County, half a mile above mouth of Elm Creek. Prior to December 20, 1922, station was at Hutchins Avenue highway bridge, half a mile upstream.

DRAINAGE AREA.—16,800 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—December 11, 1915, to September 30, 1923. Records of stage have been obtained at Hutchins Avenue gage by the United States Weather Bureau since July 1, 1903.

GAGE.—Staff gage in five sections on right bank, read by Lennis Brown, installed December 20, 1922, half a mile downstream from chain gage previously used at Hutchins Avenue highway bridge. Gage at present site read by Lennis Brown; former gage read by A. J. Voelkel. Relation between present and former gages not known.

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

CHANNEL AND CONTROL.—Banks consist of clay and gravel; medium height and wooded; subject to overflow at extremely high stages. Bed composed of hard clay, sand, gravel, and rock; shifting. Control is rock shoal one-third mile below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during years, 24.81 feet at 7 a. m. April 25 (discharge not determined); minimum discharge, 0.50 second-foot August 10–12 and 17–19.

1916–1923: Maximum stage recorded, 26.0 feet during night of April 26, 1922 (discharge, 28,000 second-feet, determined from extension of rating curve and subject to large error). No flow during several periods.

DIVERSIONS.—During low stages a large part of flow is diverted a few miles above station for irrigation. Records of the Board of Water Engineers for the State of Texas show that about 6,900 acres have been declared irrigated above station.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation not permanent prior to December 19, when station was moved downstream. Rating curve used October 1 to December 18 is fairly well defined below 16,000 second-feet, and curve used December 19 to September 30 is fairly well defined below 1,000 second-feet and poorly defined from 1,000 to 14,000 second-feet. Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage height to rating table; shifting-control method used October 29 to December 18. Records poor prior to December 18; records after that date good for low and medium stages and poor for high stages.

Discharge measurements of Colorado River at Ballinger, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 8	Ellsworth and Slack	0.47	1.23	Mar. 15	T. A. Slack	1.31	8.48
Nov. 22	T. A. Slack	.30	7.21	May 26	C. E. Ellsworth	1.70	58.6
Dec. 20	R. G. West	*1.26	4.85				

* New gage half a mile downstream set to new datum.

Daily discharge, in second-feet, of Colorado River at Ballinger, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.8	3.0	13	2.0	317	49	73	831	89	2,610	4.4	25
2	1.8	3.3	14	2.0	92	39	49	533	64	224	4.4	4,580
3	1.8	3.5	13	2.0	34	34	39	427	73	64	1.4	256
4	1.8	3.8	14	2.0	19	31	31	327	49	39	.9	128
5	1.8	3.8	15	2.0	24	27	34	270	42	26	.8	64
6	1.8	3.3	16	2.0	35	21	26	229	95	15	1.0	64
7	1.8	2.8	17	2.0	26	19	21	1,030	71	9.8	.8	69
8	1.7	2.8	18	1.5	34	17	17	1,160	78	12	.7	95
9	1.6	3.0	20	1.6	24	17	14	1,860	71	9.8	.6	71
10	1.6	3.3	21	1.8	19	16	1,030	964	1,710	6.8	.5	52
11	1.6	3.5	20	1.8	17	12	615	587	1,780	8.0	.5	36
12	1.6	284	16	1.8	12	12	12,800	376	3,090	3.2	.5	242
13	1.6	18	13	1.8	12	11	2,000	379	2,230	1.2	.8	128
14	1.6	8.4	13	1.9	8.0	11	2,300	203	1,100	26	.7	36
15	1.6	9.8	13	1.7	8.0	8.0	1,160	158	587	45	.6	25
16	1.8	1,620	11	1.7	28	5.6	587	506	454	50	.6	21
17	1.8	185	10	1.7	69	14	352	506	289	31	.5	19
18	1.8	44	9.1	1.6	31	5.0	270	284	207	21	.5	13
19	2.0	23	8.0	1.7	21	8.0	224	190	143	13	.5	12
20	2.1	13	6.8	1.8	16	4.4	8,860	139	107	6.8	.7	376
21	2.2	13	5.6	3.2	14	5.0	1,350	107	83	1.5	.9	170
22	2.3	11	5.0	6.8	12	5.0	1,030	86	64	1,350	.7	36
23	2.5	8.4	4.4	5.0	15	4.4	702	143	50	615	1.0	57
24	2.4	8.4	4.4	5.0	38	3.2	454	864	39	98	1.4	39
25	2.4	9.1	4.4	5.0	170	3.2	16,600	117	39	39	26	26
26	2.4	9.8	4.4	5.0	120	5.6	10,700	71	29	50	298	21
27	2.3	10	4.4	5.0	78	12	13,400	52	26	45	2,080	15
28	2.1	11	3.2	5.0	89	8.9	3,090	42	18	35	615	11
29	2.2	12	3.2	5.0	-------	18	1,930	49	15	28	59	7.4
30	2.8	13	2.6	5.0	-------	35	1,220	44	13	25	71	5.6
31	3.2	-------	2.0	2,080	-------	21	-------	132	-------	17	36	-------

Monthly discharge of Colorado River at Ballinger, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	3.2	1.6	2.0	123
November	1,620	2.8	78.2	4,660
December	21	2.0	10.5	644
January	6.8	1.5	69.9	4,300
February	317	8.0	49.4	2,740
March	49	3.2	15.6	957
April	16,600	14	2,700	161,000
May	1,860	42	409	25,100
June	3,090	13	423	25,200
July	2,610	1.2	178	11,000
August	2,080	.5	104	6,370
September	4,580	5.6	223	13,300
The year	16,600	.5	352	255,000

COLORADO RIVER AT MARBLE FALLS, TEX.

LOCATION.—At steel highway bridge, one-fourth of a mile south of Marble Falls, Burnet County, and 10 miles below mouth of Sandy Creek.

DRAINAGE AREA.—36,100 square miles (revised measurement on topographic map and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1923. Miscellaneous discharge measurements were made in 1902. Records of stage have been obtained by the United States Weather Bureau since January 1, 1908.

GAGE.—Chain gage on upstream side of bridge. United States Weather Bureau weight and tape gage on upstream side of bridge was used from October 1, 1916, to October 5, 1922. Both gages to same datum. Read by M. M. Galloway.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock. Banks composed of rock, gravel, and clay; wooded, and not subject to overflow. Rapids just below gage serve as fairly permanent control, except at times when sand and gravel collect.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.25 feet at 6.40 a. m. May 5 (discharge not determined); minimum stage, 0.59 foot at 6 a. m. August 20 (discharge, 55 second-feet, subject to error due to influence of wind on tape).

1900–1923: Maximum stage,[1] 23.9 feet April 7, 1900 (discharge not determined). No flow August 7, 8, and 11–25, 1918, caused by storing water above gage.

DIVERSIONS.—Several large projects have been proposed in the drainage basin above station, but none has been developed. Numerous small diversions for irrigation and municipal uses are made above station. Total amount diverted not known. Records of the Board of Water Engineers for the State of Texas show that about 36,000 acres have been declared irrigated by diversions above station. Little water is diverted between Marble Falls and Austin.

REGULATION.—None of importance, except possibly during extremely low stages.

[1] United States Weather Bureau "Daily River Stages."

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from below 6,000 second-feet and poorly defined above, owing to inability to read gage accurately on account of surge and inaccuracies in measurements due to high velocities and submerged drift. Gage read to hundredths twice daily, though influence of wind on the long gage chain and surge of water at high stages probably introduce some error. Daily discharge below 6,000 second-feet determined by applying mean daily gage height to rating table. Records fair for low stages. Discharge above 6,000 second-feet as published in previous reports is subject to large error and should be used with caution.

Discharge measurements of Colorado River at Marble Falls, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 5	C. E. Ellsworth	1.38	210	Nov. 20	McCashin and West	5.00	5,130
Nov. 17	McCashin and West	1.94	428	Apr. 14	Pritchett and Twichell	9.6	[a]26,900
18	do	8.32	[a]17,200	15	do	10.2	[a]32,600
19	do	9.18	[a]22,800				

[a]Surface velocities observed and drift timed over part of measurement and coefficient used to reduce to mean velocities. Surge made gage height doubtful.

Daily discharge, in second-feet, of Colorado River at Marble Falls, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	205	230	438	268	438	2,050	805	-------	3,330	324	252	2,230
2	214	228	413	268	438	3,120	848	5,930	2,050	5,930	286	1,060
3	216	230	388	268	388	2,140	762	4,190	1,430	-------	219	585
4	216	225	366	268	3,120	1,800	762	3,330	1,300	2,700	177	762
5	208	366	344	268	1,880	1,570	688	2,700	2,230	1,800	163	1,060
6	205	344	344	252	1,180	2,230	618	2,410	1,500	1,430	131	3,220
7	187	304	344	252	1,000	1,430	688	2,140	1,800	1,000	129	3,220
8	154	522	324	268	848	1,430	897	2,230	1,120	897	135	4,190
9	150	438	324	268	725	1,240	725	2,900	1,000	1,120	129	3,010
10	154	366	304	268	688	1,060	848	5,020	762	653	128	3,330
11	158	324	286	252	653	848	2,700	3,930	725	465	107	2,410
12	163	286	304	268	585	805	-------	3,120	618	324	120	2,140
13	163	304	286	286	522	762	-------	2,700	2,410	344	107	1,800
14	154	286	286	268	522	725	-------	2,140	-------	304	105	3,010
15	168	286	286	252	465	653	-------	1,720	5,620	286	98	2,140
16	168	304	286	252	585	585	-------	1,430	3,930	182	93	1,300
17	168	465	304	252	653	552	-------	1,300	2,700	236	92	1,120
18	163	-------	286	252	725	522	-------	1,060	1,800	222	95	-------
19	182	-------	304	236	1,240	522	5,320	1,060	1,300	185	105	4,740
20	214	-------	304	268	1,720	492	3,930	1,000	1,060	192	77	-------
21	208	2,320	286	268	1,240	465	4,740	1,300	946	168	160	-------
22	222	1,570	286	268	1,000	465	5,620	2,800	805	156	203	3,330
23	252	1,180	268	304	946	438	-------	2,500	725	139	168	2,320
24	225	897	286	304	1,060	438	5,320	3,450	552	145	128	2,410
25	252	725	286	344	1,180	438	5,620	2,900	492	141	118	1,800
26	211	585	268	805	1,430	465	-------	3,930	366	139	131	1,300
27	236	552	268	725	1,570	585	-------	2,320	366	236	324	1,000
28	233	465	286	552	1,570	688	-------	1,880	344	438	848	848
29	225	438	268	465	-------	897	-------	1,570	324	618	2,320	762
30	252	438	268	388	-------	1,120	-------	1,240	286	438	-------	688
31	268	-------	268	388	-------	1,120	-------	-------	-------	344	2,900	-------

NOTE.—Discharge above 6,000 second-feet not sufficiently accurate for publication. The following are the stages, in feet, for days for which discharge is not given: Nov. 18, 6.0; Nov. 19, 9.0; Nov. 20, 5.4; Apr. 12, 7.0; Apr. 13, 10.1; Apr. 14, 9.5; Apr. 15, 10.6; Apr. 16, 7.7; Apr. 17, 6.1; Apr. 18, 6.0; Apr. 23, 8.4; Apr. 26, 7.6; Apr. 27, 9.0; Apr. 28, 11.8; Apr. 29, 13.7; Apr. 30, 14.1; May 1, 9.0; May 31, 6.2; June 14, 6.5; July 3, 6.2; Aug. 30, 5.2; Sept. 18, 9.9; Sept. 20, 6.9; and Sept. 21, 6.0.

Monthly discharge of Colorado River at Marble Falls, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	268	150	200	12,300
December	438	268	308	19,000
January	805	236	324	19,900
February	3,120	388	1,010	56,300
March	3,120	438	1,020	62,800
May 2-30	5,930	1,000	2,560	147,000

NOTE.—See footnote to daily discharge table.

COLORADO RIVER AT AUSTIN, TEX.

LOCATION.—At Congress Avenue concrete viaduct in Austin, Travis County, half a mile below Shoal Creek and above mouth of Waller Creek, 3½ miles below Austin dam.

DRAINAGE AREA.—38,200 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—February 15, 1898, to September 30, 1923.

GAGE.—Stevens water-stage recorder installed April 26, 1918, used to February 28, 1923, when an Au recorder installed March 1, 1923, on downstream side of pier of viaduct; inspected by engineers from United States Geological Survey.

DISCHARGE MEASUREMENTS.—Made by wading or from upstream side of Montopolis highway bridge, 4 miles below gage.

CHANNEL AND CONTROL.—Channel straight for 1,000 feet above and 500 feet below gage. Right bank of medium height, composed of clay and gravel, improved by city, and subject to overflow; left bank resembles right bank, except that it is high and nearly vertical in places. Bed composed of rock, gravel, and sand; shifts. Control is gravel and rock shoal 500 feet below gage; changes during high water, and also during low water because of removal of sand for municipal use.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 13.04 feet at 5.30 a. m. May 1 (discharge, 50,200 second-feet); minimum discharge, 92 second-feet at 4.15 a. m. August 22.

1898–1923: Maximum stage recorded, 33.5 feet a few minutes after failure of dam, which occurred at 11.30 a. m. April 7, 1900 (discharge, 236,000 second-feet, determined from extension of rating curve and subject to considerable error). At time of failure depth of water over crest of dam was 11.07 feet, with a computed discharge of 151,000 second-feet.

According to information obtained from people living near Congress Avenue Bridge, water rose 6.1 feet as result of failure of dam. Therefore gage height corresponding to discharge of 151,000 second-feet was 27.4 feet. According to a statement by Mr. W. P. Johnson, who was in charge of power plant at dam, flood appeared to be practically at its crest when dam failed. Minimum stage, —0.18 foot at 6 p. m. August 18, 1918 (discharge, 13 second-feet).

DIVERSION.—Records of the Board of Water Engineers for the State of Texas show that approximately 36,000 acres of land have been declared irrigated by diversions above station. Most of the area irrigated is in the upper basin of the main stream and adjacent to large tributaries. Little water is diverted between Austin and Columbus.

REGULATION.—Flow entirely regulated at times by operation at Austin Dam, about 3½ miles upstream. Neither sluice gates, crest gates, nor power plant at dam were in operation during years ending September 30, 1919–1923. Capacity of reservoir about 24,000 acre-feet.

ACCURACY.—Stage-discharge relation not permanent. Numerous measurements made throughout year. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory, except for short breaks in record, as noted in footnote to daily discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder charts by inspection or by use of planimeter, except as noted in footnote to daily discharge table; shifting-control method used August 31 to September 30. Records good.

Discharge measurements of Colorado River at Austin, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 4	Trigg Twichell	0.50	275	Mar. 14	Trigg Twichell	1.12	828
19	do	.24	174	Apr. 2	do	1.31	1,230
Nov. 2	do	.80	470	May 3	Bebeau and Twichell	3.32	6,670
17	do	.69	408	21	Trigg Twichell	1.36	1,240
27	do	1.11	793	June 5	do	1.50	1,550
Dec. 20	do	.58	340	19	do	1.89	2,340
Jan. 6	do	.54	289	July 12	Slack and Twichell	1.07	754
20	Elliott and Twichell	.51	276	27	Trigg Twichell	.24	164
Feb. 9	do	1.32	1,200	Aug. 20	Twichell and Breeding	.05	106
27	Trigg Twichell	1.44	1,340	Sept. 15	do	1.81	2,290

Daily discharge, in second-feet, of Colorado River at Austin, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	332	388	570	339	490	1,600	1,110	44,000		420	463	3,320
2	319	463	520	301	454	1,800	1,150	17,200	1,530	480	374	2,300
3	289	446	500	283	500	2,780	1,100	7,140		3,490	307	1,650
4	260	374	472	277	500	2,680	1,030	4,860		8,820	255	1,750
5	260	381	463	289	714	2,100	1,060	3,800	1,460	4,620	220	1,400
6	255	353	454	289	2,100	2,010	825	3,200	1,710	2,300	187	1,390
7	236	367	454	301	1,580	2,030	825	2,800	1,840	1,900	183	2,400
8	218	395	412	283	1,390	2,420	798	2,500	1,840	1,420	175	4,340
9	199	395	367	289	1,170	1,940	840	2,350	1,560	1,270	144	3,760
10	187	480	332	277	945	1,560	994	2,480	1,200	1,130		3,730
11	187	570	325	295	825	1,400	1,400	3,700	1,010	1,010		3,010
12	183	550	374	295	762	1,200	4,410	4,210	840	738		3,120
13	175	480	313	295	714	994	14,000	3,290	774	560		2,650
14	183	388	319	319	624	810	23,500	3,070	714	463		2,580
15	187	353		295	591	960	23,000	2,620	6,790	438	124	2,550
16	175	339		283	613	679	25,300	2,120	5,920	381		2,750
17	203	381	322	271	635	624	12,800	1,820	3,800	325		2,480
18	161	367		283	657	702	9,240	1,600	3,070	307		4,180
19	150	10,400		289	679	500	7,320	1,420	2,260	289		19,900
20	164	17,200	325	283	726	463	5,920	1,330	1,730	250	104	9,600
21	172	7,140	313	313	1,560	500	4,660	1,240	1,390	250	102	11,600
22	195	3,400	307	339	1,730	500	4,550	1,170	1,130	215	102	10,000
23	240	2,260	283	289	1,310	602	5,920	1,970	977	207	110	5,250
24	207	1,710	255	277	1,150	560	12,800	3,010	810	195	109	3,150
25	245	1,310		301	1,270	560	7,660	5,390	702	179	140	2,930
26	255	1,040		339		591	6,440	3,890	624	164	140	2,500
27	255	870	290	374	1,390	798	12,400		550	161	158	2,010
28	235	714		624	1,500	786	19,900		540	168	195	1,580
29	245	624		702	-------	738	37,000	2,750	560	191	183	1,370
30	250	591	325	624	-------	825	47,500		446	277	840	1,150
31	446	-------	346	550	-------	977	-------		-------	510	4,970	-------

NOTE.—Daily discharge from one staff gage reading Oct. 6, 9, 10, 11, Feb. 24, 27, and 28. Discharge partly estimated Dec. 30, 31, and Jan. 12, owing to incomplete record; discharge estimated Oct. 7 and 8, Dec. 15–19, 25–29, Feb. 18, 25, and 26. Discharge estimated by comparison with the Weather Bureau gage heights May 27 to June 4 and Aug. 10–19.

Monthly discharge of Colorado River at Austin, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	446	150	228	14,000
November	17,200	339	1,820	109,000
December	570	----------	358	22,000
January	702	271	341	21,000
February	2,100	454	995	55,200
March	2,780	463	1,180	72,800
April	47,500	798	9,850	586,000
May	44,000	1,170	4,710	289,000
June	6,790	446	1,680	99,900
July	8,820	161	1,070	65,700
August	4,970	102	344	21,200
September	19,900	1,150	4,010	239,000
The year	47,500	102	2,200	1,590,000

EVAPORATION NEAR AUSTIN, TEX.

LOCATION.—At reservoir on Hill ranch, 1,000 feet from ranch house, 5 miles southeast of Austin, Travis County. Elevation, 475 feet above sea level.

RECORDS AVAILABLE.—April 1, 1916, to September 30, 1923.

EQUIPMENT.—Two evaporation pans, one floating on surface of reservoir about 30 feet wide by 250 feet long, which is supplied by spring, and the other on land about 30 feet from reservoir; auxiliary equipment consists of hook gage, rain gage, anemometer, maximum and minimum thermometers, and psychrometer.

ACCURACY.—Moss and weed growth in reservoir may at times affect results. Record from land pan more accurate than that from floating pan. Observations made daily at 8 a. m. Observer's work good.

COOPERATION.—Computations made by United States Weather Bureau.

Evaporation near Austin, Tex., for the year ending September 30, 1923

Month	Temperature (° F.)					Mean relative humidity (per cent)	Wind		Rainfall (inches)	Evaporation (inches)	
	Air		Water				Average velocity (miles per hour)	Prevailing direction		Floating pan	Land pan
	Mean maximum	Mean minimum	Mean	Floating pan (mean)	Land pan (mean)						
October	84.0	52.5	68.2	64.5	59.6	72.1	1.9	East	2.27	a4.554	6.026
November	69.5	48.3	58.9	58.7b	55.2b	84.4	2.5	North	1.74	a1.591	a2.734
December	70.4	43.1	56.8	52.8	51.7b	77.6b	3.0	do	.17	2.397	2.731
January	73.0	44.5	58.8	53.0	51.4a	76.4a	2.9	do	.56	a2.273	3.460
February	58.3a	41.4	49.8	51.0c	48.5b	89.4b	4.1	----------	5.87	a2.869	a2.120
March	67.4	43.7	55.6	54.7	51.6b	80.3b	4.5	North	3.16	a2.971	a5.268
April	76.8	56.3	66.6	66.8	63.4	89.3	2.2	East	5.66	a3.896	4.808
May	87.3	63.7	75.5	74.3	69.2	80.2	1.5	South	1.27	5.851	7.334
June	94.1	71.6	82.8	80.2	77.8	82.1	1.1	do	.18	6.385	7.957
July	96.0	71.7	83.8	81.2	77.1	78.1	1.0	do	1.20	6.839	8.737
August	97.0	71.9	84.4	83.4	77.2	79.8	1.0	do	.77	7.387	8.980
September	88.6	69.4	79.0	77.7	74.4	89.1	.7	East	3.98	3.644	4.978
The year	80.2	56.5	68.4	66.5	63.1	81.6	2.2	----------	26.83	50.657	65.133

a Estimated.

NOTE.—Letters following figures indicate number of days missing: a, 1 day; b, 2 days; etc.

COLORADO RIVER AT COLUMBUS, TEX.

LOCATION.—At county highway bridge, half a block from county jail, 400 feet below Galveston, Harrisburg & San Antonio Railway bridge, in eastern edge of Columbus, Colorado County.

DRAINAGE AREA.—40,800 square miles (revised measurement on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military maps of United States Army).

RECORDS AVAILABLE.—January 1, 1903, to December 31, 1911; May 22, 1916, to September 30, 1923.

GAGE.—Gurley graph water-stage recorder, inspected by J. H. Hastedt or L. Hastedt.

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

CHANNEL AND CONTROL.—Channel straight above and below station for 400 feet. Right bank composed of firm earth; high, and not subject to overflow. Left bank of medium height and is overflowed above a gage height of 34 feet. Bed of stream sandy; shifts. A sand and gravel section 350 feet below gage may serve as low-water control; stage-discharge relation during medium and high stages may be controlled by a bend in river below bridge.

EXTREMES OF DISCHARGE.—Maximum stage during year, estimated from graph drawn from Weather Bureau records, 28 feet on the afternoon of May 2 (discharge, 44,600 second-feet); minimum discharge, 260 second-feet December 29 and 30.

1902–1911; 1916–1923: Maximum stage, from water-stage recorder, 38.3 feet at 3 p. m. May 5, 1922 (discharge, 79,500 second-feet, determined from extension of rating curve and subject to error); minimum stage, 4.2 feet September 9 and 10, 1910 (discharge, 10 second-feet).

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted for irrigation in the drainage basin above Austin, but between Austin and Columbus little water is diverted. Station is above irrigated rice belt, which comprises several thousand acres. Records of the Board of Water Engineers for the State of Texas show that about 36,000 acres have been declared irrigated above Austin.

REGULATION.—Flow at Columbus during low stages partly controlled by storage at Lake Austin.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used October 1 to April 17 fairly well defined below 65,000 second-feet, and curve used April 18 to September 30 well defined from 100 to 65,000 second-feet. Operation of water-stage recorder not satisfactory, owing to changes in channel. Mean daily gage heights obtained from recorder graph by inspection or by use of planimeter, except October 1 to July 10 and July 15–17, which were obtained from graph based on one reading daily by the United States Weather Bureau. Daily discharge ascertained by shifting-control method. Records poor.

COOPERATION.—Record of gage heights furnished by United States Weather Bureau October 1 to July 10 and July 15–17.

Discharge measurements of Colorado River at Columbus, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 8	R. G. West	8.08	727	July 10	C. E. Ellsworth	9.32	2,370
Jan. 31	C. E. McCashin	7.54	517	Aug. 9	Trigg Twichell	6.59	461
Apr. 5	J. J. Bebeau	8.81	1,640	Sept. 13	S. D. Breeding	10.18	3,040
May 14	do	11.26	4,270				

Daily discharge, in second-feet, of Colorado River at Columbus, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	400	895	1,250	340	556	3,000	2,350	35,800	2,320	895	380	674
2	400	675	1,050	340	556	2,200	2,100	43,600	2,280	895	376	585
3	432	675	745	340	591	2,060	2,350	33,400	2,410	1,970	384	3,000
4	535	675	633	340	766	2,060	1,880	15,400	4,800	1,520	495	3,110
5	535	675	850	312	918	2,060	1,620	9,110	3,550	1,020	575	4,670
6	535	710	812	285	994	2,150	1,540	6,700	2,550	1,820	560	3,000
7	535	820	775	285	842	2,780	1,370	5,360	1,970	5,500	510	2,460
8	465	782	668	312	918	2,400	1,330	4,670	1,710	3,790	465	2,550
9	432	675	640	370	1,450	2,200	1,170	4,150	1,670	2,900	490	2,700
10	400	675	535	400	1,920	2,060	970	3,440	1,860	2,320	440	2,900
11	400	675	465	500	1,620	2,100	1,450	2,700	1,860	1,900	418	3,670
12	400	675	465	500	1,410	2,200	6,980	2,600	1,820	1,630	404	3,550
13	400	970	465	465	1,150	2,100	15,800	2,900	1,520	1,520	384	3,110
14	400	1,700	400	370	1,230	2,350	13,600	4,280	1,300	1,340	368	3,220
15	400	970	400	370	1,150	1,580	14,000	4,280	1,200	1,160	352	3,440
16	340	820	400	370	1,190	1,490	20,000	3,550	1,120	1,020	336	2,460
17	340	820	370	312	1,490	1,250	21,600	3,220	1,410	895	324	2,410
18	312	782	285	340	1,340	1,090	19,900	2,900	5,500	800	316	3,440
19	285	675	312	340	1,110	1,050	11,800	2,450	4,670	740	313	3,330
20	285	675	312	340	1,010	1,050	9,110	2,100	3,670	710	306	6,700
21	285	2,560	312	340	1,040	970	7,870	1,900	3,110	862	313	12,900
22	285	10,200	312	465	2,780	1,010	6,700	1,780	2,500	704	310	11,200
23	285	5,750	312	640	10,200	895	5,650	1,780	1,970	628	302	10,200
24	285	3,660	312	500	4,280	820	5,360	1,560	1,710	634	292	8,390
25	312	2,890	312	420	2,670	820	6,400	1,480	1,445	656	285	5,950
26	400	2,460	285	420	3,220	820	10,400	1,780	1,370	550	278	4,410
27	400	2,060	260	420	4,150	5,600	7,870	3,000	1,230	505	285	3,440
28	400	1,620	260	420	4,780	26,000	6,860	4,410	1,090	475	368	3,110
29	400	1,330	285	420	-------	19,000	12,000	3,790	992	455	4,540	2,700
30	432	1,330	285	358	-------	6,660	22,200	3,910	895	422	3,000	2,280
31	640	-------	340	420	-------	3,440	-------	2,800	-------	404	1,120	-------

Monthly discharge of Colorado River at Columbus, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	640	285	399	24,500
November	10,200	675	1,660	98,900
December	1,250	260	487	30,000
January	640	285	389	23,900
February	10,200	556	1,980	110,000
March	26,000	820	3,400	209,000
April	22,200	970	8,070	480,000
May	43,600	1,480	7,120	438,000
June	4,800	895	2,180	130,000
July	5,500	404	1,310	80,600
August	4,540	278	622	38,300
September	12,900	585	4,190	249,000
The year	43,600	260	2,640	1,910,000

COLORADO RIVER AT WHARTON, TEX.

LOCATION.—At highway bridge in western edge of Wharton, Wharton County, 200 feet below Galveston, Harrisburg & San Antonio Railway bridge.

DRAINAGE AREA.—41,200 square miles (revised measurement on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military maps of United States Army).

RECORDS AVAILABLE.—July 12 to August 31, 1916, July 3 to August 18, 1917, July 11 to August 4, 1918, and April 19, 1919, to September 30, 1923.

GAGE.—Gurley graph water-stage recorder attached to pier of highway bridge near left bank, installed March 19, 1919.

DISCHARGE MEASUREMENTS.—Made from highway or railway bridge.

CHANNEL AND CONTROL.—Channel straight above and below station for a few hundred feet. Bed composed of sand and clay, and subject to shift. Banks medium in height, composed of clay, and subject to overflow during extremely high stages. At a gage height of 34 feet water enters a channel above station known as Caney Creek and flows thence to Gulf of Mexico. The Colorado River raft, several miles below station, probably serves as control for all stages.

EXTREMES OF DISCHARGE.—Maximum stage, from water-stage recorder, 29.5 feet at 4 p. m. May 3 (discharge, 29,300 second-feet, determined from extension of rating curve); minimum stage, 6.62 feet from 3 to 7 p. m. August 25 (discharge, 176 second-feet, ascertained from extension of rating curve and subject to error).

1916–1923: Maximum stage recorded during periods of record, 40.7 feet from 9 a. m. to 6 p. m. May 6, 1922 (discharge not determined); minimum stage, 4.35 feet at 12.46 p. m. August 27, 1921 (discharge, 45 second-feet, ascertained from extension of rating curve and subject to error).

DIVERSIONS.—Station is in area of rice irrigation, roughly estimated to cover 75,000 acres, about one-third of which is irrigated by diversions from Colorado River between Columbus and Wharton, and the remaining two-thirds by diversions below Wharton. During periods of maximum demands practically the entire flow is diverted, unless the river is above ordinary stage.

REGULATION.—Flow at low and medium stages is regulated to some extent by storage in Lake Austin at Austin, Tex.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well-defined from 500 to 4,000 second-feet, and extended parallel to the old curve to cover range of stage. Operation of water-stage recorder satisfactory, except for short breaks in record. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control method, except as noted in footnote to daily discharge table. Stage-discharge relation affected by backwater from the "raft." Records fair.

Discharge measurements of Colorado River at Wharton, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 7	R. G. West	8.28	1,010	July 9	C. E. Ellsworth	11.69	3,800
Jan. 30	C. E. McCashin	7.35	533	Aug. 10	Trigg Twichell	7.37	284
Apr. 4	J. J. Bebeau	10.36	2,650	Sept. 12	Twichell and Breeding	11.45	3,800
May 14	Bebeau and McCashin	11.45	3,040				

Daily discharge, in second-feet, of Colorado River at Wharton, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	504	676	1,430	541	504	3,980	3,430	21,600	2,920	1,570	279	
2	495	1,130	1,370	520	520	3,650	2,540	26,400	2,360	1,370	224	
3	487	910	1,280	520	584	1,970	2,360	28,800	2,450	1,220	190	
4	483	700	1,190	512	800	1,740	2,540	22,400	2,450	1,540	541	
5	512	652	1,100	512	992	1,710	2,090	11,900	3,870	1,970	198	
6	584	676	1,050	508	992	1,680	1,930	8,270	3,320	1,640	216	2,440
7	584	676	1,020	512	938	1,930	1,820	6,470	2,630	2,540	230	
8		700	965	508	855	2,180	1,050	5,390	2,180	4,550	254	
9		725	910	487	855	2,010	1,570	4,550	2,090	3,650	286	
10		700	855	479	882	1,930	1,460	3,980	2,010	3,120	279	
11	461	652	855	479	1,310	1,890	1,710	3,540	1,970	2,720	286	
12		629	800	475	1,430	1,930	8,660	3,220	1,970	2,270	276	3,760
13		652	775	479	1,370	1,890	20,800	3,020	1,970	2,090	263	3,760
14	459	725	775	471	1,250	1,740	19,200	3,220	1,970	1,970	254	3,540
15	447	1,310	700	447	1,190	1,600	11,800	4,090	1,740	1,740	242	3,430
16	439	1,160	700	439	1,100	1,430	16,200	3,870	1,680	1,500	251	3,760
17	416	1,020	652	443	1,080	1,430	17,900	3,430	1,540	1,370	251	3,220
18	400	965	629	443	1,190	1,250	19,600	3,320		1,220	251	3,020
19	385	910	606	439	1,220	1,130	14,600	3,020		1,100	257	3,430
20	373	828	606	455	1,100	1,130	10,200	2,820	3,180	992	254	3,540
21	309	750	584	459	1,100	1,100	8,660	2,540		910	230	8,790
22	312	4,790	562	483	1,570	1,020	7,360	2,360	3,020	855	210	11,100
23	340	8,530	584	512	5,390	965	6,470	2,220	2,720	828	201	
24	366	5,390	584	562	8,790	938	5,510	2,220	2,360	775	184	
25	400	3,540	562	606	4,200	910	5,030	2,090	2,050	725	181	
26	420	2,820	584	606	3,120	855	7,360	2,010	1,890	629	254	8,840
27	420	2,360	562	584	3,320	3,220	9,180	2,090	1,820	606	302	
28	451	1,970	562	562	3,540	18,300	6,970	3,120	1,780	541	299	
29	467	1,780	562	562	-------	22,900	7,620	4,090	1,570	500	323	3,320
30	471	1,600	562	541	-------	12,600	12,500	3,540	1,570	400	2,920	3,120
31	520	-------	520	512	-------	5,750	-------	3,540	-------	344	2,920	-------

NOTE.—Braced figures show estimated mean discharge for periods indicated. Discharge partly estimated because of incomplete gage-height record, Oct. 14, Dec. 22, 23, July 7 and 12, Aug. 11, Sept. 12, 21, 22, 29, and 30.

Monthly discharge of Colorado River at Wharton, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	-------	309	445	27,400
November	8,530	629	1,660	99,000
December	1,430	520	790	48,600
January	606	439	505	31,100
February	8,790	504	1,830	102,000
March	22,900	855	3,440	212,000
April	20,800	1,050	7,940	472,000
May	28,800	2,010	6,550	403,000
June	-------	-------	2,350	140,000
July	4,550	344	1,520	93,700
August	2,920	181	429	26,400
September	-------	-------	4,590	273,000
The year	28,800	181	2,660	1,930,000

NORTH CONCHO RIVER AT SAN ANGELO, TEX.

LOCATION.—At county concrete viaduct in San Angelo, Tom Green County, 1 mile above confluence of North Concho and South Concho Rivers.

DRAINAGE AREA.—1,800 square miles (revised measurement on topographic maps and maps compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—October 27, 1915, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder attached to left side of web of third pier of viaduct from left bank, installed September 1, 1920; inspected by B. W. Wynn.

DISCHARGE MEASUREMENTS.—Made from second highway bridge upstream from gage or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock, which is to some extent covered in high-water channel with grass and moss; permanent. Channel straight for 800 feet above and 400 feet below gage. Banks are sloping, composed of rock and clay, and not subject to overflow except during high floods. About 20 feet below gage and at downstream side of viaduct is a concrete dam about 4½ feet high, which before the viaduct was constructed served as part of low-water crossing. This dam forms an artificial control and insures a permanent stage-discharge relation. Backwater probably occurs at this station when Concho River reaches a stage of 25 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year ending September 30, 1923, from water-stage recorder, 2.55 feet at 11 a. m. April 24 (discharge, 1,730 second-feet, partly estimated and subject to error). No flow for several periods.

1916–1923: Maximum stage from water-stage recorder, 19.3 feet at 7.30 p. m. April 26, 1922 (discharge not determined; backwater from North Concho River probably existed). No flow for several periods during record.

DIVERSIONS.—Records of the Board of Water Engineers for the State of Texas show that about 600 acres have been declared irrigated by diversions from North Concho River, all above station.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation permanent during year ending September 30, 1923, except from January 16 to May 5, when part of control was temporarily removed. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory during period that control was intact. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of a planimeter, or by averaging discharge for fractional parts of a day, except as noted in footnote to daily discharge table. Records fair.

Revised records of daily discharge for years ending September 30, 1918–1922, and monthly discharge for entire period of record are given in the tables which follow. The changes in the records are due principally to a revision of the rating curve for high stages.

Discharge measurements of North Concho River at San Angelo, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 9	Ellsworth and Slack		0	Oct. 20	Crosnoe and Fiedler	[b] 0.48	1.52
Mar. 14	T. A. Slack	[a] −3.04	2.03	Dec. 1	Fiedler and Morgan	.41	[c] 1.0
May 25	C. E. Ellsworth	.72	5.61				

[a] Dam which forms control cut to allow water to pass, changing stage-discharge relation.
[b] Point of zero flow, 0.26 foot ±0.02 foot.
[c] Estimated.

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the years ending September 30, 1918–1923

Day	May	June	July	Sept.	Day	May	June	July	Sept.
1918					1918				
1					16		2.4	186	
2					17	2,190	1.2	10	
3					18	126	.8	5.6	
4	264	222			19	38	.5	3.1	
5	210	44			20	7.1	.4	1.6	
6	38	10		3.8	21	4.2	.3	.9	
7	7.9	32		138	22	3.1	.2	.2	
8	5.1	540		6.3	23	1.9	.1		
9	3.1	174		4.2	24	1.1			
10	1.9	32		2.1	25	.5			
11	1.2	9.1		.8	26	.3			
12	.8	6.3		.4	27	.3			
13	.1	4.2		.1	28	.2			
14	.1	70			29	.1			
15		5.6	339		30				
					31				

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1918–19												
1	0	0.4			5.3	2.3	222	32	1.7	132	1.7	9.8
2	0	0			5.3	2.3	967	32	1.3	49	.9	4.5
3	0	0			5.3	2.3	3,900	32	1.1	27	1.3	2.3
4	0	0			4.9	2.3	820	32	1.1	86	1.9	.8
5	0	0			4.5	2.3	460	30	.5	132	1.7	.2
				2.0								
6	0	0			4.5	2.3	331	27	.6	114	.9	0
7	0	394			4.5	2.3	162	44	1,540	49	.6	0
8	0	746			3.9	2.3	132	38	100	1,040	.3	0
9	0	186			3.9	1.9	49	38	3,080	222	.2	0
10	1,810	76			3.9	1.9	49	38	906	9.8	.1	0
11	974	22		1.7	3.9	1.9	44		370	22	.1	0
12	1,110	9.8		1.7	3.9	1.7	38		192	24	0	0
13	76	4.5		1.7	3.9	1.7	38	30	114	11	0	0
14	.1	1.9		1.9	3.9	1.7	38		35	9.8	0	0
15	0	1.9		2.5	3.9	1.7	35		814	7.2	0	0
16	0	1.9	2.0	2.9	3.9	1.7	32	14	910	4.5	0	49
17	0			4.9	3.9	1.7	32	14	192	3.2	0	
18	0			6.2	3.9	1.7	32	9.8	150	1.9	0	
19	0			6.2	3.9	1.7	32	12	415	1.9	0	200
20	242			5.8	3.2	1.7	32	5.3	400	1,220	0	
21	5,170			5.3	3.2	1.7	32	3.9	385	548	0	790
22	2,590			5.3	3.5	1.7	32	2.3	370	102	0	222
23	331			6.2	2.7	1.7	32	2.3	560	35	0	102
24	162	2.0		5.3	2.7	2,200	32	44	278	22	.1	49
25	102			5.3	2.7	3,710	32	27	114	9.8	331	9.8
26	1,230			4.5	2.5	480	32	6.6	61	6.6	415	12
27	2,460			4.5	2.3	162	35	4.5	132	4.5	331	14
28	640			5.8	2.3	132	32	2.9	222	3.9	132	9.8
29	102			4.5		49	32	2.9	210	2.9	76	9.8
30	1.9			6.2		49	32	1.9	132	1.9	22	9.8
31	.4			5.3		162		1.3		1.9	9.8	

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the years ending September 30, 1918–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919–20												
1	9.8	22	22	22	9.8	16	6.6	4.5	1.9	4.9	0	1.9
2	8.5	22	22	22	9.8	16	6.6	4.5	1.9	3.3	0	3.5
3	5.3	22	22	22	9.8	16	6.6	4.5	4.5	3.3	4.1	1.7
4	4.5	22	22	22	9.8	16	6.6	4.5	4.5	1.8	1.2	1.4
5	3.9	22	22	22	9.8	16	9.8	1.3	2.9	1.8	.8	1.5
6	4,620	22	22	22	9.8	16	9.8	.9	1.9	.8	.4	1.4
7	5,860	22	22	22	9.8	16	9.8	.9	1.9	.8	.4	2.5
8	3,460	22	22	22	9.8	16	9.8	.9	1.9	.5	.4	3.6
9	1,600	22	22	22	9.8	16	9.8	.9	1.9	.4	.3	4.7
10	910	22	22	22	9.8	16	9.8	9.8	1.3	.4	.3	5.8
11	442	22	22	22	9.8	16	8.5	9.8	.9	.4	.3	6.9
12	49	22	22	22	9.8	16	8.5	4.5	.9	.4	1.0	7.9
13	49	19	22	22	9.8	16	8.5	2.9	.9	.4	22	6.6
14	730	14	22	22	9.8	16	8.5	1.9	.9	.2	4.1	4.5
15	460	14	22	22	9.8	16	8.5	1.9	.6	.2	49	14
16	162	14	22	22	9.8	16	8.5	1.9	.4	.2	76	16
17	102	14	22	22	9.8	16	7.2	1.9	.4	.1	850	9.8
18	44	14	22	9.8	9.8	16	6.6	1.9	.4	.1	331	6.2
19	91	14	22	9.8	9.8	14	6.6	1.9	65	.1	7.5	3.9
20	102	14	22	9.8	9.8	14	6.6	1.9	22	.1	4.9	2.5
21	210	14	22	9.8	9.8	14	6.6	1.9	13	.1	4.9	1.7
22	370	19	22	22	16	12	5.8	1.9	7.5	.1	13	1.3
23	370	22	22	22	16	12	4.5	1.9	18	0	9.6	1.1
24	370	22	22	22	16	12	4.5	1.9	7.5	0	132	.8
25	76	22	22	22	16	11	4.5	1.9	7.5	0	35	.5
26	49	22	22	22	16	9.8	4.5	1.9	7.5	0	22	.4
27	44	22	22	9.8	16	9.8	4.5	1.9	7.5	0	14	.4
28	35	22	22	9.8	16	4.5	4.5	1.9	5.9	0	9.2	.4
29	27	22	22	9.8	16	4.5	4.5	1.9	4.9	0	4.5	.3
30	22	22	22	9.8	------	9.8	4.5	1.9	4.9	0	4.5	.3
31	22	------	22	9.8	------	8.5	------	1.9	------	0	1.9	------
1920–21												
1	.2	1.2	4.5	8.5	6.2	20	7.9	2.5	0	.2	------	------
2	.2	1.4	3.9	8.5	7.2	14	7.9	1.9	0	.2	------	------
3	.2	1.4	4.9	8.5	6.2	13	7.9	1.5	0	------	------	------
4	.1	1.2	6.2	7.9	6.2	9.8	7.9	1.4	0	------	------	------
5	.1	1.2	6.2	6.6	5.8	9.8	8.5	3.9	0	------	------	------
6	.1	1.1	6.2	7.2	6.2	8.5	9.8	7.2	0	------	------	------
7	.1	1.1	6.6	7.2	6.2	8.5	11	4.9	0	------	------	------
8	.1	1.3	7.2	7.2	6.2	9.8	9.8	7.2	0	------	------	------
9	.1	2.9	7.2	7.2	6.2	9.2	9.8	7.2	48	------	------	------
10	.1	4.5	7.2	7.2	6.2	7.9	9.2	5.8	1.2	------	------	------
11	.1	30	7.2	7.9	6.6	7.2	11	4.5	.7	------	------	------
12	.1	76	7.9	8.5	7.2	7.2	11	6.6	.4	------	------	------
13	0	28	7.2	8.5	7.2	7.2	9.2	3.2	188	------	------	------
14	0	14	7.2	9.2	9.2	7.9	9.2	1.9	54	------	------	------
15	0	12	7.2	8.5	8.5	8.5	8.5	1.8	8.5	------	------	------
16	0	9.2	7.9	8.5	7.9	8.5	7.9	3.2	6.2	------	------	------
17	0	8.5	8.5	8.5	7.9	9.2	7.9	1.8	5.3	------	------	------
18	0	8.5	9.2	9.2	7.9	11	7.9	2.5	3.5	------	------	------
19	0	7.9	9.8	7.9	8.5	19	8.5	2.5	2.3	------	------	------
20	0	6.6	9.8	7.9	8.5	14	8.5	1.9	1.4	------	------	------
21	0	7.2	9.2	7.2	7.9	12	8.5	1.3	2.1	------	------	------
22	.1	9.2	9.8	7.9	8.5	11	8.5	1.1	1.8	------	------	------
23	.8	7.9	9.8	7.9	8.5	11	7.2	.9	1.3	------	------	------
24	185	5.8	9.8	7.2	8.5	8.5	6.6	.8	1.1	------	------	------
25	13	4.5	9.8	7.2	8.5	7.9	5.3	.5	.8	------	------	------
26	4.5	4.5	9.8	7.2	7.9	7.9	4.5	.5	.7	------	------	------
27	2.1	4.5	9.8	6.6	7.9	7.2	3.5	.4	.6	------	------	------
28	1.3	4.2	9.2	6.6	9.8	6.6	3.2	.3	.5	------	------	------
29	1.0	4.9	9.2	6.6	------	6.6	3.2	.2	.4	------	------	------
30	.8	4.9	9.2	6.2	------	6.6	4.5	.2	.3	------	------	------
31	1.1	------	8.5	6.6	------	6.6	------	.1	------	------	------	------

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the years ending September 30, 1918–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1921-22												
1							0	530	24	12	0.4	
2							0	604	18	1,220	.3	
3							2.9	403	188	2,740	.2	
4							.7	168	24	1,860	.2	
5							.5	97	113	523	.1	
6							.3	54	37	210		
7							.2	35	17	120		
8							2,080	27	13	81		
9							91	20	14	69		
10							14	19	12	57		
11							7.2	19	9.8	45		
12							3.2	16	9.8	33		
13							1.7	16	9.3	22		
14							1.3	39	8.2	19		
15							.8	3,330	7.2	16		
16							.6	1,820	6.6	14		
17							.4	1,140	79	12		
18							.4	936	42	11		
19							.4	321	9.8	8.2		0.1
20							.3	162	7.7	7.7		1.2
21							.2	162	57	7.2		.3
22							.2	76	30	5.6		.2
23							.2	44	16	4.0		.1
24							168	38	9.8	4.0		
25							52	32	8.2	3.5		
26							13,900	30	6.6	2.4		
27							11,300	24	4.5	1.8		
28							1,210	20	3.5	1.3		
29							247	39	2.7	.8		
30							144	22	5.2	.7		
31								18		.6		
1922-23												
1			0.1			0.5		4.5	.6			.3
2			.1			3.5	1.5		.4			108
3			.1			3.5		1.5	.3			2.8
4			.1						.2			.7
5			.1					0	.2			.5
6			.1					4.9	.2			.3
7			.1					9.2	.1			.4
8			.1			1.5	.5	9.2	.1			.4
9								9.8	.1			.4
10								11	.1			.4
11								7.9	.1			.4
12								6.2	.1			.3
13								6.6	.1			.7
14						1.0		5.8				1.1
15					0.5			8.5				1.5
16				35			.7	9.2				1.8
17								5.3				.8
18								4.9				.4
19								4.9				.3
20				.4		.6	450	3.2			2.7	.8
21								2.3			.8	.7
22		0.1						4.2			.4	.5
23		.1					12	27			4.5	.4
24		.1		.3				19				.3
25		.1					286	6.6				.2
26		.1					164	3.5			5.0	.2
27		.1		.2		.7	15	2.5				.1
28		.1						2.3			6.6	0
29		.1					3.0	1.5			1.4	0
30		.1						1.1			.7	0
31				10				.8			.4	

NOTE.—Mean discharge Nov. 17, 1918, to Jan. 10, 1919, estimated because of unreliable gage readings. Braced figures for other periods show estimated mean discharge when no gage readings were obtained. Part of dam forming control was removed and discharge estimated Jan. 16 to May 5, 1923, on basis of one discharge measurement and several measurements of depth of water passing through opening in dam. Discharge also interpolated or estimated for following days: June 20, 21, Nov. 8, 9, 1919, Jan. 1, 2, Sept. 6–12, 1920, April 13–18, July 9–12, 1922, Aug. 23–28, 1923. No flow during periods for which no discharge is given in the years ending Sept. 30, 1918, 1921, 1922, and 1923.

