DEPARTMENT OF THE INTERIOR
HUBERT WORK, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 548

SURFACE WATER SUPPLY OF THE UNITED STATES

1922

PART VIII. WESTERN GULF OF MEXICO BASINS

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Prepared in cooperation with the
STATE OF TEXAS

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SURFACE WATER SUPPLY OF WESTERN GULF OF MEXICO BASINS, 1922

AUTHORIZATION AND SCOPE OF WORK

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1922.

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

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

The work was begun in 1886 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

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

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

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	180,000.00
1922	180,000.00
1923	180,000.00

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 9.

Measurements of stream flow have been made at about 5,480 points in the United States and also at many points in Alaska and

the Hawaiian Islands. In July, 1922, 1,540 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 water-supply papers from time to time.

DEFINITION OF TERMS

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

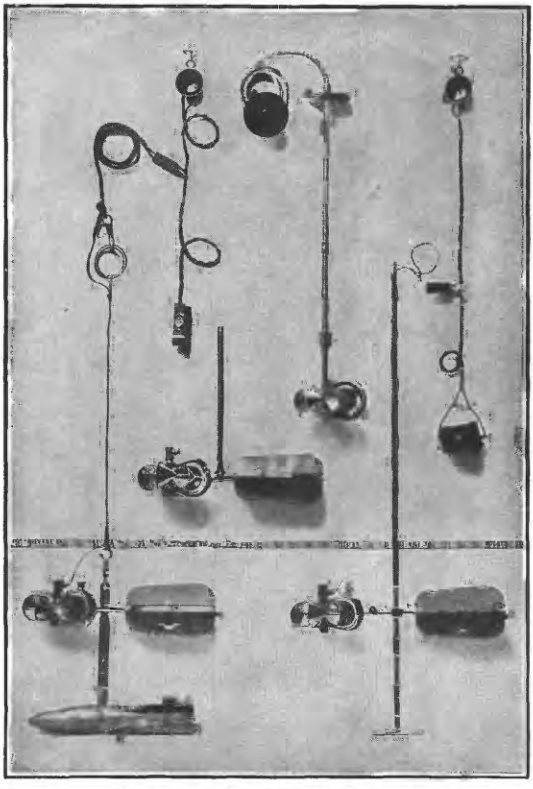
An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

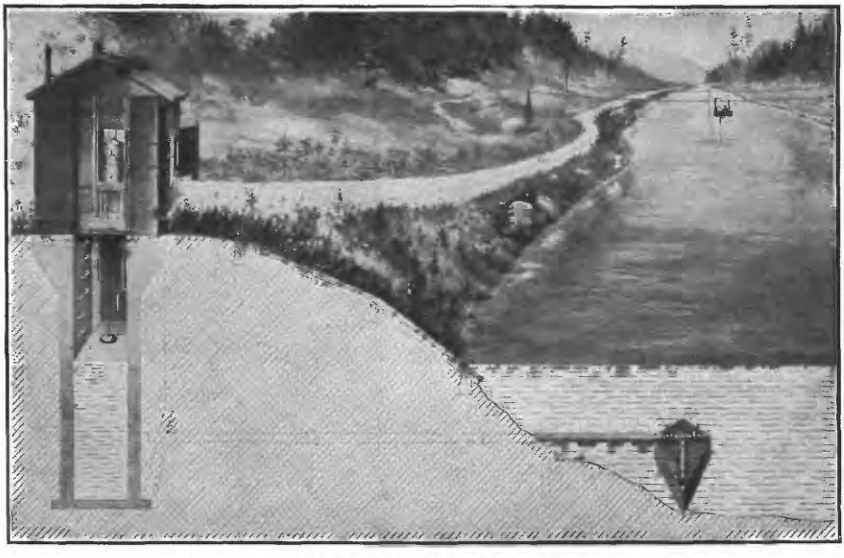
"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

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

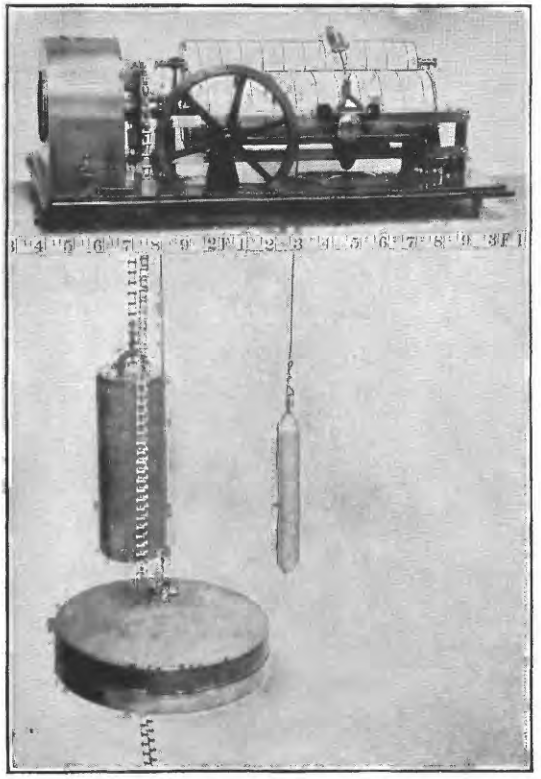
The "point of zero flow" for a gaging station is that point on the gage—the gage height—at which water ceases to flow over the control.



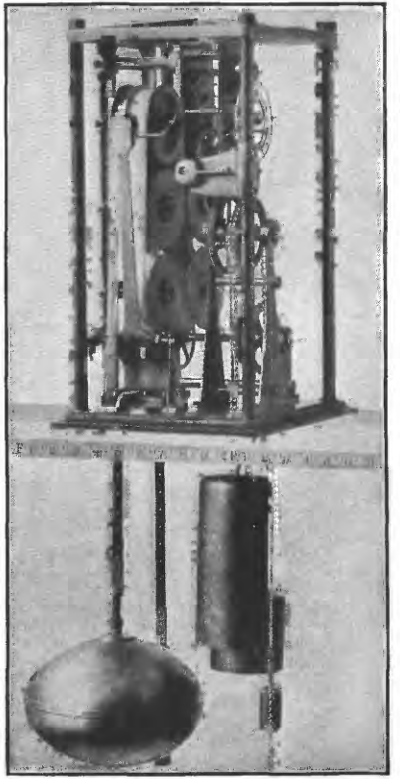
A. PRICE CURRENT METERS.



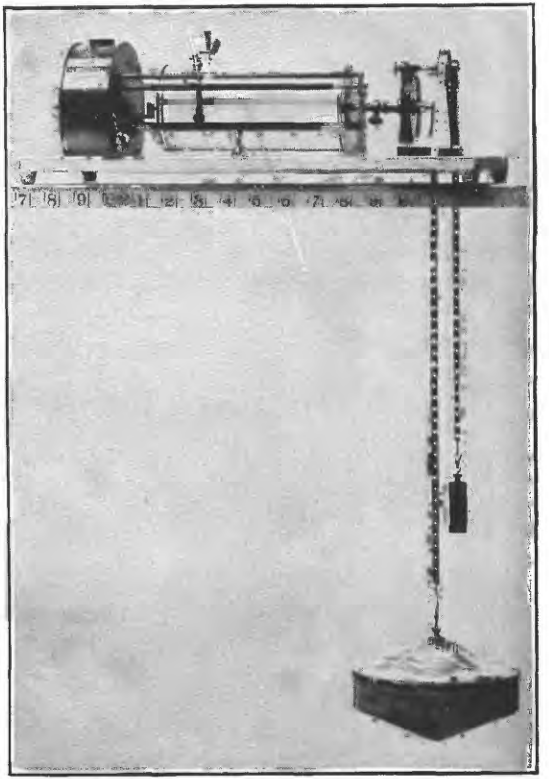
B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

EXPLANATION OF DATA

The data presented in this report cover the year beginning October 1, 1921, and ending September 30, 1922. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

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

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

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

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

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

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders, the

mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

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

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

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

A paragraph in the description of the station 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.[1]

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

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information 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. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches.

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

All figures representing "second-feet per square mile" and "run-off in inches" published by the survey in earlier reports should be used with caution because of possible inherent sources of error not known to the survey.

Many gaging stations on streams in the irrigated areas 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 data previously published.

PUBLICATIONS

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 investigations 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, monographs, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features, as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins in three volumes:
A. Pacific slope basins in Washington and upper Columbia River basin.
B. Snake River basin.
C. Lower Columbia River basin and Pacific slope basins in Oregon.