Monthly discharge of North Concho River at San Angelo, Tex., for the years ending September 30, 1916–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1915–16				
October 27–31	6.4	6.4	6.40	63.5
November	6.4	6.4	6.40	381
December	9.2	6.4	6.64	408
January	17	6.4	7.95	489
February	14	11	13.1	754
March	14	8.7	13.2	812
April	790	13	[a]50.2	2,990
May	19	1.8	11.1	682
June	19	0	1.08	64
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
The period				6,640
1916–17				
October	186	0	10.6	652
November	6.3	0	.44	26
December	.1	0	0	0
January	.1	0	0	0
February	2.6	.1	1.15	64
March	3.4	.3	1.35	83
April	2,260	.3	[b]80.5	4,790
May	158	0	6.84	421
June	1,030	0	[c]39.3	2,340
July	24	0	1.27	78
August	0	0	0	0
September	142	0	20.1	1,200
The year	2,260	0	13.3	9,640
1917–18				
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0	0	0	0
May	2,190	0	93.7	5,760
June	540	0	38.5	2,290
July	339	0	17.6	1,080
August	0	0	0	0
September	138	0	5.19	309
The year	2,190	0	13.0	9,440
1918–19				
October	5,170	0	548	33,700
November	746	0	49.1	2,920
December			2.00	123
January	6.2		3.67	226
February	5.3	2.3	3.79	211
March	3,710	1.7	225	13,900
April	3,900	32	259	15,400
May		1.3	20.9	1,280
June	3,080	.5	390	23,200
July	1,220	1.9	126	7,750
August	415	0	42.8	2,630
September	790	0	69.8	4,150
The year	5,170	0	146	105,000

[a] Revised discharge for Apr. 14, 1916, is 790 second-feet; no change for remainder of month.
[b] Revised discharge for Apr. 18, 1917, is 2,260 second-feet; no change for remainder of month.
[c] Revised discharge for June 3 and 4, 1917, is 1,020 and 106 second-feet, respectively; no change for remainder of month.

Monthly discharge of North Concho River at San Angelo, Tex., for the years ending September 30, 1916–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919–20				
October	5,860	3.9	655	40,300
November	22	14	19.7	1,170
December	22	22	22.0	1,350
January	22	9.8	18.5	1,140
February	16	9.8	11.5	662
March	16	4.5	13.7	842
April	9.8	4.5	7.04	419
May	9.8	.9	2.71	167
June	65	.4	6.71	399
July	4.9	0	.66	39
August	850	0	51.8	3,180
September	16	.3	3.78	225
The year	5,860	0	68.7	49,900
1920–21				
October	185	0	6.81	419
November	76	1.1	9.19	547
December	9.8	3.9	7.94	488
January	9.2	6.2	7.67	472
February	9.8	5.8	7.48	415
March	20	6.6	9.75	600
April	11	3.2	7.81	465
May	7.2	.1	2.57	158
June	188	0	11.0	655
July	.2	0	.01	.6
August	0	0	0	0
September	0	0	0	0
The year	188	0	5.82	4,220
1921–22				
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	13,900	0	974	58,000
May	3,330	16	331	20,400
June	188	2.7	26.4	1,570
July	2,740	.6	229	14,100
August	.4	0	.04	2.4
September	1.2	0	.06	3.8
The year	13,900	0	130	94,100
1922–23				
October	0	0	0	0
November	.1	0	.03	1.8
December	.1	0	.03	1.6
January	----------	0	1.59	97.8
February	----------	----------	.50	27.8
March	----------	----------	1.09	67.2
April	----------	----------	32.9	1,960
May	27	0	6.01	370
June	.6	0	.09	5.2
July	0	0	.00	0
August	----------	0	1.21	74.3
September	108	.0	4.16	248
The year	----------	0	3.94	2,850

NOTE.—Monthly discharges for years ending Sept. 30, 1916–1922, supersede the records published in previous reports. See "Accuracy."

CONCHO RIVER NEAR SAN ANGELO, TEX.

LOCATION.—Half a mile below confluence of North Concho and South Concho Rivers, 1¾ miles southeast of San Angelo, Tom Green County.

DRAINAGE AREA.—4,490 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—September 17, 1915, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder, installed August 9, 1917, on right bank, 1,500 feet below an old ford; inspected by B. W. Wynn.

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

CHANNEL AND CONTROL.—Bed composed of solid rock and gravel. Channel straight for 1,000 feet above and below station. Right bank rocky, wooded, and not subject to overflow; left bank of medium height, composed of clay and gravel, covered with scattered trees, subject to overflow at high stages. Rapids just below gage serve as control for medium and low stages, but affected by moss; location of control for high stages not known.

EXTREMES OF DISCHARGE.—Maximum stage during year ending September 30, 1923, from water-stage recorder, 9.6 feet at noon April 23 (discharge, 5,800 second-feet); minimum stage, 0.23 foot at 6 p. m. November 6 (discharge, 0.7 second-foot).

1915–1923: Maximum stage, 36.8 feet, April 26, 1922 (discharge, 139,000 second-feet, determined from extension of rating curve); no flow November 29, 1921.

DIVERSIONS.—Flow at low stage materially affected by diversions above station. About a mile above mouth of South Concho River a storage dam has been constructed by the San Angelo Light & Power Co. for waterworks. Records of the Board of Water Engineers for the State of Texas show that about 11,000 acres have been declared irrigated by water diverted above station and about 3,500 acres by diversions below station.

REGULATION.—Storage at dam of San Angelo Light & Power Co. has slight effect on flow at station; no regulation of consequence on North Concho River.

ACCURACY.—Stage-discharge relation permanent during year ending September 30, 1923. Rating curve well defined for all stages. Operation of water-stage recorded not satisfactory, as shown in footnote to daily discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by means of planimeter, or by averaging discharge for fractional parts of a day. Records for 1923, fair.

Discharge for certain high-water periods in years ending September 30, 1915–1922, have been revised as result of revision of rating curve on basis of recent high-water discharge measurements. The tables of daily discharge which follow give the revised discharge for the periods affected in the years ending September 30, 1915–1918, and complete records for 1919–1922.

Discharge measurements of Concho River near San Angelo, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 9	T. A. Slack	0.32	0.81	Mar. 14	T. A. Slack	1.61	67.7
Nov. 21	do	1.06	18.0	May 25	C. E. Ellsworth	1.29	31.5

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for revised periods in years ending September 30, 1915–1918

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
1915		1916		1917		1918	
Sept. 24	2,490	Sept. 1	640	June 3	595	June 4	870
Oct. 18	66	2	1,990			10	535
				1918		11	645
1916		1917		May 17	4,150	14	845
Apr. 14	900	Apr. 18	1,360	18	4,640		

NOTE.—See last paragraph under "Accuracy."

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the years ending September 30, 1919–1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1918–19												
1	0.7	134	14			20	160	23	46	945	57	34
2	1.0	122	14			23	108	21	49		46	28
3	.8	108	18			51	2,510	19	46		38	21
4	.8	90	19			42	980	18	33		37	19
5	.7	84			35	35	272	50	32		31	17
6	.6	78		30		28	146	42	29		16	10
7	1.5	482				6.8	94	57	978		12	8.3
8	1.3	548			29	3.8	74	194	185		6.6	7.9
9	1.4	154			31	3.0	67	103	5,800		4.5	7.6
10	2,190	76			31	3.4	51	57	8,760		4.0	7.9
11	2,290	15			33	3.3	48	759	1,930		266	7.9
12	724	14		25	42	3.7	38	1,140	480		86	7.6
13	152	12		22	28	3.8	33	300	258		37	6.0
14	62	11		24	24	4.0	33	122	188		16	4.2
15	37	9.5		26	24	4.0	27	74	884	700	5.0	156
16	33	8.3		38	25	4.0	23	64	2,390		3.1	974
17	38	7.9	30	44	24	4.7	22	46	500		2.7	404
18	29	7.9		41	24	3.8	21	49	296		3.3	316
19	19	8.3		37	25	6.3	21	67	332		3.7	97
20	991	7.9		36	22	3.8	20	37	580		786	76
21	6,820	6.8		226	24	4.0	21	29	464		227	713
22	3,310	7.4		141	21	5.2	21	28	633		363	516
23	752	7.9		60	21	5.5	20	26	1,980		472	841
24	352	9.1		45	22	1,750	18	1,570	684		78	251
25	204	10		39	21	5,440	18	436	440		327	149
26	1,070	10		38	21	1,990	19	182	504		382	117
27	2,200	11		38	21	508	25	92	2,300		178	103
28	638	12		38	19	230	27	70	1,810	86	86	94
29	304	12		37	-------	130	27	62	738	78	97	92
30	194	13		37	-------	101	25	57	734	74	64	90
31	152	-------		37	-------	166	---------	50	-------	67	44	-------
1919–20												
1	84		74	78	92	80	35	12	10	22	2.2	80
2	82		70	80	92	70	34	12	14	14	5.7	251
3	76		74	82	92	67	38	12	12	10	10	122
4	78	150	78	80	92	65	37	12	15	12	4.2	82
5	74		82	99	92	59	39	12	22	14	3.7	88
6	8,660		82	99	94	60	35	10	44	6.6	3.4	92
7	10,000		84	97	94	65	33	12	37	3.5	3.3	140
8	3,160	120	84	90	92	65	35	12	28	3.8	2.8	188
9	608	101	80	84	90	64	31	11	20	4.0	2.5	149
10	416	84	80	84	94	70	35	26	14	3.5	2.4	105
11	404	82	82	112	94	62	30	16	15	3.7	2.4	
12	424	80	84	112	101	53	23	18	12	5.0	110	
13	265	78	80	101	101	54	22	16	16	3.7	235	
14		80	82	92	97	51	22	18	22	3.5	53	60
15		82	82	90	92	39	26	18	16	3.1	276	
16		86	86	88	86	35	22	19	12	2.5	286	
17		82	88	86	88	33	24	18	16	3.0	487	
18		80	92	84	88	33	22	16	9.1	2.3	140	50
19		76	97	84	88	33	19	16	471	2.5	67	50
20		79	92	86	88	37	18	16	152	2.5	49	48
21		82	90	78	88	34	16	14	68	2.4	82	44
22	350	90	86	97	88	38	14	13	50	2.4	714	44
23		99	84	97	86	45	12	17	1,830	2.3	683	45
24		84	80	92	84	62	18	22	276	2.1	742	42
25		78	80	90	80	41	19	18	108	2.0	223	
26		70	80	90	80	38	19	20	80	2.4	127	
27		72	80	88	84	39	17	16	67	2.4	94	40
28		92	78	88	82	33	15	11	53	2.4		
29		86	80	90	80	36	13	14	45	2.3	80	
30		80	80	90	-------	37	12	14	30	2.5		
31		-------	78	92	-------	38	---------	12	-------	2.4		-------

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the years ending September 30, 1919–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920–21												
1	37	48	51	40	38	74	35	4.7	2.7	12	1.9	244
2	37	45	53	41	39	51	36	8.3	2.3	10	1.9	34
3	36	44	53	44	42	49	37	74	2.3	8	1.9	6.6
4	40	44	51	45	42	45	37	28	2.3	6	1.8	2.4
5	41	44	48	45	41	41	29	15	2.3	3.5	1.8	2.0
6	41	42	49	44	38	37	29	14	2.3	3.2	1.8	2.0
7	44	44	51	41	38	37	29	12	2.3	2.8	1.9	1.9
8	48	49	53	39	38	34	25	14	2.3	2.4	2.0	2.1
9	44	51	53	39	37	30	25	18	2.3	2.2	1.9	2.2
10	45	54	51	40	14	31	24	38	127	2.0	1.9	2.2
11	45	70	51	37	12	30	35	19	647	2.0	2.2	2.0
12	40	127	51	39	12	29	30	16	101	2.2	2.1	2.3
13	37	88	48	42	14	26	26	12	354	2.2	2.1	3.3
14	32	72	46	42	12	25	22	9.1	506	2.2	2.0	4.4
15	30	64	44	42	12	32	14	8.7	140	2.2	2.2	5.2
16	28	59	44	44	10	31	12	10	76	2.1	2.2	5.5
17	32	57	45	44	12	31	12	6.8	54	1.8	2.2	5.0
18	36	60	48	45	12	33	11	8.3	51	2.0	2.2	2.7
19	37	56	48	45	14	64	11	9.1	48	2.0	2.2	2.0
20	33	53	34	44	16	59	11	10	45	2.0	2.2	2.1
21	32	50	39	41	18	49	11	12	41	1.9	2.2	2.1
22	28	50	39	40	19	40	11	12	38	2.0	2.2	2.0
23	30	50	40	41	19	44	9.9	14	35	2.0	2.2	2.0
24	243	50	39	44	19	41	9.5	12	32	2.0	2.3	2.0
25	64	53	40	45	19	41	7.9	9.1	29	2.2	2.3	1.8
26	50	56	39	45	18	39	6.8	7.0	26	2.1	2.3	2.0
27	42	56	39	45	16	37	6.3	4.9	23	2.0	2.3	2.2
28	40	53	40	44	26	37	5.2	4.4	20	2.0	2.3	2.0
29	40	53	40	44	-------	42	4.9	4.0	17	2.1	2.3	2.0
30	41	51	40	41	-------	40	4.3	3.6	14	2.1	2.3	2.0
31	50	-------	40	40	-------	38	-------	3.2	-------	2.0	810	-------
1921–22												
1	2.0	1.7	1.1	1.2	6.1	1.9	2.0		149	63	2.4	2.0
2	2.0	1.6		1.2	6.7	1.8	2.0		112	872	2.3	2.2
3	1.9	1.6		1.2	7.4	1.8	21	3,000	416	6,660	2.3	1.9
4	1.9	1.6		1.2	6.8	1.6	27		178		2.2	2.0
5	1.9	1.6		1.3	7.1	1.6	19		256		2.3	1.9
6	1.8	1.6		1.3	5.5	1.6	9.5	1,780	485		2.1	1.9
7	1.6	1.6		1.4	4.5	1.8	14	1,460	273		2.1	1.6
8	1.6	1.8		1.6	7.4	1.7	12,200	1,230	182	800	2.2	1.5
9	1.6	1.7		1.9	6.3	1.7	703	1,110	154		2.1	1.7
10	1.7	1.8		1.9	3.3	1.6	186	975	127		2.1	3.3
11	1.7	1.7		1.9	2.1	1.7	84	900	117		2.0	1.6
12	1.7	1.6		2.0	1.6	1.7	50	832	112		2.0	1.5
13	1.7	1.6	1.1	1.9	1.8	1.8	32	720	103	37	1.9	1.8
14	1.7	1.8		1.8	1.8	1.8	26	1,270	92	29	1.9	1.6
15	1.7	1.8		2.0	1.7	1.8	25	4,250	88	80	1.8	1.3
16	1.7	1.6		1.9	1.7	1.8	22	3,630	70	68	1.8	1.3
17	1.7	1.6		1.8	1.9	1.8	15	5,300	144	64	2.3	1.2
18	1.7	1.6		1.6	1.9	1.8	11	1,850	163	57	2.3	1.3
19	1.7	1.6		1.6	1.8	1.7	9.1	620	101	11	2.3	5.1
20	1.7	1.5		1.6	2.0	1.8	7.1	345	84	10	2.1	3.7
21	1.7	1.3		1.7	1.8	1.7	6.3	319	125	9.6	1.7	1.9
22	1.7	1.2		1.7	2.0	1.8	9.5	230	97	8.9	1.7	1.6
23	1.7	1.3		1.8	2.1	1.8	12	200	103	8.2	1.8	1.3
24	1.7	1.3	1.2	1.8	1.9	1.8		176	78	7.5	2.2	1.3
25	1.7	1.0	1.3	1.9	2.0	1.9		143	64	6.8	2.1	1.4
26	1.7	.7	1.3	1.9	2.0	2.0	15,000	132	56	6.1	2.0	1.4
27	1.7	.4	1.2	2.7	1.8	2.0		120	50	5.4	1.9	1.3
28	1.7	.2	1.2	3.5	1.9	1.9		110	41	4.7	2.2	1.4
29	1.7	0	1.3	4.2	-------	2.0		111	26	4.0	2.1	1.4
30	1.7	.6	1.3	4.9	-------	1.9		90	72	3.3	2.0	1.2
31	1.7	-------	1.2	5.5	-------	1.9	-------	82	-------	2.6	1.9	-------

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the years ending September 30, 1919–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1922–23												
1	1.2	8.4		20	126	88	60	67	4.4	1.4	1.1	2.9
2	1.2	3.8		18		78	60	67	3.2	307	1.1	612
3	1.1	1.8	20	20		78	57	50	3.0	101	1.1	801
4	1.1	1.4		18		74	54	51	3.5	14	1.1	103
5	1.1	1.3		18		76	49	40	3.2	2.6	1.0	47
6	1.2	1.1	23	19		76	49	53	3.2	1.2	1.0	66
7	1.1	1.2	21	18	56	76	38	67	4.0	1.1	1.0	62
8	1.0	1.2	22	19		76	35	57	4.7	1.3	1.1	38
9	1.0	1.2	22	19		82	25	48	4.9	4.7	1.1	31
10	1.2	1.3	22	18		80	26	50	4.7	3.8	1.1	29
11	1.4		22	14		81	105	39	17	3.2	1.0	32
12	1.5	.8	21	16		68	131	29	5.0	2.6	1.0	33
13	1.3		21	17		72	159	29	6.6	3.2	1.0	30
14	1.3	1.1	20	18		72	115	29	6.8	2.2	1.0	29
15	1.3	2.8	19	16		59	92	19	6.6	2.1	1.0	342
16	1.4	10	21	15	70	56	92	23	6.0	2.3	1.0	1,860
17	1.9	16	21	32		65	88	19	5.7	2.1	1.0	2,060
18	1.9	22	22	22		59	78	19	6.0	1.7	1.1	1,080
19	1.5	18	21	14		65	74	21	4.5	1.2	1.4	192
20	1.5	16	22	17		65	602	19	4.7	1.5	14	101
21	1.4	15	25	19	97	64	192	16	4.5	1.5	2.9	64
22	1.8	17	26	29		57	105	23	3.1	1.4	1.7	48
23	2.3		26	29		56	84	103	2.7	1.4	1,320	39
24	1.5		27	26	82	56	76	119	2.7	1.4	159	35
25	1.2		25	25	80	56	423	34	2.5	1.4	39	36
26	1.2	20	21	25	70	51	292	24	1.7	1.2	19	33
27	1.4		22	25	99	74	143	48	1.5	1.4	368	28
28	1.2		23	25	117	65	114	24	1.3	1.3	60	21
29	1.3		22	25	-------	65	108	11	1.4	1.6	25	20
30	2.0		18	26	-------	65	84	7.4	1.4	1.2	16	17
31	1.8	-------	16	447	-------	62	---------	5.7	-------	1.1	13	-------

NOTE.—Braced figures show estimated mean discharge for the periods indicated, for which no gage-height records were obtained or for which the records were incomplete.

Monthly discharge of Concho River near San Angelo, Tex., for the years ending September 30, 1915–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1915				
September 17–30	2,490	85	318	8,830
1915–16				
October	177	66	106	6,500
November	85	54	72.9	4,340
December	108	72	85.5	5,260
January	98	79	88.6	5,450
February	90	34	67.2	3,870
March	83	24	40.1	2,470
April	900	50	121	7,220
May	83	7.4	41.6	2,560
June	51	2.3	7.02	418
July	6.3	3.1	4.46	274
August	5.3	3.3	4.15	255
September	1,990	17	139	8,260
The year	1,990	2.3	64.5	46,900

Monthly discharge of Concho River near San Angelo, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1916–17				
October	203	15	43.9	2,700
November	43	16	29.4	1,750
December	43	27	36.0	2,210
January	51	38	45.0	2,770
February	48	30	39.1	2,170
March	66	15	35.8	2,200
April	1,360	4.2	66.3	3,950
May	137	3.0	15.3	941
June	595	1.8	26.1	1,550
July	17	1.8	3.64	224
August	4.0	1.3	2.13	131
September	442	2.6	55.4	3,300
The year	1,360	1.3	33.0	23,900
1917–18				
October	4.2	2.2	2.70	166
November	4.2	2.8	3.28	195
December	2.8	1.3	1.90	117
January	16	1.2	6.31	388
February	16	3.6	9.22	512
March	11	3.4	5.93	365
April	5.8	1.8	3.03	180
May	4,640	2.3	346	21,300
June	870	2.3	169	10,000
July	39	.5	4.55	280
August	1.0	.4	.54	33.2
September	41	.5	3.55	211
The year	4,640	.4	46.6	33,700
1918–19				
October	6,820	.6	728	44,800
November	548	6.8	69.2	4,120
December			28.2	1,740
January	226		43.8	2,700
February		19	27.8	1,540
March	5,440	3.0	342	21,000
April	2,510	18	166	9,860
May	1,570	18	188	11,500
June	8,760	29	1,140	67,600
July			627	38,600
August	786	2.7	122	7,500
September	974	4.2	173	10,300
The year		.6	306	221,000
1919–20				
October	10,000		988	60,800
November		70	99.8	5,940
December	97	70	82.2	5,050
January	112	78	90.3	5,550
February	101	80	89.6	5,150
March	80	33	49.5	3,040
April	39	12	24.5	1,460
May	26	10	15.3	941
June	1,830	9.1	119	7,080
July	22	2.0	4.86	299
August	742	2.2	153	9,410
September	251		76.0	4,520
The year	10,000	2.0	150	109,000
1920–21				
October	243	28	45.9	2,820
November	127	42	56.4	3,360
December	53	34	45.4	2,790
January	45	37	42.3	2,600
February	42	10	23.1	1,280
March	74	25	39.9	2,450
April	37	4.3	18.9	1,120
May	74	3.2	13.6	836
June	647	2.3	81.5	4,850
July	12	1.8	3.07	189
August	810	1.8	28.2	1,730
September	244	1.8	11.8	702
The year	810	1.8	34.2	24,700

Monthly discharge of Concho River near San Angelo, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1921–22				
October	2.0	1.6	1.73	107
November	1.8	0	1.37	81.3
December	----------	----------	1.14	70.0
January	5.5	1.2	2.06	127
February	7.4	1.6	3.39	188
March	2.0	1.6	1.79	110
April	----------	2.0	3,950	235,000
May	----------	82	1,390	85,500
June	485	26	137	8,170
July	6,660	2.6	491	30,200
August	2.4	1.7	2.07	127
September	5.1	1.2	1.82	108
The year	----------	0	497	360,000
1922–23				
October	2.3	1.0	1.40	85.9
November	----------	----------	10.1	601
December	----------	----------	21.6	1,330
January	447	14	34.5	2,120
February	----------	----------	73.9	4,100
March	88	51	68.3	4,200
April	602	25	120	7,160
May	119	5.7	39.4	2,420
June	17	1.3	4.35	259
July	307	1.1	15.3	942
August	1,320	1.0	66.4	4,080
September	2,060	17	264	15,700
The year	----------	----------	58.7	43,000

NOTE.—See "Accuracy."

CONCHO RIVER NEAR PAINT ROCK, TEX.

LOCATION.—At Concho, San Saba & Llano Valley Railroad bridge, a quarter of a mile below mouth of Kickapoo Creek and 2 miles northwest of Paint Rock, Concho County.

DRAINAGE AREA.—5,530 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—September 20, 1915, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder attached to downstream end of middle railroad bridge pier, installed September 16, 1920; inspected by engineers of United States Geological Survey or N. N. Skaggs.

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

CHANNEL AND CONTROL.—Bed composed of solid rock. Channel straight for 500 feet above and below gage. Right bank not subject to overflow; left bank of medium height, sloping, wooded, and subject to overflow during high water. Permanent control during low and medium stages is a solid rock shoal 400 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year ending September 30, 1923, September 17 (discharge 2,020 second-feet). No flow October 9–17, June 30 to July 4, and August 1–22.

1915–1923: Maximum stage recorded, 27.5 feet at 11 a. m. April 27, 1922 (discharge not determined). No flow during several periods of every year except 1920 and 1921.

DIVERSIONS.—Records of the Board of Water Engineers for the State of Texas show that about 11,000 acres have been declared irrigated by diversions from Concho River, practically all of which are above station. Flow during low stages is materially affected by diversions.

REGULATION.—Ten storage dams of small capacity are between this station and San Angelo. An abandoned dam 12 feet in height, known as "Four Mile Dam," is 4 miles below San Angelo, and a small dam 8 feet in height has been constructed for storage on Sims ranch just above station. None of the dams appreciably affects the flow by storing water, except during extremely low stages.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 6,000 second-feet and poorly defined between 6,000 and 19,000 second-feet. Operation of water-stage recorder satisfactory, except as noted in footnote to daily discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter; shifting-control method used November 17 to December 16. Records good.

Owing to revision of rating curve for high stages, the records of discharge for certain periods of high water in the years ending September 30, 1919 and 1920, have been revised and are given in the tables which follow.

Discharge measurements of Concho River near Paint Rock, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 8	C. E. Ellsworth	0.62	[a] 0.05	Mar. 15	T. A. Slack	1.60	63.2
Nov. 23	T. A. Slack	1.30	19.3	May 26	C. E. Ellsworth	1.62	65.1
Dec. 21	R. G. West	1.34	27.1				

[a] Estimated.

Daily discharge, in second-feet, of Concho River near Paint Rock, Tex., for high-water periods in years ending September 30, 1919 and 1920

Date	Discharge	Date	Discharge	Date	Discharge
1918		1919		1919	
Oct. 22	6,950	May 24	13,600	Oct. 7	15,800
Nov. 7	7,550	June 9	8,640	8	8,190
1919		10	19,800	22	6,550
Mar. 25	7,550	July 9	7,550		
		Oct. 6	8,640		

NOTE.—See "Accuracy."

Daily discharge, in second-feet, of Concho River near Paint Rock, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.1	6.9	23	27	434	122	56	91	21	0	0	21
2	.1	6.9	23	25	130	96	56	76	17	0	0	135
3	.1	6.0	24	22	78	84	58	67	15	0	0	880
4	.1	5.0	24	22	54	78	56	63	13	0	0	317
5	.1	4.1	26	24	46	71	53	58	12	14	0	1,110
6	.1	3.1	27	24	44	69	51	53	11	19	0	248
7	.1	2.6	26	23	44	67	49	58	9.2	15	0	100
8	.1	2.2	25	23	44	65	48	63	8.3	12	0	116
9	0	2.4	26	23	42	65	45		7.8	10	0	60
10	0	2.4	27	22	42	67	42		6.9	23	0	42
11	0	2.2	26	23	42	67	51		8.4	22	0	43
12	0	2.4	26	24	42	67	132		9.2	13	0	67
13	0	9.5	27	23	46	60	161	42	9.2	9.2	0	42
14	0	11	27	22	48	60	149		6.5	6.5	0	36
15	0	9.2	28	20	45	61	133		5.0	4.4	0	34
16	0	740	28	20	48	54	101		3.8	2.6	0	898
17	0	331	31	21	94	48	96		2.4	.2	0	1,560
18	.1	80	29	22	90	51	96		1.8		0	1,540
19	.2	36	28	23	69	53	82		1.2		0	426
20	.3	27	28	27	60	51	179	25	.7		0	176
21	.2	24	28	28	56	56	556		.6	1.0	0	108
22	.3	22	28	27	56	58	198		.4		0	80
23	.4	20	26	28	51	56	132		.4		.3	60
24	.2	19	30	31	54	53	103	110	.3		556	51
25	.4	19	32	32	60	53	782		.2	1.6	119	44
26	.3	20	31	32	61	53	520	63	.2	1.0	49	39
27	.2	22	31	33	71	56	483	42	.2	.4	40	38
28	.2	22	29	31	106	63	176	34	.1		313	35
29	.2	23	27	31	-------	69	122	35	.1	.2	78	32
30	.5	22	26	31	-------	63	111	35	0		156	29
31	3.8	-------	27	141	-------	63	-------	27	-------		29	-------

NOTE.—Discharge partly estimated, owing to incomplete record, May 8, 26, July 17, 25, 27, and Aug. 4. Discharge estimated by comparison with records for other stations May 9–25, July 18–24, 26, 28–31, and Aug. 1–3.

Monthly discharge of Concho River near Paint Rock, Tex., for the years ending September 30, 1919–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1918–20				
October	6,950	0	1,010	62,100
November	7,550	19	381	22,700
December	62	19	31.0	1,910
January	1,200	25	78.9	4,850
February	165	20	39.9	2,220
March	7,550	3.4	516	31,700
April	5,620	4.3	486	28,900
May	13,600	6.8	757	46,500
June	19,800	37	1,900	113,000
July	7,550	30	614	37,700
August	900	.1	123	7,560
September	1,450	16	239	14,200
The year	19,800	0	516	373,000

Monthly discharge of Concho River near Paint Rock, Tex., for the years ending September 30, 1919–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919–20				
October	15,800	37	1,540	94,800
November	575	96	139	8,270
December	108	83	99.0	6,090
January	124	81	102	6,270
February	103	79	93.2	5,360
March	77	25	53.3	3,280
April	24	11	15.2	904
May	20	9.2	12.2	750
June	2,240	12	148	8,810
July	40	1.4	10.7	658
August	1,630	.8	207	12,700
September	220	37	78.9	4,690
The year	15,800	.8	210	152,000
1920–21				
October	165	33	47.1	2,900
November	119	46	60.2	3,580
December	54	42	47.2	2,900
January	45	40	43.0	2,640
February	42	21	30.0	1,670
March	60	31	42.1	2,590
April	44	7.8	25.2	1,500
May	29	5.7	14.7	904
June	753	3.8	117	6,960
July	11	1.0	3.82	235
August	4.1	.7	2.01	124
September	1,180	.7	52.2	3,110
The year	1,180	.7	40.2	29,100
1921–22				
October	.7	0	0.21	13.1
November	1.0	0	.32	19.0
December	1.0	.6	.80	49.0
January	6.5	.7	1.45	88.9
February	15	1.4	7.22	401
March	1.8	.5	.88	54.0
April	----------	1.2	[c]3,870	231,000
May	----------	141	[b]1,690	104,000
June	188	35	137	8,170
July	----------	----------	[c]553	34,000
August	3.1	0	.66	40.5
September	7.3	0	.49	29.4
The year	----------	0	521	378,000
1922–23				
October	3.8	0	0.26	16.1
November	740	2.2	50.1	2,980
December	32	23	27.2	1,670
January	141	20	29.2	1,800
February	434	42	73.5	4,080
March	122	48	64.5	3,960
April	782	42	163	9,670
May	----------	----------	51.0	3,140
June	21	0	5.73	341
July	23	0	5.22	321
August	556	0	43.2	2,660
September	1,560	21	279	16,600
The year	1,560	0	65.2	47,200

[a] Mean discharge, Apr. 26–29, estimated 20,000 second-feet.
[b] Mean discharge, May 1 and 2, estimated 6,000 second-feet.
[c] Mean discharge, July 3–28, estimated 600 second-feet.

NOTE.—Monthly discharge for years ending Sept. 30, 1919 and 1920, supersede those published in Water-Supply Paper 508, because of a revision of records for certain high-water periods as shown in table on page 50. Monthly discharge for years ending Sept. 30, 1921 and 1922, republished without change except that the records for certain periods in April, May, and July, 1922, were completed, as shown in the above table.

SAN SABA RIVER AT MENARD, TEX.

LOCATION.—At steel highway bridge in Menard, Menard County.

DRAINAGE AREA.—1,150 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1923.

GAGE.—Chain gage attached to floor on downstream side of highway bridge; read by Haskell Howell or Horace Wilson.

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

CHANNEL AND CONTROL.—Channel straight 800 feet above and 100 feet below station; water flows through a series of shoals and ponds; channel somewhat obstructed by reeds and grass. Right bank composed of gravel and clay, wooded, sloping, high, and not subject to overflow. Left bank similar in material, wooded, low, and subject to overflow. A sand and gravel ford just below gage forms a control during low stages; shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.10 feet at 6.30 p. m. September 5 (discharge, 3,900 second-feet, determined from poorly defined curve and subject to error); minimum discharge, 0.2 second-foot August 18.

1915–1923: Maximum stage recorded, 13.6 feet at 2.30 a. m. September 16, 1915 (discharge, 8,610 second-feet, determined from extension of rating curve and subject to large error). No flow July 12–14 and 19–31, August 1–4 and 26–31, 1918.

DIVERSIONS.—Considerable land is irrigated with water diverted above station. Noyes Canal, on right side of river, which serves a considerable area, diverts a short distance above gage. Records of Board of Water Engineers for the State of Texas show that about 4,300 acres have been declared irrigated by diversions above station and about 7,700 acres by diversions below station.

REGULATION.—Flow unregulated by storage or water-power plants, but it is largely controlled at low stages during irrigation season by diversion to Noyes Canal.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 270 second-feet and poorly defined above, being based on one slope measurement at a stage of 12.1 feet with discharge of 6,640 second-feet, using values of 0.050 and 0.030 for n in Kutter's formula, for two parts of the channel. Gage read to hundredths twice daily. Daily discharge determined by shifting-control method. Records fair.

Discharge measurements of San Saba River at Menard, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 7	T. A. Slack	1.89	13.4	Mar. 16	T. A. Slack	2.36	49.0
Nov. 24	do	2.20	29.3	16	do	2.44	46.5
24	do	2.20	39.3	May 20	C. E. Ellsworth	2.18	21.8
Dec. 21	R. G. West	1.93	26.1				

Daily discharge, in second-feet, of San Saba River at Menard, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11	20	38	23	17	100	36	63	26		1.4	2.8
2	10	17	41	22	13	93	43	60	31		.9	98
3	10	13	39	20		154	50	59	20		.5	66
4	11	13	40	19	26	131	59	59	15		.3	786
5	11	13	41	19		98	56	59	14	1.5	2.0	2,960
6	11	29	43	21	40	78	56	36	14		19	823
7	13	31	43	20	40	64	56	31	14		20	355
8	13	31	44	19	39	56	54	30	14		20	238
9	12	31	44	17	39	51	34	30	14	1.1	20	143
10	11	31	45	17	39	46	32	30	14	1.3	20	73
11	11	31	45	17	38	46	1,110	29	17	1.3	18	715
12	11	31	36	17	38	45	72	29	17	2.7	2.3	616
13	10	31	26	18	37	45	49	29	17	2.7	2.1	125
14		31	23	16	37	43		26	15	2.7	1.7	61
15	10	32	23	16	40	38	68	23	13	2.7	1.3	26
16		47	23	16	54	47	86	22	12	2.7	1.0	19
17	10	282	24	15	72	43	73	22	12	1.7	.8	118
18	10	103	24	15	54	43	82	22	12	1.1	.2	94
19	11	66	24	14	44	41	60	22	12	.5	3.8	63
20	10	49	25	14	35	40	525	21	12	.4	6.3	41
21	9.4	38	25	18	34	39	154	18	11	.4	17	29
22	12	37	25	17	206	37	124	19	10	2.4	18	15
23	13	37	25	13	93	35	86	20	10	2.4	282	50
24	12	38	24	13	143	35	70	18	9.4	2.3	32	45
25	11	37	24	13	105	35	1,400	18	7.4	2.1	13	41
26	10	38		13	82	36	496	18	5.5	1.8	5.8	39
27	10	38		12	100	38	195	18	4.4	1.8	195	36
28	10	39	24	12	109	39	84	18	4.1	1.6	227	32
29	10	39		13	-------	37	82		2.7	2.1	39	30
30	13	38		15	-------	38	66	22	2.0	2.1	46	28
31	20	-------	23	26	-------	41	-------		-------	1.8	3.8	-------

NOTE.—Braced figures show estimated mean discharge for periods indicated. Discharge interpolated Mar. 24 and May 22; gage not read.

Monthly discharge of San Saba River at Menard, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	20	----------	11.2	687
November	282	13	43.7	2,600
December	45	----------	30.9	1,900
January	26	12	16.8	1,030
February	206	----------	58.1	3,230
March	154	35	55.2	3,400
April	1,400	32	181	10,800
May	63	----------	29.5	1,810
June	31	2.0	12.7	757
July	----------	----------	1.73	107
August	282	.2	32.9	2,020
September	2,960	2.3	259	15,400
The year	2,960	.2	60.4	43,700

SAN SABA RIVER NEAR SAN SABA, TEX.

LOCATION.—200 feet above Beveridge highway bridge, 1 mile below mouth of China Creek, and 2 miles northwest of San Saba, San Saba County, 4 miles above mouth of Simpson Creek.

DRAINAGE AREA.—3,040 square miles (measured on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—December 30, 1904, to December 31, 1906; September 11, 1915, to September 30, 1923. Miscellaneous discharge measurements previous to 1904.

GAGE—Vertical and inclined staff, on right bank; read by G. M. Pool.

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

CHANNEL AND CONTROL.—Channel straight for 100 feet above and below station. Bed composed of rock and gravel; shifts. Left bank composed of gravel and clay, wooded, and not subject to overflow. Right bank consists of clay and gravel, wooded, sloping, medium in height, and subject to overflow during high water. A shoal at a ford about 75 feet below gage serves as control during medium and low stages. Control is free from vegetation, and shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 29.0 feet during morning of September 17, determined from floodmarks on gage (discharge not determined); minimum stage, 1.12 feet at 6.50 p. m. August 7 (discharge, 11 second-feet).

1904–1906; 1915–1923: Maximum stage recorded, about 37.0 feet April 26 or 27, 1922, determined from floodmarks on gage (discharge not determined). No flow August 9 and 10, 1918.

DIVERSIONS.—Considerable water is diverted from stream and tributaries above station. There are also diversions below station, but none near station. Flood water from Brady Creek at Brady is stored for municipal uses; capacity of reservoir not known, but probably small. Records of the Board of Water Engineers for the State of Texas show that about 9,300 acres have been declared irrigated by diversions above station and about 2,700 acres by diversions below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 5 to 6,500 second-feet. Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage height to rating table, except September 17, when stage was beyond limits of rating curve and discharge estimated. Records fair.

Discharge measurements of San Saba River near San Saba, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Oct. 6	Slack and Ellsworth	1.69	64.8
Dec. 22	R. G. West	1.76	75.3
May 28	C. E. Ellsworth	1.98	110

Daily discharge, in second-feet, of San Saba River near San Saba, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	63	102	91	68	111	356	138	222	82	2,060	26	85
2	61	73	94	72	124	233	129	211	88	777	26	72
3	60	76	91	76	118	244	120	189	1,000	211	23	330
4	59	88	91	76	108	256	118	178	256	115	19	590
5	60	88	91	76	108	200	256	178	138	73	28	1,040
6	59	85	84	76	108	292	138	168	104	61	23	682
7	59	79	84	69	109	200	122	222	88	63	18	1,820
8	55	73	91	75	111	158	113	211	73	54	19	1,140
9	55	73	86	69	108	148	108	178	72	51	28	713
10	55	82	82	71	101	138	108	168	75	48	27	441
11	57	82	91	65	101	138	292	148	71	43	26	129
12	58	85	88	69	101	129	4,620	138	69	41	30	1,270
13	58	86	85	76	97	124	1,140	138	64	40	29	1,500
14	58	85	88	78	96	122	500	127	60	41	30	530
15	58	84	90	76	91	124	560	118	57	38	30	256
16	64	90	90	76	109	115	713	115	59	34	30	1,500
17	90	104	86	78	148	115	809	113	63	28	30	8,740
18	86	120	80	75	168	111	651	104	60	26	30	1,100
19	75	158	82	79	148	106	412	104	50	28	51	441
20	73	200	76	82	125	109	682	108	51	27	41	292
21	72	138	71	79	118	111	441	560	46	34	35	222
22	68	116	71	91	111	108	500	304	52	40	34	189
23	72	102	71	84	330	108	412	168	42	75	57	178
24	71	99	68	76	412	108	292	384	44	42	50	158
25	73	97	68	76	317	108	938	384	39	30	44	148
26	76	94	68	73	304	106	3,220	178	33	29	39	148
27	76	94	68	76	317	138	841	127	30	27	76	138
28	76	91	68	73	292	158	470	106	31	34	148	129
29	71	91	71	82	------	158	330	99	30	38	178	118
30	78	92	71	88	------	158	268	102	33	30	158	122
31	94	------	71	101	------	158	------	97	------	24	122	------

Monthly discharge of San Saba River near San Saba, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	94	55	67.4	4,150
November	200	73	97.6	5,810
December	94	68	80.9	4,970
January	101	65	76.8	4,720
February	412	91	160	8,910
March	356	106	156	9,590
April	4,620	108	648	38,600
May	560	97	182	11,200
June	1,000	30	98.7	5,870
July	2,060	24	137	8,450
August	178	18	48.5	2,990
September	8,740	72	807	48,000
The year	8,740	18	212	153,000

NORTH LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—500 feet above remains of old Wilson Dam, 1 mile below mouth of Bear Creek, 3 miles northwest of Junction, Kimble County, 4 miles above confluence of North Llano and South Llano Rivers.

DRAINAGE AREA.—914 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1923.

GAGE.—Overhanging chain gage on left bank; read by W. M. Keen.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge, 2½ miles below station.

CHANNEL AND CONTROL.—Bed composed of solid rock. Channel straight above and below for 400 feet, with a series of pools and rapids. Left bank not subject to overflow. Right bank wooded and subject to overflow during high stages. A solid rock ledge having about 2-foot vertical fall at site of old dam is a permanent control for medium and low stages, except for slight effect from growth of moss during low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 23 feet about midnight April 24 (discharge, 43,100 second-feet, determined from extension of rating curve); minimum stage, 1.08 feet from 8 a. m. to 6.45 p. m. August 16 (discharge, 0.4 second-foot).

1915–1923: Maximum stage recorded, that of April 24, 1923. No flow during several periods.

DIVERSIONS.—Records of the Board of Water Engineers for the State of Texas show that about 1,200 acres have been declared irrigated by diversions above the station. During low stages such diversions materially reduce flow at station.

REGULATION.—No indication that flow at station is regulated.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 360 second-feet and extended above on basis of two slope measurements at gage heights of 12.9 and 19.03 feet. Gage read to hundredths twice daily, and oftener during floods. Daily discharge determined by applying mean daily gage height to rating table; shifting-control method used October 1 to November 13. Except for estimated periods, records good for low and medium stages and poor for high stages.

Revised records of daily discharge for certain high-water periods in 1915 and 1918, and unpublished records for periods in the years ending September 30, 1919, 1920, and 1922, contained in table on page 58.

Discharge measurements of North Llano River near Junction, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 25	T. A. Slack	1.31	11.0
25	do	1.31	11.5
Apr. 4	C. E. Ellsworth	1.47	29.3

Daily discharge, in second-feet, of North Llano River near Junction, Tex., for high-water periods in years ending September 30, 1915, 1918, 1919, 1920, and 1922

Date	Discharge	Date	Discharge	Date	Discharge
1915		1919		1920	
Sept. 16	20,300	Sept. 16	298	May 14	239
17	1,730	22	4,630	Aug. 14	569
18	563	23	4,970	15	1,200
19	329	24	5,420	16	455
20	259	25	886	17	222
21	225	26	491	Sept. 29	373
		27	421		
1918		28	361	1922	
Apr. 15	13,800	29	329	Mar. 29	1,430
16	1,060	30	301	30	235
June 7	1,580	Oct. 1	273	Apr. 3	3,520
Nov. 8	1,470	2	249	4	445
9	569	3	232	8	208
		4	225	24	225
1919		5	215	25	587
June 24	315	6	287	26	518
25	636	7	239	27	1,480
26	708	8	304	28	347
27	529	9	239	May 1	816
28	351	10	210	3	1,410
Aug. 21	3,410	11	198	4	333
22	1,440	12	194	17	417
23	351	22	465	June 3	304
24	191			7	431
Sept. 6–15	[a] 60	1920			
		May 13	563		

[a] Estimated mean discharge.

NOTE.—Discharge for periods given in the above table was withheld from publication in the water-supply papers containing the records for 1915, 1919, 1920, and 1922, because rating curve was not developed above gage height 2.0 feet. The figures for Apr. 15, 16, and June 7, 1918, supersede those published in Water-Supply Paper 478.