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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 obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish list giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. 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., State House.
Asheville, N. C., 316 Jackson Building.
Chattanooga, Tenn., 37 Municipal Building.
Columbus, Ohio, Brown Hall, Ohio State University.
Chicago, Ill, 1404 Kimball Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Ames, Iowa, State Highway Commission Building.
Rolla, Mo., Rolla Building, School of Mines and Metallurgy.
Topeka, Kans., 23 Federal Building.
Helena, Mont., 52 Montana National Bank Building.
Denver, Colo., 403 Post Office Building.
Salt Lake City, Utah, 313 Federal Building.
Idaho Falls, Idaho, 228 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 600 Federal Building.
Tucson, Ariz., 210 Agricultural Building, University of Arizona.
Austin, Tex., State Capitol.
Honolulu, Hawaii, 25 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

Stream-flow records have been obtained at about 5,480 points in the United States, and the data obtained have been published in the reports tabulated on pages 7 and 8.

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 September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	1895.
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	
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.

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 1921. The data for any particular station will, as a rule, 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, 1899–1922

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII—North Pacific slope basins		
	North Atlantic slope basins (St. John River to York River)	South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi)	Ohio River basin	St. Lawrence River basin	Hudson Bay and upper Mississippi River basins	Missouri River basin	Lower Mississippi River basin	Western Gulf of Mexico basins	Colorado River basin	Great Basin	Pacific slope basins in California	Pacific slope basins in Washington and upper Columbia River basin	Snake River basin	Lower Columbia River basin and Pacific slope basins in Oregon
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	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	351	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

[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 Kerns rivers and south Pacific slope drainage 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.

COOPERATION

The work of measuring streams in Texas during the year ending September 30, 1922, 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.

Acknowledgments are due to the United States Bureau of Reclamation for records furnished and general assistance rendered at the stations on Pecos River in New Mexico, and to the United States Weather Bureau for climatologic data and equipment for the evaporation station near Austin.

Assistance in the collection of records by furnishing funds, or otherwise has been given by the cities of Corpus Christi, Dallas, Fort Worth, and San Antonio, the Pecos Valley Lines, Louisiana Gravity Canal Co., Walker-Caldwell Co., Guadalupe Water Power Co., Medina Valley Irrigation Co., Zimmerman or Imperial Canal Co., Ward County Irrigation District No. 1, and Ward County Water Improvement District Nos. 2 and 3.

Acknowledgment is made in the description 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, who was assisted by Clarence E. McCashin, Donald A. Dudley, Donald S. Wallace, Trigg Twichell, Robert G. West, H. C. Pritchett, T. A. Slack, and Kate Casparis.

The records were received and the manuscript assembled by J. J. Dirzulaitis.

GAGING-STATION RECORDS

CALCASIEU RIVER BASIN

CALCASIEU RIVER NEAR OBERLIN, LA.

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

DRAINAGE AREA.—Not measured.

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

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. Both 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 the period August 16 to September 30, from water-stage recorder, 5.0 feet from 4 to 7 a. m. August 28 (discharge, 592 second-feet); minimum stage, 1.24 feet, September 30 (discharge, 70 second-feet).

ICE.—None.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory. Mean daily gage height obtained 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 Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Apr. 26	Ellsworth and Bradford	4.49	435	Aug. 26	McCashin and Joseph	3.36	307
Aug. 16	McCashin and Lee	3.80	413	Sept. 2	Joseph and Lee	1.89	122
19	McCashin and Bradford	3.29	298				

Daily discharge, in second-feet, of Calcasieu River near Oberlin, La., for the period Aug. 16 to Sept. 30, 1922.

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1		131	11		104	21	346	92
2		121	12		102	22	449	87
3		118	13		97	23	262	86
4		121	14		97	24	262	86
5		112	15		98	25	362	82
6		109	16	322	102	26	301	80
7		138	17		124	27	363	77
8		128	18		133	28	528	73
9		110	19	299	114	29	243	71
10		104	20		101	30	162	70
						31	144	

NOTE.—Discharge Aug. 16 and 19 from measurements made at that time. Discharge Aug. 21 and 22 from staff gage readings. Discharge Aug. 23 partly estimated, owing to incomplete gage-height records. Discharge obtained by applying to rating table gage heights for fractional parts of a day on Aug. 24 and 26–29. No record Aug. 17, 18, and 20.

Monthly discharge of Calcasieu River near Oberlin, La., for the period Aug. 21 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
August 21–31	528	144	311	6,790
September	138	70	102	6,070

CALCASIEU RIVER NEAR KINDER, LA.

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

DRAINAGE AREA.—Not measured.

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

GAGE.—Gurley 8-day water-stage recorder, attached to downstream side of railroad bridge pier; inspected by J. L. Joseph.

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

CHANNEL AND CONTROL.—Channel straight for 300 feet above and below the station. Both 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; shifts. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage during the period August 23 to September 30, from water-stage recorder, 3.44 feet from 1 to 6 p. m. August 28 (discharge, 1,260 second-feet); minimum stage, 1.17 feet from 8 to 12 p. m. September 30 (discharge, 423 second-feet).

ICE.—None during year.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined for all stages. Operation of recorder satisfactory. Mean daily gage heights obtained from recorder chart by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, except on August 24 when it was partly estimated owing to incomplete record. Records good.

Discharge measurements of Calcasieu River near Kinder, La., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Apr. 26	Ellsworth and Bradford	4.11	1,560	Aug. 15	McCashin and Lee	2.73	949
				26	McCashin and Joseph	2.24	822
12	McCashin and Bradford	4.62	1,610	Sept. 2	Joseph and Lee	1.65	587

Daily discharge, in second-feet, of Calcasieu River near Kinder, La., for the period Aug. 23 to Sept. 30, 1922

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1		624	11		560	21		508
2		606	12		557	22		491
3		658	13		540	23	1,000	477
4		624	14		532	24	802	470
5		588	15		564	25	820	464
6		571	16		571	26	820	457
7		571	17		549	27	931	450
8		606	18		546	28	1,230	443
9		588	19		546	29	1,060	436
10		568	20		532	30	784	430
						31	676	

Monthly discharge of Calcasieu River near Kinder, La., for the year ending Sept. 30, 1922

Month.	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
August 23-31	1,230	676	903	16,100
September	658	430	537	32,000

TRINITY RIVER BASIN

WEST FORK OF TRINITY RIVER AT BRIDGEPORT, TEX.[2]

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.—1,060 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles.

RECORDS AVAILABLE.—October 1, 1914, to September 30, 1922. 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, fastened to downstream side of bridge, 56 feet from north end of guardrail; read by Mrs. U. E. Byers or 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.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 21.9 feet at 6 p. m. April 26 (discharge, 9,800 second-feet); no flow, February 4–20, March 5–8, 14, and August 8 to September 30.

1908–1922: Maximum stage recorded, 28.9 feet June 8, 1915 (discharge, not determined); no flow during several periods.

ICE.—None reported.

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 practically permanent, except for extremely low stages when small cracks in the rock control affect the rating. Curve well defined below 11,000 second-feet. Gage read to hundredths once daily and oftener during floods. Daily discharge determined by applying mean daily gage height to rating table, except October 1 to April 3, when indirect method for shifting control was used. Records good.

The following discharge measurement was made by D. A. Dudley:

February 21, 1922: Gage height, 1.28 feet; discharge, 0.5 second-foot.

[2] Published in earlier reports as Trinity River at Bridgeport, Tex.