Daily discharge, in second-feet, of North Llano River near Junction, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.9	8.8	9.5	11			31	70	149	21	3.3	5.0
2	3.9	8.8	9.5	11			31	61	124	19	3.3	13
3	3.9	8.8	9.5	11			31	61	87	17	3.3	41
4	3.9	8.8	10	11			29	56	65	15	3.3	13
5	3.9	48	11	11			29	51	56	15	3.3	6.0
6	3.3	14	11	11			26	51	51	13	3.3	5.3
7	3.3	13	11	11			26	46	48	13	3.3	8.1
8	3.3	12	11	11			26	44	48	11	3.3	17
9	3.3	10	11	11			25	37	46	11	3.3	19
10	3.3	10	11	11			24	34	41	11	6.7	19
11	2.6	10	11	11	14		225	31	37	11	3.9	21
12	2.6	10	11	11		30	1,400	31	34	9.5	3.3	24
13	2.6	10	11	11			168	31	31	8.1	2.6	18
14	2.6	13	11	11			87	31	29	8.1	2.0	15
15	2.6	13	11	11			94	31	28	6.7	1.0	15
16	2.6	13	11	11			455	29	26	6.7	.4	37
17	6.0	13	11	11			172	29	24	5.3	1.3	1,510
18	3.6	13	11	11			120	29	24	3.9	2.0	113
19	3.6	13	11	11			94	26	24	284	2.6	61
20	3.6	11	11	11			110	26	21	26	3.3	41
21	4.6	11	11				81	26	21	15	3.9	31
22	6.0	11	11				70	26	19	13	5.3	31
23	6.7	11	11				63	75	19	8.1		26
24	6.7	11	11				2,230	46	17	5.3		26
25	6.7	11	11		50	26	7,450	31	17	3.6		21
26	6.7	11	11	11		26	194	31	15	3.3	5.0	21
27	6.7	11	11			39	131	29	13	3.3		19
28	6.7	9.5	11			44	94	26	13	3.3		19
29	6.7	9.5	11		-------	41	81	1,510	11	3.3		19
30	8.8	9.5	11		-------	37	70	1,840	9.5	3.3		19
31	8.8	-------	11		-------	33	-------	206	-------	3.3		-----

NOTE.—Gage not read Jan. 21 to Mar. 24 and Aug. 23 to Sept. 1; discharge estimated by comparison with records for other stations.

Monthly discharge of North Llano River near Junction, Tex., for the years ending September 30, 1915–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1915				
September 14–30	20,300	13	1,470	49,700
1915–16				
October	117	49	66.4	4,080
November	58	29	38.1	2,270
December	37	28	31.3	1,920
January	67	28	31.4	1,930
February	49	24	29.3	1,690
March	28	22	24.8	1,520
April	103	24	33.2	1,980
May	39	14	20.8	1,280
June	14	3.4	8.29	493
July	14	3.4	8.93	549
August	12	4.2	7.61	468
September	6.5	1.2	3.64	217
The year	117	1.2	25.4	18,400
1916–17				
October	5.7	1.7	3.95	243
November	11	5.1	7.57	450
December	14	11	12.5	769
January	16	14	14.2	873
February	16	14	14.4	800
March	21	13	14.5	892
April	14	10	12.4	738
May	392	7.8	36.5	2,240
June	13	1.5	5.91	352
July	1.6	0	.43	26
August	0	0	0	0
September	5.1	0	.86	51
The year	392	0	10.3	7,430
1917–18				
October	.5	0	.02	1
November	0	0	0	0
December	6.6	0	1.82	112
January	7.8	5.1	6.36	391
February	7.8	5.1	6.51	362
March	12	5.1	6.89	424
April	13,800	4.5	513	30,500
May	93	4.5	12.9	793
June	1,580	1.5	63.7	3,790
July	13	0	.78	48
August	0	0	0	0
September	180	0	10.2	607
The year	13,800	0	51.1	37,000
1918–19				
October	36	.3	10.5	646
November	1,470	7.2	97.7	5,810
December	34	16	20.0	1,230
January	117	21	30.2	1,860
February	36	21	28.6	1,590
March	110	21	29.3	1,800
April	168	17	28.6	1,700
May	124	25	54.1	3,330
June	708	30	136	8,090
July	153	29	62.9	3,870
August	3,410	17	217	13,300
September	5,420	55	651	38,800
The year	5,420	.3	113	82,000

Monthly discharge of North Llano River near Junction, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919–20				
October	465	143	207	12,700
November	147	78	102	6,070
December	78	51	59.9	3,680
January	78	49	63.1	3,880
February	59	49	56.0	3,220
March	59	38	46.4	2,850
April	41	32	36.6	2,180
May	563	24	58.3	3,580
June	45	22	24.8	1,480
July	26	12	17.4	1,070
August	1,200	12	120	7,350
September	373	22	52.4	3,120
The year	1,200	12	70.7	51,200
1920–21				
October	68	24	33.1	2,040
November	56	26	31.7	1,890
December	35	26	29.5	1,810
January	32	26	27.3	1,680
February	45	22	24.9	1,380
March	59	24	30.1	1,850
April	28	16	20.9	1,240
May	22	12	13.7	842
June	14	6.4	9.73	579
July	5.3	1.1	2.74	168
August	9.1	0	.67	41.2
September	16	1.0	2.60	155
The year	68	0	18.9	13,700
1921–22				
October	6.4	2.5	3.36	206
November	13	2.5	6.74	401
December	16	12	15.1	928
January	18	16	16.8	1,030
February	17	11	13.9	770
March	1,430	11	69.4	4,270
April	3,520	31	290	17,300
May	1,410	35	173	10,700
June	431	19	65.6	3,900
July	41	6.4	15.8	973
August	61	1.3	9.04	556
September	14	.4	3.45	205
The year	3,520	.4	56.9	41,200
1922–23				
October	8.8	2.6	4.63	285
November	48	8.8	12.2	727
December	11	9.5	10.8	665
January	----------	----------	11.0	676
February	----------	----------	24.3	1,350
March	----------	----------	31.2	1,920
April	7,450	24	456	27,100
May	1,840	26	150	9,230
June	149	9.5	38.2	2,280
July	284	3.3	18.7	1,150
August	----------	.4	3.65	224
September	1,510	----------	74.4	4,430
The year	7,450	.4	69.1	50,000

NOTE.—Monthly discharge for April and June, 1918, supersede the figures published in Water-Supply Paper 478. Discharge for many months in 1915, 1918, 1919, 1920, and 1922 not previously published because of lack of definition of rating curve for high stages, as indicated in footnote to table on page 58 giving the daily discharge for certain periods in these years. Monthly discharge for the remaining months republished in order to complete the record.

LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—100 feet north of Kerrville-Junction road, 3 miles below confluence of North Llano and South Llano Rivers, and 3½ miles east of Junction, Kimble County.

DRAINAGE AREA.—1,760 square miles (revised measurement on topographic maps and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—September 13, 1915, to September 30, 1923.

GAGE.—Vertical staff, reading from 0 to 7.5 feet, attached to tree on right bank, and inclined staff, reading from 7.0 to 14.7 feet, and a vertical staff, reading from 14.6 to 20.3, the two latter gages 100 feet upstream from low-water vertical staff; read by Bonnie Oliver.

DISCHARGE MEASUREMENTS.—Made by wading at Mason road crossing, a quarter of a mile above gage, or from cable 400 feet above gage.

CHANNEL AND CONTROL.—Bed composed of solid rock; permanent. Channel straight for 700 feet above and 350 feet below gage. Left bank slightly wooded and subject to overflow during high water; right bank not subject to overflow. One channel at all stages, except above a stage of 11.3 feet, when a small part of the flow may follow a slough that leaves the river a short distance above gage and enters the main stream below gage. Control for low and medium stages is a rock ledge 75 feet below gage, having a fall of about 3 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.0 feet on September 18 (discharge, 35,700 second-feet; see "Accuracy"); minimum stage, 1.50 feet August 15–21 (discharge, 52 second-feet).

1915–1923: Maximum stage recorded, 26.3 feet at 3 a. m. September 16, 1915 (discharge, 98,800 second-feet, determined from extension of rating curve); minimum stage, 1.32 feet August 23–28, 1918 (discharge, 13 second-feet).

DIVERSIONS.—Records of the Board of Water Engineers for the State of Texas show that about 2,500 acres have been declared irrigated by diversions above station and about 1,300 acres below station. Diversions materially reduce flow at station during low stages.

REGULATION.—Slight regulation for water-power plant on South Llano River at Junction.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 24 to 1,700 second-feet, and extended above on basis of one slope measurement at a stage of 24.83 feet and discharge of 85,500 second-feet on October 29, 1923, using a value of 0.0375 for n in Kutter's formula. Gage read to hundredths once daily. One reading daily for medium and high stages may not be true index to discharge owing to rapid fluctuations. Daily discharge ascertained by applying daily gage height to rating table. Records good for low stages and poor for high stages.

Revised records of daily discharge for certain high-water periods in 1915, 1916, and 1918, and unpublished records for periods in the years ending September 30, 1919, 1920, and 1922, contained in the table on page 62.

Discharge measurements of Llano River near Junction, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 26	T. A. Slack	1.58	72	Nov. 27	T. A. Slack	1.58	76.9
26	do	1.58	72.2	Apr. 4	C. E. Ellsworth	1.69	106

Daily discharge, in second-feet, of Llano River near Junction, Tex., for high-water periods in years ending September 30, 1915, 1916, 1918, 1919, 1920, and 1922

Date	Discharge	Date	Discharge	Date	Discharge
1915		1918		1919	
Sept. 15	5,650	Apr. 14–16	* 10,000	Sept. 23	27,800
16	45,800	17	378	24	22,000
17	3,220	June 3	965	25	1,870
18	1,330	Sept. 6	428	26	1,330
19	845	Nov. 8	1,080	Oct. 22	745
20	655	9	965	1920	
21	615	10	745	May 14	13,700*
22	4,800	11	745	15	965
23	745	12	745	Aug. 14	1,000
24	575	1919		Sept. 29	965
26	409	May 11	2,170	1922	
27	409	12	10,600	Mar. 29	1,020
28	348	13	883	30	1,520
29	330	June 26	2,320	Apr. 2	745
30	318	27	4,830	3	16,100
Oct. 1	306	28	1,100	4	2,020
2	289	Aug. 21	8,920	26	1,140
3	289	22	9,360	27	5,820
1916		23	3,830	May 3	3,990
May 21	655	24	2,290	July 4	1,080
22	2,770	25	845	6	965
23	1,080	26	727		
24	289	Sept. 22	24,400		

* Estimated mean discharge.

NOTE.—Discharge for the periods in September and October, 1915, May, 1916, April, June, and September, 1918, supersede the records previously published, because of revision of rating curve for high stages. Records for the above periods from Nov. 8, 1918, to July 6, 1922, not previously published because of lack of definition of rating curve for high stages.

Daily discharge, in second-feet, of Llano River near Junction, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	63	63	74	74	94	170	109	229	378	74	63	58
2	63	63	69	74	94	170	109	229	260	74	63	80
3	63	63	69	74	94	170	109	218	239	74	63	80
4	63	63	63	74	87	151	116	218	229	74	63	208
5	63	63	63	74	87	134	109	208	198	74	63	189
6	63	63	63	74	80	125	109	208	179	74	63	116
7	63	63	63	69	80	125	109	208	170	74	63	102
8	63	63	63	69	80	116	102	198	160	74	69	80
9	63	69	63	69	80	109	102	189	142	74	63	80
10	63	69	63	69	80	109	102	189	134	74	63	260
11	63	74	63	69	74	109	575	179	134	74	63	102
12	63	74	63	69	74	109	440	160	125	74	63	102
13	63	74	63	69	80	109	260	151	125	74	58	102
14	63	74	63	63	87	109	208	142	125	74	58	102
15	63	74	63	63	87	109	208	142	125	69	52	102
16	63	74	63	63	87	109	3,070	134	125	69	52	102
17	63	74	69	63	87	109	505	134	116	63	52	2,470
18	63	74	69	63	87	109	295	116	109	63	52	35,700
19	63	74	74	63	87	102	239	116	109	63	52	845
20	63	74	74	63	87	102	229	109	102	151	52	615
21	63	74	74	69	440	102	208	109	102	94	52	229
22	63	74	74	69	409	102	198	109	102	80	58	208
23	63	74	74	69	378	102	208	3,220	102	80	69	198
24	63	74	74	74	218	102	208	189	94	69	63	189
25	63	74	74	74	208	102	208	160	87	63	58	189
26	63	74	74	74	189	102	208	160	87	63	58	179
27	63	74	74	74	189	102	208	125	80	63	58	160
28	63	74	74	74	179	102	229	125	80	63	58	151
29	63	74	74	74	------	102	229	125	74	63	58	151
30	63	74	74	74	------	102	229	15,600	74	63	58	142
31	63	------	74	94	------	109	------	403	------	63	58	------

Monthly discharge of Llano River near Junction, Tex., for the years ending September 30, 1915–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1915				
September 13–30	45,800	64	3,690	132,000
1915–16				
October	306	180	208	12,800
November	180	148	163	9,700
December	160	128	142	8,730
January	152	116	123	7,560
February	144	105	116	6,670
March	105	97	99.8	6,140
April	152	82	109	6,490
May	2,770	90	294	18,100
June	128	53	84.4	5,020
July	120	46	69.8	4,290
August	82	60	70.7	4,350
September	75	46	62.6	3,720
The year	2,770	46	129	93,600
1916–17				
October	82	53	72.1	4,430
November	63	50	61.2	3,640
December	69	63	66.1	4,060
January	76	69	69.5	4,270
February	72	60	66.4	3,690
March	63	56	59.4	3,650
April	69	45	56.1	3,340
May	101	38	52.8	3,250
June	56	22	34.0	2,020
July	32	20	26.2	1,610
August	82	17	25.6	1,570
September	132	25	47.6	2,830
The year	132	17	53.0	38,400
1917–18				
October	43	32	38.1	2,340
November	45	38	41.2	2,450
December	45	38	41.8	2,570
January	45	41	42.0	2,580
February	45	41	42.4	2,350
March	56	41	43.8	2,690
April	----------	41	1,090	64,600
May	240	41	111	6,820
June	965	32	98.9	5,890
July	36	20	23.7	1,460
August	24	13	20.0	1,230
September	428	20	50.1	2,980
The year	----------	13	135	98,000
1918–19				
October	74	35	55.8	3,430
November	1,080	63	244	14,500
December	102	87	93.0	5,720
January	434	72	114	7,010
February	116	84	102	5,660
March	229	74	84.8	5,210
April	112	44	69.7	4,150
May	10,600	48	575	35,400
June	4,830	80	383	22,800
July	165	91	116	7,130
August	9,360	39	939	57,700
September	27,800	208	2,810	167,000
The year	27,800	35	464	336,000

Monthly discharge of Llano River near Junction, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919–20				
October	745	306	369	22,700
November	428	239	308	18,300
December	239	189	217	13,300
January	198	179	192	11,800
February	198	179	188	10,800
March	229	160	182	11,200
April	179	134	156	9,280
May	13,700	125	630	38,700
June	260	116	130	7,740
July	125	109	119	7,320
August	1,000	109	171	10,500
September	965	116	183	10,900
The year	13,700	109	238	173,000
1920–21				
October	198	134	151	9,280
November	179	142	150	8,930
December	151	134	143	8,790
January	142	142	142	8,730
February	142	134	141	7,830
March	880	109	162	9,960
April	116	80	108	6,430
May	87	80	86.8	5,340
June	198	87	112	6,660
July	94	69	86.4	5,310
August	865	48	84.6	5,200
September	151	52	70.1	4,170
The year	880	48	120	86,600
1921–22				
October	69	52	60.8	3,740
November	60	55	56.8	3,380
December	66	60	61.2	3,760
January	63	60	61.6	3,790
February	63	63	63.0	3,500
March	1,520	55	142	8,720
April	16,100	55	1,020	60,700
May	3,990	142	400	24,600
June	147	91	123	7,320
July	1,080	58	155	9,520
August	94	58	64.7	3,980
September	69	58	61.7	3,670
The year	16,100	52	189	137,000
1922–23				
October	63	63	63.0	3,870
November	74	63	70.7	4,210
December	74	63	68.7	4,230
January	94	63	70.5	4,340
February	440	74	139	7,740
March	170	102	116	7,110
April	3,070	102	308	18,300
May	15,600	109	768	47,200
June	378	74	139	8,260
July	151	63	73.5	4,520
August	69	52	59.3	3,650
September	35,700	58	1,440	85,900
The year	35,700	52	275	199,000

NOTE.—Monthly discharge for September and October, 1915, May, 1916, April, June, and September, 1918, supersede the records previously published. Discharge for many months in the years ending Sept. 30, 1919, 1920, and 1922 not previously published because of lack of definition of rating curve at high stages. Monthly discharge for the remaining months from 1915 to 1922 republished in order to complete the record.

BARTON SPRINGS AT AUSTIN, TEX.

LOCATION.—Barton Springs issue from channel of Barton Creek, 1,600 feet above Austin-Bee Cave highway bridge, half a mile above confluence of Barton Creek with Colorado River, half a mile southwest of Austin, Travis County.

RECORDS AVAILABLE.—October 1, 1918, to September 30, 1923. Daily records of flow of Barton Creek, which closely approximate flow of Barton Springs, as the ordinary flow of the creek is from the springs, have been published from April 25, 1917, to September 30, 1918. Miscellaneous discharge measurements of Barton Creek made from 1894 to 1906, and during 1916 and 1917.

DISCHARGE MEASUREMENTS.—Made by wading Barton Creek above and below the springs, in order to determine the flow of springs as indicated in table below.

Discharge measurements of Barton Springs at Austin, Tex., during the year ending September 30, 1923

Date	Made by—	Discharge	Date	Made by-	Discharge
		Sec.-ft.			*Sec.-ft.*
Oct. 4	Trigg Twichell	28.2	Mar. 14	Trigg Twichell	23.5
19	do	26.3	Apr. 2	do	37.4
Nov. 2	do	27.3	May 11	do	50.4
17	do	30.1	21	do	45.6
27	do	24.3	June 5	do	42.8
Dec. 20	do	23.3	19	do	38.8
Jan. 6	do	22.5	July 6	do	34.0
20	Twichell and Elliott	24.5	27	do	27.2
Feb. 8	Trigg Twichell	22.7	Aug. 20	Twichell and Breeding	23.4
27	do	23.9	Sept. 25	Twichell and Crosnoe	31.3

NOTE.—Measurements made in channel of Barton Creek below the springs. There was no flow in Barton Creek above the springs on the above dates.

GUADALUPE RIVER BASIN

GUADALUPE RIVER NEAR COMFORT, TEX.

LOCATION.—On Comfort-Kerrville road, 100 feet upstream from Boerner Crossing and 3 miles west of Comfort, Kerr County.

DRAINAGE AREA.—916 square miles (revised measurement on topographic maps, progressive military maps of United States Army, and map compiled by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—December 16, 1917, to September 30, 1923.

GAGE.—Vertical staff in two sections on left bank; read by Robert W. Faust.

DISCHARGE MEASUREMENTS.—Low-water measurements made by wading. No suitable section available for high-water measurements.

CHANNEL AND CONTROL.—Bed composed of rock, sand, and gravel. Left bank composed of clay, slightly wooded, and subject to overflow at high stage. Right bank low, wooded, and subject to overflow at medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.2 feet at 5.30 p. m. September 18 (discharge not determined); minimum discharge, 6.2 second-feet August 20.

1917–1923: Maximum stage about 41 feet on August 21, 1919, determined from floodmarks near gage (discharge not determined); minimum stage 0.80 foot August 2, 1918 (discharge 0.4 second-foot, probably due to diversions above gage).

DIVERSIONS.—Few pumping plants along stream about 7 miles above station. Records of the Board of Water Engineers for State of Texas show that a total of about 400 acres has been declared irrigated by diversions above station.

REGULATION.—At Kerrville and Center Point dams are constructed and water used for mill purposes, but effect of regulation is slight, except during low stages.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 400 second-feet, and extended above that point on basis of one slope measurement at a stage of 8.5 feet, discharge 3,120 second-feet, using a value of 0.040 for n in Kutter's formula. Gage read to hundredths once daily except Sundays. One reading a day may not be a true index to daily discharge at low stages, owing to storage and intermittent pumping, and at high stages, owing to rapid fluctuations. Daily discharge ascertained by shifting-control method October 1 to December 1 and July 24 to August 31, and by applying mean daily gage height to rating table for remainder of year. Records poor.

Discharge measurements of Guadalupe River near Comfort, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 13	R. G. West	1.80	52.6	May 8	J. J. Bebeau	1.95	76.4
Apr. 3	C. E. Ellsworth	1.81	50.3	Aug. 15	Trigg Twichell	1.13	7.83

Daily discharge, in second-feet, of Guadalupe River near Comfort, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	28	38	46	38	56	96	a64	116	79	a14	9.4	22
2	26	165	48	38	58	96	61	104	96	9.0	11	a19
3	25	112	a48	38	58	93	58	89	a77	16	8.7	19
4	22	67	48	38	a60	a91	58	86	58	a18	9.4	19
5	22	a58	45	38	56	89	58	79	58	21	a8.8	26
6	21	50	45	38	56	79	58	a78	56	23	8.3	22
7	22	48	45	a38	53	70	58	76	53	14	6.7	29
8	a22	45	43	38	50	67	a58	72	48	a12	6.7	28
9	21	40	43	38	48	64	58	68	48	10	9.0	a26
10	23	36	a42	38	48	61	58	58	a46	15	a8.8	25
11	21	38	40	38	a49	a58	73	53	45	13	8.7	165
12	18	a42	40	38	50	56	96	53	38	16	a8.1	
13	25	45	40	38	50	56	194	a53	36	9.0	7.5	
14	29	43	40	a38	53	53	139	53	33	11	7.0	
15	a28	40	40	38	53	50	a118	53	29	a11	7.8	115
16	26	38	40	38	56	48	96	50	26	11	7.0	
17	28	50	a39	38	56	48	96	48	a22	13	6.5	
18	31	56	38	40	a57	a46	79	45	19	11	6.5	5,200
19	33	a50	38	40	58	45	79	43	18	9.0	a6.4	1,190
20	34	44	38	40	58	48	79	a40	16	8.3	6.2	455
21	36	39	38	a40	58	48	73	38	11	7.8	9.8	1,090
22	a38	37	37	40	68	50	a70	38	13	a16	8.3	495
23	40	37	37	43	79	53	67	38	13	18	8.3	a280
24	43	37	a38	43	96	56	64	116	a17	16	8.7	165
25	48	37	38	45	a96	a57	1,040	73	21	11	7.5	139
26	45	a38	38	45	96	58	415	56	16	9.4	a8.2	130
27	43	39	37	45	96	58	261	a54	8.3	8.3	9.0	125
28	38	42	37	a46	96	61	165	53	7.8	9.0	16	116
29	a38	42	37	48	-------	64	a140	50	9.8	a9.4	16	112
30	38	44	37	48	-------	67	116	50	11	9.8	13	a100
31	38	-------	a37	50	-------	67	-------	64	-------	8.7	20	-------

a Interpolated or estimated; gage not read.

NOTE.—Discharge Sept. 12–17 estimated by comparison with records of flow for other stations.

Monthly discharge of Guadalupe River near Comfort, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	48	18	30.6	1,880
November	165	36	49.9	2,970
December	48	37	40.5	2,490
January	50	38	40.6	2,500
February	96	48	63.1	3,510
March	96	45	63.0	3,870
April	1,040	58	135	8,030
May	116	38	62.8	3,860
June	96	7.8	34.3	2,040
July	23	7.8	12.5	769
August	20	6.2	9.14	562
September	----------	16	356	21,200
The year	----------	6.2	74.1	53,700

GUADALUPE RIVER NEAR SPRING BRANCH, TEX.

LOCATION.—At New Braunfels-Blanco City highway bridge, known as Esser Bridge, 4 miles below Spring Branch, Comal County, 6 miles below mouth of Curry Creek, and 22 miles by road above New Braunfels.

DRAINAGE AREA.—1,430 square miles (measured on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military map of United States Army).

RECORDS AVAILABLE.—June 28, 1922, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder, attached to downstream side of pier on right bank; attended by E. L. Jonas.

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

CHANNEL AND CONTROL.—Channel straight for 200 feet above and 700 feet below gage. Bed composed of solid rock and gravel; permanent. Right bank consists of clay, wooded, and not subject to overflow; left bank of clay and gravel, covered with grass and brush, and subject to overflow at a stage of about 46 feet. Low-water control is a rock and gravel riffle 350 feet below gage, and is probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 19.75 feet at 6.40 p. m. September 19 (discharge, 18,200 second-feet); minimum stage, 1.74 feet during period of missing record, August 18 (discharge, 4.7 second-feet).

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 1,000 second-feet, and fairly well defined from 1,000 to 18,000 second-feet. Operation of water-stage recorder satisfactory, except for short breaks in record. Daily discharge determined by applying to rating table mean daily gage height ascertained from recorder graph by inspection or by use of planimeter, or by averaging discharge for fractional parts of a day. Records fair.

Discharge measurements of Guadalupe River near Spring Branch, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 19	C. E. Ellsworth	2.30	71.3	Sept. 19	Pritchett and Crosnoe	13.22	9,460
Jan. 31	do	2.20	54.1	19	do	19.31	18,100
Apr. 11	Trigg Twichell	2.78	194	20	do	4.97	1,570
May 8	J. J. Bebeau	2.65	164	21	do	3.88	817
Aug. 15	Trigg Twichell	1.78	6.2	21	do	9.57	6,290
Sept. 6	Breeding and Twichell	2.22	52.9	22	do	5.76	2,000
18	Pritchett and Crosnoe	6.74	2,070				

Daily discharge, in second-feet, of Guadalupe River near Spring Branch, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	36	145	52	50	55	109	102	196	68	30	17	20
2	34	85	52	50	55	102	93	179	66	36	13	22
3	36	64	52	50	62	100	91	153	68	26	11	66
4	34	57	55	50	78	95	85	145	70	26	10	93
5	32	53	53	52	76	95	87	132	72	24	13	35
6	31	53	50	53	68	116	80	121	78	25	13	136
7	32	50	52	53	68	114	76	124	66	32	12	929
8	32	52	52	53	66	104	72	137	64	27	12	345
9	32	48	53	53	68	95	135	124	57	30	12	101
10	30	50	52	53	66	87	827	111	53	26	10	66
11	30	44	52	53	66	87	353	107	47	25	7.7	74
12	28	44	52	53	66	82	1,180	102	46	23	6.5	136
13	31	82	52	52	64	78	656	98	47	20	7.7	204
14	33	61	50	53	66	74	475	93	44	23	7.7	146
15	34	61	53	55	68	70	331	93	42	20	6.2	98
16	33	68	53	53	78	66	272	89	41	19	6.5	62
17	32	68	53	55	80	61	237	82	41	19	5.4	55
18	30	64	52	53	85	59	205	76	41	18	5.8	5,310
19	32	72	52	53	104	57	184	72	40	16	6.2	9,710
20	30	66	52	50	102	55	167	72	37	13	7.7	2,270
21	33	61	52	52	91	59	162	66	37	22	6.9	3,100
22	34	59	52	52	82	59	156	64	34	18	6.9	2,360
23	38	53	52	48	76	59	148	514	33	19	6.5	627
24	38	52	52	49	80	57	150	491	30	19	6.5	347
25	41	48	52	51	89	57	193	134	28	20	5.8	254
26	40	48	52	52	107	68	949	126	27	21	5.8	208
27	40	53	53	54	121	95	478	102	26	22	7.7	173
28	44	53	52	55	119	162	336	89	25	22	20	137
29	44	52	52	52	-------	137	254	82	26	23	21	121
30	52	52	52	52	-------	119	221	82	27	23	19	111
31	264	-------	52	53	-------	111	-------	72	-------	23	20	-------

NOTE.—Owing to incomplete record, discharge partly estimated Nov. 11–13, 20, 21, Jan. 23, 28–30, Apr. 13, July 22, 29, Aug. 7, and 19. Discharge interpolated Jan. 24–27, July 23–28, and Aug. 18, when gage did not operate.

Monthly discharge of Guadalupe River near Spring Branch, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	264	28	42.3	2,600
November	145	44	60.6	3,610
December	55	50	52.2	3,210
January	55	48	52.2	3,210
February	121	55	78.8	4,380
March	162	55	86.7	5,330
April	1,180	72	292	17,400
May	514	64	133	8,190
June	78	25	46.0	2,740
July	36	13	22.9	1,410
August	21	5.4	10.2	628
September	9,710	20	911	54,200
The year	9,710	5.4	148	107,000

GUADALUPE RIVER AT NEW BRAUNFELS, TEX.

LOCATION.—At highway bridge on San Antonio-Austin post road, 700 feet below International & Great Northern Railway bridge, 1 mile below mouth of Comal River, and 1 mile northeast of center of New Braunfels, Comal County.

DRAINAGE AREA.—1,770 square miles (revised measurement on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military maps of United States Army).

RECORDS AVAILABLE.—March 13, 1898, to December 30, 1899; January 27, 1915, to September 30, 1923.

GAGE.—Stevens water-stage recorder, attached to downstream side of middle pier of highway bridge; inspected by engineers from Austin office.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of solid rock, with pockets of coarse gravel. Banks gravel, clay, and rock, slightly wooded, and not subject to overflow. Rock and gravel shoal just below gage serves as control; changes slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 15.1 feet at 6.45 a. m. September 20 (discharge, 17,500 second-feet). No flow 12.30 p. m. to 3.30 p. m. October 10, owing to regulation at dam under construction 300 feet above gage.

1898–99; 1915–1923: Maximum stage recorded, 28.6 feet at 3 a. m. September 10, 1921 (discharge, 56,600 second-feet, determined from extension of rating curve and subject to error). No flow for two hours on each of several days in August and September, 1922, and for three hours on October 10, 1923, owing to regulation at dam under construction 300 feet above gage.

DIVERSION.—Some water diverted for irrigation above station in Kerr and Comal Counties, and for water power, waterworks, and other municipal uses in Kerr, Kendall, and Comal Counties; amount not known.

REGULATION.—Flow at this point entirely regulated at times by operation of power plants on Comal River and by plant 300 feet above.

4241—27—WSP 568——6

ACCURACY.—Stage-discharge relation not permanent, owing to dredging operations on the channel. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory, except for short breaks in record. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control method; for days of large range in stage, discharge averaged for intervals of a day. Records good.

Discharge measurements of Guadalupe River at New Braunfels, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 15	R. G. West	1.96	483	Aug. 16	Trigg Twichell	1.65	346
Feb. 7	C. E. McCashin	1.90	424	30	do	1.57	328
May 2	J. J. Bebeau	2.27	609	Sept. 19	J. L. Saunders	4.51	2,420
July 4	Trigg Twichell	1.78	398				

Daily discharge, in second-feet, of Guadalupe River at New Braunfels, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	411	675	419	403	399	538	548	742	552	419	379	327
2	411	625	411	403	407	502	512	690	530	415	371	331
3	442	525	419	403	399	489	498	665	520	407	359	335
4	403	484	415	403	411	480	494	645	516	395	363	395
5	391	462	415	407	407		480	635	512	403	351	570
6	399	458	419	407	423		458	625	502	399	375	476
7	395	458	419	411	431		444	615	502	399	351	1,060
8	407	435	423	415	415		466	606	498	407	359	1,240
9	399	427	423	415	419		458	606	502	403	367	825
10	368	427	423	407	415		717	597	480	399	355	592
11	403	440	419	407	419		1,020	579	466	399	347	574
12	407	435	415	403	415		1,170	566	471	399	347	516
13	395	431	415	403	419	434	1,280	561	484	399	367	525
14	395	498	411	403	415		1,060	552	462	399	351	640
15	399	512	411	403	415		1,000	548	440	395	351	579
16	442	462	415	407	423		910	530	440	387	351	543
17	391	448	415		458		852	520	444	379	343	516
18	395	462	411		462		825	516	440	391	319	2,640
19	399	462	411		444		798	512	435	387	315	4,580
20	371	453	411		440		770	512	435	395	323	8,780
21	379	462	411		476		742	502	431	391	308	1,670
22	400	448	411		514	387	715	489	419	399	315	3,800
23	466	448	407		458	395	715	879	423	395	323	1,540
24	411	435	407	401	448	395	644	1,340	423	399	323	1,060
25	403	435	407		462	391	690	910	419	399	339	880
26	393	427	407		512	391	823	665	427	395	319	770
27	391	419	411		530	466	635	615	419	383	323	690
28	407	419	411		538	570	970	588	411	371	331	650
29	411	419	407		-------	584	852	566	411	371	339	610
30	419	419	407		-------	548	770	861	403	375	327	592
31	638	-------	407	395	-------		-------	597	-------	367	331	-------

NOTE.—Owing to incomplete gage-height record, discharge interpolated May 6 and partly estimated Jan. 31, Mar. 29, Apr. 2, 14, and May 7. No record and discharge estimated Jan. 17–30, Mar. 5–21, Mar. 30 to Apr. 1, Apr. 12 and 13. Braced figures show estimated mean discharge for periods indicated.

Monthly discharge of Guadalupe River at New Braunfels, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	638	368	411	25,300
November	675	419	464	27,600
December	423	407	413	25,400
January			404	24,800
February	538	399	442	24,500
March	584		454	27,900
April		444	744	44,300
May	1,340	489	640	39,300
June	552	403	461	27,400
July	419	367	394	24,200
August	379	308	343	21,100
September	8,780	327	1,280	76,000
The year	8,780		536	388,000

GUADALUPE RIVER BELOW CUERO, TEX.

LOCATION.—Three-fourths mile upstream from Heards Bridge on Arneckville road and 2½ miles southeast of Cuero, Dewitt County.

DRAINAGE AREA.—5,070 square miles (revised measurement on topographic maps, map compiled by United States Geological Survey, scale 1:500,000, and progressive military maps of United States Army).

RECORDS AVAILABLE.—August 6, 1916, to September 30, 1923. (Fragmentary from May 29, 1919, to August 10, 1920.) From December 26, 1902, to December 31, 1906, and August 19, 1915, to August 6, 1916, a station was maintained at Schleicher's Bridge, 4 miles above this point. Discharge at two sites practically same.

GAGE.—Stevens water-stage recorder on left bank; inspected by E. B. Dietze.

DISCHARGE MEASUREMENTS.—Made from cable 40 feet upstream from gage, from Schleicher highway bridge 4 miles upstream, from San Antonio & Aransas Pass Railway bridge 6 miles upstream, or by wading.

CHANNEL AND CONTROL.—Channel straight above and below station for 1,000 feet. Bed composed of gravel and small rock; shifts slightly. Left bank composed of sand and dirt, covered with brush and open timber, and is overflowed at stages above a gage height of 20 feet, the water submerging an area for 1 mile back from river. Right bank composed of sand and dirt, covered with brush and trees on sloping side and cultivated land on top, high, and not subject to overflow. Rock and gravel rapid 250 feet below gage serves as a control during low and medium stages; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 13.45 feet at 5 p. m. March 3 (discharge, 9,980 second-feet); minimum stage, 0.75 foot at 8 a. m. September 4 (discharge, 170 second-feet).

1916–1923: Maximum stage occurred about October 20, 1919, when recorder was not in operation, and reached a height of about 32.2 feet, as determined from floodmarks on gage house (discharge not determined); minimum stage from water-stage recorder, approximately 0.58 foot from 9 to 10 a. m. November 1, 1917 (discharge, 80 second-feet, determined from extension of rating curve and possibly slightly in error).

DIVERSIONS.—There are numerous small diversions above station for irrigation and municipal uses, but flow is probably not materially affected thereby, except possibly during extremely low stages.

REGULATION.—Flow partly regulated during low and medium stages by operation of water-power plants upstream, chiefly by a plant about 8 miles above.

ACCURACY.—Stage-discharge relation for the year permanent. Curve well defined from 200 to 15,000 second-feet and fairly well defined to 36,000 second-feet. Operation of water-stage recorder satisfactory, except for breaks in the record, as noted in footnote to daily discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter, or by averaging discharge for fractional parts of a day. Records good.

Discharge measurements of Guadalupe River below Cuero, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft*
Dec. 6	R. G. West	1.54	570	May 12	Bebeau and McCashin	2.12	1,000
Jan. 30	C. E. McCashin	1.60	614	Aug. 12	Trigg Twichell	.99	312
Mar. 25	Twichell and Bebeau	1.49	622	Sept. 11	Breeding and Twichell	3.70	2,210

Daily discharge, in second-feet, of Guadalupe River below Cuero, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	569	605	599	605	653	2,500	1,450	1,270	2,120	1,390	515	922
2	498	1,070	623	653	653	1,130	1,160	1,130	1,490	1,820	482	623
3	587	1,240	593	659	611	890		1,100	890	1,750	488	551
4	569	922	602	641	605	825		1,020	955	1,100	405	339
5	569	890	653	605	792		1,020		792	1,130	361	
6	569	792	611	659	623	760			747	858	471	
7	581	825	623	653	641	747	890		695	695	482	1,000
8	563	754	617	647	623	728	760	939	714	515	438	
9	498	792	617	721	617	713	760		747	605	454	
10	569	858	611	677	617	721	754		611	617	422	
11	551	1,240	605	665	623	695	747		647	734	394	2,120
12	539	683	629	671	599	702	922	858	754	623	422	1,490
13	539	702	611	671	599	714	3,430	747	1,100	527	557	1,410
14	527	858	599	677	623	671	6,460	922	659	539	399	2,090
15	533	890	593	647	629	653	8,500	858		493	405	1,160
16	488	721	587	683	605	653	4,860	740	680	493	383	955
17	557	695	599	677	563	623	1,940	890		449	422	1,340
18	545	747	545	653	647	617	1,600	760		488	515	1,860
19	551	695	611	647	740	617	1,450	665		677	388	1,640
20	551	647	587	653	747	641	1,340	708	702	471	416	976
21	551	689	587	659	825	617	1,270	858	599	378	422	2,500
22	557	671	575	629	1,020	623	1,200	702	611	569	449	4,060
23	504	641	587	677	3,650	623	1,160	792	557	599	444	4,780
24	605	635	599	702	8,240	605	1,130	659	504	521	416	2,880
25	922	617	551	740	7,600	599	1,130	781	539	527	405	2,950
26	825	593	605	671	1,680	1,200	1,160	1,900	510	471	449	1,790
27	683	617	611	629	1,160	4,940	1,200	2,050	653	438	444	1,380
28	635	635	611	599	2,650	5,580	1,300	1,340	569	539	569	1,160
29	605	611	641	635	-------	7,420	1,270	1,060	563	466	734	1,020
30	527	599	617	641	-------	9,600	1,450	2,350	454	444	1,310	922
31	611	-------	617	641	-------	5,160	-------	1,640	-------	498	1,640	-------

NOTE.—Owing to incomplete record, discharge partly estimated Dec. 3, 6, Apr. 7, May 1–4, 12, June 14, and Sept. 11. Discharge from one staff gage reading June 20. No record and discharge estimated Dec. 4, 5, Apr. 3–6, May 5–11, June 15–19, and Sept. 5–10.

Monthly discharge of Guadalupe River below Cuero, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	922	488	580	35,700
November	1,240	593	764	45,500
December	641	545	602	37,000
January	740	599	659	40,500
February	8,240	563	1,410	78,200
March	9,600	599	1,720	106,000
April	8,500	747	1,780	106,000
May	2,350	659	1,030	63,600
June	2,120	454	753	44,800
July	1,820	378	691	42,500
August	1,640	361	519	31,900
September	4,780	339	1,560	93,100
The year	9,600	339	1,000	725,000

SAN MARCOS RIVER AT OTTINE, TEX.

LOCATION.—At highway bridge, one-fourth mile southwest of Ottine, Gonzales County, and 4 miles below mouth of Plum Creek.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—June 22, 1915, to September 30, 1923.

GAGE.—Chain gage attached to upstream handrail of bridge; read by W. C. Meek.

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

CHANNEL AND CONTROL.—Bed composed of sand, clay, and gravel; shifts. Banks wooded; right bank subject to overflow at gage height 28.7 feet, and left bank at 34 feet. Channel straight above and below station for 150 feet. Low-water control is a shoal 150 feet below gage. Backwater affects stage-discharge relation during high stages in Guadalupe River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 33.3 feet at 8 a. m. February 22 (discharge, 16,700 second-feet, determined from extension of rating curve and subject to slight error). No flow at 6.30 p. m. July 29.

1915–1923: Maximum stage recorded, 37.5 feet at 7.30 a. m. May 16, 1920 (discharge not determined); minimum stage that of July 29, 1923.

DIVERSIONS.—Small amounts of water are diverted above station for irrigation and municipal uses, but only a small part of total run-off is used. Little water, if any, is diverted below station.

REGULATION.—Flow regulated by operation of small cotton gin a short distance above station. Operation of several small water-power plants in the upper drainage basin near San Marcos and Martindale does not materially affect the flow at this station.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 70 to 15,000 second-feet, and extended beyond these limits to cover range in stage for year. Gage read to hundredths twice daily, but mean of two readings daily may not be true index to discharge owing to regulation. Daily discharge ascertained by shifting-control method. Records fair.

Discharge measurements of San Marcos River at Ottine, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 12	R. G. West	2.52	143	June 20	C. E. Ellsworth	2.56	173
Jan. 29	C. E. McCashin	2.43	148	Aug. 12	Trigg Twichell	2.03	103
Mar. 24	Twichell and Bebeau	2.50	166	Sept. 10	Twichell and Breeding	3.42	261
May 16	Bebeau and McCashin	2.83	209				

Daily discharge, in second-feet, of San Marcos River at Ottine, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	129	293	164	136	157	278	278	278	234	150	42	143
2	129	220	143	136	157	248	263	263	220	263	143	87
3	143	192	143	143	150	248	263	248	338	413	143	108
4	143	192	143	150	157	220	248	248	206	263	136	206
5	150	157	150	150	164	206	220	234	206	206	115	192
6	143	150	150	164	150	206	220	220	206	206	129	178
7	136	157	150	150	150	206	220	234	192	192	157	788
8	115	150	150	136	171	192	220	234	192	192	136	728
9	122	150	136	136	164	206	206	220	192	192	150	518
10	129	157	136	143	171	206	192	220	206	178	157	278
11	129	143	122	150	150	206	908	220	206	192	129	192
12	122	136	129	143	157	206	2,620	206	192	192	108	293
13	115	136	136	157	150	178	8,040	220	206	171	108	278
14	108	129	122	143	143	178	1,280	206	192	178	136	171
15	115	157	122	136	143	171	533	248	192	171	129	164
16	136	164	143	136	150	178	458	206	192	157	115	220
17	115	94	136	143	108	164	443	220	178	157	108	533
18	122	157	129	143	192	171	398	206	178	164	94	248
19	122	150	192	157	171	171	398	234	178	192	79	220
20	115	150	136	143	150	164	353	220	171	178	76	206
21	115	143	143	157	220	164	338	220	171	157	122	192
22	115	150	136	178	15,600	178	353	220	164	164	164	178
23	220	143	136	220	2,250	164	368	263	192	164	157	122
24	136	143	143	150	428	164	353	338	150	164	171	115
25	150	136	143	164	353	171	338	878	164	164	157	136
26	143	129	136	157	968	171	593	488	164	150	122	157
27	150	129	129	150	1,970	758	323	323	178	150	136	192
28	129	122	136	150	458	9,370	308	278	171	150	171	143
29	136	129	136	150	-------	1,600	293	234	136	55	220	164
30	115	150	136	157	-------	443	278	220	164	178	171	136
31	398	-------	150	171	-------	353	-------	248	-------	157	150	-------

Monthly discharge of San Marcos River at Ottine, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	398	108	140	8,620
November	293	94	154	9,140
December	192	122	141	8,640
January	220	136	152	9,320
February	15,600	108	905	50,300
March	9,370	164	566	34,800
April	8,040	192	710	42,300
May	878	206	268	16,500
June	338	136	191	11,400
July	413	55	183	11,200
August	220	42	133	8,190
September	788	87	249	14,500
The year	15,600	42	310	225,000

SAN ANTONIO RIVER AT SAN ANTONIO, TEX.

LOCATION.—At South Alamo Street Bridge in San Antonio, Bexar County, 4 miles below San Antonio Springs, source of normal flow of river, and 1¼ miles above mouth of San Pedro Creek.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—January 26, 1915, to September 30, 1923. Miscellaneous discharge measurements were made from 1895 to 1906.

GAGE.—Gurley graph water-stage recorder on right bank at downstream side of bridge.

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

CHANNEL AND CONTROL.—Channel is straight for 100 feet below gage and curved above. Bed composed of sand, gravel, and silt. Control formed by gravel bar; shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.22 feet at 8 a. m. July 21 (discharge, 390 second-feet); minimum stage, caused by power regulation, 0.97 foot at 10.30 a. m. August 19 (discharge not determined).

1914–1923: Maximum stage recorded, 20.14 feet about 3 a. m. September 10, 1921, determined from floodmarks on gage (discharge, 15,300 second-feet, determined by slope method, using value of 0.035 and 0.050 for n in Kutter's formula); minimum stage, 0.58 foot on several days during November and December, 1918 (discharge, 7.0 second-feet).

DIVERSIONS.—Quantity of water diverted above gage not known, but is probably small. Considerable land is irrigated from diversions below gage.

REGULATION.—Operation of water wheels at the Guenther flour mill, just above gage, causes sharp fluctuations in stage.

ACCURACY.—Stage-discharge relation not permanent. Two well-defined rating curves used during year, one applicable October 1 to March 2, the other one from March 3 to September 30. Operation of water-stage recorder not satisfactory for a few periods noted in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter; shifting-control method used February 1 to April 30. Records fair.

The normal flow of San Antonio River comes from springs within city limits, but two tributaries from north furnish considerable run-off at times of heavy precipitation. Changes in mean daily stage during low flow are believed to be due to pumping from deep wells for the city water supply and the use of artesian water for irrigation in areas adjacent to the river, for probably wells draw from underground reservoir that feeds river by springs.

Discharge measurements of San Antonio River at San Antonio, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 11	R. G. West	2.17	72.0	July 4	Trigg Twichell	1.60	42.8
Jan. 31	C. E. Ellsworth	2.05	52.3	Aug. 13	do	1.29	19.6
Mar. 2	do	1.88	65.4	Sept. 7	Breeding and Twichell	2.46	178.0
Apr. 13	J. J. Bebeau	1.88	86.4	17	Slack and Saunders	1.72	61.8
May 9	McCashin and Bebeau	1.81	70.7				

Daily discharge, in second-feet, of San Antonio River at San Antonio, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	61		78	70	55	66	73	79	61	58	38	33
2	61		74	73	52	67	83	76	57	50	38	33
3	61		72	64	50	67	82	75	60	50	37	35
4			78	62	58	68	80	72	62	52	37	40
5	60		74	61	55	69	79	77	61	53	32	49
6			72	62	52	67	77	73	61	52	37	37
7	60	70	72	55	54	67	80	84	58	54	34	96
8	56		72	58	60	65	75	72	62	53	33	50
9	58		70	55	64	65	77	69	61	53	31	50
10	56		64	55	67	57	77	69	59	52	32	55
11	56		74	55	67	54	77	68	59	48	33	55
12	58		68	54	72	58	135	67	61	45	30	55
13	58	70	72	54	73	58	83	67	57	43	33	57
14	58	72	74		76	58	83	68	54	43	32	57
15	55	73	74		104	61	83	67	53	42	31	59
16	61	76	73	54	136	59	86	63	56	44	29	56
17	60	79			82	59	79	63	55	42	27	62
18	60	76			78	57	77	63	54	41	29	57
19	58	74			79	59	77	63	55	46	25	55
20	60	73	55		79	61	80	64	52	41	29	56
21	58	73		54	97	65	77	63	50	90	29	53
22		72		60	62	68	75	61	50	57	29	55
23		73	73	54	60	65	77	63	50	56	31	49
24		70	73	52	66	61	84	62	49	48	29	54
25	60	73	74	54	66	55	92	62	52	45	31	52
26		66	79	54		84	80	62	50	42	27	52
27		72	73	55	66	129	80	59	47	40	63	52
28	61	72	72	48	64	77	82	58	46	42	68	50
29	61	73	72	55	-------	77	77	64	44	38	35	25
30		72	76	50	-------	76	79	64	44	40	32	47
31	92	-------	68	49	-------	75	-------	61	-------	40	34	-------

NOTE.—Recorder not operating, and discharge estimated Oct. 4–6, 22–27, 29, 30, Nov. 1–12, 19, 20, Dec. 17–22, Jan. 14–19, Feb. 25, 26, and June 3. Discharge partly estimated Oct. 7, Nov. 13, 18, 21, Dec. 16, 23, Jan. 13, 20, Feb. 27, and June 4. Discharge from one staff gage reading Oct. 21, 28, and 31.

Monthly discharge of San Antonio River at San Antonio, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	92	55	60.3	3,710
November	----------	66	71.7	4,260
December	79	64	72.9	4,480
January	73	48	56.2	3,460
February	136	50	70.0	3,890
March	129	54	66.9	4,110
April	135	73	81.5	4,850
May	84	58	67.0	4,120
June	62	44	54.7	3,250
July	90	38	48.4	2,980
August	68	25	34.0	2,090
September	96	33	52.1	3,100
The year	136	25	61.2	44,300

SAN ANTONIO RIVER AT CALAVERAS, TEX.

LOCATION.—One-fourth mile south of San Antonio & Aransas Pass Railway station in Calaveras, Wilson County, 1 mile below mouth of Calaveras Creek.

DRAINAGE AREA.—1,780 square miles (revised measurement on topographic maps, progressive military maps of United States Army, and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—March 12, 1918, to September 30, 1923.

GAGE.—Vertical staff in five sections on left bank near old brick plant; read by I. M. Smith.

DISCHARGE MEASUREMENTS.—Made from highway bridge, half a mile upstream from gage, or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and clay; shifts. Channel straight above and below station for 150 feet. Left bank wooded and not subject to overflow; right bank steep, wooded, and subject to overflow only at extremely high stages. Old bricks piled into channel form a semi-permanent low-water control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 16.55 feet at 5.10 p. m. September 7 (discharge, 2,340 second-feet); minimum discharge, 48 second-feet August 31, September 1 and 2.

1918–1923: Maximum stage recorded, 42.0 feet at 4 a. m. September 11, 1921 (discharge not determined); minimum discharge, 15 second-feet at 8.30 a. m. September 14, 1918.

DIVERSIONS.—The Medina Dam and Reservoir, with a storage capacity of 254,000 acre-feet, is on Medina River about 50 miles above its confluence with the San Antonio. Four miles below Medina Dam are the diversion works, with a capacity of 850 second-feet. There were probably about 5,000 acres under irrigation in this project in 1922.

REGULATION.—The ordinary flow may be slightly affected by storage and diversions on Medina River.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined between 30 and 1,500 second-feet, and extended above by means of the $A\sqrt{d}$ method based on a measurement at a discharge of 11,000 second-feet and subject to error. Gage read to hundredths twice daily, but mean of two readings a day may not be a true index to discharge, owing to rapid fluctuations. Daily discharge ascertained by shifting-control method. Records fair for low and medium stages and poor for high stages.

Discharge measurements of San Antonio River at Calaveras, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 1	R. G. West	9.25	910	July 3	Trigg Twichell	2.11	116
12	do	2.64	151	Aug. 13	do	1.15	65.4
Feb. 2	C. E. Ellsworth	2.30	126	Sept. 17	Twichell and Breeding	16.09	2,220
May 9	Bebeau and McCashin	2.70	164				

Daily discharge, in second-feet, of San Antonio River at Calaveras, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	89	854	154	130	130	188	188	188	138	95	77	48
2	89	470	146	130	130	179	188	188	130	286	77	48
3	89	322	146	130	130	179	198	179	130	108	72	72
4	83	286	146	130	198	179	188	170	130	95	72	77
5	83	179	146	130	387	179	188	162	130	95	72	387
6	89	130	146	130	240	179	179	162	130	89	67	83
7	89	130	138	130	138	170	170	170	130	89	67	1,062
8	89	138	138	130	138	162	162	162	122	89	67	1,140
9	89	146	138	130	138	162	162	162	122	95	67	218
10	83	146	138	130	138	162	188	162	122	89	67	122
11	83	154	130	122	138	162	322	162	122	83	67	101
12	83	146	130	122	138	154	573	154	115	77	67	108
13	83	374	130	130	138	154	1,570	146	122	77	67	130
14	83	310	130	130	138	154	663	146	130	77	67	108
15	83	251	138	122	154	154	251	154	115	72	67	101
16	83	179	138	122	663	146	198	146	122	72	67	115
17	83	229	138	122	870	146	198	146	138	77	62	115
18	83	162	138	122	310	138	130	138	122	72	62	115
19	83	162	138	122	218	138	229	138	122	67	60	108
20	83	162	138	122	170	146	208	138	115	67	60	101
21	83	154	138	122	179	146	198	138	108	218	62	101
22	83	154	138	322	1,490	146	198	138	108	251	62	95
23	130	154	138	470	694	146	198	130	108	122	57	89
24	95	154	138	138	400	146	198	130	108	101	57	89
25	108	154	138	130	543	138	428	130	108	95	57	95
26	130	146	138	122	240	138	442	130	108	89	60	89
27	115	146	138	138	198	694	262	130	108	89	648	83
28	101	146	138	130	198	1,140	218	130	101	89	335	83
29	95	154	138	130	-------	710	198	130	95	77	101	77
30	89	146	130	208	-------	298	188	262	95	77	77	77
31	208	-------	130	130	-------	198	-------	170	-------	77	48	-------

NOTE.—Gage not read Feb. 4; discharge estimated.

Monthly discharge of San Antonio River at Calaveras, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	208	83	94.8	5,830
November	854	130	215	12,800
December	154	130	138	8,500
January	470	122	148	9,080
February	1,490	130	309	17,100
March	1,140	138	230	14,100
April	1,570	130	289	17,200
May	262	130	155	9,500
June	138	95	118	7,050
July	286	67	102	6,260
August	648	48	94.0	5,780
September	1,140	48	175	10,400
The year	1,570	48	171	124,000

SAN PEDRO CREEK AT SAN ANTONIO, TEX.

LOCATION.—At south end of Missouri, Kansas & Texas Railway culvert, 50 feet west of tracks, 700 feet south of its terminal, 200 feet south of Arsenal Street crossing, 1 mile above mouth of Salsamora and Martinez Creeks, 2 miles below San Pedro Springs, its source, and 2½ miles above confluence with San Antonio River.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—July 20, 1916, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder installed March 14, 1921; attended by engineers of city of San Antonio.

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

CHANNEL AND CONTROL.—Bed and banks composed of smooth concrete; permanent. Low-stage control is a 4 by 4 inch timber bolted across bed of flume.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.55 feet at 8.20 a. m. August 28 (discharge, 404 second-feet); minimum stage, 0.35 foot at 6.40 p. m. March 23 (discharge, 1.9 second-feet).

1916–1923: Maximum stage recorded, 8.6 feet at 11.30 p. m. September 9, 1921, when backwater from Alizan Creek existed (discharge not determined); minimum stage, 1.30 feet December 10–11, 1918 (discharge, 0.7 second-foot).

ICE.—None reported.

DIVERSIONS.—None.

REGULATION.—Flow partly regulated by small dam at swimming pool in San Pedro Park, a few miles above.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 7 to 11 second-feet and poorly defined from 11 to 200 second-feet, and extended above by use of Kutter's formula with a value of 0.014 for n at gage height 6.0 feet. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter, except as noted in footnote to daily discharge table. Records good.

Entire flow of San Pedro Creek, except during times of heavy precipitation, is furnished by San Pedro Springs, and the flow at this station is believed to be that which reaches San Antonio River. Martinez and Salsamora Creeks carry no water except during heavy local rains, and have been known to be dry for several years at a time.

Discharge measurements of San Pedro Creek at San Antonio, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 9	R. G. West	0.51	7.69
Sept. 18	Saunders and Slack	.49	6.87

Daily discharge, in second-feet, of San Pedro Creek at San Antonio, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.5	10	7.5	7.5	19	5.6	5.2	7.5	7.5	13	7.0	5.6
2	7.5	9.0	7.5	7.5	7.5		5.2	7.0	7.0	8.5	7.5	5.6
3	7.5	8.0	7.5	7.5	7.0	3.7	6.5	7.0	6.8	7.5	5.6	6.0
4	7.5	11	7.5	7.5	10	3.4	7.5	6.5	6.5	6.5	5.6	7.5
5	7.5	11	7.5	7.5	7.5	3.4	7.5	6.0		6.0	5.2	14
6	7.5	11	7.5	7.5	7.5	4.8	7.0	6.0	6.2	5.6	5.6	6.5
7	7.5	9.6	7.5	7.5	7.0	6.5	7.0	12		5.2	6.0	25
8	7.0	9.0	7.5	7.5	7.0	6.0	7.0	7.0		6.0	4.8	8.0
9	7.0	8.0	7.5	7.0	7.0	6.0	7.0	6.5	6.0	6.5	6.0	6.0
10	6.5	9.6	7.5	6.5	7.0	6.5	7.0	7.0	6.5	6.5	5.2	6.5
11	6.5	9.0	7.5	6.0		5.6	8.0	7.0	6.0	6.5	5.6	6.5
12	6.5	9.6	7.5	7.5	7.0	6.5	29	7.0	6.5	7.0	5.2	8.0
13	6.5	8.0	7.5	7.0		6.0	11	7.0	6.0	6.5	5.2	7.0
14	6.5	8.0	7.5	7.5		4.4	6.5	7.0	4.0	7.0	5.6	7.5
15	6.5	8.0	7.5	7.5	11	7.0	7.5	7.0	4.4	4.4	5.2	7.5
16	7.0	8.5	7.5	7.5		6.5	9.0	7.0	4.4	5.6	5.2	6.5
17	7.5	8.5	7.5	7.5	9.6	5.2	8.5	6.5	4.0	5.2	4.8	7.0
18	8.0	7.5	7.5	7.5	8.5	5.6	8.5	7.5	4.0	5.6	5.2	7.5
19	7.5	7.5	8.0	7.5	7.5	5.6	8.5	7.5	3.7	7.0	4.8	6.0
20	7.0	8.0	8.0	6.5	6.5	6.5	8.5	7.5	4.0	7.5	5.2	5.6
21	6.5	8.0	8.0	6.5	12	6.0	8.0	6.5	4.4	22	5.6	7.5
22	9.6	8.0	8.0	9.0	9.6	5.6	8.0	8.0	4.4	9.6	5.6	7.5
23	12	7.5	7.5	11	8.5	5.6	8.0	7.5	4.4	6.5	5.6	6.5
24	7.5	7.5	7.5	9.6	9.0	4.4	10	7.0	4.4	6.5	5.2	6.5
25	11	7.5	8.5	9.0	7.5	5.6	11	7.0	4.8	7.0	5.6	8.0
26	8.5	7.5	8.5	8.0	7.5	15	8.5	8.0	4.8	7.5	5.2	7.0
27	8.5	7.5	8.0	8.5	7.5	28	8.5	8.0	4.4	6.5	18	6.5
28	7.5	7.5	7.5	8.5	7.5	6.0	7.5	7.0	4.8	6.0	27	6.5
29	7.5	7.5	7.5	8.5	-------	5.6	6.5	11	6.0	7.0	5.6	6.5
30	7.5	7.5	7.5	8.0	-------	5.2	7.5	8.5	4.4	7.0	7.0	6.5
31	27	-------	7.5	7.5	-------	4.8	-------	7.5	-------	6.5	5.2	-------

NOTE.—Owing to incomplete record, discharge estimated or partly estimated Oct. 27, Nov. 12, 13, Jan. 12, 13, 26, 31, Feb. 1, 11–17, 25–27, May 16–20, June 3, 5–8, and July 21. Braced figures show estimated mean for periods indicated. Discharge determined from one daily reading of staff gage Feb. 10 and June 4.

Monthly discharge of San Pedro Creek at San Antonio, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	27	6.5	8.25	507
November	11	7.5	8.49	505
December	8.5	7.5	7.65	470
January	11	6.0	7.73	475
February	19	-------	8.49	471
March	28	3.4	6.52	401
April	29	5.2	8.51	507
May	12	6.0	7.40	455
June	7.5	3.7	5.30	315
July	22	4.4	7.28	448
August	27	4.8	6.65	409
September	25	5.6	7.63	454
The year	29	3.4	7.48	5,420

MEDINA RIVER NEAR PIPE CREEK, TEX.

LOCATION.—2 miles below mouth of Privilege Creek, 2 miles above backwater from Medina Dam, 3½ miles above mouth of Pipe Creek, 4 miles southwest of Pipe Creek post office, Bandera County, and 8 miles east of Bandera.

DRAINAGE AREA.—412 square miles (measured on progressive military map of United States Army).

RECORDS AVAILABLE.—December 6, 1922, to September 30, 1923.

GAGE.—Stevens eight-day water-stage recorder on left bank; inspected by R. E. Buck.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed of stream consists of rock and gravel and some moss. Channel is straight for 1,000 feet above and below gage. Right bank rocky, and not subject to overflow. Left bank has gentle incline, is sparsely covered with small trees, and begins to be overflowed at gage height of 9 feet. Low-water control is a concrete weir 100 feet below gage. Weir is about 1.5 feet high for a distance of 95 feet, with abutments 4 feet higher than crest. A rock riffle 600 feet below gage serves as control during medium stages.

EXTREMES OF DISCHARGE.—Maximum stage during period of record from water-stage recorder, 15.36 feet at 1 p. m. April 25 (discharge not determined); minimum stage, 0.62 foot August 27–29 and September 4 (discharge, 5.4 second-feet).

DIVERSIONS.—None above. Medina Dam and Reservoir, with storage capacity of 254,000 acre-feet, is 19 miles below gage. Diversion works have a capacity of 850 second-feet, but only a small per cent of this capacity was used in 1923.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined below 300 second-feet, and extended above to cover mean daily stage during year by means of the formula $Q=Clh^{\frac{3}{2}}$ with a value for C derived from current-meter measurements made at the station. Operation of water-stage recorder satisfactory, except for short breaks in the record. Daily discharge determined by applying to rating table mean daily gage height obtained from recorder graph by inspection or by use of planimeter. Records for low stages good and poor for high stages.

Discharge measurements of Medina River near Pipe Creek, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Sept. 6	C. E. Ellsworth	0.71	10.4
Nov. 14	R. G. West	.79	27.2
Aug. 14	Trigg Twichell	.66	10.2

Daily discharge, in second-feet, of Medina River near Pipe Creek, Tex., for the year ending September 30, 1923

Day	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1			28	26	46	35	110	33	37	12	8.2
2			28	28	41	30	92	35	26	12	8.2
3			28	28	37	30	79	41	25	11	7.3
4			28	25	39	30	72	37	20	11	5.4
5			28	28	39	30	68	33	16	9.1	6.4
6		25	28	26	48	32	62	30	14	9.1	98
7		25	28	28	52	30	60	28	14	9.1	356
8		25	28	28	44	30	56	25	14	8.2	30
9		28	28	28	41	28	54	25	14	7.3	19
10		28	28	32	41	26	52	25	11	8.2	52
11		28	28	30	37	23	48	25	12	8.2	96
12		28	28	26	39	347	46	25	12	8.2	54
13		28	28	30	39	148	48	25	12	8.2	30
14	26	28	28	26	41	76	46	25	13	9.1	20
15		28	28	26	41	60	42	25	13	9.1	17
16		28	28	37	35	58	41	25	13	7.3	16
17		28	28	52	35	60	37	26	14	7.3	386
18		28	28	66	33	62	37	23	14	6.4	1,240
19		28	28	62	32	62	37	22	16	6.4	560
20		28	28	58	30	62	37	20	35	6.4	182
21		28	25	52	28	58	37	20	596	6.4	193
22		28	28	50	28	54	35	20	58	6.4	122
23		28	28	50	28	50	32	20	30	6.4	92
24		28	28	50	28	46	32	20	19	6.4	70
25		28	28	52	28	2,940	32	19	14	6.4	60
26		28	28	60	26	680	33	16	13	6.4	52
27		28	26	56	42	341	33	14	13	5.4	46
28		28	25	50	42	240	33	13	16	5.4	42
29		28	23		35	179	33	13	23	5.4	39
30		28	25		35	138	32	22	17	7.3	33
31		28	25		37		32		14	6.4	

NOTE.—Owing to incomplete record, discharge partly estimated Dec. 6–9, Mar. 4, July 21, 22, and Sept. 10.

Monthly discharge of Medina River near Pipe Creek, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
December 6–31	28	25	27.7	1,430
January	28	23	27.4	1,680
February	66	25	39.6	2,200
March	52	26	37.0	2,280
April	2,940	23	199	11,900
May	110	32	48.0	2,950
June	41	13	24.3	1,450
July	596	11	37.4	2,300
August	12	5.4	7.80	480
September	1,240	5.4	131	7,820
The period				34,500

MEDINA RIVER NEAR RIOMEDINA, TEX.

LOCATION.—Just above Medina Valley Irrigation Co.'s diversion dam, 1 mile above Haby's crossing, 4 miles below company's main dam, 6 miles northwest of Riomedina, Medina County.

DRAINAGE AREA.—606 square miles (measured on progressive military map of United States Army).

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

GAGE.—Gurley graph water-stage recorder attached to right upstream side of diversion dam; attended by J. B. Milam.

DISCHARGE MEASUREMENTS.—Made from cable 2,000 feet below gage, or by wading near Haby's crossing 1 mile below gage.

CHANNEL AND CONTROL.—Channel composed of rock and gravel; permanent. Banks high and not subject to overflow. Control is concrete spillway of dam; permanent. Point of zero flow over dam is gage height 0.60 foot.

EXTREMES OF DISCHARGE.—No flow over dam during year.

1922–23: Maximum stage from water-stage recorder, 0.74 foot from 4 p. m. May 5 to 11 p. m. May 6, 1922 (discharge, 28 second-feet, determined by subtracting seepage past dam from a measurement made 1 mile below dam). No flow over dam, except May 4 to 12, 1922.

DIVERSIONS.—Water is diverted to Medina Canal just above gage. About 5,000 acres irrigated in 1922. Maximum capacity of canal, 850 second-feet. See "Medina Canal near Riomedina."

REGULATION.—Flow regulated by main storage dam, 4 miles upstream, except when main reservoir is full and water flows over spillway.

ACCURACY.—Stage-discharge relation permanent. No flow over dam this year. A seepage curve, giving relation between height of water behind dam and seepage past dam measured 1 mile below, is fairly well defined for all lake levels this year. Mean monthly seepage past dam determined by applying to seepage rating table mean monthly lake levels obtained by averaging daily gage readings. Records fair.

COOPERATION.—Daily gage readings of lake level furnished by Medina Valley Irrigation Co.

Discharge measurements of Medina River near Riomedina, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 10	R. G. West	−1.44	24.1
Apr. 3	C. E. Ellsworth	−.83	23.1
Aug. 14	Trigg Twichell	−1.42	25.1

NOTE.—There was no flow over the dam when the above measurements were made. Discharge is the seepage inflow between dam and measuring section at Haby crossing, 1 mile downstream.

Monthly seepage of Medina River past diversion dam near Riomedina, Tex., for the year ending September 30, 1923

[Measured at Haby's crossing, 1 mile below dam]

Month	Mean discharge in second feet	Run-off in acre-feet	Month	Mean discharge in second feet	Run-off in acre-feet
October	23	1,410	May	24	1,430
November	24	1,430	June	24	1,430
December	23	1,410	July	24	1,480
January	24	1,480	August	24	1,480
February	24	1,330	September	24	1,430
March	23	1,410			
April	24	1,430	The year		17,200

MEDINA CANAL NEAR RIOMEDINA, TEX.

LOCATION.—Just above upper end of flume No. 1 on Medina Valley Irrigation Co.'s main canal, one-third mile below head of canal and 6 miles north of Riomedina, Medina County.

RECORDS AVAILABLE.—March 30, 1922, to September 30, 1923. Station maintained during irrigation seasons of 1920 and 1921 by United States Department of Agriculture in cooperation with Texas Board of Water Engineers for seepage studies.

GAGE.—Gurley graph water-stage recorder, with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading or from foot plank just above gage.

CHANNEL AND CONTROL.—Metal flume and concrete-lined canal; permanent.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 2.07 feet from 8 a. m. to noon June 26 (discharge, 128 second-feet). No flow during several periods.

1922–23: Maximum stage, that of June 26, 1923. No flow for several periods.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates. Canal ordinarily carries a small flow during nonirrigation season for domestic and stock water uses.

ACCURACY.—Stage-discharge relation permanent. Rating curves fairly well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or by use of planimeter, except as noted in footnote to daily discharge table. Records good.

Canal diverts from right bank of Medina River. Water used for irrigation near Lacoste and Natalia.

Discharge measurements of Medina Canal near Riomedina, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 10	R. G. West		0	Apr. 3	C. E. Ellsworth		0
20	C. E. Ellsworth		0	Aug. 14	Twigg Twichell	1.50	62.2

Daily discharge, in second-feet, of Medina Canal near Riomedina, Tex., for the years ending September 30, 1922 and 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1922												
1							2.8	6.5	25	83		68
2							2.2	8.2	25	93		64
3							1.6	6.7	25	93	65	64
4							2.8	6.5	21	78		60
5							5.9	7.0	20	68		52
6							6.5	7.0	20	64	49	52
7							4.7	7.0	20	64	49	52
8							12	7.0	20	64	46	52
9							20	8.2	32	68	46	56
10							15	12	37	73	49	49
11							13	17	37	73	49	46
12							13	25	37	73	46	52
13							13	25	37	73	46	56
14							12	31	37	73	52	56
15							12	37	37	73	52	56
16							32	37	37	78	60	49
17							40	34	28	83	64	49
18							52	34	21	83	68	46
19							46	30	21	83	64	43
20							37	25	21	73	60	37
21							37	16	26	68	60	40
22							40	13	43	64	64	40
23							40	13	43	64	64	40
24							40	13	46	64	64	37
25							37	17	56	64	64	37
26							37	19	64	73	64	37
27							6.5	19	68	73	64	37
28							3.6	23	64	73	64	40
29							3.8	28	52		68	31
30							5.6	28	73	65	68	30
31						2.2		26			68	
1922-23												
1	32	0	22	17	23	0	0	13	110	59	73	48
2	31	0	12	14	25	0	0	16	104	110	73	59
3	30	0	6.3	8.2	16	0	0	18	110	104	73	59
4	35	0	6.7	7.5	7.5	5.4	15	24	110	88	73	55
5	37	0	7.0	8.9	5.2	22	12	19	110	83	73	55
6	37	0	7.2	14	0	7.7	12	26	110	73	73	51
7	37	0	11	18	0	0	12	29	110	83	73	24
8	35	0	18	20	0	0	12	30	110	83	78	18
9	37	0	20	24	0	0	12	30	110	73	78	15
10	37	0	19	25	0	0	7.5	28	104	68	83	16
11	37	0	17	24	0	0	7.2	31	104	68	78	16
12	35	0	19	21	0	0	4.3	32	99	64	83	14
13	37	0	19	20	0	0	0	38	99	64	59	12
14	37	0	19	13	8.9	0	0	41	94	64	68	12
15	35	0	19	12	10	0	0	41	99	73	68	11
16	35	0	19	12	2.6	0	0	38	88	78	64	11
17	35	0	7.5	12	0	7.7	0	38	99	88	68	11
18	30	0	8.2	12	0	13	0	38	104	88	68	11
19	30	0	8.2	12	0	22	3.3	41	104	88	68	12
20	30	0	8.4	12	0	23	9.7	73	99	94	68	16
21	27	0	8.4	12	3.4	21	13	78	104	68	73	15
22	21	0	10	11	0	19	13	88	99	64	73	17
23	17	4.8	12	11	0	15	14	94	110	64	73	18
24	13	19	12	12	0	13	14	99	104	64	73	17
25	4.0	15	12	12	0	18	10	104	59	59	73	10
26	7.7	7.7	13	12	0	10	8.2	110	99	64	73	0
27	8.2	11	14	12	0	0	7.9	104	122	59	64	0
28	5.6	25	13	12	0	0	11	99	116	55	38	0
29	3.4	25	16	12		0	11	110	110	68	38	1.6
30	3.6	24	19	12		0	10	110	116	64	41	0
31	1.1		18	19		0		110		73	38	

NOTE.—The above record for 1922 supersedes that published in Water-Supply Paper 548. Owing to incomplete record, discharge based on record of Medina Valley Irrigation Co.s gage Aug. 19–24, 1923. Braced figures show estimated discharge for period indicated.

Monthly discharge of Medina Canal near Riomedina, Tex., for the years ending September 30, 1922 and 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1922				
April	52	1.6	19.8	1,180
May	37	6.5	18.9	1,160
June	73	20	36.4	2,170
July	93		72.6	4,460
August	68	46	59.3	3,640
September	68	30	47.6	2,830
The period				15,400
1922-23				
October	37	1.1	25.8	1,590
November (8 days)	25	4.8	16.4	261
December	22	6.3	13.6	835
January	25	7.5	14.3	880
February (9 days)	25	2.6	11.3	202
March	23	5.4	15.1	390
April (21 days)	15	3.3	10.4	435
May	110	13	56.5	3,470
June	122	59	104	6,180
July	110	55	74.0	4,550
August	83	38	67.7	4,160
September (26 days)	59	1.6	23.3	1,200
The year				24,200

NOTE.—Monthly discharge for 1922 supersedes data published in Water-Supply Paper 548.

NUECES RIVER BASIN

NUECES RIVER NEAR CINONIA, TEX.

LOCATION.—Just below suspension bridge, near Oswald ranch, 2 miles east of Cinonia, Zavalla County, and 8 miles northeast of Crystal City.

DRAINAGE AREA.—2,150 square miles (revised measurement on topographic maps, progressive military maps of United States Army, and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—July 5, 1915, to September 30, 1923.

GAGE.—Vertical staff in six sections, installed May 6, 1918, on right bank, 200 feet below highway bridge; read by C. C. Oswald.

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

CHANNEL AND CONTROL.—Bed composed of clay and gravel. Banks wooded; not subject to overflow, except at extremely high stages. Channel straight above and below station. A concrete control was completed at site of gage on September 23, 1917; point of zero flow, gage height 0.85 foot.

EXTREMES OF DISCHARGE.—Maximum stage during year, by leveling to floodmarks, 48.2 feet on September 19 (discharge not determined); minimum stage, 0.95 foot September 3 (discharge, 0.3 second-foot).

1915–1923: Maximum stage recorded, 49.1 feet September 23, 1919, determined by leveling from floodmarks (discharge not determined). According to residents, the greatest flood on record occurred in 1913, when river reached a stage of about 53.2 feet by present gage datum. No flow during several periods of record.

DIVERSIONS.—Considerable water diverted above station for irrigation; amount not known.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 700 second-feet and extended above by means of area-velocity curves, but does not cover range of stage during year. Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage height to rating table, except as noted in footnote to daily discharge table. Records for low and medium stages good and for high stages poor.

Backwater from a dam 40 feet high, about 20 miles below station, extends within 2 miles of station when reservoir is full. A large part of flow of river is known to seep into bed just below Uvalde and return to surface just above station. Condition of underground water may have an effect on this return water and thus help to equalize flow.

The following discharge measurement was made by C. E. Ellsworth:

July 20, 1923: Gage height, 1.10 feet; discharge, 2.5 second-feet.

Daily discharge, in second-feet, of Nueces River near Cinonia, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10	13	14	14	14	18	15	12	6.6	4.7	1.4	0.4
2	10	12	14	14	14	18	15	12	6.6	4.1	1.3	.4
3	10	12	14	14	14	17	14	12	458	3.8	1.2	.3
4	9.7	12	14	14	14	76	14	12	82	3.5	1.2	5.0
5	8.9	11	14	14	14	19	14	12	22	3.0	1.0	1.5
6	8.9	11	14	14	14	19	14	12	14	3.0	1.0	27
7	8.9	15	14	14	14	18	14	11	13	2.6	1.0	868
8	8.1	14	14	14	14	18	14	11	10	2.6	1.0	560
9	7.7	14	14	14	14	17	14	11	10	2.6	.9	82
10	7.4	13	14	14	14	17	14	11	10	2.6	.9	30
11	7.4	13	14	14	14	17	14	10	10	2.6	.9	67
12	7.4	13	14	14	14	17	64	9.7	9.7	2.6	.9	232
13	7.4	13	14	14	14	17	53	9.7	9.3	2.4	.9	173
14	7.4	13	14	13	16	17	28	8.9	8.1	2.4	.9	43
15	7.4	13	14	13	19	17	18	8.9	7.4	2.2	.8	33
16	7.4	14	14	13	23	17	14	8.9	6.6	1.8	.8	20
17	7.4	14	14	13	25	17	14	8.1	6.6	1.8	.7	12
18	7.4	14	14	13	21	16	14	8.1	10	1.8	.6	10
19	7.4	14	14	13	17	16	14	8.1	9.7	1.7	.6	-------
20	8.1	14	14	13	15	16	14	8.1	8.9	1.6	.6	-------
21	8.1	14	14	13	14	16	14	8.1	8.1	28	.5	3,770
22	8.1	14	14	14	14	16	14	7.7	7.7	2.8	.5	1,250
23	187	15	14	14	17	16	14	7.4	7.4	5.6	.4	448
24	145	14	14	14	16	16	14	7.4	7.4	11	.4	232
25	33	14	14	14	94	16	14	7.4	7.0	5.6	.4	187
26	26	14	14	14	19	16	14	7.4	6.6	5.0	.4	187
27	22	14	14	14	19	46	14	7.4	6.0	4.1	1.6	180
28	18	14	14	14	18	145	14	7.4	5.6	3.5	5.0	166
29	14	14	14	14	-------	38	13	7.4	5.0	2.4	1.0	152
30	14	14	14	14	-------	22	13	7.4	4.7	1.8	.5	138
31	13	-------	14	14	-------	18	-------	6.6	-------	1.6	.4	-------

NOTE.—Stage beyond limits of rating curve Sept. 19 and 20 and mean daily gage heights for the respective days partly estimated as 36.7 and 39.2 feet. Discharge partly estimated Sept. 18, 21, and 22.

Monthly discharge of Nueces River near Cinonia, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	187	7.4	21.0	1,290
November	15	11	13.4	799
December	14	14	14.0	861
January	14	13	13.7	845
February	94	14	18.9	1,050
March	145	16	24.8	1,530
April	64	13	17.6	1,050
May	12	6.6	9.23	567
June	458	4.7	26.1	1,560
July	28	1.6	4.03	248
August	5.0	.4	.96	58.9
September	----------	.3	----------	----------

NOTE.—See footnote to daily discharge table.

NUECES RIVER NEAR THREE RIVERS, TEX.

LOCATION.—At San Antonio, Uvalde & Gulf Railroad bridge, 1 mile west of Kittie, 2 miles southeast of Three Rivers, Live Oak County, and half a mile below mouth of Frio River.

DRAINAGE AREA.—15,600 square miles (measured on topographic maps, progressive military maps of United States Army, and maps of Texas, scale 1:500,000).

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1923.

GAGE.—Vertical staff in four sections, attached to piers of railroad bridge; read by M. L. Mouser or Eldon Gullett.

DISCHARGE MEASURMENTS.—Made by wading or from highway bridge half a mile below gage.

CHANNEL AND CONTROL.—Bed composed of adobe shale and sand; does not change greatly. Channel straight above and below station. Banks wooded and not subject to overflow, except at extremely high stages. Location of high-water control not known; shoal just below gage probably forms low-water control; shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 41.6 feet February 24 (discharge, 16,400 second-feet, determined from extension of rating curve and subject to large error); minimum discharge, 0.1 second-foot August 27.

1915–1923: Maximum stage recorded, 46.0 feet at 5 a. m. September 18, 1919 (discharge not determined; probably backwater caused by Gulf storm). No flow during several periods of record.

DIVERSIONS.—Records for the Board of Water Engineers for the State of Texas show that about 10,000 acres have been declared irrigated by diversions from stream above station.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 7,000 second-feet and extended above by use of area-velocity curves and subject to error. Gage read to nearest tenth or half-tenth once daily, and oftener during floods. Daily discharge determined by shifting-control method. Records fair for low and medium stages and poor for high stages.

Discharge measurements of Nueces River near Three Rivers, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 30	R. G. West	5.14	663	May 10	J. J. Bebeau	1.75	51.1
Feb. 3	C. E. Ellsworth	1.42	8.8	July 18	C. E. Ellsworth	.70	a3
Apr. 12	J. J. Bebeau	3.80	276				

a Estimated.

Daily discharge, in second-feet, of Nueces River near Three Rivers, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	517	4,390	18	9.5	9.5	8,950	13,400	696	17	455	3.4	517
2	355	3,550	18	9.5	9.5	7,950	12,800	812	15	295	295	315
3	222	1,950	18	9.5	9.2	6,490	10,500	696	14	495	495	70
4	124	1,800	16	8.2	9.5	4,670	6,910	276	12	257	583	60
5	80	1,480	16	8.2	11	3,400	4,030	192	10	130	673	980
6	51	1,320	16	8.2	11	2,660	2,450	130	10	47	495	1,290
7	28	908	15	8.2	11	2,070	1,740	106	9.2	32	130	1,140
8	28	415	15	8.2	11	1,060	1,190	75	8.7	20	32	1,800
9	25	239	15	8.2	11	375	719	46	7.9	15	56	4,950
10	25	207	13	8.2	11	375	475	50	7.3	56	56	3,400
11	17	124	13	8.2	11	435	335	45	6.8	39	47	1,950
12	17	207	13	8.2	9.5	539	335	39	7.9	25	32	2,100
13	15	4,150	11	8.2	9.5	627	2,480	32	6.8	20	25	3,120
14	15	6,350	11	8.2	9.5	719	3,150	32	6.8	15	25	3,360
15	14	3,670	11	8.2	295	765	932	32	130	12	22	3,120
16	14	517	11	8.2	719	812	583	28	118	9.2	20	4,110
17	10	276	11	8.2	2,620	335	375	25	96	6.8	15	4,670
18	7.9	177	11	8.2	2,340	295	276	25	60	4.1	12	7,100
19	6.8	130	11	8.2	2,130	257	239	22	39	3.4	9.2	8,600
20	6.8	106	9.5	8.2	2,560	90	192	20	32	2.7	6.8	8,050
21	5.8	80	9.5	8.2	2,450	43	149	112	25	4.1	5.0	7,340
22	5.0	70	9.5	70	12,400	56	124	192	32	85	3.4	6,310
23	5.0	56	9.5	70	15,800	43	101	101	56	257	2.2	5,500
24	90	45	9.5	36	16,400	39	90	56	35	32	1.2	6,400
25	1,210	42	9.5	23	14,200	35	149	39	25	20	.6	6,170
26	1,110	37	9.5	18	12,200	35	192	39	20	12	.2	5,940
27	980	32	9.5	14	10,200	6,540	239	32	15	9.2	.1	5,500
28	627	32	9.5	11	9,200	11,000	276	28	14	6.8	3,630	2,940
29	539	27	9.5	11	----------	11,800	239	25	13	5.0	6,170	2,760
30	650	27	9.5	11	----------	10,200	375	22	12	4.1	7,810	2,420
31	673	-------	9.5	11	----------	11,400	--------	20	------	3.7	4,270	-------

Monthly discharge of Nueces River near Three Rivers, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,210	5.0	241	14,800
November	6,350	27	1,080	64,300
December	18	9.5	12.2	748
January	70	8.2	14.6	895
February	16,400	9.2	3,700	206,000
March	11,800	35	3,030	187,000
April	13,400	90	2,170	129,000
May	812	20	130	8,020
June	130	6.8	28.7	1,710
July	455	2.7	76.7	4,720
August	7,810	.1	804	49,400
September	8,600	60	3,730	222,000
The year	16,400	.1	1,230	889,000

NUECES RIVER AT CALALLEN, TEX.

LOCATION.—At old pump house for city of Corpus Christi, half a mile northwest of Calallen, Nueces County, 18 miles west of Corpus Christi, half a mile above edge of tidewater and breakwater dam.

DRAINAGE AREA.—16,900 square miles (revised measurement on topographic maps, progressive military maps of United States Army, and map of Texas, scale, 1:500,000).

RECORDS AVAILABLE.—August 2, 1915, to September 30, 1923.

GAGE.—Vertical staff attached to pipe-line support of old pump house; read by John W. Cunningham.

DISCHARGE MEASUREMENTS.—Made by wading at backwater or from cable 125 feet below gage.

CHANNEL AND CONTROL.—Bed composed of clay and gravel. Channel straight above and below station. Left bank wooded, low, and bordered by levee constructed to prevent overflow; right bank wooded, medium in height, and not subject to overflow. Breakwater dam, which is a loose rock fill half a mile below, serves as control. It leaks badly and is subject to change during floods. Flood damage is repaired by dumping loose rock on crest.

EXTREMES OF STAGE.—Maximum stage recorded, 10.90 feet from 4 p. m. February 27 to 8 a. m. February 28; minimum stage, 1.15 feet 4 p. m. August 4, and 4 p. m. August 25 to 8 a. m. August 28.

1915–1923: During September, 1919, the river reached a stage of about 12 feet, as determined from floodmarks on gage. This was not only the highest stage reached during period covered by records, but probably exceeds any that occurred for many years prior to the establishment of this station. Discharge indeterminate, because of lowlands on left bank overflowing for a width of several miles. No flow August 23–28, 1918.

DIVERSIONS.—Considerable water taken from river for irrigation immediately above station, and river water is also used for irrigation throughout drainage above. City of Corpus Christi pumps water just below gage for municipal supply. They reported a consumption of 922 acre-feet during 1918.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation not permanent, because of leakage through and repair to breakwater dam. Rating curve poorly defined. Gage read to hundredths twice daily. Daily discharge not computed, because of changing control and insufficient discharge measurements. Records poor.

No discharge measurements have been made at this station since 1919.

Daily gage height, in feet, of Nueces River at Calallen, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.65	3.00	1.60	1.30	1.50	10.45	8.65	1.95	1.50	1.42	1.25	5.48
2	1.75	3.10	1.55	1.30	1.60	9.98	9.05	1.92	1.45	1.40	1.22	6.20
3	1.70	3.30	1.50	1.30	1.60	9.55	9.20	2.35	1.45	1.48	1.20	6.12
4	1.70	3.85	1.52	1.30	1.58	9.28	9.35	2.68	1.42	2.12	1.18	2.40
5	1.60	5.05	1.48	1.30	1.50	9.10	9.60	2.60	1.45	2.38	1.25	2.05
6	1.62	4.40	1.45	1.30	1.55	8.85	9.65	2.25	1.40	2.25	2.20	2.10
7	1.60	3.78	1.45	1.30	1.52	8.22	9.42	2.08	1.40	2.00	2.45	2.65
8	1.60	3.60	1.40	1.30	1.50	7.32	8.62	1.92	1.45	1.70	2.48	3.38
9	1.58	2.90	1.35	1.30	1.48	6.25	7.12	1.85	1.40	1.55	2.18	3.75
10	1.55	2.50	1.35	1.30	1.45	3.88	4.42	1.82	1.35	1.58	2.02	4.22
11	1.50	2.20	1.38	1.30	1.45	2.60	2.68	1.72	1.32	1.50	1.85	5.10
12	1.48	2.05	1.32	1.30	1.40	2.50	2.52	1.70	1.38	1.40	1.68	5.82
13	1.45	1.95	1.30	1.30	1.40	2.52	2.48	1.68	1.40	1.38	1.58	5.45
14	1.45	2.90	1.30	1.30	1.40	2.68	2.70	1.65	1.40	1.45	1.50	4.42
15	1.40	4.40	1.30	1.32	1.40	2.78	4.08	1.60	1.40	1.45	1.48	4.62
16	1.40	5.55	1.30	1.40	2.65	2.88	4.38	1.52	1.40	1.42	1.45	5.18
17	1.40	6.48	1.30	1.40	4.05	2.95	3.05	1.58	1.40	1.35	1.38	5.65
18	1.35	5.80	1.30	1.40	4.98	2.75	2.42	1.52	1.50	1.30	1.35	5.95
19	1.30	2.45	1.30	1.40	5.60	2.40	2.20	1.55	1.50	1.30	1.35	6.15
20	1.20	2.05	1.30	1.40	5.42	2.18	2.10	1.52	1.62	1.28	1.32	6.45
21	1.20	2.00	1.30	1.40	4.92	2.05	2.02	1.50	1.65	1.20	1.30	6.85
22	1.25	1.90	1.30	1.40	5.35	1.98	1.95	1.50	1.58	1.58	1.28	7.18
23	1.30	1.88	1.30	1.40	6.48	1.92	1.90	1.50	1.55	1.70	1.22	7.55
24	1.35	1.80	1.30	1.40	7.70	1.90	1.90	1.58	1.52	1.95	1.20	7.85
25	1.32	1.75	1.30	1.40	9.05	1.92	1.90	1.80	1.45	2.10	1.18	8.00
26	1.32	1.70	1.30	1.40	9.95	2.18	1.88	1.78	1.45	1.95	1.15	7.98
27	1.32	1.70	1.30	1.40	10.85	2.52	1.85	1.68	1.48	1.72	1.15	7.85
28	2.55	1.68	1.30	1.60	10.85	4.55	1.95	1.58	1.45	1.58	1.18	7.80
29	2.80	1.65	1.30	1.58	-------	6.12	1.92	1.55	1.42	1.48	2.30	7.78
30	3.10	1.65	1.35	1.55	-------	7.15	1.98	1.52	1.40	1.30	3.80	7.50
31	3.50	-------	1.40	1.52	-------	7.98	-------	1.50	-------	1.28	4.48	-------

FRIO RIVER NEAR DERBY, TEX.

LOCATION.—At International & Great Northern Railway bridge, 900 feet below mouth of Leona River, 400 feet below highway bridge, 4 miles south of Derby, Frio County.

DRAINAGE AREA.—3,490 square miles (revised measurement on topographic maps, progressive military map of United States Army, and map of Texas, scale 1:500,000).

RECORDS AVAILABLE.—August 1, 1915, to September 30, 1923.

GAGE.—Vertical staff attached to railway bridge pier; read by C. E. Harris.

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

CHANNEL AND CONTROL.—Bed composed of rock, sand, and gravel. Channel curved above and below station, but straight at gage for 150 feet. Banks wooded, high, and subject to overflow at extremely high stages. A concrete dam 50 feet below gage serves as control during low and medium stages; location of high-water control not known. Point of zero flow, gage height 0.07 foot, except when affected by moss on control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet from 9 p. m. to midnight September 20 (discharge, 5,600 second-feet). No flow for several periods.

1915–1923: Maximum stage recorded, 18.5 feet September 18, 1919 (discharge, 34,400 second-feet). No flow during several periods of each year.

DIVERSIONS.—Small areas are irrigated by diversions in headwaters, but available information does not show that water is taken from stream immediately above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year ending September 30, 1923. Rating curve well defined for all stages. Gage read twice daily to hundredths. Daily discharge determined by applying mean daily gage height to rating table. Records good.

Owing to revision of rating curve for high stages, the records for the years ending September 30, 1915, 1916, and 1918–1922, have been revised and are published in the tables which follow.