Daily discharge, in second-feet, of West Fork of Trinity River at Bridgeport, Tex. for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	16	0.5	1.3	0.3	0.3	0.3	11	2,520	878	4.3	1.6
2	15	.5	1.3	.3	.2	.2	5.2	1,360	710	4.3	1.5
3	13	.6	1.2	.4	.2	.2	12	1,120	106	974	1.3
4	11	.7	1.2	.3	-------	.1	4,920	854	830	321	1.1
5	8.5	.8	1.2	.9	-------	-------	1,470	424	878	202	.9
6	6.0	.8	1.1	.8	-------	-------	1,530	277	401	116	.5
7	3.9	.7	1.0	.8	-------	-------	998	97	1,050	66	.2
8	2.3	.7	1.0	.8	-------	-------	424	1,590	1,310	33	-------
9	2.0	.7	.9	.6	-------	.2	518	4,460	614	20	-------
10	1.8	.7	.8	1.3	-------	.2	390	950	181	16	-------
11	1.6	.7	.7	1.3	-------	.1	806	998	91	14	-------
12	1.4	.7	.7	1.2	-------	.1	1,770	1,070	38	12	-------
13	1.2	.7	.7	1.1	-------	.1	1,090	1,310	23	9.7	-------
14	1.0	.6	.7	1.1	-------	-------	321	590	15	8.2	-------
15	1.2	.6	.7	.9	-------	16	156	299	13	8.2	-------
16	1.5	.6	.7	.8	-------	6.2	100	244	9.4	6.8	-------
17	1.3	1.4	.7	.7	-------	3.9	494	66	7.9	5.5	-------
18	1.3	1.3	.7	.6	-------	2.9	187	288	7.9	4.3	-------
19	1.2	1.3	.7	.6	-------	2.1	43	179	6.5	3.3	-------
20	1.1	1.3	.6	.4	-------	1.6	29	102	6.5	3.3	-------
21	1.0	1.3	.6	.4	.2	1.4	25	64	6.5	3.3	-------
22	1.0	1.2	.6	.3	.3	1.2	25	1,120	5.2	2.4	-------
23	1.0	1.1	.6	.3	.2	1.0	244	590	5.2	2.3	-------
24	1.0	1.1	.5	.3	.2	.8	355	266	5.2	2.3	-------
25	.9	1.1	.5	.2	.2	3.9	5,270	49	5.2	2.3	-------
26	.7	1.0	.5	.2	.5	.8	9,560	40	5.2	2.2	-------
27	.6	1.0	.5	.1	.4	.7	8,120	32	4.8	2.1	-------
28	.5	1.1	.4	.1	.3	.7	4,610	22	4.8	2.0	-------
29	.5	1.3	.3	.6	-------	6.2	4,180	16	4.8	1.8	-------
30	.4	1.8	.3	.5	-------	16	3,620	13	4.1	1.7	-------
31	.3	-------	.3	.5	-------	51	-------	12	-------	1.7	-------

NOTE.—No flow Feb. 4–20, Mar. 5–8, 14, and Aug. 8 to Sept. 30.

Monthly discharge of West Fork of Trinity River at Bridgeport, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	16	0.3	3.23	199
November	1.4	.5	.91	54.1
December	1.3	.3	.74	45.5
January	1.3	.1	.60	36.9
February	.5	.0	.11	6.11
March	51	.0	3.80	234
April	9,560	5.2	1,710	102,000
May	4,460	12	678	41,700
June	1,310	4.1	241	14,300
July	974	1.7	59.9	3,680
August	1.6	.0	.23	14.1
The year	9,560	.0	224	162,000

NOTE.—No flow during September.

WEST FORK OF TRINITY RIVER AT FORT WORTH, TEX.

LOCATION.—At old intake pump house of 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.—2,420 square miles (measured on post-route map of Texas).

RECORDS AVAILABLE.—October 1, 1920, to September 30, 1922. 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.

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

CHANNEL AND CONTROL.—Channel straight for 500 feet above and 1,000 feet below section. 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, 23.95 feet at 12.20 p. m. April 25 (discharge, 85,000 second-feet, determined as follows for Clear Fork of Trinity: By city of Fort Worth engineers by slope method using Kutter's formula. Average hydraulic factors from six cross sections between Marys Creek and Frisco railroad bridge. $A=17{,}700$ square feet; $P=2{,}449$ feet; $R=7.2$ feet; $n=0.055$; $s=0.0015$; $v=4.2$ feet per second; $Q=74{,}340$ second-feet. Discharge for West Fork of Trinity River at Lake Worth dam determined by formula, $Q=3.33\ LH^{3/2}$, $H=26$ inches, $Q=8{,}100$ second-feet. Inflow between gage and points measured estimated at 2,500 second-feet.) Minimum stage, 0.92 foot, December 6, determined by comparison with Weather Bureau gage and subject to error (discharge, 1.4 second-feet).

1910–1922: Maximum stage that of April 25, 1922. (This is the highest stage at this point of which there is any authentic record). No flow during several periods of record.

ICE.—None during year.

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

REGULATION.—Flow is partly regulated by the 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 to cover range of stage by use of one slope measurement at gage height of 23.95 feet (see footnote to discharge measurements). Operation of water-stage recorder not satisfactory. 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 fair.