Discharge measurements of Frio River near Derby, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 30	R. G. West	0.26	7.45	Sept. 21	Breeding and Bones	5.72	1,65[illegible]
July 19	C. E. Ellsworth		0	22	do	1.92	357
Sept. 20	Breeding and Bones	7.60	3,300	22	do	2.13	446
21	do	7.36	3,200				

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the years ending September 30, 1915, 1916, and 1918–1923

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1915			1915			1915		
1	0	30	11	0	0	21	0	172
2	0	10	12	0	0	22	0	362
3	0	3	13	0	0	23	0	42[illegible]
4	0	1	14	0	0	24	0	542
5	0	0	15	0	0	25	0	106
6	0	0	16	0	0	26	0	19[illegible]
7	0	0	17	0	0	27	0	126
8	0	0	18	0	3,800	28	0	72
9	0	0	19	0	2,810	29	730	41
10	0	0	20	0	429	30	2,720	24
						31	138	

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the years ending September 30, 1915, 1916, and 1918–1923—Continued

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1915–16							
1	7.2	850	4.7	6.7		81	270
2	5.2	5,400	4.7	4.2		25	121
3	2.7	9,690	3.2	2.5		7.2	49
4	2.7	1,190	1.9	.7		2.5	25
5		215	.7			1.5	16
6		78					14
7		37					8.1
8		20					4.7
9		15					1.5
10		11					.2
11		6.2			18		
12		3.7			22		
13		1.1			5.7		
14		.4			6.7		
15		7.2			3.7		60
16		3,000					21
17		8,400					9.0
18		1,480					6.2
19	223	263					12
20	229	163	187			74	6.7
21	60	27	44			63	3.2
22	24	23	794			158	1.5
23	6.7	104	3,660			221	
24	2.7	17	1,480			132	
25	1.9	13	353			45	
26		13	182			21	
27		15	98			12	
28		11	60			8.1	
29		8.1	34			5.7	
30		6.7	23		48	160	
31			12		60	235	

Day	Nov.	Apr.	May	Aug.	Sept.
1917–18					
1			2,380		0.5
2			321		.1
3			189		
4			52		
5			321		
6			2,810		
7		763	3,190		
8		243	289		4.6
9		38	78		26
10		12	32		12
11		3.5	12		2.0
12		2.4	6.2		.5
13		.5	2.7		
14			2.7		
15			1.3		
16			1.0		
17			.4		
18					
19	4.6				
20	27				
21	3.8				
22	2.4	.2			41
23	.5	2.7			12
24		1.0			3.5
25					1.7
26					.2
27				46	
28				89	
29				21	
30		273		5.6	
31				2.4	

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the years ending September 30, 1915, 1916, and 1918–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1918–19												
1	------	2.5	------	7.3	77	------	49	0.9	14	850	113	654
2	------	1.8	------	4.7	36	------	213	2.7	103	393	86	566
3	------	1.2	------	3.4	21	------	65	2.5	654	281	68	473
4	------	.3	------	2.0	19	------	233	2.0	957	292	57	393
5	------	------	------	1.6	23	------	118	2.7	152	208	52	344
6	------	------	------	1.4	62	------	107	1.6	49	194	46	298
7	------	------	------	1.2	175	------	54	160	22	162	39	257
8	------	------	------	.9	84	------	27	45	12	730	35	227
9	------	------	------	.9	41	------	16	20	6.0	3,310	30	199
10	------	------	------	.5	23	------	11	12	4.0	4,220	28	175
11	32	------	------	.5	14	------	6.0	6.7	2.5	896	24	155
12	162	------	------	------	8.6	------	2.7	4.7	1.8	519	21	138
13	730	------	------	------	4.0	------	1.6	2.5	1.4	379	21	122
14	312	------	------	------	2.7	------	1.2	298	.7	284	21	109
15	68	------	------	.3	2.7	------	.9	267	.5	227	21	408
16	32	------	------	1.4	2.7	------	.3	152	.5	191	18	1,420
17	16	------	------	1.4	4.0	------	------	763	1.4	155	16	12,400
18	8.0	------	------	1.4	3.4	------	------	1,920	54	133	13	24,100
19	2.7	------	823	.7	3.4	------	------	44	278	113	10	10,200
20	1.6	------	4,700	.5	3.4	------	------	20	77	92	8.6	5,200
21	.5	------	3,000	.3	2.3	------	------	13	362	82	264	2,810
22	216	------	730	896	.9	------	------	12	473	248	850	1,590
23	2,460	------	388	6,000	.7	------	------	5.3	344	611	5,600	3,310
24	3,660	------	1,020	4,540	.5	------	------	7.3	284	2,460	26,200	6,600
25	1,590	------	2,220	976	.5	6.0	------	995	896	6,200	15,600	7,600
26	260	------	519	227	.3	1,040	------	3,000	1,370	3,420	6,400	5,200
27	52	------	186	103	------	874	------	1,590	1,720	2,000	3,100	4,220
28	22	------	77	937	------	566	------	1,150	3,420	937	1,720	3,310
29	16	------	41	874	------	210	1.8	194	5,200	654	1,150	2,630
30	8.0	------	22	429	------	105	4.0	51	4,540	267	937	2,300
31	2.7	------	15	162	------	55	------	25	------	168	763	------
1919–20												
1	1,720	2,540	175	62	86	38	27	2.7	6.0	1.8	0	2.0
2	1,370	1,480	165	62	86	38	27	2.7	6.0	1.8	0	2.0
3	1,150	2,540	158	60	84	38	17	2.7	2.7	1.8	0	4.0
4	1,020	1,270	150	58	82	38	17	2.7	9.3	6.7	0	7.3
5	937	896	145	58	79	38	16	2.7	9.3	10	0	7.3
6	917	1,720	145	60	79	38	17	2.7	17	65	0	7.3
7	794	730	145	65	75	38	17	2.7	17	60	0	7.3
8	794	730	140	68	75	36	17	9.3	17	32	0	7.3
9	1,190	730	131	66	73	32	17	86	17	13	1.4	7.3
10	1,060	763	120	62	68	38	17	126	17	13	1.4	7.3
11	937	654	111	58	68	38	17	32	9.3	12	0	7.3
12	1,020	566	105	62	68	38	17	13	6.0	5.3	0	2.0
13	1,270	519	103	72	65	38	17	9.3	2.5	2.5	.3	2.0
14	937	473	101	84	65	38	13	9.3	2.5	1.4	251	2.0
15	937	429	99	94	65	38	9.3	1,020	2.5	1.4	109	2.0
16	976	408	96	88	62	38	9.3	1,650	2.5	1.4	81	7.3
17	1,190	400	88	82	62	38	9.3	408	2.5	1.4	55	4.0
18	5,200	382	90	77	62	27	9.3	116	2.5	1.4	35	4.0
19	7,600	348	92	72	60	27	9.3	60	8.6	0	24	2.0
20	4,860	323	99	68	57	27	9.3	52	2.5	0	15	4.0
21	3,420	306	101	66	55	27	9.3	32	8.0	0	7.3	2.0
22	2,460	284	101	63	55	27	9.3	27	8.0	0	7.3	2.0
23	1,920	270	99	60	54	27	13	17	2.3	0	7.3	2.0
24	1,590	248	88	63	51	27	17	17	2.3	0	7.3	.9
25	1,370	230	81	70	46	27	17	17	2.3	0	4.0	0
26	1,150	222	75	84	44	17	9.3	9.3	2.0	0	7.3	0
27	1,020	205	72	92	42	22	9.3	13	7.3	0	4.0	0
28	976	194	68	97	41	27	9.3	13	7.3	0	2.0	0
29	1,270	180	68	96	38	27	8.0	9.3	7.3	0	2.0	2.0
30	3,000	180	65	92	------	27	6.0	9.3	2.0	0	2.0	2.0
31	2,140	------	62	86	------	27	------	9.3	------	0	4.0	------

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the years ending September 30, 1915, 1916, and 1918–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920–21												
1	2.0	7.3	7.3	7.3	7.3	7.3	10	7.3	7.3	7.3		
2	2.0	7.3	7.3	7.3	7.3	109	10	13	7.3	6.0		
3	2.0	7.3	7.3	7.3	7.3	1,150	10	8.0	6.7	6.0		
4	2.0	7.3	7.3	7.3	7.3	267	10	6.0	5.3	4.7		
5	2.0	7.3	7.3	7.3	7.3	179	10	5.3	3.4	3.4		
6	2.0	7.3	7.3	7.3	7.3	63	10	2.7	2.0	3.4		
7	2.0	7.3	7.3	7.3	7.3	29	10	3.4	1.2	4.0		
8	2.0	7.3	7.3	7.3	7.3	19	10	4.7	.3	3.4		
9	2.0	7.3	7.3	7.3	7.3	15	320	4.0	0	3.4		
10	2.0	7.3	7.3	7.3	7.3	15	81	2.5	0	3.4		
11	2.0	7.3	7.3	7.3	7.3	15	42	4.0	0	3.4		1,090
12	2.0	7.3	7.3	7.3	11	15	27	6.0	4.0	2.5		1,190
13	2.0	7.3	8.6	7.3	11	15	18	3.4	519	1.8		145
14	2.0	7.3	7.3	7.3	10	15	14	2.3	2,000	1.6		41
15	2.0	7.3	7.3	7.3	10	15	12	2.0	1,720	1.4		15
16	2.0	7.3	7.3	7.3	8.0	15	9.3	1.8	251	.9		6.0
17	2.0	7.3	11	7.3	7.3	15	8.6	1.6	175	.3		2.5
18	2.0	7.3	7.3	7.3	7.3	15	8.6	1.6	84			1.8
19	2.0	11	7.3	7.3	8.0	13	8.6	136	44			.9
20	2.0	15	7.3	7.3	7.3	15	8.0	82	18			.3
21	2.0	15	7.3	7.3	8.6	15	7.3	20	16			
22	2.0	13	7.3	7.3	8.6	15	6.0	27	12			
23	2.0	11	7.3	7.3	7.3	15	4.7	17	10			
24	7.3	11	7.3	7.3	8.6	12	4.7	10	10			
25	15	11	7.3	7.3	8.6	12	4.7	8.6	10			
26	7.3	8.6	7.3	7.3	7.3	13	4.7	7.3	10			
27	7.3	7.3	7.3	7.3	7.3	15	4.7	7.3	7.3			
28	7.3	7.3	7.3	7.3	7.3	14	3.4	7.3	7.3			
29	7.3	7.3	7.3	7.3		14	3.4	7.3	7.3			
30	7.3	7.3	7.3	7.3		15	4.0	7.3	7.3			
31	7.3		7.3	7.3		15		7.3				
1921–22												
1					.7	1.2	312	3,940	126	11	.9	
2					.7	.5	183	9,460	49	11	.9	
3					.5	.5	44	6,800	79	16	.9	
4					.5	.5	16	4,220	41	12	.5	
5					.7	.5	1,040	3,660	49	9.3	.5	
6					.9	.5	1,780	1,040	51	17	.5	
7					.5	.5	654	654	35	20	.5	
8					.5	.5	162	382	23	16	.5	
9					.5	.5	57	267	16	12	.5	
10					.5	.5	22	236	14	8.6	.5	
11					.5	.5	13	180	16	6.7	.5	
12					.5	.5	8.6	155	12	6.0	.5	
13					.5	.5	6.7	135	38	5.3	.1	
14	17				.5	.5	6.7	135	194	4.7	.1	
15	18				.7	.5	4.7	408	1,530	4.0		
16	16				.9	.5	4.0	170	874	4.0	.5	
17	5.3				.9	.5	2.7	96	245	4.0	.5	
18	2.5				.9	.5	2.7	73	68	2.7	.5	
19	1.2				.7	.5	2.5	90	60	2.3	.1	
20	.5				.5	.5	1.6	75	51	2.0	.1	
21	.1				.5	.1	1.4	63	44	1.8		
22					.5	.1	.9	49	36	1.4		
23					.1	.1	.9	38	27	1.4		
24					.7	.1	.9	429	21	1.4		
25					.9	1.8	.9	348	16	.9		
26					.9	1.4	730	68	16	.9		
27					.5	1.4	4,080	63	14	.9		
28					1.4	1.4	4,540	32	12	.9		
29						14	7,200	19	12	.9		
30						260	3,940	16	11	.9		
31						566		408		.9		

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the years ending September 30, 1915, 1916, and 1918–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1922–23												
1		451	3.2	3.2	3.2	21	27	84	1.6			
2		388	3.2	3.2	3.2	13	17	34	1.0			
3		44	3.2	3.2	3.2	12	13	22	1.0			
4		16	3.2	3.2	3.2	29	11	14	1.0			
5		7.9	3.2	3.2	2.7	67	8.4	12	1.0			
6		6.3	2.7	4.2	2.7	188	8.4	10	90			
7		4.8	2.1	4.2	2.7	51	8.4	8.4	39			60
8		3.2	2.1	5.3	3.2	22	7.4	7.4	14			1,370
9		3.2	2.1	4.2	4.8	13	7.4	6.3	10			1,850
10		2.7	2.1	4.2	5.8	9.2	7.4	5.3	7.9			388
11		2.1	2.1	4.2	6.3	8.4	7.4	5.3	5.8			175
12		2.1	2.1	4.2	6.3	7.4	9.2	5.3	3.7			102
13		2.7	2.1	4.2	6.3	7.4	8.4	5.3	2.4			214
14		2.7	2.1	3.2	10	7.4	8.4	4.2	1.8			334
15		2.7	1.6	3.2	9.2	7.4	31	4.2	1.6			188
16		23	1.6	3.2	10	7.4	39	4.2	1.0			104
17		11	1.6	3.2	10	7.4	29	3.2	1.6			32
18		6.8	1.6	3.2	10	7.4	21	2.7	1.6			58
19		4.8	1.6	2.7	10	7.4	13	2.7	1.6			370
20		4.2	1.6	2.7	10	7.4	7.9	2.1	1.0			3,490
21		3.2	1.6	2.7	10	6.3	7.4	2.1	1.0			1,320
22		3.2	2.4	2.7	214	6.3	7.4	2.1	1.0			611
23		3.2	3.7	2.7	81	6.3	7.4	2.1	.5	98		730
24		3.2	4.2	2.7	31	6.3	6.3	2.1	.5	81		242
25	122	4.2	4.2	2.7	34	6.3	6.3	2.1	.5	23		104
26	162	3.2	3.2	2.9	39	6.3	271	2.1	.1	9.2		54
27	67	3.2	3.2	3.2	67	10	896	2.1	.1	3.7		25
28	22	3.2	3.2	3.2	39	14	1,040	2.1		2.4		16
29	11	3.2	4.2	3.2		60	351	1.6		1.3		9.2
30	6.8	3.2	4.2	3.2		111	175	1.6		.3		6.8
31	6.8		3.2	3.2		67		1.6				

NOTE.—Daily discharge for years ending Sept. 30, 1915, 1916, and 1918–1922, as given in the above table supersede the records previously published because of revision of rating curve for high stages. Records for year ending Sept. 30, 1917, not revised. No flow during periods for which no discharge is given in the years ending Sept. 30, 1916 and 1918–1923.

Monthly discharge of Frio River near Derby, Tex., for the years ending September 30, 1915–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1915				
August	2,720	0	116	7,120
September	3,800	0	303	18,000
1915–16				
October	229	0	18.2	1,120
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	9,690	.4	1,040	61,600
May	3,660	0	224	13,800
June	6.7	0	.47	28
July	60	0	5.29	325
August	235	0	40.4	2,480
September	270	0	21.0	1,250
The year	9,690	0	111	80,600

Monthly discharge of Frio River near Derby, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1916–17				
October	1,300	0	70.4	4,330
November	0	0	0	0
December	0	0	0	0
January	0	0	.0	0
February	0	0	0	0
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	54	0	3.90	232
July	18	0	.89	55
August	0	0	0	0
September	605	0	46.5	2,770
The year	1,300	0	10.2	7,390
1917–18				
October	0	0	0	0
November	27	0	1.28	76.2
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	763	0	44.6	2,660
May	3,190	0	313	19,200
June	0	0	0	0
July	0	0	0	0
August	89	0	5.29	325
September	41	0	3.47	206
The year	3,190	0	31.1	22,500
1918–19				
October	3,660	0	317	19,500
November	2.5	0	.19	11.5
December	4,700	0	443	27,300
January	6,000	0	489	30,100
February	175	0	22.0	1,220
March	1,040	0	92.1	5,660
April	233	0	30.4	1,810
May	3,000	.9	347	21,400
June	5,200	.5	700	41,700
July	6,200	82	990	60,800
August	26,200	8.6	2,040	126,000
September	24,100	109	3,250	193,000
The year	26,200	0	730	529,000
1919–20				
October	7,600	794	1,810	111,000
November	2,540	180	674	40,100
December	175	62	108	6,640
January	97	58	72.5	4,460
February	86	38	63.7	3,660
March	38	17	32.3	1,990
April	27	6.0	13.9	827
May	1,650	2.7	122	7,500
June	17	2.0	6.95	414
July	65	0	7.48	460
August	251	0	20.2	1,240
September	7.3	0	3.55	211
The year	7,600	0	247	179,000

Monthly discharge of Frio River near Derby, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1920–21				
October	15	2.0	3.62	223
November	15	7.3	8.54	508
December	11	7.3	7.46	459
January	7.3	7.3	7.30	449
February	11	7.3	7.99	444
March	1,150	7.3	69.6	4,280
April	320	3.4	22.8	1,360
May	136	1.6	13.7	842
June	2,000	0	165	9,810
July	7.3	0	1.84	113
August	0	0	0	0
September	1,190	0	83.1	4,940
The year	2,000	0	32.4	23,400
1921–22				
October	18	0	1.95	120
November	0	0	0	0
December	0	0	0	0
January	.3	0	.01	.6
February	1.4	.1	.65	35.9
March	566	.1	27.6	1,700
April	7,200	.9	827	49,200
May	9,460	16	1,090	66,900
June	1,530	11	126	7,500
July	20	.9	6.03	371
August	.9	0	.29	18.0
September	0	0	0	0
The year	9,460	0	174	126,000
1922–23				
October	162	0	12.8	789
November	451	2.1	34.1	2,030
December	4.2	1.6	2.66	163
January	5.3	2.7	3.37	207
February	214	2.7	22.8	1,270
March	188	6.3	25.8	1,590
April	1,040	6.3	102	6,060
May	84	1.6	8.52	524
June	90	0	6.41	381
July	98	0	7.06	434
August	0	0	0	0
September	3,490	0	395	23,500
The year	3,490	0	51.0	36,900

NOTE.—Monthly discharge for years ending Sept. 30, 1915, 1916, and 1918–1922 supersede the records previously published. Records for year ending Sept. 30, 1917, not revised.

RIO GRANDE BASIN

RIO GRANDE BELOW ELEPHANT BUTTE DAM, N. MEX.

LOCATION.—In T. 13 S., R. W., 1 mile below Elephant Butte Dam, Sierra County. Nearest tributary, Mescal Canyon, enters half a mile downstream.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1924.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from car and cable at gage.

CHANNEL AND CONTROL.—Bed composed of compact gravel; probably permanent. Control is gravel bar at mouth of Mescal Canyon; shifts.

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

REGULATION.—Flow controlled by Elephant Butte Dam, which forms reservoir having capacity of 2,638,000 acre-feet.

EXTREMES OF DISCHARGE.—No data.

COOPERATION.—Records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Rio Grande below Elephant Butte Dam, N. Mex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,490	517	517	3	840	840	950	2,000	2,100	2,100	2,300	1,000
2	1,490	517	517	3	840	840	950	2,000	2,100	2,100	2,300	1,000
3	1,490	517	340	3	840	840	950	2,000	2,100	2,100	2,300	1,000
4	1,490	517	210	3	3	840	950	2,000	2,100	2,100	2,300	1,000
5	1,490	517	413	3	3	840	1,150	2,000	2,100	2,100	2,300	1,000
6	1,490	517	500	3	3	840	1,150	2,000	2,100	2,100	2,440	1,400
7	1,490	517	517	3	3	840	1,150	2,000	2,100	2,100	2,440	1,400
8	1,490	517	510	3	3	840	1,150	2,000	2,100	2,100	2,440	1,400
9	1,490	517	517	3	600	840	1,450	2,000	2,100	2,100	2,440	1,400
10	1,490	517	282	3	600	840	1,850	2,000	2,300	2,100	2,440	1,400
11	1,490	517	570	3	600	840	1,850	2,000	2,300	2,100	1,900	1,400
12	1,320	517	730	3	600	840	2,000	2,000	2,300	2,100	2,440	1,400
13	650	517	733	3	840	840	2,000	2,000	2,300	2,100	2,440	1,400
14	650	517	718	3	840	840	2,000	2,000	2,300	2,100	2,000	1,400
15	650	517	718	3	840	840	2,200	2,000	2,300	2,100	2,010	1,400
16	650	517	718	3	840	840	2,200	2,000	2,300	2,100	2,010	1,400
17	650	510	718	3	840	840	2,000	2,000	2,300	2,100	2,010	1,400
18	650	497	718	3	840	840	2,000	2,000	2,300	2,100	2,010	1,400
19	650	497	718	3	840	840	2,000	2,000	2,300	2,100	2,010	1,400
20	639	497	743	3	840	840	2,000	2,000	2,300	2,100	1,500	1,400
21	639	500	718	3	840	950	2,000	2,000	2,300	2,100	1,000	1,400
22	650	517	718	3	840	950	2,000	2,000	2,300	2,100	1,000	1,400
23	650	517	718	3	840	950	2,000	2,000	2,300	2,100	1,000	1,400
24	650	517	718	3	840	950	2,000	2,000	2,300	2,100	1,000	1,400
25	650	517	718	976	840	950	2,000	2,000	2,300	1,900	1,000	1,400
26	650	517	718	840	840	950	2,000	2,000	2,100	1,900	3	1,400
27	650	531	718	840	840	950	2,000	2,000	2,100	1,900	3	1,400
28	650	517	720	840	840	950	2,000	2,000	2,100	2,300	1,000	1,400
29	650	517	720	840	------	950	2,000	2,000	2,100	2,300	1,000	1,400
30	618	517	164	840	------	950	2,000	2,000	2,100	2,300	1,000	1,400
31	517	------	3	840	------	950	------	2,000	------	2,300	1,000	------

Monthly discharge of Rio Grande below Elephant Butte Dam, N. Mex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,490	517	964	59,300
November	531	497	515	30,600
December	743	3	582	35,800
January	976	3	196	12,100
February	840	3	656	36,400
March	950	840	879	54,000
April	2,200	950	1,730	103,000
May	2,000	2,000	2,000	123,000
June	2,300	2,100	2,210	132,000
July	2,300	1,900	2,110	130,000
August	2,440	3	1,710	105,000
September	1,400	1,000	1,330	79,100
The year	2,440	3	1,240	900,000

RIO GRANDE NEAR EL PASO, TEX.

LOCATION.—At Courchesne's limekiln, 1 mile upstream from pumping house of smelter company, 4 miles north of El Paso, El Paso County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 10, 1889, to June 30, 1893, for station at Old Fort Bliss, 1,500 feet above Mexican dam; January 25, 1895, to May 1, 1897, for station at pumping house of smelter company, 3 miles north of El Paso; and May 1, 1897, to September 30, 1923, for present site.

GAGE.—Continuous water-stage recorder. A number of inclined gages have been used, located at slightly different points but referred to same datum.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifting. Banks high, with brush along edges, and not subject to overflow. Control is a stretch of the channel of the stream.

EXTREMES OF DISCHARGE.—Maximum stage during year ending September 30, 1923, 5.84 feet August 27 (discharge, 4,500 second-feet); minimum mean daily discharge, 88 second-feet January 26.

1889–1893; 1895–1923: Maximum mean daily discharge, 23,680 second-feet June 12, 1905. No flow for several periods.

DIVERSIONS.—Considerable water is diverted in Colorado and New Mexico; amount not known.

REGULATION.—Flow regulated by storage at Elephant Butte Dam, 120 miles above El Paso.

ACCURACY.—Stage-discharge relation not permanent. Daily discharge based largely on frequent current-meter measurements.

COOPERATION.—Records of daily discharge, June, 1915, to February, 1923, furnished by the United States Bureau of Reclamation. Gage-height records from March 1, to September 30, 1923, furnished by United States Bureau of Reclamation, and daily discharge by the Mexican section of the International Boundary Commission.

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1915					1915				
1	3,525	2,675	2,950	670	16	3,945	530	1,015	905
2	3,580	2,735	2,260	715	17	3,820	605	870	405
3	3,410	1,885	2,075	760	18	3,705	615	915	765
4	590	1,325	2,025	1,160	19	3,655	625	850	2,630
5	2,986	1,000	2,120	1,255	20	3,265	625	790	1,615
6	3,385	1,055	2,115	1,120	21	4,045	1,040	750	700
7	3,725	810	2,630	940	22	3,670	845	820	240
8	4,185	760	3,065	1,035	23	985	1,440	685	745
9	4,250	855	2,880	1,005	24	1,455	1,035	685	1,125
10	4,440	885	2,345	970	25	1,380	1,480	815	1,545
11	4,100	805	2,225	1,005	26	1,345	1,190	510	1,220
12	3,650	930	2,120	895	27	1,540	3,375	610	1,015
13	2,995	890	1,490	890	28	1,910	1,815	355	1,120
14	3,865	740	1,230	900	29	2,525	935	640	1,015
15	3,905	645	1,090	940	30	2,750	1,575	880	910
					31		2,950	715	

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1915–16												
1	685	5	-------	115	10	440	1,310	1,650	2,200	1,350	1,350	1,350
2	650	5	-------	60	10	290	1,140	1,880	2,200	1,550	1,350	1,160
3	660	3	-------	50	10	430	405	1,760	2,200	1,650	800	980
4	635	3	-------	45	10	355	190	1,550	2,200	1,550	650	650
5	605	3	-------	60	5	315	175	980	2,300	1,550	650	440
6	575	3	-------	110	5	395	220	800	2,200	1,450	650	500
7	615	3	-------	95	5	390	195	1,350	2,300	1,550	650	650
8	575	3	-------	95	10	130	185	980	2,300	1,450	650	650
9	575	3	-------	80	200	130	195	55	2,300	1,160	650	580
10	616	3	-------	115	400	125	190	30	2,200	650	800	580
11	616	3	-------	95	420	100	505	30	2,300	650	730	440
12	535	3	-------	55	475	175	560	30	2,300	800	650	380
13	455	2	-------	65	350	145	680	800	2,300	650	730	380
14	375	2	-------	70	360	855	675	890	2,200	500	980	320
15	235	2	-------	60	340	670	685	1,550	2,200	500	730	260
16	175	2	-------	55	345	520	1,395	1,550	2,100	440	890	260
17	215	2	-------	40	330	745	1,460	1,350	1,450	650	800	260
18	215	2	-------	15	310	700	1,580	1,450	1,450	800	1,250	320
19	255	2	-------	10	285	785	1,365	1,550	1,450	980	890	260
20	155	3	-------	60	300	870	1,425	1,650	1,550	800	890	210
21	55	3	-------	50	440	815	1,425	2,600	1,450	650	800	165
22	55	3	-------	45	510	875	1,105	2,200	1,550	650	730	165
23	55	3	-------	40	490	860	1,210	2,100	1,350	580	800	165
24	50	2	-------	30	475	985	1,370	2,300	1,250	580	890	85
25	45	2	-------	95	400	900	1,160	2,400	1,550	500	980	165
26	40	2	-------	40	320	945	1,105	2,400	1,550	500	1,050	165
27	25	2	-------	25	510	910	1,265	2,500	1,550	500	1,100	165
28	25	255	-------	20	490	905	1,315	2,200	1,450	500	1,100	260
29	20	280	-------	15	405	880	1,315	2,100	1,450	500	1,200	500
30	5	365	-------	15	-------	855	1,315	2,100	1,450	650	1,200	580
31	10	-------	-------	10	-------	930	-------	2,500	-------	800	1,300	-------
1916–17												
1	540	10	10	1,980	688	1,310	830	700	1,210	2,335	2,260	1,395
2	650	10	300	2,050	855	1,350	1,092	798	1,190	2,645	2,120	1,350
3	650	10	300	1,980	1,023	1,078	1,092	1,055	1,230	2,603	2,485	1,440
4	700	10	800	2,120	1,190	970	914	1,040	1,310	2,410	2,260	1,115
5	740	10	800	1,983	1,350	580	865	1,040	1,134	2,410	2,190	1,040
6	780	10	900	1,326	1,270	520	970	1,078	1,005	2,410	2,335	1,040
7	680	10	900	1,190	1,270	550	935	1,078	1,040	2,410	1,270	1,059
8	760	10	900	1,190	1,270	1,078	935	970	1,078	2,560	1,134	1,005
9	680	10	900	1,440	1,230	970	970	1,190	1,078	2,823	1,078	970
10	650	10	1,350	1,270	1,230	970	900	1,190	1,115	2,522	988	1,190
11	980	10	650	1,190	1,225	970	900	1,130	1,270	2,335	970	1,152
12	1,120	10	500	1,190	1,220	1,078	900	1,190	1,190	2,260	970	1,115
13	1,300	10	980	1,152	1,215	1,100	900	1,440	1,190	2,560	1,290	1,152
14	1,650	10	1,420	1,270	1,210	1,019	900	1,270	1,190	2,120	1,418	1,190
15	5,300	10	1,350	1,270	1,205	970	900	1,190	1,210	2,260	2,190	1,152
16	1,760	10	1,350	1,350	1,200	1,055	970	1,115	1,115	2,190	1,980	1,190
17	650	10	1,160	1,350	1,195	1,040	778	1,270	1,115	1,980	1,740	1,440
18	290	10	1,300	1,350	1,190	1,040	830	1,270	1,270	1,980	1,980	1,740
19	100	10	1,250	1,368	1,152	1,040	798	1,310	1,190	2,120	1,640	1,440
20	40	10	1,230	1,206	1,190	1,078	830	1,640	1,115	2,120	1,640	1,645
21	20	10	1,160	1,270	1,270	865	900	1,795	1,115	2,155	1,350	1,740
22	10	10	1,300	270	1,190	900	900	1,372	1,096	2,260	330	1,635
23	10	10	1,470	170	1,190	1,078	935	1,350	1,040	2,260	209	1,465
24	10	10	1,450	132	1,190	1,078	1,168	1,190	1,270	2,085	121	1,465
25	10	10	1,250	140	1,190	984	1,040	1,190	1,210	1,850	70	1,355
26	8	10	1,350	107	1,190	984	830	1,190	1,270	2,410	70	1,300
27	8	10	1,350	70	1,190	900	830	1,190	1,270	2,410	70	1,355
28	7	10	1,500	90	1,350	778	830	1,230	2,410	2,050	1,005	1,520
29	7	10	260	170	-------	700	830	1,230	2,225	1,850	865	1,410
30	7	10	670	490	-------	670	865	1,115	2,260	2,410	1,350	1,410
31	7	-------	2,480	520	-------	949	-------	1,115	-------	2,522	1,490	-------

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr..	May	June	July	Aug.	Sept.
1917–18												
1	1,465	1,350	1,498	45	30	1,390	535	715	408	250	218	218
2	1,300	1,350	1,545	44	29	1,670	470	875	595	309	240	250
3	1,355	870	1,592	41	30	1,535	605	1,045	408	408	218	250
4	1,410	320	1,612	41	29	1,560	535	960	330	388	236	240
5	1,300	210	1,545	41	28	1,490	675	1,225	830	408	306	225
6	1,300	175	1,545	41	28	1,335	710	1,405	408	388	375	218
7	1,465	128	1,790	41	29	1,290	745	960	440	460	650	218
8	1,382	145	1,516	41	27	1,200	820	1,045	440	440	375	260
9	1,410	128	1,516	41	25	877	820	1,225	490	352	408	250
10	1,465	110	1,516	41	25	990	900	1,002	650	375	595	250
11	1,606	110	1,516	40	25	1,035	900	790	650	300	860	232
12	1,328	85	1,516	40	25	655	990	1,225	540	330	1,900	232
13	1,410	72	1,516	40	26	620	990	1,135	300	290	770	330
14	1,300	72	1,516	36	26	550	1,035	917	280	300	1,458	330
15	1,465	72	1,516	33	25	360	1,080	790	321	595	1,360	330
16	1,265	72	1,516	33	25	297	860	882	290	617	1,085	540
17	1,180	72	1,516	33	24	200	780	882	375	540	1,111	490
18	1,222	72	1,516	33	20	350	780	875	330	408	854	408
19	1,265	970	1,516	33	1,390	535	820	790	330	388	225	408
20	1,265	1,360	1,516	33	1,615	550	820	408	330	408	175	408
21	1,435	1,360	1,516	33	1,725	500	1,135	408	352	420	157	440
22	1,520	1,360	86	31	1,670	605	1,180	375	440	710	225	540
23	1,308	1,360	86	29	1,705	605	820	375	562	770	1,020	650
24	1,565	1,360	86	29	1,635	535	780	375	1,150	890	408	650
25	1,520	1,360	86	42	1,670	605	605	408	650	460	375	650
26	1,435	1,498	86	36	1,445	500	605	408	490	490	352	171
27	1,392	1,498	86	42	1,390	470	675	595	595	408	240	125
28	1,435	1,450	86	45	1,390	570	715	408	510	595	232	108
29	1,392	1,545	86	42	-------	535	875	375	460	1,220	220	105
30	1,350	1,545	86	42	-------	605	1,225	300	490	180	218	295
31	1,392	-------	86	36	-------	605	-------	300	-------	185	240	-------
1918–19												
1	333	65	114	69	55	508	902	1,340	1,040	1,180	1,170	810
2	227	59	109	63	55	573	884	1,490	1,310	1,015	1,300	740
3	227	55	109	57	55	508	875	1,460	1,300	1,135	1,260	700
4	255	55	105	54	56	476	884	1,600	1,040	1,400	1,860	670
5	333	450	101	55	57	400	857	1,797	1,080	1,075	1,280	660
6	407	485	101	54	58	436	821	1,590	1,060	1,720	1,385	650
7	433	436	96	55	59	670	866	1,500	940	1,320	1,330	700
8	350	380	96	58	60	736	1,012	1,500	1,020	1,120	1,550	800
9	394	401	92	59	55	664	1,012	1,682	1,000	1,045	1,615	775
10	440	380	88	60	54	612	742	1,954	1,195	1,100	1,465	850
11	1,065	332	84	63	54	560	848	2,091	1,090	1,255	1,315	765
12	1,112	387	101	57	53	554	911	1,808	1,120	1,300	1,150	875
13	749	387	96	56	51	592	920	1,570	1,195	1,560	1,080	905
14	732	715	96	56	50	554	875	1,480	1,140	1,740	1,010	1,055
15	724	1,065	96	57	52	554	875	1,270	1,150	1,600	940	1,190
16	706	885	84	59	638	554	857	1,290	1,160	1,830	865	1,230
17	749	659	75	60	703	592	812	1,222	1,245	1,585	825	1,110
18	868	530	71	57	677	580	830	1,240	1,225	1,180	695	1,120
19	1,122	394	75	57	788	528	875	1,480	1,335	965	670	905
20	912	286	75	57	748	521	1,240	1,370	1,620	1,005	620	1,135
21	993	244	75	56	599	547	1,420	1,290	1,325	960	715	1,000
22	1,260	162	109	56	469	788	1,098	1,270	1,195	840	1,080	890
23	1,103	178	133	56	370	1,039	475	1,300	1,245	680	650	1,200
24	552	147	152	56	690	1,151	432	1,290	1,225	645	610	1,080
25	306	172	152	56	638	1,060	355	1,420	1,245	625	630	1,025
26	172	167	143	56	508	1,146	920	1,560	1,195	560	635	930
27	147	209	133	56	430	1,060	1,300	1,400	1,255	575	635	550
28	138	220	128	56	540	911	1,620	1,370	1,360	665	670	480
29	114	199	109	56	-------	902	1,520	1,350	1,225	685	680	440
30	88	133	109	55	-------	875	1,390	1,270	1,290	720	685	410
31	75	-------	118	55	-------	965	-------	1,212	-------	775	860	-------

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919–20												
1	750	110	145	105	177	555	655	1,148	1,260	1,960	1,185	920
2	670	110	140	515	115	555	690	1,197	1,250	1,750	1,165	950
3	560	110	135	515	110	520	725	1,247	1,340	2,000	1,250	1,160
4	560	105	130	580	108	480	760	1,188	1,810	1,800	1,185	1,095
5	570	195	125	700	110	510	794	1,129	1,990	1,940	1,125	1,160
6	580	340	120	720	90	595	592	1,070	2,940	1,690	2,760	1,240
7	585	395	115	570	95	600	390	830	1,820	1,450	2,720	1,200
8	600	360	110	580	80	805	448	820	1,170	1,380	1,750	1,215
9	610	400	105	705	60	695	506	900	1,210	1,295	1,770	1,210
10	620	530	100	980	60	625	564	970	1,150	1,330	1,750	1,200
11	650	500	100	825	55	675	622	930	1,230	1,280	1,800	1,195
12	740	485	95	860	60	765	680	970	1,380	1,240	1,890	1,185
13	1,790	500	90	660	60	795	735	1,010	1,400	1,240	2,310	1,050
14	900	540	85	375	55	815	787	1,060	1,520	1,100	2,695	1,050
15	760	480	85	300	47	795	843	1,100	1,500	1,050	3,170	1,060
16	545	345	95	290	50	960	897	1,145	1,390	1,040	2,175	1,070
17	380	290	100	265	70	915	951	1,190	1,240	1,040	2,130	1,110
18	200	275	105	255	145	935	1,005	1,090	1,160	995	2,040	1,185
19	190	250	125	240	615	1,115	1,060	1,005	1,080	965	1,905	1,220
20	190	220	142	200	595	1,064	1,035	860	930	1,065	1,905	1,220
21	190	210	142	190	525	1,012	1,175	990	1,290	1,135	1,630	1,220
22	200	200	135	183	490	960	1,125	1,160	1,240	1,300	1,840	1,450
23	140	195	142	175	555	968	1,100	1,350	1,140	1,320	2,380	1,690
24	85	185	145	170	425	977	1,115	1,390	1,080	1,450	1,020	1,480
25	70	180	145	180	390	985	1,165	1,320	1,190	1,560	1,650	1,500
26	70	175	135	180	365	994	880	1,310	1,160	1,690	2,440	1,510
27	70	170	125	180	355	902	950	1,320	1,210	1,690	950	1,570
28	70	160	115	175	360	911	999	1,920	1,565	1,195	810	1,570
29	70	155	110	175	390	1,020	1,049	2,080	1,505	1,080	795	1,475
30	70	150	110	173	-------	820	1,098	1,570	1,495	1,200	790	1,530
31	90	-------	110	175	-------	620	-------	1,280	-------	1,165	800	-------
1920–21												
1	1,710	140	230	132	166	1,500	930	990	1,382	1,200	2,432	1,524
2	1,835	140	230	128	164	1,300	973	1,270	1,260	1,100	1,515	1,912
3	1,815	280	230	125	160	1,000	850	1,770	1,330	1,200	2,280	1,804
4	1,770	200	700	120	134	960	960	1,015	1,305	1,660	1,908	2,096
5	1,805	290	1,160	117	96	1,200	1,000	945	3,160	1,925	1,678	1,811
6	1,780	530	1,160	113	78	1,120	900	425	2,910	1,586	1,440	1,680
7	1,780	640	1,140	109	70	1,220	870	465	2,895	1,340	1,640	1,520
8	1,860	730	1,090	105	72	1,060	865	705	1,100	1,636	2,236	1,515
9	1,850	760	950	101	78	1,200	860	1,163	1,260	1,740	2,000	1,550
10	1,845	810	860	97	74	1,250	860	1,126	1,380	1,825	1,580	1,490
11	1,910	730	910	93	60	1,257	1,080	1,025	1,401	790	1,540	1,572
12	1,845	670	910	89	60	1,212	1,050	980	1,510	1,945	1,700	2,050
13	1,830	740	1,000	85	60	1,127	955	1,070	2,000	1,672	1,740	1,940
14	1,920	760	1,120	80	60	1,187	830	1,110	1,782	1,440	1,910	1,710
15	1,995	690	790	77	420	1,100	1,060	1,305	1,648	1,485	1,980	1,730
16	1,980	710	780	75	780	1,075	845	1,560	1,800	1,405	1,845	1,970
17	1,940	750	790	69	870	1,022	1,045	1,628	1,618	1,378	1,690	2,780
18	800	800	810	65	873	1,048	1,230	1,700	1,340	1,585	1,890	2,450
19	680	810	840	63	864	1,029	1,145	1,640	1,360	1,526	3,110	2,200
20	680	820	910	69	855	998	895	1,688	1,380	1,405	1,030	2,060
21	680	480	1,080	80	886	1,043	735	1,730	1,315	1,440	1,900	2,020
22	680	260	870	95	833	1,101	600	1,677	1,285	1,655	2,430	2,080
23	680	190	300	107	797	1,059	590	1,515	1,185	1,395	2,160	2,130
24	675	170	240	119	742	975	644	1,407	1,267	1,500	1,900	2,130
25	675	160	240	126	740	962	871	1,340	1,462	1,867	1,890	2,260
26	655	160	230	132	760	947	875	1,252	1,541	2,268	1,880	2,625
27	640	160	230	136	810	990	842	1,163	1,495	2,463	1,615	1,920
28	640	180	230	153	950	1,046	892	1,163	1,360	2,426	1,635	1,900
29	430	230	230	158	-------	1,010	945	1,155	1,190	2,584	1,855	2,000
30	400	230	220	162	-------	929	985	1,215	1,290	2,642	1,485	1,980
31	420	-------	220	167	-------	865	-------	1,420	-------	2,700	1,500	-------

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1921–22												
1	2,080	1,150	1,280	650	860	1,000	920	1,419	1,581	1,245	2,190	962
2	2,150	1,550	1,390	482	860	985	1,170	1,180	1,722	1,400	2,139	980
3	2,120	1,418	760	465	930	958	1,352	971	1,621	1,369	2,000	1,200
4	1,860	1,362	675	383	930	945	1,420	931	1,429	1,268	2,100	1,548
5	1,875	1,250	580	300	910	892	1,228	900	1,451	1,390	1,640	1,550
6	1,880	1,150	475	276	920	960	1,125	1,066	1,490	1,319	1,550	1,190
7	1,950	1,150	400	228	910	895	1,228	1,111	1,380	1,294	1,870	1,252
8	1,940	1,052	310	187	832	850	1,390	1,176	1,169	1,220	1,700	1,128
9	1,800	1,052	310	129	850	940	1,620	1,000	940	1,190	1,920	1,420
10	1,910	1,176	310	150	820	940	1,550	881	970	1,180	1,870	1,730
11	1,740	1,335	275	150	817	900	1,350	1,110	1,207	1,130	1,880	1,640
12	1,630	1,362	260	130	856	1,060	1,254	1,139	1,153	1,049	2,030	1,392
13	2,070	1,150	260	127	818	1,390	1,369	1,128	1,156	1,180	2,180	1,367
14	2,230	1,176	250	129	815	1,353	1,470	1,152	1,223	1,721	2,340	1,450
15	1,610	1,065	570	130	918	1,126	1,719	1,460	1,152	1,075	1,780	1,549
16	1,610	1,042	570	130	891	1,210	1,590	1,468	1,310	1,170	1,690	1,640
17	1,005	1,065	640	130	746	1,120	1,904	1,270	1,260	1,063	1,750	1,880
18	1,430	1,150	625	129	760	1,270	1,771	1,267	1,237	1,010	1,960	1,840
19	1,650	960	640	128	860	1,490	1,520	1,181	1,510	915	2,078	1,498
20	1,370	725	650	128	935	1,320	1,449	1,320	1,670	952	2,390	1,580
21	1,200	1,180	640	128	870	1,114	1,622	1,298	1,690	1,396	2,400	1,769
22	1,010	1,170	660	127	790	1,080	1,600	1,280	1,486	1,260	2,400	1,665
23	940	609	1,000	123	910	1,035	1,670	1,220	1,351	1,383	1,970	1,308
24	1,410	850	1,050	124	890	985	1,840	1,190	1,208	1,660	1,660	959
25	1,560	1,486	1,125	124	835	1,113	1,330	1,270	1,183	1,348	1,620	1,056
26	1,630	1,470	1,040	124	838	1,180	1,380	1,260	1,276	1,650	1,570	1,021
27	1,900	990	1,040	124	865	1,150	1,419	1,270	1,177	1,976	1,340	1,330
28	1,350	1,150	1,010	421	920	1,125	1,270	1,573	1,308	1,790	1,300	1,250
29	1,362	1,280	1,055	995	-------	1,290	1,186	1,631	1,195	1,652	1,319	1,240
30	1,150	1,340	1,115	1,060	-------	1,370	1,410	1,300	1,315	1,720	1,010	1,100
31	1,150	-------	1,180	1,070	-------	990	-------	1,319	-------	1,990	1,021	-------
1922–23												
1	910	519	613	670	791	942	933	1,404	1,007	1,295	1,524	663
2	870	690	610	880	860	910	933	1,558	945	1,427	1,406	920
3	800	624	598	575	775	894	782	1,305	1,107	1,432	1,347	1,083
4	810	590	594	510	770	823	642	1,217	1,392	1,393	1,110	1,064
5	981	600	589	378	956	894	592	1,338	1,267	2,161	1,171	860
6	976	578	587	240	840	831	551	1,360	1,196	1,393	1,666	762
7	1,150	540	580	210	530	778	592	1,300	1,177	1,190	1,433	822
8	1,690	579	580	205	210	748	551	1,262	1,263	1,177	1,719	1,231
9	1,410	614	580	205	256	676	921	1,276	1,291	1,585	2,318	1,004
10	1,298	710	590	205	271	616	848	1,267	1,138	1,554	2,842	1,118
11	1,280	629	590	198	240	646	716	1,418	1,349	1,554	3,194	1,074
12	1,214	660	582	175	213	688	836	1,502	1,368	1,536	2,777	909
13	1,200	619	583	173	233	616	1,114	1,527	1,743	1,356	3,063	947
14	1,330	673	487	171	287	510	1,134	1,670	1,734	1,545	2,471	936
15	1,370	675	509	167	400	624	1,473	1,628	1,642	1,843	2,729	969
16	1,398	677	548	161	390	700	2,018	1,465	1,559	1,644	2,499	1,007
17	797	679	537	153	553	705	1,815	1,367	1,559	1,487	1,952	1,048
18	650	680	580	147	623	740	1,935	1,432	1,605	1,475	1,794	1,057
19	681	590	590	139	650	772	1,953	1,424	1,623	1,475	2,285	1,057
20	670	590	599	131	553	673	1,804	1,515	1,830	1,324	2,686	998
21	630	582	698	123	571	622	1,610	1,639	1,844	1,533	2,352	990
22	610	580	710	101	791	611	1,610	1,581	1,857	1,811	2,562	947
23	610	591	689	97	860	651	1,832	1,556	1,877	2,023	1,742	1,060
24	590	600	740	93	963	594	1,502	1,470	1,910	1,514	1,883	1,240
25	583	603	830	91	850	638	1,278	1,536	1,970	1,504	1,626	1,200
26	513	598	783	88	880	727	1,187	1,344	1,950	1,464	1,578	1,040
27	470	590	653	103	850	709	1,279	1,392	1,869	1,107	3,051	1,020
28	440	609	619	103	819	818	1,307	1,456	1,715	1,124	1,663	1,160
29	430	613	610	360	-------	1,240	1,247	1,354	1,350	1,233	1,460	1,132
30	440	600	606	680	-------	1,279	1,385	1,381	1,382	1,292	1,426	1,144
31	460	-------	606	785	-------	1,125	-------	1,093	-------	1,360	636	-------

NOTE.—No record Dec. 1–31, 1915. Discharge for January, 1916, determined from rating curve based on discharge measurements made during September, October, and November, 1915. Discharge estimated or interpolated Aug. 27–31, Nov. 1–11, Nov. 19 to Dec. 9, 1916, Feb. 1–3, 11–17, Dec. 9–31, 1917, Jan. 26 to Feb. 2, Oct. 31, 1919, Mar. 20, 21, 23–28, 30, Apr. 1–4, 6, 8–11, 13–18, 28–30, May 1, 2, 4, 5, Dec. 4, 7–9, 16–31, 1920, Jan. 1 to Feb. 11 Apr. 8–21 July 24, 25, 30, 1921, June 22–27, and Dec. 19–21, 1922.

Monthly discharge of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1914–15				
October	2,820	400	1,107	68,073
November	1,190	710	857	50,985
December	3,410	690	1,097	67,458
January	1,040	145	639	39,263
February	1,200	130	577	32,023
March	1,000	65	361	22,185
April	1,500	170	635	37,765
May	3,740	530	2,329	143,226
June	4,440	590	3,090	184,000
July	3,380	530	1,250	76,700
August	3,060	355	1,440	88,300
September	2,630	240	1,080	59,900
The year	4,440	65		870,000
1915–16				
October	685	5	316	19,500
November	365	2	32.5	1,930
January	115	10	56.0	3,440
February	510	5	283	16,300
March	985	100	594	36,500
April	1,580	175	904	53,800
May	2,600	30	1,530	93,800
June	2,300	1,450	1,880	112,000
July	1,650	440	874	53,700
August	1,350	650	900	55,300
September	1,350	85	435	25,900
1916–17				
October	5,300	7	649	39,900
November	10	10	10.0	595
December	2,480	10	1,050	64,600
January	2,120	70	1,050	64,800
February	1,350	688	1,180	65,700
March	1,350	520	957	58,800
April	1,170	778	911	54,200
May	1,800	700	1,190	73,300
June	2,410	1,000	1,280	76,200
July	2,820	1,850	2,300	141,000
August	2,480	70	1,320	81,100
September	1,740	970	1,310	77,900
The year	5,300	7	1,100	798,000
1917–18				
October	1,610	1,180	1,380	85,100
November	1,540	72	736	43,800
December	1,790	86	1,070	65,900
January	45	29	38.0	2,340
February	1,720	20	575	32,000
March	1,670	200	793	48,700
April	1,220	470	816	48,600
May	1,400	300	757	46,600
June	1,150	280	481	28,600
July	1,220	180	461	28,300
August	1,900	157	552	33,900
September	650	105	327	19,500
The year	1,900	20	668	483,000

Monthly discharge of Rio Grande near El Paso, Tex., for the years ending September 30, 1915–1923—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1918–19				
October	1,260	75	551	33,900
November	1,060	55	341	20,300
December	152	71	104	6,400
January	69	54	57.3	3,520
February	788	50	308	17,100
March	1,150	400	697	42,900
April	1,620	355	948	56,400
May	2,090	1,210	1,470	90,200
June	1,620	940	1,190	71,100
July	1,830	560	1,090	67,200
August	1,860	610	1,010	62,000
September	1,230	410	855	50,900
The year	2,090	50	721	522,000
1919–20				
October	1,790	70	438	26,900
November	540	105	277	16,500
December	145	85	118	7,260
January	980	105	393	24,200
February	615	47	228	13,100
March	1,120	480	805	49,500
April	1,180	390	846	50,400
May	2,080	820	1,180	72,500
June	2,940	930	1,390	82,600
July	2,000	965	1,370	84,100
August	3,170	790	1,740	107,000
September	1,690	920	1,260	74,800
The year	3,170	47	838	609,000
1920–21				
October	2,000	400	1,300	79,700
November	820	140	474	28,200
December	1,160	220	668	41,100
January	167	63	108	6,640
February	950	60	447	24,800
March	1,500	865	1,090	67,000
April	1,230	590	906	53,900
May	1,730	425	1,250	76,600
June	3,160	1,100	1,570	93,600
July	2,700	790	1,700	105,000
August	3,110	1,030	1,850	114,000
September	2,780	1,490	1,950	116,000
The year	3,110	60	1,110	807,000
1921–22				
October	2,230	940	1,630	100,000
November	1,550	609	1,160	69,200
December	1,390	250	714	43,900
January	1,070	123	290	17,800
February	935	746	863	47,900
March	1,490	850	1,100	67,500
April	1,900	920	1,440	85,500
May	1,630	881	1,220	74,900
June	1,720	940	1,330	79,000
July	1,990	915	1,350	83,200
August	2,400	1,010	1,830	112,000
September	1,880	959	1,380	82,300
The year	2,400	123	1,190	863,000
1922–23				
October	1,690	430	879	54,100
November	710	519	616	36,700
December	830	487	615	37,800
January	880	88	268	16,500
February	963	210	607	33,700
March	1,280	510	768	47,200
April	2,020	551	1,210	72,200
May	1,670	1,090	1,420	87,300
June	1,970	945	1,520	90,300
July	2,160	1,110	1,480	90,900
August	3,190	636	2,000	123,000
September	1,240	663	1,020	60,400
The year	3,190	88	1,040	750,000

NOTE.—Monthly discharge, October, 1914, to May, 1915, republished in order to complete the year. Daily discharge for this period published in Water-Supply Paper 408.

RIO GRANDE NEAR FINLAY, TEX.

LOCATION.—At lower end of valley of El Paso, in Hudspeth County, 1½ miles below Old Fort Quitman, 11½ miles south of Finlay, Hudspeth County, and 70 miles below El Paso.

DRAINAGE AREA.—Not measured.

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

GAGE.—Vertical staff on left bank; range, zero to 13 feet; read by Lorenzo Navarro.

DISCHARGE MEASUREMENTS.—Made from cable near gage.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifting. Banks never overflowed. Channel straight for 500 feet above and below station. Control is a stretch of the channel of stream.

EXTREMES OF DISCHARGE.—Maximum stage during period of record, 6.7 feet August 26, 1923 (discharge, 2,600 second-feet); minimum mean daily discharge, 49 second-feet April 15.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

REGULATIONS.—Flow regulated by storage at Elephant Butte Dam, 120 miles above El Paso.

ACCURACY.—Stage-discharge relation not permanent. Discharge based on frequent discharge measurements.

COOPERATION.—Station maintained and records furnished by the Mexican Section of the International Boundary Commission.

Daily discharge, in second-feet, of Rio Grande near Finlay, Tex., for the year ending September 30, 1923

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	456	295	563	438	357	272	451	185	1,286
2	423	472	641	411	299	217	391	219	1,190
3	469	475	575	428	280	210	385	274	1,090
4	525	478	550	328	307	204	416	323	1,023
5	439	482	552	237	307	230	349	290	803
6	386	513	532	209	250	267	424	255	764
7	323	697	470	170	227	332	475	258	521
8	287	732	423	149	381	333	490	290	450
9	265	524	462	123	343	308	496	322	656
10	239	397	445	85	338	258	387	333	752
11	232	330	397	93	291	264	593	514	612
12	215	250	337	81	239	333	593	828	596
13	197	216	350	96	240	292	535	902	502
14	192	197	390	78	240	277	629	931	476
15	187	173	332	49	374	321	683	920	448
16	177	145	312	150	446	362	700	991	442
17	173	206	298	348	489	423	732	1,021	493
18	164	220	235	446	527	689	761	1,091	544
19	151	266	305	448	444	424	655	1,179	518
20	150	340	287	477	361	405	422	1,363	500
21	150	362	282	551	341	750	363	1,216	430
22	151	370	306	562	351	449	363	1,308	370
23	177	325	273	505	398	498	488	1,461	339
24	182	373	227	478	446	548	620	1,508	460
25	178	481	225	458	461	555	627	1,583	479
26	164	574	212	478	446	655	529	2,466	575
27	150	534	210	347	396	689	432	1,884	898
28	155	510	185	297	378	755	344	1,721	905
29	157	-------	186	269	328	645	246	1,585	903
30	159	-------	258	258	375	633	190	1,429	790
31	159	-------	466	-------	366	-------	185	1,279	-------

Monthly discharge of Rio Grande near Finlay, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
January	525	150	240	14,700
February	732	145	391	21,700
March	641	185	364	22,400
April	562	49	302	17,900
May	527	227	356	21,900
June	755	204	420	25,000
July	761	185	482	29,700
August	2,470	185	965	59,400
September	1,290	339	660	39,300
The period				252,000

RIO GRANDE ABOVE PRESIDIO, TEX.

LOCATION.—1 mile above Haciendita, 8 miles above mouth of Rio Conchos and 10 miles northwest of Presidio, Presidio County.

RECORDS AVAILABLE.—May 22, 1900, to March 31, 1914; September 1, 1919, to March 31, 1920; and August 1 to September 30, 1923. The records from May 22, 1900, to September 25, 1905, and from July 7, 1909, to March 31, 1914, were obtained at Haciendita, and from September 26, 1905, to July 6, 1909, at a site 8 miles farther upstream, but the flow is practically the same as at present site.

GAGE.—Inclined staff on left bank 200 feet below cable; read by Lauro T. Sosa.

DISCHARGE MEASUREMENTS.—Made from cable near gage.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifts. Channel straight 1,000 feet above and below station. Right and left banks medium in height and steep. Control is a stretch of channel of stream. Backwater reaches this station at extremely high stages from Rio Conchos.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during period August 1 to September 30, 1923, 3,100 second-feet August 28; minimum mean daily discharge, 149 second-feet August 6.

1900–1914; 1919–20; 1923: Maximum mean daily discharge, 18,100 second-feet, September 15 and 16, 1919.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

REGULATION.—Flow largely regulated by storage at Elephant Butte Dam, 120 miles above El Paso.

ACCURACY.—Stage-discharge relation not permanent. Gage read to half-tenths twice daily. Daily discharge based largely on frequent discharge measurements.

COOPERATION.—Station maintained and records furnished by the Mexican Section of the International Boundary Commission.

Daily discharge, in second-feet, of Rio Grande above Presidio, Tex., for the year ending September 30, 1923

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1	302	1,695	11	326	644	21	1,714	837
2	238	1,663	12	310	701	22	1,286	738
3	201	1,726	13	564	844	23	1,531	738
4	155	1,379	14	554	1,496	24	1,361	647
5	149	1,442	15	849	1,638	25	1,410	675
6	149	1,253	16	849	1,411	26	1,752	571
7	247	899	17	1,155	1,976	27	1,849	543
8	247	1,042	18	2,160	837	28	3,104	543
9	387	643	19	980	738	29	2,032	599
10	247	615	20	1,508	1,210	30	1,703	1,110
						31	1,670	

Monthly discharge of Rio Grande above Presidio, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
August	3,100	149	1,000	61,500
September	1,980	543	1,030	61,200
The period				123,000

RIO GRANDE BELOW PRESIDIO, TEX.

LOCATION.—At west end of canyon section of Rio Grande, 6 miles below Presidio, Presidio County, and 7 miles below mouth of Rio Conchos.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1900, to July 31, 1915; September 1, 1919, to March 31, 1920; and August 1, to September 30, 1923.

GAGE.—Inclined staff on left bank 300 feet below cable and vertical staff at gravel hills; read by Maria Hernandez.

DISCHARGE MEASUREMENTS.—Made from cable near gage or in overflow area from boat.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifts. Right bank steep and not subject to overflow. Left bank wooded and subject to overflow at a gage height of 20 feet for about 750 feet. Overflow area is cultivated land with small brush. Control consists of sand; shifts. Alamito Creek, an intermittent stream reaching the river one-fourth mile below station, is subject to torrential floods which bring large quantities of boulders and gravel into Rio Grande, forming a temporary dam which causes changes in stage-discharge relation.

EXTREME OF DISCHARGE.—Maximum stage recorded during period August 1 to September 30, 1923, 25 feet September 15 (discharge, 40,000 second-feet); minimum mean daily stage, 13.35 feet August 6 (discharge, 595 second-feet).

1900–1915; 1919–20: Maximum stage recorded, 26.35 feet September 11, 1904 (discharge, 149,200 second-feet); minimum mean daily discharge, 5 second-feet May 4–14, 1904.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

REGULATION.—Flow partly regulated by storage at Elephant Butte Dam, 120 miles above El Paso.

ACCURACY.—Stage-discharge relation not permanent. Gage read to half tenths twice daily. Determination of discharge based on frequent measurements.

COOPERATION.—Station maintained and records furnished by the Mexican Section of the International Boundary Commission.

Daily discharge, in second-feet, of Rio Grande below Presidio, Tex., for the year ending September 30, 1923

Day	Aug.	Sept.	Day		Sept.	Day		Sept.
1	1,087	6,684	11	3,884	10,040	21	3,944	14,072
2	1,005	4,690	12	4,260	19,173	22	4,565	7,632
3	841	4,358	13	5,266	25,917	23	4,396	5,584
4	698	4,077	14	6,238	35,212	24	4,734	4,564
5	636	3,948	15	6,176	38,420	25	10,000	5,448
6	595	3,048	16	5,145	33,505	26	9,557	5,968
7	1,825	3,647	17	3,930	29,709	27	7,234	4,733
8	1,415	3,761	18	4,042	24,794	28	10,514	4,641
9	1,579	4,787	19	2,924	22,874	29	9,229	4,641
10	1,947	7,415	20	3,496	19,896	30	7,382	5,390
						31	6,889	

Monthly discharge of Rio Grande below Presidio, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
August	10,500	595	4,370	269,000
September	38,400	3,050	12,300	731,000
The period				1,000,000

RIO GRANDE NEAR LAREDO, TEX.

LOCATION.—At Fort McIntosh, 1½ miles above Mexican National Railroad bridge, 1¼ miles west of Laredo post office, Webb County, and 2¼ miles above international highway bridge.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1900, to March 31, 1914 (records of stage and discharge measurements); November 1, 1922, to September 30, 1923.

GAGE.—Vertical and inclined staff in four sections on left bank; read by Humberto Volpe. Zero of gage 351.35 feet above sea level and 350.44 feet above International Boundary Commission datum.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet below gage.

CHANNEL AND CONTROL.—Channel straight for 1,000 feet above and below gage. Right bank medium in height and wooded along edge for 25 feet from low-water edge and clean from there back, and is overflowed at a stage of about 10 feet. Left bank high, steep, and is overflowed at gage height 30 feet. It is wooded with mesquite, grangeno, and willows. Bed composed of sand. Control is a stretch of channel of the stream.

EXTREMES OF DISCHARGE.—Maximum mean daily stage during year, 20.3 feet September 8 (discharge, 76,700 second-feet); minimum mean daily discharge, 1,900 second-feet July 16.

1900–1914; 1922–23: Maximum stage recorded, 32.2 feet on night of June 30, 1905 (discharge not determined); minimum mean daily discharge, 955 second-feet August 17, 1910.

The highest stage known was about 46 feet, present gage datum, on June 20 and 21, 1922.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

REGULATION.—Flow partly regulated by storage at Elephant Butte Dam, 120 miles above El Paso, on Pecos River, and on Mexican tributaries.

ACCURACY.—Stage-discharge relation not permanent. Daily discharge determined by shifting-control method on basis of frequent discharge measurements.

COOPERATION.—Records of daily discharge furnished by the Mexican Section of the International Boundary Commission. Monthly and yearly figures changed to conform with the computation rules of the United States Geological Survey.

Daily discharge, in second-feet, of Rio Grande near Laredo, Tex., for the year ending September 30, 1923

Day	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,376	2,804	2,566	2,442	3,041	3,462	2,650	2,202	3,938	2,631	7,191
2	3,319	2,792	2,603	2,514	3,041	3,364	2,638	2,509	2,951	2,504	8,517
3	3,309	2,792	2,639	2,493	3,041	3,326	2,636	7,309	2,871	2,454	9,120
4	3,220	2,780	2,612	2,493	3,041	3,289	2,636	11,267	2,982	2,412	9,453
5	3,155	2,778	2,584	2,472	3,188	3,215	2,636	4,623	2,828	2,412	8,986
6	3,122	2,776	2,599	2,464	3,188	3,215	2,609	2,890	2,468	2,496	11,741
7	3,113	2,794	2,599	2,457	3,030	3,215	2,609	2,691	2,374	2,423	26,630
8	2,863	2,813	2,614	2,453	3,030	3,158	2,590	2,654	2,342	2,348	76,700
9	2,859	2,781	2,604	2,449	2,810	3,158	2,597	2,628	2,531	2,078	19,200
10	2,865	2,781	2,594	2,451	2,797	3,158	2,479	2,607	2,473	2,078	16,066
11	2,842	2,749	2,594	2,451	2,784	4,519	2,361	2,559	2,143	1,930	12,553
12	2,825	2,750	2,595	2,453	2,784	3,976	2,361	2,453	2,035	1,930	9,508
13	2,809	2,758	2,591	2,453	2,784	3,704	2,518	2,427	2,008	1,999	11,901
14	2,780	2,757	2,591	2,600	2,780	18,102	2,278	2,376	1,938	1,999	11,702
15	2,773	2,757	2,595	8,929	2,780	7,728	2,179	2,321	1,920	2,005	12,203
16	2,780	2,757	2,591	12,752	2,734	4,656	2,179	2,032	1,900	2,039	12,918
17	2,821	2,756	2,586	8,563	2,710	3,592	2,130	2,008	3,160	2,039	26,900
18	2,804	2,756	2,586	5,317	2,680	3,566	2,100	2,008	2,577	2,039	36,100
19	2,802	2,778	2,556	3,333	2,680	3,513	2,090	1,982	2,515	2,019	44,100
20	2,799	2,699	2,564	3,161	2,615	3,493	2,085	1,957	2,515	7,880	43,500
21	2,818	2,682	2,564	2,990	2,552	3,350	2,085	1,920	2,527	6,995	49,700
22	2,864	2,651	2,573	4,637	2,531	3,343	2,076	3,752	4,355	6,663	53,000
23	2,830	2,651	2,517	6,991	2,531	3,343	2,068	4,179	8,214	6,033	40,550
24	2,823	2,582	2,461	5,572	2,531	3,303	1,946	3,996	4,866	6,033	21,525
25	2,838	2,582	2,444	4,670	2,448	3,743	1,946	3,813	2,686	6,546	17,192
26	2,830	2,592	2,427	3,380	2,448	3,743	1,971	3,576	3,008	8,737	13,354
27	2,823	2,602	2,427	3,654	4,591	3,686	1,986	5,590	7,732	13,109	10,478
28	2,814	2,602	2,427	3,243	3,576	3,587	1,946	5,071	6,266	10,260	10,478
29	2,815	2,608	2,354	-------	3,464	2,784	1,931	6,282	3,726	8,655	10,257
30	2,831	2,624	2,362	-------	3,559	2,697	1,931	5,763	3,062	11,292	10,037
31	-------	2,624	2,370	-------	3,559	-------	1,947	-------	2,869	10,670	-------

Monthly discharge of Rio Grande near Laredo, Tex., for the year ending September 30, 1293

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
November	3,380	2,770	2,920	174,000
December	2,800	2,580	2,720	167,000
January	2,640	2,350	2,540	156,000
February	12,800	2,440	3,990	222,000
March	4,590	2,450	2,950	181,000
April	18,100	2,700	4,100	244,000
May	2,650	1,930	2,260	139,000
June	11,300	1,920	3,580	213,000
July	8,210	1,900	3,220	198,000
August	13,100	1,930	4,670	287,000
September	76,700	7,190	21,700	1,290,000
The period	----------	----------	----------	3,270,000

RIO GRANDE AT ROMA, TEX.

LOCATION.—At Roma, Starr County, just above United States customhouse and ferry crossing between Roma, Tex., and San Pedro, Mexico, and 9½ miles above mouth of Rio San Juan.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 14, 1900, to March 31, 1914; November 1, 1922, to September 30, 1923.

GAGE.—Vertical and inclined staff in five sections on left bank, 100 feet above customhouse; read to half-tenths twice daily, and oftener during floods, by Francisco Gonzales. Datum of present gage 1.1 feet lower than that of the gage used prior to 1922.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifts. First right bank steep, covered with trees and brush, and is overflowed at extremely high stages for 600 feet. Second right bank not subject to overflow. Left bank slightly wooded and not subject to overflow. Channel straight for 1,000 feet above and below station. Control is a stretch of channel.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge, 82,000 second-feet September 9; minimum mean daily discharge, 1,393 second-feet June 22 and 23.

1900–1914, 1922–23: Maximum stage recorded, 25.75 feet September 16, 1904 (discharge, 96,900 second-feet, determined from poorly defined rating curve and subject to considerable error); minimum mean daily discharge 810 second-feet March 28 and 29, 1912.

On June 22, 1922, a stage of 32.4 feet, present gage datum, was reached (from levels by the International Boundary Commission, Mexican Section) and the discharge, as determined by United States Geological Survey engineers by the slope method, was 240,000 second-feet.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

REGULATION.—Flow partly regulated by storage at Elephant Butte Dam, 120 miles above El Paso. Slight storage on Pecos and Mexican tributaries.

ACCURACY.—Stage-discharge relation not permanent. Gage read to half-tenths twice daily, and oftener during floods. Frequent discharge measurements made. Records good.

COOPERATION.—Station maintained by the Mexican Section of the International Boundary Commission, by whom records were furnished.

Daily discharge, in second-feet, of Rio Grande at Roma, Tex., for the year ending September 30, 1923

Day	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4,248	3,132	2,710	2,785	4,721	3,577	3,355	1,872	4,734	3,050	10,749
2	4,587	3,188	3,359	2,724	3,938	3,410	3,141	1,872	4,671	2,683	8,553
3	3,678	3,188	3,359	2,802	3,811	3,252	3,154	2,068	4,594	2,426	12,183
4	3,850	3,244	3,255	2,919	3,769	3,199	3,168	5,171	3,255	2,286	10,549
5	4,090	3,260	3,150	2,958	3,769	3,199	3,168	9,968	2,942	2,196	9,640
6	3,925	3,277	3,150	2,853	3,829	3,013	3,168	5,498	2,969	2,048	11,093
7	6,710	3,140	3,058	2,749	4,604	3,020	2,880	4,477	2,622	2,250	7,557
8	4,282	3,003	3,058	2,791	4,048	2,990	2,706	3,455	2,495	2,221	77,000
9	3,944	3,003	3,117	2,834	3,275	2,993	2,706	2,771	2,495	1,998	82,000
10	3,608	3,003	3,177	2,834	3,275	2,993	3,350	2,560	2,565	1,887	54,500
11	3,608	3,480	3,164	2,928	3,239	3,218	2,681	2,402	3,059	1,887	61,800
12	3,574	3,242	3,164	2,928	3,203	2,108	2,681	2,217	2,309	1,796	44,900
13	3,474	3,005	3,063	3,171	3,185	4,440	2,527	2,566	2,146	1,766	35,600
14	3,435	2,897	3,063	11,933	2,919	5,419	2,527	2,221	2,041	1,830	32,500
15	3,396	3,113	2,962	10,756	2,923	12,029	2,476	2,106	2,041	2,020	35,300
16	3,336	3,029	2,940	10,520	2,927	7,746	2,374	1,981	2,211	2,182	36,200
17	3,277	2,776	2,918	16,274	2,927	5,440	2,374	1,669	2,339	2,182	39,800
18	3,229	2,944	3,041	9,441	3,039	4,747	2,323	1,481	3,151	1,915	44,700
19	3,205	3,084	3,041	4,766	3,039	4,193	2,271	1,456	2,981	3,907	50,600
20	3,181	3,084	3,041	4,518	2,790	3,847	2,271	1,432	2,261	5,439	56,500
21	3,214	3,035	3,057	3,394	2,512	3,821	2,220	1,412	2,141	6,061	68,700
22	3,247	2,995	3,057	3,525	2,589	3,742	2,095	1,393	2,741	5,881	66,600
23	3,260	2,995	2,871	20,791	2,589	3,637	2,107	1,393	4,987	5,022	60,300
24	3,313	3,108	2,684	27,733	2,589	3,512	2,158	1,878	5,087	4,502	49,000
25	3,313	3,108	2,731	14,643	2,495	3,430	2,012	3,887	4,377	4,205	40,200
26	3,069	3,111	2,777	10,552	2,495	4,192	2,012	6,658	3,743	4,454	32,000
27	3,069	3,114	2,777	5,136	19,053	4,065	1,918	3,508	3,388	9,754	27,400
28	3,108	2,988	2,777	4,721	15,337	5,302	2,388	4,451	7,144	16,221	26,300
29	3,136	2,862	3,179	-------	7,678	4,852	2,148	5,397	5,502	9,828	24,800
30	3,134	2,786	2,902	-------	5,502	3,840	2,046	5,993	3,865	7,973	24,000
31	-------	2,786	2,847	-------	4,414	-------	1,902	-------	3,447	12,294	-------

Monthly discharge of Rio Grande at Roma, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
November	6,710	3,070	3,620	215,000
December	3,480	2,780	3,060	188,000
January	3,360	2,680	3,010	185,000
February	27,700	2,720	7,000	389,000
March	19,100	2,510	4,400	271,000
April	12,000	2,110	4,170	248,000
May	3,360	1,900	2,530	155,000
June	9,970	1,390	3,170	189,000
July	7,140	2,040	3,360	207,000
August	16,200	1,770	4,330	266,000
September	82,000	7,560	38,000	2,260,000
The period				4,570,000

RIO GRANDE NEAR BROWNSVILLE, TEX.

LOCATION.—Opposite Matamoros, Tamaulipas, Mexico; half a mile above international railroad bridge and 1 mile above Brownsville, Cameron County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 29, 1900, to March 31, 1914 (discharge not computed); October 1, 1922, to September 30, 1923.

GAGE.—Vertical staff in two section on right bank 40 feet below cable; read by Pablo Guerra. All gages to same datum.

DISCHARGE MEASUREMENTS.—Made from cable near gage.

CHANNEL AND CONTROL.—Bed of stream composed of sand; shifting. Channel is straight for 500 feet above and 2,000 feet below station. Banks subject to overflow at extremely high stages. Control is a stretch of channel.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge, 25,500 second-feet September 12 and 13; minimum mean daily discharge, 386 second-feet May 25.

DIVERSIONS.—Considerable water diverted in Colorado, New Mexico, Texas, and Mexico; amount not known.

Between Roma and Brownsville many lagoons (old river channels) take river water during moderate floods, and a large area is overflowed deeply in large floods. Much of this water returns slowly to the river as the floods subside, thus making the flow more uniform at Brownsville than at Roma. During extremely high stages large quantities also leave the river entirely, reaching the Gulf of Mexico by other channels.

REGULATION.—Flow partly regulated by storage at Elephant Butte Dam, 120 miles above El Paso.

ACCURACY.—Stage-discharge relation not permanent. Gage read to half-tenths twice daily. Discharge determined principally from frequent discharge measurements.

COOPERATION.—Station maintained and records furnished by the Mexican Section of the International Boundary Commission.

Daily discharge, in second-feet, of Rio Grande near Brownsville, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	17,581	5,124	4,031	3,081	1,353	8,277	6,135	3,398	1,260	3,286	3,772	4,310
2	18,561	4,798	4,031	3,033	1,133	7,030	6,135	3,836	919	4,811	3,214	9,632
3	17,600	4,581	3,896	2,886	913	8,588	5,586	3,215	794	5,840	2,766	10,090
4	13,542	4,554	3,896	2,748	1,023	9,315	4,762	2,594	957	5,773	2,496	9,072
5	14,919	4,554	3,794	2,610	1,188	8,223	4,109	2,204	839	5,250	2,428	9,324
6	11,764	4,526	3,656	2,542	1,383	6,817	3,672	1,967	446	4,392	2,190	9,426
7	9,573	4,196	3,521	2,680	1,650	5,761	3,530	2,045	1,546	3,573	1,604	8,106
8	9,612	5,187	3,431	2,884	1,553	5,351	3,450	1,666	4,086	3,060	1,220	10,800
9	8,145	13,099	3,340	2,766	1,391	5,189	3,430	1,494	4,020	2,715	1,204	20,100
10	7,334	13,487	3,515	2,727	1,277	5,042	3,341	1,632	3,622	2,350	1,231	23,500
11	7,111	7,535	3,600	2,713	1,124	4,699	3,252	1,432	3,091	2,035	1,415	24,500
12	7,064	6,161	3,600	2,713	1,009	4,307	3,021	2,687	2,719	2,080	1,687	25,500
13	6,627	5,932	3,527	2,700	1,009	4,114	2,790	3,744	2,584	2,602	1,687	25,500
14	6,498	5,340	3,708	2,869	813	3,920	2,606	3,656	2,281	2,828	1,421	22,900
15	5,992	5,044	3,768	2,970	442	3,787	3,020	2,907	2,108	2,659	1,217	21,900
16	5,830	4,777	3,768	2,695	2,829	3,653	3,458	2,159	2,065	1,980	1,135	20,600
17	5,519	4,644	3,768	2,329	8,242	3,578	6,922	1,460	2,194	1,587	956	20,800
18	5,455	4,540	3,509	2,206	10,148	3,504	7,522	1,092	2,097	1,207	956	21,600
19	5,123	4,488	3,428	2,206	11,524	3,207	6,462	892	2,000	1,207	1,126	21,600
20	4,656	4,435	3,348	2,206	8,323	3,121	5,568	892	1,902	1,237	1,483	22,000
21	4,738	3,898	3,159	2,251	5,710	3,070	4,625	1,229	1,527	1,442	1,439	21,800
22	4,853	3,898	3,159	2,385	5,003	2,990	4,102	886	1,303	1,887	1,527	21,800
23	4,895	3,898	3,159	2,047	4,556	2,720	3,997	544	1,237	2,127	2,867	21,500
24	4,850	4,543	3,159	1,793	4,396	2,472	3,516	465	1,259	1,819	4,063	21,000
25	4,663	4,543	3,283	1,541	17,250	2,372	3,039	386	1,391	6,392	4,285	21,600
26	10,233	4,634	3,390	1,505	19,502	2,422	2,924	445	1,217	8,645	4,307	21,900
27	9,734	4,846	3,229	1,464	16,342	2,272	2,869	504	1,282	5,357	4,177	22,000
28	8,214	4,943	3,127	1,339	10,605	2,609	2,908	1,336	1,779	4,521	3,939	21,900
29	7,415	4,410	2,973	1,381	-------	17,254	3,062	2,258	2,236	3,854	6,117	22,000
30	6,350	4,112	2,871	1,381	-------	15,076	3,178	2,069	2,341	3,597	9,381	21,200
31	5,776	-------	3,031	1,188	-------	8,290	-------	1,571	-------	3,954	7,831	-------

Monthly discharge of Rio Grande near Brownsville, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	18,600	4,660	8,390	516,000
November	13,500	3,900	5,360	319,000
December	4,030	2,870	3,470	214,000
January	3,080	1,190	2,320	142,000
February	19,500	442	5,060	281,000
March	17,300	2,270	5,450	335,000
April	7,520	2,610	4,100	244,000
May	3,840	386	1,830	112,000
June	4,090	446	1,900	113,000
July	8,640	1,210	3,360	206,000
August	9,380	956	2,750	169,000
September	25,500	4,310	18,600	1,110,000
The year	25,500	386	5,190	3,760,000

PECOS RIVER NEAR DAYTON, N. MEX.

LOCATION.—In sec. 13, T. 18 S., R. 26 E., 3 miles east of Dayton, Eddy County, half a mile above mouth of Penasco River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24, 1905, to September 30, 1923.

GAGE.—Stevens water-stage recorder on right bank; installed August 27, 1914.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifts, especially during high stages. Right bank consists of clay; left bank of sand. Banks are overflowed at stage of about 11.5 feet. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum mean daily stage, 10.60 feet on June 10 (discharge, 2,130 second-feet); minimum mean daily discharge, 20 second-feet August 16 and 18.

1905–1923: Maximum stage recorded, 15.9 feet for five or six hours during morning of September 18, 1919 (discharge not determined; probably exceeded previous maximum of 50,300 second-feet on July 25, 1915, which was derived from discharge at Lake McMillan and included flow of Penasco River); minimum stage, that of August 16 and 18, 1923.

ICE.—None reported.

DIVERSIONS.—Considerable water is diverted above station for irrigation; quantity not known, but not in conflict with rights of Carlsbad project of the United States Bureau of Reclamation, which serves about 20,000 acres near Carlsbad and stores part of the water used near Carlsbad in Lake McMillan, 10 miles below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permament, but periods of change are covered by discharge measurements. Curve well defined from 30 to 1,100 second-feet, and extended parallel to former curves to cover range of stage. Operation of water-stage recorder satisfactory, except as noted in footnote to daily discharge table. Mean daily gage heights determined from recorder graph by inspection or by averaging gage heights for fractional parts of a day. Daily discharge ascertained by shifting-control method, using mean daily gage height except for days of considerable range in stage, when discharge was averaged for fractional parts of the day. Records good.

COOPERATION.—Daily discharge records and list of discharge measurements furnished by the United States Bureau of Reclamation.

Discharge measurements of Pecos River near Dayton, N. Mex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 31	J. R. Yates	6.00	112	May 20	J. R. Yates	6.46	230
Dec. 18	do	6.38	175	June 23	do	6.60	167
Jan. 31	do	6.85	240	July 10	do	5.40	49
Feb. 24	do	7.68	453	19	Yates and Teeter	5.70	90
Apr. 11	do	5.80	139	Sept. 1	J. R. Yates	6.95	260
27	H. H. Robins	6.10	164	16	do	9.00	1,100

Daily discharge, in second-feet, of Pecos River near Dayton, N. Mex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	66	104	202	147	231	352	227	307	181	75	210	302
2	60	104	208	147	227	314	225	270	181	75	210	428
3	56	104	197	147	225	314	216	237	119	63	218	322
4	46	104	185	144	221	290	221	203	131	63	186	290
5	39	104	172	142	237	268	218	177	131	75	123	456
6	39	104	158	142	235	257	199	147	115	63	84	352
7	39	108	162	139	218	237	172	147	88	48	68	247
8	41	111	167	139	235	218	164	131	181	48	55	181
9	46	111	162	139	252	208	164	131	425	39	48	101
10	51	111	158	155	270	208	150	139	2,130	48	43	81
11	48	111	158	163	290	204	142	147	1,014	58	39	75
12	44	111	158	163	279	204	152	147	524	288	30	69
13	39	118	158	169	257	204	543	155	524	583	31	66
14	39	126	158	181	243	186	1,232	163	290	375	31	63
15	44	155	158	181	231	155	695	155	268	218	21	64
16	48	142	155	177	231	155	532	208	190	164	20	910
17	53	142	155	176	237	155	478	309	190	149	21	1,080
18	53	142	155	176	231	152	440	290	147	123	20	930
19	58	150	155	176	227	152	416	279	139	94	81	302
20	69	158	155	176	218	155	404	237	108	81	543	172
21	73	162	155	199	212	144	372	208	268	73	1,763	415
22	75	165	155	221	221	144	380	147	456	98	1,359	302
23	79	167	155	231	380	147	326	128	172	139	803	233
24	79	179	155	253	440	142	257	123	543	155	603	172
25	85	190	155	257	380	139	227	123	366	108	352	155
26	91	197	160	257	380	142	199	233	227	81	285	194
27	91	201	163	262	355	142	177	352	155	68	283	190
28	91	218	163	262	361	147	257	218	123	79	208	139
29	94	223	158	247	-------	181	395	172	108	326	208	115
30	97	216	158	247	-------	199	440	172	88	803	863	89
31	101	-------	158	237	-------	212	-------	181	-------	352	339	-------

NOTE.—Record incomplete and discharge estimated Nov. 4, 15, 16, 21, 22, Feb. 8–10, 23, Mar. 7–9, Apr. 28, 29, May 9–12, Aug. 22–25, and Sept. 19–22.

Monthly discharge of Pecos River near Dayton, N. Mex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	101	39	62.4	3,840
November	223	104	145	8,600
December	208	155	164	10,100
January	262	139	189	11,600
February	440	212	269	14,900
March	352	139	198	12,200
April	1,230	142	334	19,900
May	352	123	195	12,000
June	2,130	88	319	19,000
July	803	39	162	9,940
August	1,760	20	295	18,100
September	1,080	63	283	16,800
The year	2,130	20	217	157,000

PECOS RIVER AT CARLSBAD, N. MEX.

LOCATION.—In SE. ¼ sec. 6, T. 22 S., R. 27 E., at Green Street Bridge in Carlsbad, Eddy County, 300 feet downstream from Atchison, Topeka & Santa Fe Railway station, 1,500 feet above mouth of Dark Canyon, and 2,000 feet below Hagerman Dam.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 28, 1903, to March 31, 1908; May 13, 1914, to September 30, 1923.

GAGE.—Stevens eight-day water-stage recorder attached to downstream end of middle bridge pier, installed June 1, 1920; inspected by J. R. Yates.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and rock, but considerable changes have taken place, due to sand deposits. Banks of medium height, not subject to overflow. Location of control not known.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 1.82 feet at 2 p. m. February 23 (discharge, 790 second-feet, determined from extension of rating curve and subject to error); minimum stage, 0.49 foot at 7 a. m. September 23 (discharge, 59 second-feet, determined from extension of rating curve and subject to error).

1903–1908; 1914–1923; Maximum stage recorded about 21.0 feet August 7, 1916 (discharge, 85,700[2] second-feet); minimum discharge, 30 second-feet September 30, 1918.

ICE.—None reported.

DIVERSIONS.—Large quantities of water are stored a few miles above station at Lakes McMillan and Avalon by the United States Bureau of Reclamation for irrigating land near Carlsbad. Water is also diverted for irrigation in valleys adjacent to river above Lake McMillan. Capacity of storage reservoirs in connection with the Carlsbad project, 58,500 acre-feet. Considerable water seeps into river between storage reservoirs and gaging station, quantity depending on amount being used for irrigation between the two points.

REGULATION.—Flow at this point completely controlled by storage reservoirs at Carlsbad project, except extreme floods.

[2] Discharge at Avalon Dam; reported by engineers of the United States Bureau of Reclamation.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 73 to 300 second-feet, and extending to cover range of stage. Operation of water-stage recorder satisfactory, except for short break in record. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control methods, using mean daily gage height except for days of considerable fluctuation in stage, when discharge was averaged for fractional parts of a day. Records good.

COOPERATION.—Records of stage furnished by United States Bureau of Reclamation.

Discharge measurements of Pecos River at Carlsbad, N. Mex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 13	Slack and West	0.65	75.1	June 16	J. R. Yates	0.62	71.8
Nov. 18	J. R. Yates	.62	77.0	July 30	do	.60	87.0
Jan. 22	do	.62	77.4	Sept. 28	do	.64	87.9
Mar. 9	do	.90	175				

Daily discharge, in second-feet, of Pecos River at Carlsbad, N. Mex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	87	83	80	103	78	137	100	100	97	87	83	87
2	83	83	80	92	75	152	100	100	83	83	85	90
3	87	83	80	87	78	148	92	107	103	87	83	92
4	85	80	80	83	73	160	92	95	103	85	83	92
5	85	78	80	83	75	177	92	100	100	87		90
6	83	80	75	83	75	172	92	96	100	85		92
7	83	80	73	83	97	177	92	103	184	87	84	90
8	80	80	73	83	119	181	92	97	119	87		90
9	87	83	75	83	126	181	95	94	83	87		90
10	83	80	75	85	137	190	95	92	83	87		92
11	75	80	78	85	145	194	97	97	83	85	85	92
12	83	78	78	85	145	194	95	97	85	85	83	90
13	78	78	78	85	119	194	95	87	83	85	80	90
14	78	78	78	85	110	199	97	97	83	85	80	90
15	80	78	78	85	100	199	100	97	71	80	80	90
16	80	78	78	85	95	203	107	95	73	83	80	155
17	80	78	75	85	97	203	107	97	80	87	78	90
18	83	80	80	85	95	203	103	95	80	90	78	90
19	83	75	78	85	97	203	110	97	78	87	190	87
20	85	78	80	87	90	208	100	92	80	85	87	85
21	90	78	78	80	92	208	103	103	80	124	85	87
22	80	83	78	80	78	203	113	90	71	92	85	87
23	75	80	78	80	160	203	110	97	87	85	85	85
24	75	78	80	80	100	168	113	100	72	85	85	89
25	73	78	78	80	87	145	119	100	78	87	87	85
26	75	78	80	80	90	126	107	90	80	85	87	90
27	78	80	80	80	103	116	110	92	80	87	85	90
28	78	80	83	78	123	110	107	92	83	85	90	87
29	80	83	80	80	-------	110	107	95	83	87	85	87
30	83	80	83	78	-------	107	103	95	80	87	85	87
31	78	-------	87	80	-------	103	-------	95	-------	83	85	-------

NOTE.—Mean discharge Aug. 6–10 estimated by comparison with records for other stations.

Monthly discharge of Pecos River at Carlsbad, N. Mex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	90	73	81.1	4,980
November	83	75	79.6	4,740
December	87	73	78.6	4,830
January	103	78	83.6	5,140
February	160	73	102	5,670
March	208	103	170	10,500
April	119	92	101	6,040
May	107	87	96.3	5,920
June	184	71	88.2	5,250
July	124	80	87.1	5,360
August	190	78	87.2	5,360
September	155	85	91.3	5,430
The year	208	71	95.6	69,200

PECOS RIVER NEAR MALAGA, N. MEX.

LOCATION.—In sec. 18 or 19, T. 24 S., R. 29 E., 3½ miles southeast of Malaga, Eddy County, and 4¼ miles below mouth of Black River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1920, to September 30, 1923.

GAGE.—Stevens seven-day water-stage recorder installed on right bank, with staff gage attached to still well; inspected by W. F. Gerlach.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock covered with sand; shifts. Right bank solid rock and steep. Left bank sand and high. Control is rock ledge overlain with sand 500 feet below gage; shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 8.83 feet at 11.50 a. m. August 28 (discharge 4,640 second-feet); minimum stage, 3.42 feet at 9 p. m. April 7 (discharge, 36 second-feet, determined from extension of rating curve and subject to error).

1920–1923: Maximum stage from water-stage recorder, 12.85 feet at 1 a. m. June 8, 1921 (discharge, 22,000 second-feet, determined from extension of curve and subject to error); minimum stage that of April 7, 1923.

In September, 1919, river reached a stage of 26.4 feet (discharge not determined).

DIVERSIONS.—The Carlsbad project of United States Bureau of Reclamation, with reservoirs that have a capacity of 58,500 acre-feet, diverts a large part of the natural run-off above Carlsbad, N. Mex. During season of irrigation considerable water is returned to the stream by seepage from lands near Carlsbad. In addition to water used by the Carlsbad project, some diversions are made for irrigation in the basin above storage reservoirs of the Carlsbad project.

REGULATION.—Operation of the water-power plant of 300 horsepower capacity above station, just below Carlsbad, N. Mex., owned and operated by Carlsbad Electric Light & Power Co., does not materially regulate flow at gage. The flow is, however, regulated to a large extent by waters stored in the reservoirs of the Carlsbad project. In the season of irrigation the effect of the regulation is decreased by return seepage water, but during the winter the flow depends on water released at the reservoirs.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used; one applicable from October 1 to December 31 and the other from January 1 to September 30, both of which are well defined for all stages. Operation of water-stage recorder satisfactory. Mean daily gage height obtained from recorder chart by inspection or by averaging gage heights for fractional parts of a day. Daily discharge determined by shifting-control method, using mean daily gage height except for days of considerable range in stage, when discharge was averaged for fractional parts of the day. Records good.

COOPERATION.—Most of discharge measurements and records of daily discharge furnished by United States Bureau of Reclamation.

Discharge measurements of Pecos River near Malaga, N. Mex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 13	West and Slack	3.80	151	Mar. 5	J. R. Yates [a]	4.06	247
Nov. 17	J. R. Yates [a]	3.90	162	June 3	Yates-Teeter [a]	3.68	108
Jan. 7	do	3.80	133	July 21	J. R. Yates	3.67	106

[a] Employee of United States Bureau of Reclamation.

Daily discharge, in second-feet, of Pecos River near Malaga, N. Mex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	162	228	113	126	136	208	256	101	98	133	110	276
2	117	208	143	169	120	240	228	89	95	120	110	296
3	180	165	143	220	147	256	176	104	123	133	117	288
4	180	150	126	147	158	252	133	80	104	117	104	312
5	180	158	158	162	176	264	123	107	133	126	104	348
6	196	133	158	143	165	280	123	126	133	126	98	280
7	188	161	147	110	147	272	69	113	126	107	107	300
8	180	154	165	130	192	284	69	120	582	110	113	256
9	117	162	140	169	200	276	80	110	280	101	110	288
10	162	154	150	180	212	268	83	120	200	104	101	260
11	173	169	126	158	188	264	80	92	184	123	117	260
12	165	158	158	133	204	248	83	113	208	200	123	268
13	147	158	133	184	216	256	95	173	208	154	120	268
14	154	173	162	224	224	256	95	113	188	130	123	348
15	192	169	143	204	220	264	107	120	173	130	130	425
16	192	173	150	196	228	264	83	120	113	126	113	1,865
17	192	136	147	162	228	268	101	95	104	130	123	615
18	184	133	107	147	224	272	101	101	92	136	117	360
19	169	147	147	143	212	264	98	107	101	140	162	324
20	158	154	154	140	196	272	80	92	113	143	365	316
21	196	165	133	154	244	272	92	89	228	143	212	288
22	232	133	169	120	276	248	69	69	173	252	196	280
23	173	162	101	136	292	248	83	98	176	169	208	272
24	184	147	120	154	248	252	89	89	136	150	196	372
25	165	169	113	143	208	244	184	92	126	130	200	316
26	200	161	140	130	184	280	165	104	113	126	236	272
27	200	120	117	162	192	276	110	126	101	133	192	268
28	154	143	158	154	196	280	95	95	107	120	1,117	256
29	173	176	117	120	-------	280	95	110	95	120	402	248
30	204	162	110	126	-------	276	101	89	107	117	288	320
31	244	-------	117	140	-------	256	-------	98	-------	113	276	-------

NOTE.—Discharge estimated Sept. 12–14; partly estimated Sept. 15.

Monthly discharge of Pecos River near Malaga, N. Mex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	244	117	178	10,900
November	228	120	159	9,480
December	169	101	138	8,460
January	224	110	154	9,490
February	292	120	201	11,200
March	284	208	263	16,100
April	256	69	112	6,640
May	173	69	105	6,460
June	582	92	157	9,360
July	252	101	134	8,260
August	1,120	98	197	12,100
September	1,860	248	361	21,500
The year	1,860	69	180	130,000

PECOS RIVER NEAR ANGELES, TEX.

LOCATION.—In T. 26 S., R. 29 E., just below Pecos Valley Railroad bridge, crossing Delaware Creek at its mouth, 2 miles north of New Mexico-Texas State line, and 8½ miles northwest of Angeles, Reeves County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 27, 1914, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder, at first outcropping of rock on right bank 600 feet below railroad bridge and mouth of Delaware Creek; inspected by engineers of United States Geological Survey.

DISCHARGE MEASUREMENTS.—Made by wading or from cable half a mile downstream.

CHANNEL AND CONTROL.—Bed and banks composed of sand, gravel, and rock; banks not subject to overflow. Control formed by a series of rapids 200 feet below gage; shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 6.84 feet at 2.15 a. m. September 16 (discharge, 12,400 second-feet, determined from extension of curve parallel to curve for 1921); minimum discharge, 68 second-feet August 19 and 20.

1914–1923: Maximum stage recorded, 21.5 feet at 10 a. m. August 8, 1916, measured by leveling from floodmarks (discharge not determined); minimum discharge, that of August 19 and 20, 1923.

ICE.—Stage-discharge relation not seriously affected by ice; open-channel rating assumed applicable.

DIVERSIONS.—The Carlsbad project of the United States Bureau of Reclamation, with reservoirs that have a capacity of 58,500 acre-feet, diverts a large part of the natural run-off above Carlsbad, N. Mex. During the season of irrigation considerable water is returned to the stream by seepage from lands near Carlsbad. In addition to the water used by the Carlsbad project some diversions are made for irrigation in the basin above the storage reservoir of the Carlsbad project.

REGULATION.—Operation of a water-power plant of 300 horsepower capacity above station, just below Carlsbad, N. Mex., owned and operated by Carlsbad Electric Light & Power Co., does not materially regulate flow at gage. The flow is, however, regulated to a large extent by waters stored in the reservoirs of the Carlsbad project. In the season of irrigation the effect of the regulation is decreased by return seepage waters, but during winter flow depends on water released at the reservoirs.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined above 90 second-feet, and extended below to cover range of stage for year. Operation of water-stage recorder not satisfactory. Mean daily heights obtained from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control method, using mean daily gage heights except for days of large range in stage, when discharge was averaged for fractional parts of a day, and as noted in footnote to daily discharge table. Records fair.

Discharge measurements of Pecos River near Angeles, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	R. G. West	0.21	145	Apr. 29	T. A. Slack	0.08	109
Nov. 9	T. A. Slack	.27	174	May 13	do	.09	115
Dec. 5	do	.09	112	June 4	do	.10	119
Jan. 8	do	.11	120	25	do	.08	92.4
25	do	.19	157	July 21	H. C. Pritchett	.17	109
Feb. 8	do	.07	117	Aug. 12	do	.16	106
Mar. 2	do	.26	180	Sept. 8	do	.38	160
22	do	.33	218	19	A. G. Fiedler	.45	247
Apr. 9	do	.03	91.6				

Daily discharge, in second-feet, of Pecos River near Angeles, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	155	200		117	148	170	191	114		95	81	
2	155	195		129	141	186	186	112	95	107	81	210
3	129	177	143	145	138	195	160	105		95	83	
4	169	138		222	138	217	125	114	122	97	86	
5	164	151		177	151	200	105	102	100	90	83	300
6	164	148	135	132	155	212	102	117	119	95	86	200
7	164	138	129	141	145	212	97	129	160	97	88	175
8	155	151	129	114	132	212	81	109	575	86	95	155
9	160		135	129	173	222	86	112	300	93	102	160
10	119		117	155	177	217	90	107	250	90	97	195
11	148		125	151	195	206	93	112	220	93	102	186
12	148		112	145	169	222	92	102	200	100	97	186
13	138		129	135	191	195		117	180	154	71	182
14	135		119	169	195	212		138	150	112	71	194
15	145		132	206	206	206		114	145	112	70	450
16	177		122	182	206	200		102	130	112	70	4,670
17	169		135	173	206	206		112	140	100	71	1,360
18	169		125	151	206	217			120	97	69	400
19	160		107	141	182	212			110	102	68	262
20	151	143	129	141	155	222	90	98	100	105	68	262
21	151		132	141		212			160	105	270	247
22	169		122	151		212			164	97	200	232
23	182		141	122		186			122	117	175	217
24	148		109	132		191			125	93		239
25	151		114	148	170	200			102	88		304
26	151		112	135		206			100	80	160	234
27	164		122	135		217		95	93	78		217
28	155		114	151		212			88	80		206
29	148		138	148	-------	228	109		88	78	1,150	243
30	160		117	129	-------	217	109		86	85	425	297
31	182	-------	112	148	-------	206	-------	-------	-------	85	250	-------

NOTE.—Braced figures show estimated mean discharge for periods indicated. Discharge estimated or interpolated Mar. 1 and Sept. 18, 21, and 22; partly estimated Mar. 2, Apr. 12, 29, June 7, 20, Aug. 20, Sept. 19, 20, and 23.

Monthly discharge of Pecos River near Angeles, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	182	119	156	9,590
November	----------	----------	148	8,810
December	----------	107	127	7,790
January	222	114	148	9,110
February	----------	----------	170	9,460
March	228	170	207	12,700
April	191	----------	102	6,080
May	----------	----------	105	6,480
June	575	86	151	8,990
July	154	78	97.4	5,990
August	1,150	68	158	9,740
September	4,670	155	420	25,000
The year	4,670	----------	165.	120,000

PECOS RIVER NEAR PORTERVILLE, TEX.

LOCATION.—At highway bridge on Pecos-Porterville road, half a mile east of Arno station on Santa Fe Railway, 2 miles west of Porterville, Loving County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 1, 1922, to September 30, 1923.

GAGE.—Chain gage attached to downstream side of highway bridge; read by Tom Wright.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, sand, and gravel; shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.05 feet at 5.25 p. m. September 16 (discharge, 4,110 second-feet); minimum discharge, 58 second-feet, July 4, 5, and August 2.

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

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

DIVERSIONS.—The Carlsbad project of the United States Bureau of Reclamation, with reservoirs of a capacity of 58,500 acre-feet, diverts a large part of the natural run-off above Carlsbad, N. Mex. During the season of irrigation considerable water is returned to stream by seepage from lands near Carlsbad. In addition to the water used by the Carlsbad project, some diversions are made for irrigation in the basin above storage reservoir of Carlsbad project.

REGULATION.—Operation of a water-power plant of 300 horsepower capacity above station, just below Carlsbad, N. Mex., owned and operated by Carlsbad Electric Light & Power Co., does not materially regulate flow at gage. The flow is, however, regulated to a large extent by waters stored in the reservoirs of the Carlsbad project. In the season of irrigation the effect of the regulation is decreased by return seepage waters, but during winter flow depends on water released at reservoirs.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 60 to 400 second-feet and fairly well defined above 400 second-feet. Gage read to hundredths once a day; reading may not be a true index to mean daily discharge at high stages, owing to rapid fluctuations. Daily discharge determined by shifting-control method, except as noted in footnote to daily discharge table. Records fair.

Discharge measurements of Pecos River near Porterville, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 14	T. A. Slack	1.72	135	May 3	T. A. Slack	1.62	97.3
Nov. 6	do	1.71	119	20	do	1.38	74.4
Dec. 8	do	1.83	139	June 9	do	3.15	390
22	do	1.81	132	22	do	1.81	119
Jan. 12	do	1.96	157	July 11	H. C. Pritchett	1.86	131
26	do	1.85	140	31	do	1.30	66.5
Feb. 9	do	1.91	149	Aug. 25	do	1.66	110
28	do	1.99	152	Sept. 3	do	2.16	179
Mar. 21	do	2.25	194	9	do	2.06	172
Apr. 2	do	2.23	184				

Daily discharge, in second-feet, of Pecos River near Porterville, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	a153	158	143	120	136	158	a182	99	93	a74	71	190
2	182	190	150	120	136	150	182	93	93	76	66	a186
3	182	182	a150	128	128	143	182	99	a96	76	62	182
4	128	182	150	120	a136	a162	190	93	99	76	58	182
5	136	a151	150	128	143	182	190	87	99	82	a58	166
6	143	120	150	128	143	173	182	a90	93	76	59	308
7	150	120	150	a139	158	182	190	93	87	82	61	227
8	a150	120	143	150	150	190	a186	99	622	a79	66	166
9	150	128	136	128	150	190	182	82	408	76	59	173
10	143	113	a140	120	143	182	166	82	a313	287	61	173
11	143	120	143	120	a162	a166	76	82	218	128	61	173
12	93	a135	136	158	182	150	76	82	173	106	a60	158
13	136	150	143	150	158	150	82	a84	136	99	59	143
14	136	143	143	a150	158	150	82	87	136	93	59	136
15	a132	143	128	150	173	158	a87	93	143	a93	66	128
16	128	136	136	166	173	150	93	99	136	93	71	4,110
17	166	136	a132	173	190	150	87	99	a132	87	76	2,810
18	166	143	128	158	a186	a166	87	106	128	87	82	903
19	158	a143	128	158	182	182	82	99	99	82	a82	438
20	158	143	128	143	166	190	82	76	93	82	82	438
21	158	136	106	a143	166	190	93	99	82	82	82	438
22	a158	136	120	143	190	190	a84	106	99	a84	246	438
23	158	150	128	143	218	173	76	99	82	87	150	a409
24	173	150	120	143	236	150	82	93	82	128	136	380
25	158	150	113	113	a213	a166	82	93	82	128	113	308
26	166	a146	99	120	190	182	82	87	82	99	a132	256
27	128	143	128	143	173	190	71	a93	76	99	150	236
28	158	158	128	a143	158	190	99	99	76	99	136	199
29	a158	136	113	143	-------	182	a99	99	76	a90	1,220	173
30	158	120	106	136	-------	190	106	93	71	82	438	a182
31	158	-------	a113	136	-------	182	-------	87	-------	66	236	-------

a Discharge interpolated.

Monthly discharge of Pecos River near Porterville, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	182	93	150	9,250
November	190	113	143	8,490
December	150	99	132	8,090
January	173	113	139	8,550
February	236	128	168	9,320
March	190	143	171	10,500
April	190	71	118	7,020
May	106	76	92.6	5,700
June	622	71	140	8,340
July	287	66	96.1	5,910
August	1,220	58	141	8,640
September	4,110	128	480	28,600
The year	4,110	58	164	118,000

PECOS RIVER ABOVE BARSTOW, TEX.

LOCATION.—400 feet below dam and diversion of Barstow Canal (Ward County Irrigation District No. 1) and 10 miles northwest of Barstow, Ward County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 1, 1916, to May 11, 1921; March 22, 1922, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder on left bank. Prior to March 4, 1923, Gurley eight-day water-stage recorder on left bank; attended by R. G. Hamilton or engineers of United States Geological Survey. Gage used 1916–1921 was a Stevens continuous water-stage recorder at a site 4 miles upstream.

DISCHARGE MEASUREMENTS.—Measurements made by wading or from cable near gage, or from Texas Pacific Railroad bridge near Pecos.

CHANNEL AND CONTROL.—Channel straight for several hundred feet above and below station. Bed composed of rock; permanent. Banks of silt and sand, steep; shift. Left bank not subject to overflow. Right bank subject to overflow at extremely high stages. Low-water control is rock ledge 150 feet below gage; permanent. Point of zero flow is gage height 1.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.50 feet at 5.20 a. m. September 17 (discharge, 2,900 second-feet); minimum discharge, 0.2 second-foot April 27–29, June 25 to July 10, July 13–20, and July 24 to August 21.

1915–1923: Maximum stage from water-stage recorder, 12.1 feet from gage (at original site) at 6 a. m. August 10, 1916 (discharge not determined); minimum stage same as given above.

DIVERSION.—In addition to water diverted in New Mexico by the Carlsbad project, the three principal diversions in Texas are the Farmers Independent, Cedarvale (formerly Biggs), and Barstow Canals. Small amount diverted by Boxley and Porterville irrigation systems. According to records of the Board of Water Engineers for the State of Texas, these projects have declared a total of 17,500 acres irrigated.

REGULATION.—Flow during low and medium stages regulated by storage reservoir on Carlsbad project in New Mexico and by diversion dams in Texas. Flood flow partly regulated by reservoirs on Carlsbad project.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 1,000 second-feet and fairly well defined from 1,000 to 3,000 second-feet. Operation of water-stage recorder not satisfactory prior to March 3, principally due to improper attendance. Daily discharge determined by shifting-control method, using mean daily gage height except for days of considerable range in stage, when discharge was averaged for fractional parts of the day, except as noted in footnote to daily discharge table. Records fair.

Discharge measurements of Pecos River above Barstow, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 20	West and Slack	2.05	18.8	Apr. 28	T. A. Slack	1.42	[a]0.2
Nov. 10	T. A. Slack	2.71	118	June 12	do	1.58	[a]1.0
Jan. 3	do	2.14	28	July 5	do	1.39	[a].2
24	do	2.36	56.3	Aug. 9	H. C. Pritchett	1.38	[a].2
Feb. 7	do	2.32	48.1	30	do	2.84	144
24	do	3.09	216	Sept. 10	Wallace and Pritchett	1.61	[b]2.2
Mar. 10	do	2.32	50	19	D. S. Wallace	3.06	214
Apr. 7	do	1.65	2.1				

[a] Estimated. [b] Partly estimated.

Daily discharge, in second-feet, of Pecos River above Barstow, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.5	117	13	31	12	110	6.5	0.3	0.4	0.2	0.2	1.1
2	1.7	115	13	29	44	80	5.6	.3	.4	.2	.2	1.0
3	1.7	115	19	28	33	72	5.1	.3	.3	.2	.2	.9
4	1.9	95	42	52	78	88	5.1	.4	.4	.2	.2	1.0
5	1.5	75	59	108	122	91	3.6	.5	.4	.2	.2	1.0
6	1.5	60	103	25	122	34	2.6	.3	.4	.2	.2	1.3
7	2.3	53	112	6.0	72	60	2.1	.3	.4	.2	.2	1.3
8	2.8	101	97	5.0	19	9.2	1.7	.3	.4	.2	.2	1.1
9	3.0	99	77	4.0	3.0	9.2	1.4	.3	27	.2	.2	1.1
10	3.0	110	56	3.2	3.2	45	1.7	.4	1.5	.2	.2	1.1
11	3.0	106	106	2.6	3.2	161	2.1	.3	1.4	.5	.2	1.0
12	2.1	112	112	2.6	4.1	102	2.3	.3	1.1	.3	.2	1.0
13	1.3	86	108	8.0	31	57	2.1	.3	1.0	.2	.2	1.0
14	1.5	101	94	84	98	28	1.7	.3	.8	.2	.2	.9
15	1.9	86	66	95	139	5.6	1.3	.3	.9	.2	.2	.8
16	1.9	115	64	88	127	4.1	1.2	.3	.8	.2	.2	13
17	3.0	97	68	86	158	6.0	1.0	.4	.7	.2	.2	2,180
18	13	70	66	84	175	8.0	1.0	.4	.8	.2	.2	1,070
19	24	41	72	75	161	5.6	1.0	.4	.7	.2	.2	224
20	20	32	46	67	129	6.5	.8	.4	.6	.2	.2	129
21	17	48	50	60	99	9.5	.8	.4	.8	.4	.2	31
22	6.0	42	27	51	145	6.5	.8	.4	.5	.3	.3	4.6
23	4.1	18	32	50	180	5.6	.7	.4	.5	.3	.3	3.4
24	7.5	6.8	54	55	215	5.1	.4	.4	.3	.2	.3	2.8
25	34	18	20	55	221	3.6	.3	.4	.2	.2	.3	3.0
26	42	16	1.9	45	204	.7	.3	.4	.2	.2	.3	2.6
27	50	15	1.7	46	153	.7	.2	.4	.2	.2	.6	48
28	46	12	1.7	48	116	.7	.2	.3	.2	.2	.8	50
29	64	13	1.7	36	-------	15	.2	.3	.2	.2	.7	45
30	84	13	1.7	31	-------	53	.4	.3	.2	.2	135	41
31	112	-------	31	10	-------	35	-------	.3	-------	.2	1.5	-------

NOTE.—No record and discharge estimated Nov. 29, 30, Dec. 1, 2, 25, Jan. 6–9, Feb. 22 and 23. Discharge partly estimated Oct. 29, Nov. 18, 28, Dec. 3, 26, 30, 31, Jan. 5, 10–17, Feb. 15, 24, July 27 and 28.

Monthly discharge of Pecos River above Barstow, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1 12	1.3	18.0	1,110
November	117	6.8	66.3	3,940
December	112	1.7	52.1	3,200
January	108	2.6	44.2	2,720
February	221	3.0	102	5,690
March	161	.7	36.1	2,220
April	6.5	.2	1.81	108
May	.5	.3	.35	21.4
June	27	.2	1.46	86.7
July	.5	.2	.23	13.9
August	135	.2	4.65	286
September	2,180	.8	129	7,660
The year	2,180	.2	37.4	27,100

PECOS RIVER NEAR GRANDFALLS, TEX.

LOCATION.—At site of old highway bridge where Grandfalls-Fort Stockton road formerly crossed Pecos River, 1½ miles upstream from present Grandfalls-Fort Stockton road crossing at iron bridge, 2 miles below diversion dam for the low-line (silt-line) canal of the Imperial Irrigation Co., about 3 miles south of Grandfalls, Ward County, and 4½ miles above diversion dam of Zimmerman project.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 4, 1917, to September 30, 1923, at present site; November 6, 1915, to August 3, 1917, at iron bridge, 1½ miles downstream from present site. Discharge at both points believed to be the same.

GAGE.—Stevens water-stage recorder installed August 9, 1917, on downstream side of old bridge pier near left water's edge; inspected by engineers of United States Geological Survey.

DISCHARGE MEASUREMENTS.—Made by wading near gage, from cable 50 feet above gage, or during extremely high stages at iron bridge.

CHANNEL AND CONTROL.—Bed of stream solid rock and permanent, except for small deposits of sand and gravel. Channel straight for 100 feet above and below station. One channel below gage height of 8 feet; above this stage banks, which are dirt and wooded, are subject to overflow. Rock ledge extends diagonally across stream just below gage and serves as low-water control; shifts, due to clogging of crevices.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.72 feet at 4.30 p. m. September 18 (discharge, 1,990 second-feet); minimum discharge, 0.80 second-foot at 5 a. m. July 18, determined from extension of rating curve and subject to error.

1915–1923: Maximum stage from water-stage recorder, 9.6 feet from 2 to 6 a. m. September 25, 1919 (discharge 13,000 second-feet); minimum discharge, less than 0.7 second-foot April 17, 1916.

DIVERSIONS.—Station is 2 miles below diversion of low-line (silt-line) canal of the Imperial Irrigation Co., 18½ miles below diversion for the Imperial Reservoir (capacity, 17,000 acre-feet), 25½ miles below diversion for Ward County Water Improvement District No. 2 (of which the old Grandfalls project is a part), and 4½ miles above diversion for Zimmerman project. Available data show that tracts aggregating about 143,000 acres are irrigable between station and lower limits of Carlsbad project of the United States Bureau of Reclamation. Records of the Board of Water Engineers for the State of Texas show total number of acres declared irrigated in

Texas above station to be about 58,000. The effect of diversions is somewhat counterbalanced by water returned to stream by seepage. The only diversion of importance below the station is that for the Zimmerman project, which has been declared an irrigated area of 2,005 acres.

REGULATION.—Slight regulatory effect caused by operation of storage reservoirs on Carlsbad project.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 2 to 15,000 second-feet. Operation of water-stage recorder satisfactory, except for short breaks in record. Daily discharge determined by shifting-control method, using mean daily gage height except for days of considerable range in stage, when discharge was averaged for fractional parts of a day, and as noted in footnote to daily discharge table. Records fair.

Discharge measurements of Pecos River near Grandfalls, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 11	R. G. West	0.48	4.6	May 17	T. A. Slack	0.49	[a] 5.9
21	Slack and West	.64	22.8	June 7	do	.48	[a] 4.9
Nov. 15	T. A. Slack	.93	71.4	28	Pritchett and Slack	.44	[b] 3.5
Dec. 9	do	.78	46.2	July 24	H. C. Pritchett	.50	[b] 3.5
16	do	.77	40.6	Sept. 11	do	.69	[b] 6.0
Jan. 6	do	.50	8.8	29	D. S. Wallace	.52	[b] 8.0
Apr. 4	do	.50	11.6				

[a] Partly estimated. [b] Estimated.

Daily discharge, in second-feet, of Pecos River near Grandfalls, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.0	72	64	9.0	13	15	12	8.0	6.0	3.8	2.3	3.8
2	6.5	76	60	8.5	12	13	13	7.5	6.0	3.5	2.3	3.8
3	6.0	79	58	9.0	10	13	13	8.0	7.0	3.2	2.3	4.1
4	5.5	82	64	8.5	10	13	12	8.0	7.0	3.2	2.0	4.1
5	5.0	86	75	9.0	11	13	12	7.5	7.5	2.9	2.0	5.5
6	6.5	84	77	8.5	12	11	12	8.0	7.0	2.6	2.0	8.5
7	6.2	77	75	8.5	11	11	12	8.0	6.0	2.6	2.0	9.0
8	5.9	75	61	8.5	11	10	11	8.0	6.0	2.6	2.3	7.5
9	5.6	71	48	8.5	10	11	11	8.0	6.0	2.6	2.0	6.5
10	5.3	77	48	8.5	10	11	11	7.0	6.0	2.6	2.0	6.0
11	5.0	80	46	9.0	10	10	13	7.0	5.5	2.9	2.0	5.5
12	5.0	80	42	9.0	10	10	13	6.5	5.5	3.2	2.3	6.0
13	5.5	77	37	9.0	9.0	10	13	6.5	5.0	3.5	2.3	6.5
14	7.0	80	37	9.0	9.0	9.0	12	7.0	5.0	2.9	2.3	6.0
15	9.0	75	39	9.0	9.5	10	12	6.0	4.7	2.6	2.3	6.5
16	12	74	44	9.0	11	9.5	12	7.0	4.7	2.3	2.3	7.5
17	14	74	36	9.0	12	10	11	6.5	4.4	2.0	2.0	9.0
18	16	73	39	9.0	12	9.5	10	6.5	4.1	1.9	2.0	908
19	18	72	37	9.0	11	10	10	7.0	4.4	2.0	2.6	817
20	21	71	36	9.0	11	10	13	6.5	6.4	2.6	3.2	212
21	23	71	31	10	10	10	11	6.5	7.5	3.2	3.2	71
22	30	70	21	12	12	9.5	9.0	6.5	5.0	3.8	3.8	33
23	33	69	13	14	15	10	9.0	6.5	4.7	3.5	3.8	26
24	38	68	9.5	13	18	10	9.5	6.5	4.1	3.5	3.8	18
25	42	68	9.0	11	17	11	9.5	6.5	3.8	3.2	3.2	12
26	47	67	9.0	10	13	12	12	6.5	3.5	2.9	4.6	10
27	51	66	9.0	10	14	13	11	7.0	3.5	2.6	44	9.0
28	56	66	9.0	10	15	13	9.5	6.0	3.5	2.6	20	8.5
29	61	65	9.0	11	-------	13	8.5	6.0	3.5	2.9	12	9.0
30	65	64	9.0	12	-------	15	8.5	6.5	3.8	2.9	5.5	11
31	68	-------	9.0	13	-------	14	-------	6.5	-------	2.9	4.1	-------

NOTE.—Discharge partly estimated because of incomplete record Oct. 11; 14, 21, 23, Nov. 5, 15, and 31. Discharge interpolated Oct. 7-10, 15-20, 24-29, 31, Nov. 4 and 16-29.

Monthly discharge of Pecos River near Grandfalls, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	68	5.0	22.1	1,360
November	86	64	73.6	4,380
December	77	9.0	37.4	2,300
January	14	8.5	9.76	600
February	18	9.0	11.7	652
March	15	9.0	11.3	693
April	13	8.5	11.2	665
May	8.0	6.0	6.95	427
June	7.5	3.5	5.24	312
July	3.8	1.9	2.89	178
August	44	2.0	4.92	302
September	908	3.8	75.0	4,460
The year	908	1.9	22.6	16,300

PECOS RIVER NEAR BUENAVISTA, TEX.

LOCATION.—At highway bridge on Fort Stockton-Midland road, 4½ miles east of Buenavista, Pecos County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 5, 1921, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder, attached to left abutment at downstream side of bridge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, sand, and gravel; shifts. Banks are overflowed during extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 4.14 feet at 2 p. m. September 19 (discharge, 992 second-feet, determined from extension of rating curve and subject to error); minimum discharge, 15 second-feet July 17 to 18.

1921–1923: Maximum and minimum stages occurred in 1923 as given above.

DIVERSIONS.—Station is below all diversions. During much of time practically the only flow past station is waste and seepage water from the irrigated area above gage.

REGULATION.—Flow regulated by storage and diversion dams in New Mexico and Texas.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 25 to 600 second-feet, and extended above and below this to cover range of stage for the year. Operation of water-stage recorder satisfactory, except for short breaks in record. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection, by use of planimeter, or by averaging discharge for fractional parts of a day; shifting-control method used April 28 to September 30. Records good.

Discharge measurements of Pecos River near Buenavista, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 6	R. G. West	0.33	29.6	Apr. 5	T. A. Slack	0.36	33.2
11	T. A. Slack	.31	26.8	23	do	.39	37.5
29	do	.35	32.1	May 17	do	.38	29.4
Nov. 14	do	.35	30.2	June 7	do	.40	25.2
29	do	.35	32.2	28	do	.44	21.8
Dec. 15	do	.36	33.5	July 24	H. C. Pritchett	.68	21.1
Jan. 5	do	.37	34.3	Aug. 15	do	.78	20.2
19	do	.37	31.5	15	do	.78	20.2
Feb. 21	do	.38	35.0	Sept. 12	D. S. Wallace	.88	44.4
Mar. 6	do	.38	33.2	30	do	1.20	114

Daily discharge, in second-feet, of Pecos River near Buenavista, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	28	33	34	37	37	37	34	31	28	23	19	31
2	28	32	34	37	36	37	41	30	31	22	19	49
3	28	31	34	34	33	41	44	30	30	20	19	115
4	30	33	34	36	37	37	33	30	28	19	19	36
5	30	33	36	36	43	39	31	30	28	18	19	34
6	30	33	36	36	54	36	33	28	28	17	20	41
7	28	32	34	36	39	38		30	28	17	20	33
8	30	32	34	38	38	38		30	28	16	20	25
9	31	31	36	38	41	41		32	31	17	22	25
10	31	31	36	36	39	41		30	30	17	20	25
11	30	31	36	36	37	42		30	30	19	19	34
12	28	32	34	34	36	36		28	31	19	20	44
13	28	32	36	36	36	48		28	28	19	20	42
14	30	32	34	34	34	43		30	28	17	20	38
15	30	31	34	34	37	41	35	28	30	16	20	39
16	32	32	36	34	41	37		28	30	16	22	34
17	36	32	36	33	38	36		30	32	15	23	30
18	36	32	36	34	34	34		30	33	15	24	43
19	33	32	36	34	33	36		30	41	16	42	725
20	34	31	34	42	33	36		28	34	18	66	328
21	32	32	34	48	34	36		28	50	17	30	92
22	32	34	50	42	36	36		28	38	17	27	43
23	33	36	54	39	41	36	37	27	36	17	32	39
24	33	36	52	38	41	34	43	27	33	18	37	44
25	33	36	48	38	38	34	43	28	26	19	33	78
26	33	34	42	44	36	34	44	27	25	18	63	78
27	32	32	46	38	38	38	54	26	24	18	47	75
28	32	32	50	37	41	37	44	25	24	20	50	90
29	33	31	51	37	-------	38	38	25	23	22	32	84
30	33	33	48	37	-------	37	32	25	23	20	31	110
31	34	-------	46	37	-------	34	-------	26	-------	19	31	-------

NOTE.—Mean discharge estimated Apr. 7-22; partly estimated Apr. 6 and 23 because of incomplete record.

Monthly discharge of Pecos River near Buenavista, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	36	28	31.3	1,930
November	36	31	32.5	1,930
December	54	34	39.4	2,420
January	48	33	37.1	2,280
February	54	33	37.9	2,100
March	48	34	37.7	2,320
April			37.0	2,200
May	32	25	28.5	1,750
June	50	23	30.3	1,800
July	23	15	18.1	1,110
August	66	19	28.6	1,760
September	725	25	85.0	5,060
The year	725	15	36.8	26,700

PECOS RIVER NEAR SHEFFIELD, TEX.

LOCATION.—At highway bridge on Fort Stockton-Ozona road, 3½ miles east of Sheffield, Pecos County, and 41 miles west of Ozona.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 10, 1921, to September 30, 1923.

GAGE.—Chain gage attached to upstream side of bridge; read by Kyle Smith. Auxiliary staff gage attached to pier near left bank.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of silt, sand, and gravel; shifts. Right bank not subject to overflow; left bank is overflowed during extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.32 feet at 6.30 p. m. September 7 (discharge, 2,360 second-feet, determined from extension of rating curve and subject to error); minimum discharge, 15 second-feet at 6 p. m. August 15, determined from extension of rating curve and subject to error.

DIVERSIONS.—Station is below all diversions. During much of the time practically the only flow past station is waste and seepage water from irrigated area above.

REGULATION.—Flow partly regulated by storage and diversion dams in New Mexico and Texas.

ACCURACY.—Stage-discharge relation not permanent. Rating curve poorly defined from 100 to 700 second-feet, and extended to cover range of stage for year. Gage read twice daily to hundredths, but readings were unreliable and it was necessary to estimate most of the year. Daily discharge, March 4–31 and May 18 to September 30, determined by shifting-control method; discharge for remainder of year estimated. Records of daily discharge not sufficiently accurate to warrant publication. Records poor.

Discharge measurements of Pecos River near Sheffield, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 22	West and Slack	2.10	58.8	May 18	T. A. Slack	1.78	50.8
Nov. 29	T. A. Slack	2.14	64.6	June 29	do	2.03	33.0
Jan. 5	do	2.11	64.9	July 25	H. C. Pritchett	2.27	30.9
Feb. 20	do	1.96	61.6	Aug. 16	do	2.11	24.2
Apr. 5	do	1.77	61.4	Sept. 18	D. S. Wallace	2.23	71.7

Monthly discharge of Pecos River near Sheffield, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October			59.9	3,680
November			62.2	3,700
December			65.0	4,000
January			64.2	3,950
February			63.4	3,520
March	72	45	58.6	3,600
April	1,400		105	6,230
May			56.4	3,470
June	62	28	47.3	2,810
July	38	20	29.3	1,800
August	610	20	61.6	3,790
September	1,070	31	117	6,970
The year			65.6	47,500

PECOS RIVER NEAR COMSTOCK, TEX.

LOCATION.—At Pecos High Bridge of Galveston, Harrisburg & San Antonio Railway Co., 11 miles west of Comstock, Val Verde County, and below all tributaries.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1900, to September 30, 1923. (Also gage heights for 1898).

GAGE.—Vertical staff attached to downstream side of bridge pier on left bank; read by W. A. Clare. Datum of section of gage below 6.7 feet as used January 10, 1917, to September 30, 1922, was 0.05 foot higher than present datum; no change in datum of gage above 6.7 feet.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet above bridge.

CHANNEL AND CONTROL.—Banks and stream bed composed of rock and gravel. Water flows through a series of rapids and pools in a canyon approximately 300 feet deep.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.60 feet at 7 a. m. September 17 (discharge, 1,500 second-feet); minimum stage, 0.13 foot August 6–8, 10–13, 15, 16, and 19–22 (discharge, 149 second-feet).

1900–1923: Maximum stage recorded, 35.75 feet April 6, 1900 (discharge not determined); minimum discharge recorded, 106 second-feet July 29 to August 1, 1918.

ICE.—None reported.

DIVERSIONS.—Considerable water is diverted and stored above station for irrigation. Lakes McMillan and Avalon of the Carlsbad project of the United States Bureau of Reclamation, with a combined capacity of 58,500 acre-feet, are on Pecos River a few miles above Carlsbad, N. Mex. In addition to the water stored in New Mexico, water from Pecos River is used to irrigate large areas of land near Barstow and Grandfalls, Tex. No diversions below station. Return waters tend to equalize effects of diversions in lower part of drainage basin.

REGULATION.—Flow partly controlled by storage and diversions for irrigation above station. No water-power plants of any consequence operated in the drainage basin, except a public utility plant of about 300 horsepower, near Carlsbad, N. Mex.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined for all stages during year. Gage read to hundredths twice daily, but observer's work doubtful. Daily discharge determined by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Pecos River near Comstock, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 26	West and Slack	0.47	257	June 30	Pritchett and Slack	0.20	164
Feb. 17	T. A. Slack	.45	243	Sept. 15	Pritchett and Wallace	.42	244

Daily discharge, in second-feet, of Pecos River near Comstock, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	245	273	245	245	245	273	309	309	209	182	167	252
2	228	252	248	245	228	273	276	287	252	182	159	245
3	228	245	252	238	245	273	238	298	298	196	154	680
4	245	273	248	245	245	273	238	298	238	182	154	245
5	238	280	248	245	245	262	238	298	206	164	151	238
6	238	252	238	245	228	245	238	280	212	154	149	348
7	228	245	245	245	228	238	238	273	206	154	149	276
8	217	294	245	245	228	238	238	262	209	154	149	287
9	212	262	242	238	228	238	228	280	196	154	154	309
10	218	273	245	238	228	238	231	262	196	154	149	287
11	228	262	238	238	228	238	317	262	209	157	149	252
12	218	262	245	238	228	238	340	266	212	179	149	273
13	212	252	242	228	228	235	740	262	209	176	149	245
14	212	252	242	238	228	231	444	245	206	176	154	228
15	218	238	242	238	238	222	421	242	193	167	149	235
16	228	252	245	238	280	212	468	245	182	154	149	225
17	228	266	242	228	245	212	468	245	182	154	151	800
18	238	259	245	228	228	212	444	245	182	154	154	235
19	245	252	245	228	228	212	417	245	182	157	149	468
20	262	266	238	238	228	212	395	245	182	167	149	336
21	245	252	245	228	238	212	399	228	182	245	149	291
22	245	252	242	228	245	212	390	228	182	193	149	255
23	245	248	245	228	280	212	390	238	182	187	212	235
24	262	259	238	231	280	212	365	228	187	215	218	444
25	262	248	248	228	280	212	399	212	179	196	417	377
26	269	248	238	231	273	212	365	212	176	182	262	328
27	273	245	238	238	273	252	365	212	179	182	209	291
28	262	248	238	228	273	273	325	212	176	182	287	245
29	273	252	242	231	-------	298	340	245	176	176	336	228
30	245	245	245	228	-------	309	309	228	164	182	468	228
31	309	-------	245	280	-------	309	-------	209	-------	176	287	-------

NOTE.—Discharge interpolated Nov. 18 and Dec. 2.

Monthly discharge of Pecos River near Comstock, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	309	212	241	14,800
November	294	238	257	15,300
December	252	238	243	15,000
January	280	228	237	14,600
February	280	228	245	13,600
March	309	212	242	14,900
April	740	228	352	21,000
May	309	209	252	15,500
June	298	164	198	11,800
July	245	154	175	10,800
August	468	149	195	12,000
September	800	225	313	18,600
The year	800	149	245	178,000

FARMERS INDEPENDENT CANAL NEAR PORTERVILLE, TEX.

LOCATION.—200 feet east of track of Santa Fe Railroad, 300 feet below head gates of canal in Reeves County, 5 miles southwest of Porterville, Loving County.

RECORDS AVAILABLE.—February 9, 1922, to September 30, 1923.

GAGE.—Stevens eight-day water-stage recorder; attended by Otis Harrell.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of sand and clay; shifts.

EXTREMES OF DISCHARGE.—Maximum discharge during year, probably 105 second-feet June 8–10. No flow December 19 to January 13.

1922 and 1923: Maximum daily discharge, 160 second-feet June 14, 1922. No flow December 19, 1922, to January 13, 1923.

DIVERSIONS.—Above all diversions.

ACCURACY.—Stage-discharge relation not permanent. Rating curve poorly defined from 15 to 70 second-feet, and extended above and below these limits to cover the range of stage for the year. Operation of the water-stage recorder not satisfactory. Mean daily gage height determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control method, except as noted in footnote to daily discharge table. Records poor.

Discharge measurements of Farmers Independent Canal near Porterville, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 14	West and Slack	1.51	41.1	May 3	T. A. Slack	2.37	46.0
Nov. 6	T. A. Slack	1.49	36.8	20	do	2.23	27.8
Dec. 8	do	1.57	41.2	June 14	do	2.90	53.6
Jan. 26	do	1.30	35.1	22	do	1.44	28.0
Feb. 9	do	.87	24.0	July 11	H. C. Pritchett	2.56	58.3
28	do	.77	20.7	31	do	1.05	23.6
Mar. 21	do	1.17	28.0	Aug. 25	do	2.45	53.0
Apr. 2	do	1.05	23.2	Sept. 9	D. S. Wallace	1.74	40.4

Daily discharge, in second-feet, of Farmers Independent Canal near Porterville, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	39	51	45	0	34	22	26	40	27	12	27	80
2	39	56	48	0	41	22	23	40	27	7.8	25	73
3	42	56	42	0	39	22	23	47	26	14	20	78
4	39	55	37	0	38	23	36	42	27	18	17	72
5	31	47	41	0	41	25	34	36	29	4.4	27	66
6	45	38	39	0	26	25	26	39	34	7.5	26	47
7	47	45	35	0	25	24	17	38	77	6.3	23	44
8	48	41	40	0	24	23	14	48	105	12	21	41
9	49	40	39	0	22	32	16	51	105	18	21	41
10	46	42	41	0	21	33	10	44	105	41	28	39
11	29	46	42	0	25	32	16	40	87	43	29	38
12	38	41	38	0	26	32	30	35	70	38	29	41
13	42	44	41	0	24	32		42	59	29	28	38
14	41	41	37	30	17	32		34	56	36	30	38
15	37	40	40	30	44	30		44	62	58	33	36
16	52	44	38	48	61	31		53		40	32	45
17		44	42	53	64	30		42		37	30	38
18		46	18	50	61	27		42		37	35	35
19		46	0	47	56	27		38	45	30	35	45
20	58	40	0	42	54	28		29	45	31	35	46
21		38	0	38	52	28	40	29		46	37	27
22		42	0	40	56	28		35	30	47	87	27
23	49	50	0	42	37	27		26	34	34	69	26
24	53	48	0	35	30	26		27	32	74	60	25
25	52	44	0	35	29	24		23	27	38	55	26
26	48	50	0	33	28	24			26	64	76	35
27	45	46	0	39	25	24			28	51	67	38
28	47	50	0	35	23	25		22	30	42	51	36
29	49	46	0	34	-------	27			19	41		33
30	49	39	0	42	-------	28			12	40	90	32
31	47	-------	0	40	-------	28	-------	22	------	28		-------

NOTE.—Discharge partly estimated because of incomplete record Oct. 23, Jan. 16, 26, Apr. 2, May 3, 10, 11, 16, 31, June 11, 22, Aug. 1, 3, Sept. 1 and 9. No record and discharge estimated by comparison with records for other stations Oct. 17–22, Jan. 14, 15, 24, 25, Apr. 13 to May 2, May 17, 18, 26–30, June 8–10, 16–21, Aug. 2, 18–20, and 29–31.

Monthly discharge of Farmers Independent Canal near Porterville, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	----------	29	46.8	2,880
November	56	38	45.2	2,690
December (18 days)	48	18	39.1	1,390
January (18 days)	53	----------	39.6	1,410
February	64	17	36.5	2,030
March	33	22	27.1	1,670
April	----------	10	33.0	1,970
May	53	----------	35.4	2,170
June	----------	12	46.8	2,780
July	74	4.4	33.1	2,030
August	----------	17	42.7	2,620
September	80	25	42.9	2,550
The year	----------	----------	----------	26,200

CEDARVALE CANAL NEAR BARSTOW, TEX.

LOCATION.—At head gates of canal, 1½ miles above Ward County Irrigation District, District No. 1 (Barstow) Dam and 10 miles northwest of Barstow, Ward County. Prior to August 21, 1923, station was at highway

bridge across canal near Barstow Canal head gates, below Boxley Canal pumping plant, 1½ miles above present site.

RECORDS AVAILABLE.—February 12, 1922, to September 30, 1923.

GAGE.—Stevens eight-day water-stage recorder; attended by R. G. Hamilton or engineer from United States Geological Survey Office.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

EXTREMES OF DISCHARGE.—Maximum stage not known. No flow for several periods.

DIVERSIONS.—The Boxley Canal diverts water from this canal between river and lower location of gage, but only at times when there is no flow past lower location of gage.

ACCURACY.—Stage-discharge relation not permanent. Rating curve not defined. Operation of water-stage recorder not satisfactory. Daily and monthly discharge not determined on account of poor gage-height record and backwater conditions. Total discharge for year estimated at 12,800 acre-feet from incomplete gage-height record, comparison with records for other stations, and discharge measurements. Records poor.

Canal diverts from left bank of Pecos River between Farmers Independent Canal and Barstow Canal.

Discharge measurements of Cedarvale Canal near Barstow, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 10	T. A. Slack	0.46	14.8	June 23	H. C. Pritchett	2.30	62.8
Jan. 24	do	1.84	71	26	T. A. Slack	2.17	58.8
Mar. 10	do	1.66	16.4	July 26	H. C. Pritchett	2.42	46.1
24	do	1.38	[a] 1.7	28	do	2.05	23.3
Apr. 28	do	2.08	43.9	Aug. 24	do	1.62	55.3
May 26	do	.99	32.8	Sept. 22	D. S. Wallace	.60	42.1
June 9	do	2.77	130	28	do	.44	39.1

[a] Estimated.

BARSTOW CANAL NEAR BARSTOW, TEX.

LOCATION.—200 feet below head gates and dam of Ward County Irrigation District No. 1, 8 miles northwest of Barstow, Ward County.

RECORDS AVAILABLE.—February 12, 1922, to September 30, 1923.

GAGE.—Stevens eight-day water-stage recorder attached to footbridge.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge about 2,500 feet downstream from gage.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; shifts. Low-water control is a rock and gravel shoal 150 feet below gage. Point of zero flow, about gage height 0.70 foot.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.42 feet at 8 a. m. August 30 (discharge, 499 second-feet). No flow from 4 a. m. to 1 p. m. August 8.

1922–23: Maximum stage, that of August 30, 1923. No flow for several periods of record.

DIVERSIONS.—Above all diversions.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used during year, one applicable from October 1 to August 29, which is well defined from 0 to 180 second-feet and poorly defined to 420 second-feet; the other from August 30 to September 30, which is well defined from 0 to 240 second-feet and poorly defined to 480 second-feet. Operation of

water-stage recorder not satisfactory, as noted in footnote to daily discharge table. Mean daily gage heights obtained from recorder graph by inspection or by use of planimeter. Daily discharge ascertained by shifting-control method. Records fair.

Barstow Canal diverts water on left bank from Pecos River for irrigation and domestic use.

Discharge measurements of Barstow Canal near Barstow, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 20	West and Slack	3.10	118	July 5	H. C. Pritchett	1.71	25.3
Dec. 14	T. A. Slack	2.20	49.9	13	do	1.67	23.4
Jan. 3	do	2.56	73.7	28	do	.87	[a].5
24	do	.80	[a].5	30	do	1.57	22
Feb. 7	do	2.49	70.9	Aug. 9	do	.73	[a].1
Mar. 10	do	2.62	79.6	17	do	1.38	13.5
24	do	3.53	147	23	do	1.97	38.5
Apr. 7	do	2.91	96.5	29	do	2.79	86
21	do	2.07	41	30	do	7.36	486
May 5	do	2.09	40.2	Sept. 6	do	4.48	230
26	do	.94	[a]1	10	do	3.36	136
June 2	do	1.87	35.3	19	D. S. Wallace	4.15	212
9	do	6.56	404				

[a] Estimated.

Daily discharge, in second-feet, of Barstow Canal near Barstow, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	78	22	59	83	40	48	178	46	35	24	18	144
2	80	37	95	78	48	31	162	43	36	23	17	117
3	82		104	75	101	28	154	41	36	23	17	107
4	85	42	83	40	52	38	154	40	34	23	17	119
5	77	40	47	16	80	48	131	40	32	25	15	110
6	80	38	2.4	70		85	112	38	32	22	7.4	189
7	93	28	2.6	73	71	56	97	38	30	21	2.0	191
8	95	1.4	21	78	96	79	85	38	24	20	.4	148
9	99	1.2	51		118	99	83	42	282	20	.1	144
10	99	4.9	47	68	118	67	78	48	184	23	3.5	136
11	98	2.0	2.8	64	115	5.5	69	41	146	72	3.2	121
12	92	2.0	2.8	36	131	45	62	39	111	46	4.8	132
13	88	19	2.4	1.2	92	97	60	34	87	24	5.4	126
14		27	37	1.0	6.0	136	56	30	71	15	4.1	113
15	95	20	48	.7	3.6	129	50	29	78	16	3.8	101
16	98	1.7	47	.5	3.6	121	46	42	83	37	12	136
17	97	31	48	.5	3.4	150	44	54	83	20	14	359
18	107	46	47	.5	3.6	162	47	49	101	14	14	250
19		59	48	.4	6.2	150	50	53	73	16	16	246
20	118	85	71	.4	49	154	40	50	56	20	17	152
21	106	52	74	.5	71	162	44	44	58	24	17	167
22	64	52	74	.5	47	158	50	44	54	39	15	164
23	52	45	94	.5	30	146	54	46	53	23	38	144
24	59	100	68	.5	31	146	41	34	13	3.2	7.3	128
25	60	97	55	.5	31	121	12	6.0	4.5	9.7	5.8	144
26	48	83	76	.5	37	30	11	1.6	2.8	7.9	16	132
27		83	97	.5	54	27	9.6	2.0	2.4	.9	92	130
28		71	103	2.8	56	27	11		7.6	8.9	122	91
29	50	74	102	9.9	-------	32	31		29	26	88	91
30	40	68	105	11	-------	94	57	18	27	22	385	102
31	23	-------	85	24	-------	169	-------	34	-------	20	228	-------

NOTE.—No record and discharge estimated by comparison with other stations Oct. 13, 14, 18, 19, 26, 27, 28, Nov. 2, 3, Dec. 26, Jan. 8, 9, Feb. 5, 6, 23, and May 27 to June 1. Discharge partly estimated owing to incomplete record Oct. 6, 7, 12, 17, 20, 25, 29, Nov. 1, 4, Jan. 10, Feb. 7, 15, 24, May 26, and June 3.

Monthly discharge of Barstow Canal near Barstow, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	118	23	79.1	4,870
November	100	1.2	43.0	2,560
December	105	2.4	58.0	3,570
January	83	.4	26.3	1,620
February	131	3.4	56.2	3,120
March	169	5.5	91.6	5,630
April	178	9.6	69.3	4,120
May	54	----------	34.5	2,120
June	282	2.4	62.2	3,700
July	72	.9	22.2	1,370
August	385	.1	38.9	2,390
September	359	91	148	8,790
The year	385	----------	60.6	43,900

GRANDFALLS-BIG VALLEY CANAL NEAR BARSTOW, TEX.

LOCATION.—At head gates, 10 miles southeast of Barstow, Ward County.

RECORDS AVAILABLE.—March 2, 1922, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder; attended by engineers of United States Geological Survey.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of clay. Point of zero flow, gage height —0.40 foot.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.55 feet at 5 a. m. September 4 (discharge, 304 second-feet, determined from extension of rating curve and subject to error). No flow October 4 to December 11.

DIVERSIONS.—Above all diversions.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 0 to 160 second-feet and extended above. Operation of water-stage recorder satisfactory. Mean daily discharge determined by applying to rating table mean daily gage height ascertained from recorder graph by inspection, or by use of planimeter, or by averaging discharge for fractional parts of a day. Records good.

Discharge measurements of Grandfalls-Big Valley Canal near Barstow, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 13	T. A. Slack	−0.20	1.8	May 29	T. A. Slack	0.54	27.3
Jan. 11	do	1.26	71.6	June 21	Slack and Pritchett	1.04	58.0
28	do	1.45	85.0	July 7	H. C. Pritchett	.37	18.6
Feb. 10	do	.98	53.7	Aug. 2	do	.25	14.5
Mar. 4	do	2.21	149.0	31	do	2.14	130
23	do	1.26	73.5	Sept. 10	Wallace and Pritchett	1.25	71.6
Apr. 10	do	.97	52.6	27	D. S. Wallace	1.92	127
May 2	do	.76	39.6				

Daily discharge, in second-feet, of Grandfalls-Big Valley Canal near Barstow, Tex., for the year ending September 30, 1923

Day	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	40	------	68	52	190	118	40	29	24	14	66
2	41	------	66	49	179	87	40	29	23	14	49
3	20	------	68	56	146	87	41	29	22	14	41
4	------	------	68	83	127	99	39	29	21	13	218
5	------	------	73	78	142	94	39	29	20	12	130
6	------	------	114	132	138	74	39	28	19	14	47
7	------	------	133	139	114	63	39	25	19	17	38
8	------	------	150	114	103	56	39	25	19	14	35
9	------	------	127	78	92	53	38	30	19	13	42
10	------	------	105	55	95	54	40	37	25	12	69
11	------	------	73	53	117	54	38	35	24	12	67
12	------	1.7	60	62	174	59	34	31	22	12	53
13	------	1.8	73	56	139	57	34	30	22	12	52
14	------	1.2	125	65	114	54	35	29	21	12	39
15	------	1.1	123	146	80	55	31	28	19	12	31
16	------	.5	110	157	65	55	29	26	18	11	86
17	------	.2	102	152	74	57	30	27	17	11	118
18	------	.2	106	184	74	56	31	30	16	11	.6
19	------	48	110	201	96	55	30	74	16	11	.4
20	------	87	102	190	78	55	25	65	17	15	62
21	------	91	98	179	68	52	21	56	17	14	102
22	------	87	98	174	67	54	20	51	38	12	89
23	------	81	90	237	68	50		53	25	12	160
24	------	76	80	249	67	48		48	21	13	135
25	------	80	87	273	73	47		39	19	36	105
26	------	85	112	285	73	47	28	35	17	108	125
27	------	88	94	261	70	45		33	16	27	120
28	------	82	87	225	63	42		31	16	29	130
29	------	77	90	------	78	40	29	28	16	32	110
30	------	78	78	------	95	41	29	25	15	31	114
31	------	78	69	------	114	------	29	------	14	110	------

NOTE.—No flow on days for which discharge is not given. Discharge May 23–28 estimated.

Monthly discharge of Grandfalls-Big Valley Canal near Barstow, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October (3 days)	41	20	33.7	200
November	0	0	0	0
December (20 days)	91	.2	52.2	2,070
January	150	60	94.8	5,830
February	285	49	142	7,900
March	190	63	102	6,290
April	118	40	60.3	3,590
May	41	20	32.5	2,000
June	74	25	35.5	2,110
July	38	14	19.9	1,220
August	110	11	21.9	1,350
September	218	.4	81.1	4,830
The year				37,400

IMPERIAL HIGH-LINE CANAL NEAR GRANDFALLS, TEX.

LOCATION.—4 miles below head gates of canal in Reeves County, 15 miles west of Grandfalls and 25 miles southeast of Pecos.

RECORDS AVAILABLE.—March 14, 1922, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder; attended by engineers of United States Geological Survey.

DISCHARGE MEASUREMENTS.—Made by wading or from a bridge 300 feet above gage.

CHANNEL AND CONTROL.—Bed composed of coarse gravel. Point of zero flow, 0.20 foot gage datum.

EXTREMES OF DISCHARGE.—Maximum stage during year, from marks on recorder well, was 6.85 feet September 18, during period when recorder was not operating properly (discharge not determined). No flow for several periods.

1922 and 1923: Maximum stage, that of September 18, 1923. No flow for several periods.

DIVERSIONS.—Above all diversions. Sand gates 300 feet above are opened occasionally for a short time to clean canal.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 0 to 150 second-feet, and extended to cover range of stage for year. Operation of water-stage recorder not satisfactory. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Daily discharge determined by shifting-control method, except as noted in footnote to daily discharge table. Records poor.

Discharge measurements of Imperial High-line Canal near Grandfalls, Tex., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 10	R. G. West	1.34	30.9	Mar. 6	T. A. Slack	0.66	6.6
21	Slack and West	2.49	84.2	Apr. 4	do	.53	5.4
Dec. 16	T. A. Slack	1.81	53.9	23	do	.44	3.2
Jan. 6	do	.59	6.1	May 17	do	.21	*1.0
19	do	.61	6.2	Sept. 11	H. C. Pritchett	.19	*.2
Feb. 21	do	.73	7.2	29	D. S. Wallace	.68	10.8

* Estimated.

Daily discharge, in second-feet, of Imperial High-line Canal near Grandfalls, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Aug.	Sept.
1	1.5	0.8	------	7.5	4.8	8.8	6.5	2.7	------	2.1
2	1.5	------	------	6.2	4.0	8.5	7.0	2.5	------	2.1
3	1.9	------	------	6.0	3.1	9.8	6.2	2.3	------	.9
4	56	------	------	5.5		7.0	5.5	2.3	------	16
5	42	------	------	5.8		6.8	5.0	2.5	------	8.0
6	33	------	------	5.8		6.5	5.5	2.1	------	2.7
7	32	------	------	7.0		7.0	5.5	2.3	------	1.4
8	30	------	------	7.2		6.2	4.2	2.1	------	.8
9	35	------	83	8.0		6.5	4.5	1.9	------	.4
10	35	------		8.2		6.2	4.2	2.1	------	.3
11	41	------		7.5		7.2	4.8	1.9	------	.2
12	35	------	72	6.8	4.5	4.0	5.8	1.7	------	.3
13	38	------		5.0		6.0	5.2	1.2	------	.6
14	34	------		4.8		5.2	3.8	1.7	------	.3
15	41	------		4.8		5.5	4.8	1.7	------	.2
16	56	------	54	6.5		4.8	4.8	1.0	------	1.4
17	66	------	68	6.5		4.2	4.2	1.0	------	4.5
18	59	------	72	6.2		4.5	3.9	.9	------	368
19	58	------	71	6.2		4.8	3.6	.9	------	184
20	77	------	32	6.5		5.2	3.3	------	------	25
21	87	------	13	7.0	7.0	5.2	3.1	------	------	
22	84	------	12	8.0	8.2	4.2	3.3	------	------	
23	67	------	11	6.8	11	4.0	3.3	------	------	
24	1.0	------	10	5.8	11	4.2	3.3	------	------	
25	.8	------	9.8	5.2	9.5	4.2	4.2	------	114	11
26	.6	------	10	5.2	9.2	4.5	4.2	------	21	
27	.6	------	20	5.8	11	5.2	3.8	------	8.0	
28	.6	------	19	5.5	10	5.8	2.9	------	4.5	
29	.6	------	11	5.2	------	5.5	2.3	------	3.1	10
30	.8	------	9.0	5.5	------	7.0	2.5	------	2.5	10
31	.8	------	8.0	5.8	------	6.0	------	------	1.9	------

NOTE.—No flow Nov. 2-21 and May 20 to Aug. 24. No record Nov. 22 to Dec. 8. Record incomplete and discharge estimated Dec. 10-15, 17, Feb. 4-20, Apr. 3, 18-20, and Sept. 21-28. Record not complete and discharge partly estimated Dec: 9, 16, Feb. 3, 21, Apr. 2, 4, 17, 21, Sept. 10, 11, 18, 19, 20, and 29. Discharge Sept. 18 from extension of rating curve and subject to error.

Monthly discharge of Imperial High-line Canal near Grandfalls, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	87	0.6	32.8	2,020
December 9-31	------	------	41.1	1,870
January	8.2	4.8	6.25	384
February	11	------	5.90	328
March	9.8	4.0	5.82	358
April	7.0	2.3	4.37	260
May (19 days)	2.7	.9	1.83	69.0
August (7 days)	114	1.9	22.1	307
September	368	.2	24.2	1,440

IMPERIAL LOW-LINE CANAL NEAR GRANDFALLS, TEX.

LOCATION.—Opposite gage on Pecos River near Grandfalls, 3 miles below head gates of canal and 4 miles west of Grandfalls, Pecos County.

RECORDS AVAILABLE.—March 29, 1922, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder; attended by engineers of United States Geological Survey.

DISCHARGE MEASUREMENTS.—Measurements by wading or from footbridge near gage.

CHANNEL AND CONTROL.—Bed of canal consists of clay, gypsum, and silt. Point of zero flow, about gage height 0.66 foot.

EXTREMES OF DISCHARGE.—Maximum stage, from silt marks on well, 4.25 feet September 18 (discharge, 254 second-feet, determined from extension of rating curve and subject to error). No flow during long periods.

1922 and 1923: Maximum stage, that of September 18, 1923. No flow for several periods.

DIVERSIONS.—Above all diversions. Sand gates 1½ miles above opened occasionally for short periods.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 160 second-feet and extended above. Operation of water-stage recorder satisfactory, except for short breaks in record, as noted in footnote to daily discharge table. Mean daily discharge determined by applying to rating table mean daily gage height ascertained from recorder graph by inspection, by use of planimeter, or by averaging discharge for fractional part of a day; shifting-control method used November 4 to December 20. Records fair.

Discharge measurements of Imperial Low-line Canal near Grandfalls, Tex., during the year ending September 30, 1923

[Made by T. A. Slack]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Oct. 30	1.60	30.4	Dec. 9	1.30	21.9
Nov 15	1.85	45.9	16	1.12	15.1

Daily discharge, in second-feet, of Imperial Low-line Canal near Grandfalls, Tex., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Apr.	Aug.	Sept.	Day	Oct.	Nov.	Dec.	Apr.	Aug.	Sept.
1	------	50	34	------	------	------	16	------	54	15	------	------	------
2	------	57	31	------	------	------	17	------	56	8.5	------	------	------
3	------	63	30	------	------	------	18	------	66	10	------	------	
4	------	67	38	------	------	------	19	------	56	4.1	------	------	66
5	------	63	51	------	------	------	20	------	45	2.0	------	------	
6	------	56	51	------	------	------	21	------	41	------	------	------	------
7	------	47	51	------	------	------	22	------	48	------	------	------	------
8	------	44	30	------	------	------	23	------	54	------	------	------	------
9	------	40	22	------	------	------	24	------		------	------	------	------
10	------	50	22	------	------	------	25	16		------	------	------	------
11	------	56	19	------	------	------	26	20	46	------	2.5	5.1	------
12	------	56	11	------	------	------	27	26		------	1.8	7.0	------
13	------	51	------	------	------	------	28	28		------	------	------	------
14	------	50	12	------	------	------	29	31		------	------	------	------
15	------	48	18	------	------	------	30	31	38	------	------	------	------
							31	38	------	------	------	------	------

NOTE.—Discharge interpolated Nov. 14 and estimated Nov. 24–29 and Sept. 18–20. Record incomplete and discharge partly estimated Oct. 30, Nov. 13, 15, 30, Aug. 26 and 27. No flow during periods for which no discharge is given.

Monthly discharge of Imperial Low-line Canal near Grandfalls, Tex., for the year ending September 30, 1923

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October (7 days)	38	16	27.1	377
November	67	----------	51.1	3,040
December (19 days)	51	8.5	24.1	912
April (2 days)	2.5	1.8	2.15	8.5
August (2 days)	7.0	5.1	6.05	24.0
September (3 days)	----------	----------	66.0	393
The year	----------	----------	----------	4,750

MISCELLANEOUS DISCHARGE MEASUREMENTS

In addition to the records of flow obtained at the gaging stations and reported in the preceding pages, measurements were made at other points as shown by the following table:

Miscellaneous discharge measurements in western Gulf of Mexico basins during the year ending September 30, 1923

Date	Stream	Tributary to—	Locality	Gage height	Discharge
				Feet	*Sec.-ft.*
May 5	Bosque River	Brazos River	Bosqueville Road, 5 miles north of Waco, Tex.		207
Sept. 23	do	do	do		48.2
Nov. 7	Noyes Canal	Diverts from San Saba River.	Menard, Tex		10.4
Apr. 4	North Llano River	Llano River	10-mile crossing near Junction, Tex.		25.0
5	South Llano River	do	Telegraph, Tex		50.5
4	do	do	Mouth at Junction, Tex		74.9
May 11	Mill Spring[a]	Barton Creek	Near Austin, Tex		2.44
21	do	do	do		[b].3
June 5	do	do	do		[b].1
19	do	do	do		[b].1
Dec. 5	Guadalupe River	Gulf of Mexico	Highway bridge near Gonzales, Tex.	[c]1.39	570
Jan. 29	do	do	do	[c]1.70	773
Mar. 24	do	do	do	[c]1.00	529
Aug. 12	do	do	do	[c].20	360
Sept. 10	do	do	do	[c]3.05	1,510
Apr. 6	do	do	Highway bridge at Victoria, Tex.	[c]1.28	976
May 11	do	do	do	[c].60	811
June 21	do	do	do	[c].25	748
Aug. 11	do	do	do	[c]—.19	704
Sept. 11	do	do	do	[c]7.72	3,240
Nov. 15	San Marcos River	Guadalupe River	Austin-San Marcos road crossing at San Marcos, Tex.		169
Feb. 7	do	do	do		128
Mar. 24	do	do	do		132
May 7	do	do	do		168
July 4	do	do	do		157
Aug. 16	do	do	do		116
Sept. 5	do	do	do		152
19	do	do	do		165
June 29	Pecos River	Rio Grande	Near Girvin, Tex		25.3
Feb. 19	do	do	Just above mouth of Independence Creek, Tex.		87.2
July 31	Porterville Canal	Diverts from Pecos River.	Just below pump near Porterville, Tex.		5.46
June 27	Drain ditch	Pecos River	2 miles west of Barstow, Tex.		1.91
27	do	do	Near Barstow, Tex		12.3
July 14	do	do	3 miles south of Barstow, Tex.		4.40
Aug. 10	do	do	Near Barstow, Tex		1.61
Sept. 7	do	do	do		1.33
7	Return water	do	Near Barstow, Tex., below point where drain ditches empty into quarry draw.		13.2
June 23	Boxley Canal	Diverts from Pecos River.	Pump near Barstow, Tex		11.5
July 12	do	do	do		11.0
27	do	do	do		9.4
Aug. 9	do	do	do		9.4
23	do	do	do		9.8
Apr. 26	Diversion from San Solomon Springs.	Pecos River	Near Balmorhea, Tex		2.3
26	do	do	do		3.9
26	San Solomon Springs	do	Near Balmorhea, Tex., at old gate.		26.5
26	First diversion	Diverts from Balmorhea Canal.	Near Balmorhea, Tex		3.0

[a] No flow in Mill Spring, near Austin, Tex., Oct. 4, 19, Nov. 2, 17, 27, Dec. 20, Jan. 6, 20, Feb. 8, 27, Mar. 14, Apr. 2, July 6, 27, Aug. 20, and Sept. 25.
[b] Estimated.
[c] United States Weather Bureau gage.

Miscellaneous discharge measurements in western Gulf of Mexico basins during the year ending September 30, 1923—Continued

Date	Stream	Tributary to—	Locality	Gage height	Discharge
				Feet	*Sec.-ft.*
Apr. 26	Giffin Springs	Balmorhea Canal	Near Balmorhea, Tex., at canal.		4.9
26	do	do	Near Balmorhea, Tex., 1 mile above entrance to main canal.		5.4
26	Balmorhea Canal	Pecos River	Near Balmorhea, Tex., below entrance of Giffin Springs.		26.2
27	Second diversion	Diverts from Balmorhea Canal.	Near Balmorhea, Tex		7.0
27	Third diversion	do	do		3.5
27	Fourth diversion	do	do		7.4
27	Balmorhea Canal	Pecos River	Near Balmorhea, Tex., below fourth diversion.		8.0
27	do	do	Near Balmorhea, Tex., below town delivery.		7.7
27	Fifth diversion	Diverts from Balmorhea Canal.	Near Balmorhea, Tex		3.8
27	Sixth diversion	do	do		3.6
27	Balmorhea Canal	Pecos River	Near Balmorhea, Tex., below sixth diversion.		0
27	Reservoir outlet canal	do	Near Balmorhea, Tex		28.1
Oct. 22	Comanche Springs	do	Fort Stockton, Tex		42.4
Feb. 19	Independence Creek	do	Near mouth near Sheffield, Tex.		24.0
Oct. 27	Goodenough Springs	Rio Grande	Near Comstock, Tex		256
Feb. 18	do	do	do		240
July 1	do	do	do		237
Sept. 14	do	do	do		210
Oct. 24	Devils River	do	Proposed dam site 10 miles above mouth and 15 miles from Del Rio, Tex.		303
25	do	do	Del Rio-Comstock highway bridge near Del Rio, Tex.		348
27	do	do	Old gaging station at Devils River, Tex.		349
25	San Felipe Springs	do	Del Rio, Tex		91.9

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 result of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural-drainage features as indicated below:

Part I. North Atlantic basins (St. John 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 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 furnish list 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.
Charlottesville, Va., University of Virginia.
Asheville, N. C., 316 Jackson Building.
Chattanooga, Tenn., 37 Municipal Building.
Columbus, Ohio, Engineering Experimental Station, Ohio State University.
Madison, Wis., c/o Railroad Commission of Wisconsin.
Chicago, Ill., 940 Transportation Building.
Ames, Iowa, State Highway Commission Building.
Rolla, Mo., Rolla Building, School of Mines and Metallurgy.
Topeka, Kans., 23 Federal Building.
Austin, Tex., Capitol Building.
Helena, Mont., 45–46 Federal Building.
Denver, Colo., 403 Post Office Building.
Tucson, Ariz., College of Law Building, University of Arizona.
Salt Lake City, Utah, 313 Federal Building.
Boise, Idaho, Federal Building.
Idaho Falls, Idaho, 228 Federal Building.
Tacoma, Wash., 404 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Calif., 303 Customhouse.
Los Angeles, Calif., 600 Federal Building.
Honolulu, Hawaii, Territorial Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS

Stream-flow records have been obtained at about 4,800 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	Description, measurements, gage heights, and ratings	1893 and 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 years)	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 15th and 17th 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.

Numbers of water-supply papers containing results of stream measurements, 1899–1923

[For basins included see p. 145]

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												A	B	C
1899 [a]	35	[p] 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	[b] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[p] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[p] 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, 17	174	175, [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	332–A	332–B	332–C
1913	251	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
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	463	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. Tables of 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. Tables of monthly discharge for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill 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.

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 145, and the records for large lakes are taken up in order of streams around the rim of the lake.

PRINCIPAL STREAMS

The western Gulf of Mexico drainage basins include all streams draining into the Gulf of Mexico west of the mouth of the Mississippi and into the Rio Grande. The largest streams flowing into the Gulf of Mexico north of the mouth of the Rio Grande are Sabine, Trinity, and Brazos Rivers, Colorado River of Texas, and Guadalupe River. The principal tributaries of the Rio Grande are Chama River, Rio Puerco, and Pecos River in the United States and Rio Salado and Rio San Juan in Mexico. The streams drain wholly or in part the States of Colorado, Louisiana, New Mexico, Texas, and northern States of Mexico.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 162.)

GAGING STATIONS

NOTE.—Dash after a date indicates that station was being maintained September 30, 1923; period after a date indicates discontinuance. Tributaries are indicated by indention.

CALCASIEU RIVER BASIN

Calcasieu River near Oberlin, La., 1922–
Calcasieu River near Kinder, La., 1922–

SABINE RIVER BASIN

Sabine River near Longview, Tex., 1904–1906.
Sabine River at Loganport, La., 1903–1906.
Neches River at Evadale, Tex, 1904–1906.

TRINITY RIVER BASIN

West Fork of Trinity River at Bridgeport, Tex., 1914–
West Fork of Trinity River at Fort Worth, Tex., 1920–
Trinity River at Dallas, Tex., 1898–99; 1903–1906; 1920–

Trinity River at Riverside, Tex., 1903–1906.
Elm Fork of Trinity River near Dallas, Tex., 1920–

BRAZOS RIVER BASIN

Brazos River near Graham, Tex., 1915–1920.
Brazos River at Brazos, Tex., 1914–1920.
Brazos River at Waco, Tex., 1898–1911; 1914–
Brazos River near Lewis (Hearne), Tex., 1898–99.
Brazos River near College Station, Tex., 1918–
Brazos River at Rosenberg, Tex., 1922–
Brazos River at Richmond, Tex., 1903–1906.
Clear Fork of Brazos River at Crystal Falls, Tex., 1921–
Clear Fork of Brazos River at Eliasville, Tex., 1915–1920.
Little River at Cameron, Tex., 1916–

COLORADO RIVER (OF TEXAS) BASIN

Colorado River near Bronte, Tex., 1915–1920.
Colorado River at Ballinger, Tex., 1915–
Colorado River near Chadwick, Tex., 1915–1922.
Colorado River at Marble Falls, Tex., 1916–
Colorado River at Austin, Tex., 1895–
Evaporation near Austin, Tex., 1916–
Colorado River at Columbus, Tex., 1903–1911; 1916–
Colorado River at Wharton, Tex., 1916–
Colorado River seepage investigations, 1918.
North Concho River at San Angelo, Tex., 1915–
Concho River near San Angelo, Tex., 1915–
Concho River near Paint Rock, Tex., 1915–
Concho River seepage investigations, 1918.
Pecan Bayou at Brownwood, Tex., 1917–1918.
San Saba River at Menard, Tex., 1915–
San Saba River near San Saba, Tex., 1905–6; 1915–
North Llano River near Junction, Tex., 1915–
Llano River near Junction, Tex., 1915–
Barton Springs at Austin, Tex., 1918–
Barton Creek at Austin, Tex., 1917–18.

GUADALUPE RIVER BASIN

Guadalupe River near Comfort, Tex., 1917–
Guadalupe River near Spring Branch, Tex., 1922–
Guadalupe River at New Braunfels, Tex., 1898–99; 1915–
Guadalupe River near Gonzales, Tex., 1915–1922.
Guadalupe River near Cuero, Tex., 1903–1906; 1915–16.
Guadalupe River below Cuero, Tex., 1916–
San Marcos River at San Marcos, Tex., 1915–1921.
San Marcos River at Ottine, Tex., 1915–
San Antonio River at San Antonio, Tex., 1915–
San Antonio River at Calaveras, Tex., 1918–
San Pedro Creek at San Antonio, Tex., 1916–
Medina River near Pipe Creek, Tex., 1922–
Medina River near Riomedina, Tex., 1922–
Medina Canal near Riomedina, Tex., 1922–

NUECES RIVER BASIN

Nueces River near Cinonia, Tex., 1915–
Nueces River near Cotulla, Tex., 1915–1918.
Nueces River near Three Rivers, Tex., 1915–
Nueces River at Calallen, Tex., 1915–
Frio River near Derby, Tex., 1915–
Frio River at Fowlerton, Tex., 1915–1919.
Frio River at Three Rivers, Tex., 1915.
Frio Lake outlet near Fowlerton, Tex., 1915–1919.

RIO GRANDE BASIN

Rio Grande at Thirtymile Bridge near Creede, Colo., 1909–1913.
Rio Grande near Creede (Wason), Colo., 1907–1913.
Rio Grande near Del Norte, Colo., 1889–1906; 1908–1913.
Rio Grande near Alamosa, Colo., 1894–95; 1903; 1912–13.
Rio Grande near Lobatos (Cenicero), Colo., 1899–1913.
Rio Grande at Embudo, N. Mex., 1899–1903; 1912–16.
Rio Grande near Buckman, N. Mex. (Rio Grande near Ildefonso), 1895–1905; 1909–1914.
Rio Grande near San Marcial, N. Mex., 1895–1921.
Rio Grande below Elephant Butte Dam, N. Mex., 1916–
Rio Grande near El Paso, Tex., 1889–1893; 1895–
Rio Grande near Fort Hancock, Tex., 1900–1903.
Rio Grande near Finlay, Tex., 1923–
Rio Grande above Presidio, Tex., 1900–1914; 1919–20; 1923–
Rio Grande below Presidio, Tex., 1900–1915; 1919–20; 1923–
Rio Grande near Langtry, Tex., 1900–1914; 1919–20.
Rio Grande near Devils River, Tex., 1900–1915; 1919–20.
Rio Grande at Eagle Pass, Tex., 1900–1916.
Rio Grande near Laredo, Tex., 1900–1914; 1922–
Rio Grande at Roma, Tex., 1900–1914; 1922–
Rio Grande near Brownsville, Tex., 1900–1914; 1922–
Clear Creek near Creede, Colo., 1910.
South Fork of Rio Grande at South Fork, Colo., 1910–1913.
San Luis Creek at Villa Grove, Colo., 1911–12.
San Luis Creek near Villa Grove, Colo., 1910.
Kerber Creek near Villa Grove, Colo., 1911–12.
Saguache Creek near Saguache, Colo., 1910–1913.
Rio Alamosa near Monte Vista, Colo., 1911–12.
Rio Alamosa near La Jara, Colo., 1909–1912.
Conejos River near Mogote, Colo., 1899–1900; 1903–1913.
Rio San Antonio near Ortiz, Colo., 1911.
Culebra River at San Luis, Colo., 1910–11.
Costilla Creek near mouth, N. Mex., 1912.
Rio Colorado above Questa, N. Mex., 1910–11.
Rio Colorado near Questa, N. Mex., 1912–1915.
Rio Colorado below Questa, N. Mex., 1910–1915.
Rio Hondo near Arroyo Hondo, N. Mex., 1910–1915.
Rio Pueblo de Taos near Taos, N. Mex., 1910–1916.
Rio Taos at Los Cordovas, N. Mex., 1910–1915.
Rio Lucero near Taos, N. Mex., 1910–1916.
Rio Fernando de Taos near Taos, N. Mex., 1910; 1912–1915.

Rio Grande tributaries—Continued.
Chama River at Chama, N. Mex., 1912–1914.
Chama River near Chama, N. Mex., 1914–1917.
Chama River at Park View, N. Mex., 1912–1916.
Chama River near El Vado [Tierra Amarilla], N. Mex., 1913–1917.
Chama River at Abiquiu, N. Mex., 1895–1897.
Chama River near Chamita, N. Mex., 1912–1915.
Brazos River near Brazos, N. Mex., 1913–1917.
Brazos River at Brazos, N. Mex., 1912–13.
Little Brazos River near Brazos, N. Mex., 1914.
Nutritus Creek near El Vado [Tierra Amarilla], N. Mex., 1914.
Nutrias Creek near Cebolla, N. Mex., 1914.
Horn River near Canjilon, N. Mex., 1911–1914.
Rio Vallecitos at Vallecitos, N. Mex., 1911–1914.
Santa Fe Creek at Monument Rock, near Santa Fe, N. Mex., 1910–11.
Santa Fe Creek above reservoir, near Santa Fe, N. Mex., 1910; 1913–14.
Santa Fe Creek at Santa Fe, N. Mex., 1907–1911.
Santa Fe Water & Light Co. ditch near Santa Fe, N. Mex., 1910.
Arroyo Hondo near Santa Fe, N. Mex., 1913–14.
Rio Puerco at Rio Puerco, N. Mex., 1910–1914.
Rio Puerco near La Joya, N. Mex., 1910–1914.
Bluewater Creek (head of San Jose River) near Bluewater, N. Mex., 1912–1914.
Bluewater Creek at Grants, N. Mex., 1912–1914.
San Jose River near Suwanee, N. Mex., 1910–1914.
Pecos River near Cowles, N. Mex., 1910–1914.
Pecos River near Anton Chico, N. Mex., 1910–1914.
Pecos River at Santa Rosa, N. Mex., 1903–1906; 1910–11; 1912–1914.
Pecos River near Guadalupe, N. Mex., 1912–1914.
Pecos River near Fort Sumner, N. Mex., 1904–1910; 1912–13.
Pecos River near Roswell, N. Mex., 1903–1906.
Pecos River near Dayton, N. Mex., 1905–
Lake McMillan at Lakewood, N. Mex., 1906–7.
Pecos River near Lakewood, N. Mex., 1906–1911.
Pecos River at Avalon, N. Mex., 1906–7.
Pecos River at Carlsbad, N. Mex., 1903–1908; 1914–
Evaporation near Carlsbad, N. Mex., 1914–1916.
Pecos River near Malaga, N. Mex., 1920–
Pecos River near Angeles, Tex., 1914–
Pecos River near Porterville, Tex., 1922–
Pecos River above Barstow, Tex., 1916–
Pecos River near Pecos, Tex., 1898–1907.
Pecos River near Barstow, Tex., 1914–15.
Pecos River near Grandfalls, Tex., 1915–
Pecos River near Buenavista, Tex., 1921–
Pecos River near Sheffield, Tex., 1921–
Pecos River near Comstock [Moorhead], Tex., 1898; 1900–
Pecos River seepage investigations, 1918.
Gallinas River near Las Vegas, N. Mex., 1903–1912; 1912–1914
South Fork of Gallinas River near El Porvenir, N. Mex., 1911–1914.
Hondo River at Hondo Reservoir, N. Mex., 1903–1906.
Hondo River at Roswell, N. Mex., 1903–1906.
Rio Ruidoso, N. Mex., 1911.
Rio Ruidoso near Glencoe, N. Mex., 1910–1911.
Taylor-Moore ditch near Roswell, N. Mex., 1905.

Rio Grande tributaries—Continued.
Pecos River tributaries—Continued.
Hondo Reservoir inlet near Roswell, N. Mex., 1906–1908.
Hondo Reservoir scour gate near Hondo Reservoir, N. Mex., 1906.
Penasco River at Elk, N. Mex., 1900–1911.
Penasco River at Cleve's ranch, near Elk, N. Mex., 1911.
Penasco River near Dayton, N. Mex., 1905–1908.
Black River near Malaga, N. Mex., 1914–15.
Delaware River near Malaga, N. Mex., 1912–13.
Delaware River near Angeles, Tex., 1914–15.
Farmers Independent Canal near Porterville, Tex., 1922–
Cedarvale Canal near Barstow, Tex., 1922–
West Valley ditch near Pecos, Tex., 1904.
Margueretta flume near Pecos, Tex., 1898; 1900–1907.
Barstow Canal near Barstow, Tex., 1922–
Grandfalls-Big Valley Canal near Barstow, Tex., 1922–
Imperial High-line Canal near Grandfalls, Tex., 1922–
Imperial Low-line Canal near Grandfalls, Tex., 1922–
Devils River at Devils River, Tex., 1900–1914.
Rio Salado near Guerrero, Tamaulipas, Mexico, 1900–1912.
Rio San Juan at La Quemada, Tamaulipas, Mexico, 1900–1902.
Rio San Juan near Santa Rosalia ranch, Tamaulipas, Mexico, 1902–1914.

INTERIOR BASINS IN NEW MEXICO.

Mimbres River Basin:
Mimbres River near Faywood, N. Mex., 1908–1914.
Lampbright Draw near Santa Rita, N. Mex., 1912–1914.
Whitewater Creek near Hurley, N. Mex., 1913–14.
Cameron Creek at Fort Bayard, N. Mex., 1907–1911; 1912–13.
Cameron Creek near Hurley, N. Mex., 1913–14.
Stevens Creek near Fort Bayard, N. Mex., 1907–1911; 1912–1914.
Rio de Arena near Hurley, N. Mex., 1913–14.
Rio Tularosa Basin:
Rio Tularosa at Mescalero, N. Mex., 1910–11.
Rio Tularosa near Bent, N. Mex., 1911.
Rio Tularosa near Tularosa, N. Mex., 1912–1914.
Rio La Luz Basin:
Rio La Luz near La Luz, N. Mex., 1911–12.
Rio La Luz at La Luz, N. Mex., 1910–1913.
Rio Fresnal near Mountain Park, N. Mex., 1911–12.

REPORTS ON WATER RESOURCES OF THE WESTERN GULF STATES

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.

*10. Irrigation in Mesilla Valley, N. Mex., by F. C. Barker. 1898. 51 pp., 11 pls.

Describes primitive methods of irrigation and agriculture employed in an area lying along both sides of the Rio Grande, extending from Fort Seldon, N. Mex., on the north to within 3 miles of El Paso on the south. Chiefly of historic interest.

*13. Irrigation systems in Texas, by W. F. Hutson. 1898. 68 pp., 10 pls.

Discusses climate, rainfall, irrigation works, and projects in Texas; considers use of both surface and underground waters.

*40. The Austin Dam, by T. U. Taylor. 1900. 52 pp., 16 pls.

Describes preliminary projects, construction, economic aspect, and failure of the dam across Colorado River.

*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" gives 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.).

*71. Irrigation systems of Texas, by T. U. Taylor. 1902. 137 pp., 9 pls.

Discusses principal irrigation systems in geographic order and gives statistics as to the location, cost, and benefits of the devices for obtaining water; describes rice irrigation systems and appends a brief statement of laws governing irrigation in the State.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses drainage and irrigation and gives records of stream flow.

*93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904, 361 pp. [Inquiries concerning this report should be addressed to the Bureau of Reclamation.]

Contains "Investigations in Pecos Valley," by W. M. Reed.

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.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. [Superseded by No. 152, q. v.]

Cites statutory re[illegible] water pollution.

105. The water powers of Te[illegible] Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé o[illegible]able data regarding water powers and briefly describes the principa[illegible]streams.

*114. Underground waters of eastern United States, by M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls.

Contains brief report on Louisiana and southern Arkansas; discusses the geologic formation as related to water supply; gives a list of the principal publications.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp.

Cites legislative acts relating to ground waters in Colorado and New Mexico.

*140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 12 pp., 15 pls.

Contains a chapter giving results of tests of typical pumping plants in the Rio Grande Valley in Texas and New Mexico.

*141. Observation on the ground waters of the Rio Grande Valley, by C. S. Slichter. 1905. 83 pp., 5 pls.

Describes investigation of the underflow in the valley of the Rio Grande in Texas and New Mexico, gives details of tests of pumping plants near El Paso, Tex., in Mesilla Valley, N. Mex., and near Berino, N. Mex., and analyses of well waters and data concerning wells at and near El Paso.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Pecos River Basin flood, New Mexico, from report of Frank S. Dobson.
Failures of Lake Avalon Dam near Carlsbad, N. Mex., by E. C. Murphy.
Rio Grande floods, New Mexico, by E. C. Murphy.

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives, by States (and within the States by counties), location, depth, diameter, field, height of water, and other available information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp.

Cites statutory restrictions of water pollution in Colorado, Louisiana, New Mexico, and Texas.

*158. Preliminary report on the geology and underground waters of the Roswell artesian area, New Mexico, by C. A. Fisher. 1906. 29 pp., 9 pls.

Discusses topography and geology of belt lying along Pecos River from Roswell to Lake McMillan; discusses area and extent of artesian basins, source, amount, pressure, quality (with analyses), and waste of artesian waters, and irrigation; lists typical wells and gives well records.

*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 accounts of floods on Pecos and Hondo Rivers and the Rio Grande, and estimates flood frequency and discharge for Rio Grande at San Marcial, N. Mex., and Colorado River (of Texas) at Austin; contains also index to literature on floods in American streams.

*188. Water resources of the Rio Grande Valley in New Mexico, and their development, by W. T. Lee. 1907. 59 pp., 10 pls.

Describes the physical features of the valley, rock formation and structure, the Eagle, San Acaci, San Felipe, and Espanola Reservoir sites, surface and underground waters by districts, the origin, course, and quantity of the underflow, the chemical character of the water in the Mesilla and other districts, and the utilization of the underflow by wells and seepage ditches.

*190. Underground waters of Coastal Plain of Texas, by Thomas U. Taylor. 1907. 73 pp., 3 pls.

Describes topography, drainage, and geology, and discusses the underground waters by counties; gives many well records and analyses.

*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 Brazos and Colorado (of Texas) Rivers and the Rio Grande.

240. Geology and water resources of the San Luis Valley, Colorado, by C. E. Siebenthal. 1910. 128 pp., 13 pls. 25c.

Describes the topography, drainage, climate, geologic features, flowing and nonflowing wells, springs, the grouping of wells, and variations in flow and temperature, and the quality (with analyses) and uses of the water; discusses briefly well-drilling methods and costs, and approximately measurements of flows.

*260. Preliminary report on the ground waters of Estancia Valley, New Mexico, by O. E. Meinzer. 1910. 33 pp. (See Water-Supply Paper 275.)

Discusses briefly the geographic relation and industrial development, geology, and soils. Discusses the source, disposal, recovery, quality, and utilization of the ground waters, cost of pumping, windmills, value of crops, and the alkali problem.

*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 analysis; discusses soap-consuming power of waters, water softening, boiling waters, and water for irrigation; gives results of analyses of water of the Rio Grande and of Pecos, Gallinas, and Hondo Rivers.

*275. Geology and water resources of Estancia Valley, New Mexico, with notes on ground-water conditions in adjacent parts of central New Mexico, by O. E. Meinzer. 1911. 89 pp., 14 pls.

Describes physiographic features and geologic formations, soils and climate; discusses the source and disposal of the water supply, the head of the water supply, artesian conditions, yield of wells and quantity of water available, the quality of the water (dissolved solids, chlorine, sulphates, carbonates, and bicarbonates), the storage of storm water, the present and future use of ground water for irrigation, proper types of wells, windmills, cost of pumping, value of crops, and the alkali problem; tables give depths to water and field assays. Contains also brief reports on physiography, geology, soil, ground water, and irrigation in Encino and Pinos Wells basins.

*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.

*335. Geology and underground waters of the southeastern part of the Texas Coastal Plain, by Alexander Deussen. 1914. 365 pp., 9 pls.

Describes an area lying east of Brazos River and south of a line extending east and west through Jefferson, in Marion County; discusses the underground-water horizons of the region and the artesian conditions and prospects in the several counties; gives well sections and tabulated details of the wells.

*343. Geology and water resources of Tularosa Basin, New Mexico, by O. E. Meinzer and R. F. Hare. 1915. 317 pp., 19 pls.

Describes a closed basin lying between the Pecos and the Rio Grande; gives an account of the climate, history of previous investigations and literature, and industrial development; discusses the physiography and drainage, rocks, sources of the underground water, yield of wells, and quality of the waters in the various formations; suggests methods of drilling, boring, digging, casing, and finishing wells; discusses also soil and native vegetation in relation to water supply, irrigation from streams, springs, flood waters, and wells, and railroad and public water supplies; gives detailed information in regard to watering places on routes of travel.

345. Contributions to the hydrology of the United States. 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

*(c) Underground water of Luna County, N. Mex., by N. H. Darton, with results of pumping tests, by A. T. Schwennesen, pp. 25–40.

Describes briefly the extent and thickness of the water-bearing beds underlying the wide bolsons of Luna County, the source and quality of the underground waters, the wells in the region about Deming, Iola, Waterloo, Columbus, and Myndus in the Carne region, lower Mimbres Valley, the region west of Red Mountain, and other parts of the county; discusses the depletion of supply by the pumping plants. The pumping tests were made at plants representing average types.

358. Water resources of the Rio Grande Basin, 1888–1913, by Robert Follansbee and H. J. Dean, including surface water supply of the western Gulf of Mexico basins, 1913, by Robert Follansbee, W. W. Follett, and G. A. Gray. 1915. 725 pp. . 3 pls. 50c.

Describes the general features of the Rio Grande Basin and the closed basins lying between the Rio Grande and Pecos, west of the Rio Grande, and in Mexico; discusses the distribution of precipitation, forestation, and population. Contains "not only all data concerning stream flow in the Rio Grande Basin collected by the survey and cooperating parties, but also records furnished by individuals connected with private interests." Most of the records have been taken from publications of the Geological Survey, but original estimates have been revised where later data have indicated errors.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clark, chief chemist. 1914. 40 pp.

Contains analyses of brines from Texas, spring waters from Colorado and New Mexico, water from the Gulf of Mexico, and mine waters from Crede, Colo.

421. Profile surveys in 1915 along the Rio Grande, Pecos River, and Mora River, New Mexico, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 11 pp., 11 pls. 15c.

Gives 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 at 20 to 100 feet.

422. Ground water in Animas, Playas, Hachita, and San Luis Basins, N. Mex., by A. T. Schwennesen. 1918. 152 pp., 9pls. 20c.

Covers the southern part of Grant County. Describes the physiography and geology and the ground-water conditions in each basin with respect to the occurrence, depth, quantity, quality, artesian conditions, and irrigation prospects. Gives well data, analyses of water, and analyses of the water soluble contents of the soil. Contains a map of the area showing depths to the water table and other features.

* 425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918.

Issued also in separate chapters. The following papers relate to ground water:

*(a) Ground water in San Simoa Valley, Ariz., by A. T. Schwennesen, with a chapter on agriculture by R. H. Forbes (pp. 1–35, Pls. I–III). Describes the physiography and geology of the valley, the upper water horizon, and the deeper artesian horizon of the San Simon and Bowie areas, the ground water in the Rodeo and Artesia Valleys, and the irrigation supplies from flowing and nonflowing wells; contains 39 analyses of well and spring waters, numerous records of deep wells and maps showing areas of artesian flow, depth to water table and lands irrigated with well water; also includes a chapter by R. H. Forbes on soil vegetation, and agricultural prospects.

448. Gazetteer of streams of Texas, prepared under the direction of G. A. Gray. 1919. 267 pp. 20c.

488. The floods in central Texas in September, 1921, by C. E. Ellsworth. 1923. iv, 56 pp., 8 pls. 15c.

Discusses the area covered by the storm and the damage caused by flood. Discusses also length of the floods on Brazos, Colorado, Guadalupe, and San Antonio Rivers and describes previous floods on these streams.

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 purpose 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; sediment in the Rio Grande, pp. 55–57.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River Basin and in the Arkansas, Rio Grande, California, Labontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statements of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including 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 California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a brief report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

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. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, pls. 54–57. Describes reservoir sites in Rio Arriba, Taos, Santa Fe, Bernalillo, Mora, San Miguel, Valencia, Socorro, and Sierra Counties, N. Mex., and on tributaries of the Rio Grande; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

*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 the river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin Basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

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. N. Wilson, pp. 351–437, pls. 147–182. Discusses surveys, flood-water storage, dam site, estimated cost of El Paso Reservoir, Tex.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1925.) 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. 20c. 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.

*Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. II. Papers chiefly of a theoretic nature, v, 653 pp., 105 pls. Contains:

*Geology of portions of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Tex., with especial reference to the occurence of artesian and other underground waters, by R. T. Hill and T. W. Vaughan, pp. 193–322, pls. 21–64. Discusses the general principles of artesian waters, the capacity of the various rock sheets for water, the nonflowing wells, the gravity springs, and artesian wells of the Edwards Plateau and Rio Grande Plain; the probable identity of source of artesian and fissure spring waters, and the availability and limitations of underground waters; treats of the chemical quality of the artesian well waters, and gives analyses of waters from the various beds and of spring waters from Austin and vicinity.

*Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts 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. 113–146. Describes the area lying in an irregular belt 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 Smoky 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, temperature, 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.

* Part VII. Geography and geology of the Black and Grand Praries, Tex., with detailed descriptions of the Cretaceous formations and special reference to artesian waters, by R. T. Hill. 1901. 666 pp., 71 pls.

Gives a general description of the geography of a region including Texas, Oklahoma, and New Mexico east of the Rio Grande, and describes in more detail the geography and geology of the Black and Grand Prairies. Discusses the principles governing artesian and other ground waters, the artesian systems of Texas, and the quality of the waters of these systems. Describes the artesian conditions by counties and gives analyses. Includes maps showing the geology, the locations of artesian wells, and the outcrop of, depths to, and areas of artesian flow from the Trinity, Paluxy, and Woodbine formations.

* Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Pts. III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 631–669 pp., pls. 51–65. $2.20. Contains:

* Conclusion of The High Plains and their utilization.

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.

* 264. Records 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 geologists; describes the general methods of work; gives tabulated records of wells in Colorado, Louisiana, New Mexico, and Texas, and detailed record of well near Houston, Harris County, Tex. This well was selected because it affords definite stratigraphic information.

* 298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 209 pp.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Louisiana, New Mexico, and Texas; and detailed records of wells in Eddy and Torrance Counties, N. Mex.; and Bexar, Cameron, Coleman, Dallas, Dimmit, Duval, Fayette, Fort Bend, Guadalupe, Hardin, Harris, Hays, Jasper, Johnson, Kendall, Lampasas, Liberty, Medina, Navarro, Nueces, Parker, Williamson, and Zavalla Counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

* 618. Geology and underground water of Luna County, N. Mex., by N. H. Darton. 1916. 188 pp., 13 pls.

Describes the geography and geology, the mineral resources, the water supplies from streams, springs, and wells, and the irrigation development from surface and ground waters. Discusses the source, quantity, and quality of the ground waters and the extent of the water-bearing strata and gives well data by townships. Includes maps showing the geology, the contours of the water table, and the depths to ground water.

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 descriptions 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 geological features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea levels 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 area 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 geological 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, 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 for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in high-priced folios) are ordered at one time a discount of 40 per cent is allowed; $5.10 is the minimum amount accepted at this rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contains 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.

*42. Nueces, Tex.

Describes geography and geology and relations of geological formations to underground waters.

*64. Uvalde, Tex.

Describes the topography and geology of the area, the streams, springs, and wells, and discusses the possibility of obtaining artesian flows.

[2] Index maps showing areas in the western Gulf of Mexico basins 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.

*76. Austin, Tex.

Describes the topography and geology of the area, the drainage, and discusses the possibility of obtaining artesian water.

*120. Silverton, Colo.

*166. El Paso, Tex.

Gives analyses of underground waters.

*183. Llano-Burnet, Tex. 5c.

Under "Mineral Resources" discusses rainfall, streams, springs, wells, tanks, and cisterns.

194. Van Horn, Tex. 25c.

Gives analyses of water from railroad wells at Van Horn and well at Figure 2 ranch headquarters.

199. Silver City, N. Mex. 25c.

207. Deming, N. Mex. 25c.

214. Raton-Brilliant-Koehler, N. Mex.-Colo. 50c.

MISCELLANEOUS REPORTS

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the western Gulf of Mexico drainage basins are the reports of the State Geological Surveys of Louisiana and Texas, the reports of the State engineers of Colorado and New Mexico, and the annual reports of the United States Bureau of Reclamation. The following deserve special mention:

Report of commission appointed to revise the laws of the State of Colorado regulating the appropriation, distribution, and use of water. 1890.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the Chief of Engineers, together with a report of Capt. Chittenden: 55th Cong., 2d sess, House Doc. 141.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others, made under the direction of the Sta[illegible]xperiment stations; Louisiana Geol. Survey Bull. 1, 1905.

Preliminary report on the soils and waters of the upper Rio Grande and Pecos Valleys in Texas, by H. H. Harrington: Texas Geol. Survey Bull. 2, 1890.

Water supply of southwest Texas, compiled by H. M. Madison. 1912.

Artesian water on the Llano Estacado, by G. G. Shumard: Texas Geol. Survey Bull. 1, 1892.

Preliminary reports on the artesian wells of the Gulf coastal slope, by J. A. Singley, and on the organic remains from the deep well at Galveston, by Gilbert D. Harris: Texas Geol. Survey Fourth Ann. Rept., 1892.

A study of the use of water for irrigation on the Rio Grande del Norte, by W. W. Follett: International (Water) Boundary Comm. Proc., pp. 284–323, 1903.

Silt in the Rio Grande, by W. W. Follett: International Boundary Comm. Proc., 1913.

Silt survey on Pecos River: U. S. Recl. Service Third Ann. Rept., 1905.

AREAS AND PUBLICATIONS COVERED

[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.

STREAMS ON WHICH GAGING STATIONS HAVE BEEN MAINTAINED

4241—27—wsp 568——12

INDEX