Discharge measurements of West Fork of Trinity River at Fort Worth, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 23	C. E. Ellsworth	1.15	25.5	Apr. 25	[a]	23.95	85,000
Feb. 22	D. A. Dudley	1.06	13	28	C. E. McCashin	6.40	5,510
Apr. 7	C. E. Ellsworth	3.47	1,560	Sept. 15	C. E. Ellsworth	.95	[b]2.0

[a] Maximum discharge determined as follows: For Clear Fork of Trinity River by city of Fort Worth engineers by slope method, using Kutter's formula. Average hydraulic factors from six cross sections between Marys Creek and Frisco railroad bridge, $A=17{,}700$ square feet; $P=2{,}449$ feet; $R=7.2$ feet; $n=0.055$; $s=0.0015$; $v=4.2$ feet per second; $Q=74{,}340$ second-feet. For West Fork of Trinity River at Lake Worth dam, by formula $Q=3.33\ LH^{3/2}$, $H=26$ inches, $Q=8{,}100$ second-feet. Inflow between gage and points of measurement estimated at 2,500 second-feet.

[b] Estimated.

Daily discharge, in second-feet, of West Fork of Trinity River at Fort Worth, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.0	20	52	7.2	14	14	17	6,600	364	40	12	20
2	2.0	22	20	8.4	12	9.6	15	5,970	490	130	12	9.6
3	20	24	80	8.4	11	9.6	276	5,340	660	466	12	9.6
4	8.4	24	20	7.2	18	11	3,960	4,080	1,020	179	11	9.6
5	8.4	24	12	8.4	15	11	748	2,100	919	163	11	8.4
6	8.4	24	1.4	9.6	11	11	295	1,040	1,090	344	9.6	5.2
7	8.4	24	5.2	20	9.6	9.6	1,320	716	1,320	317	9.6	3.6
8	8.4	25	6.0	6.0	11	11	2,100	8,560	1,690	219	17	3.6
9	8.4	25	7.2	6.0	9.6	12	2,670	28,400	1,350	134	42	3.6
10	20	25	15	20	9.6	11	2,600	9,580	1,310	90	18	4.4
11	8.4	24	12	6.0	11	9.6	1,520	4,780	1,480	74	14	6.0
12	8.4	24	12	6.0	11	9.6	1,040	4,240	1,050	55	11	4.4
13	20	25	15	6.0	9.6	11	1,010	4,080	590	52	11	4.4
14	20	25	12	8.4	9.6	9.6	1,180	2,940	376	52	9.6	3.6
15	20	25	11	8.4	9.6	9.6	1,320	2,800	278	52	9.6	2.8
16	24	25	9.6	8.4	11	8.4	1,090	2,100	210	56	11	3.6
17	25	25	8.4	8.4	11	8.4	780	1,370	167	47	8.4	3.6
18	25	25	8.4	8.4	11	8.4	502	946	167	40	17	5.2
19	25	25	8.4	8.4	11	7.2	328	708	160	33	33	6.0
20	25	24	7.2	8.4	9.6	8.4	278	583	137	31	11	6.0
21	24	24	7.2	8.4	8.4	7.2	223	490	112	27	7.2	5.2
22	24	24	6.0	9.6	15	6.0	171	865	99	25	5.2	7.2
23	25	24	7.2	11	11	6.0	160	991	93	20	3.6	14
24	24	22	6.0	12	9.6	7.2	169	1,370	86	24	3.6	12
25	24	20	6.0	22	9.6	40	47,300	1,420	66	17	3.6	11
26	24	17	7.2	12	12	66	27,200	982	90	18	4.4	9.6
27	22	7.2	7.2	12	15	40	11,400	604	69	17	9.6	8.4
28	14	8.4	8.4	12	80	40	5,840	426	60	17	9.6	7.2
29	5.2	18	9.6	25	------	96	7,500	333	50	17	9.6	6.0
30	7.2	31	8.4	18	------	130	8,500	338	45	17	9.6	5.2
31	15	------	6.0	14	------	96	------	292	------	17	9.6	------

NOTE.—Owing to incomplete record, discharge determined from staff gage reading Oct. 8, 15, Nov. 26, Dec. 10, Jan. 1, 14, Sept. 23, 30; discharge partly estimated Oct. 16, Dec. 3, 31, Jan. 7, 21, Feb. 21, 27, 28, Mar. 2, 7, 8, 10, Apr. 4, 29, May 6, July 1, Aug. 26, and Sept. 2. Discharge determined from gage heights ascertained by comparison with Weather Bureau gage, and subject to some error: Oct. 1-7, 9-14, Nov. 27 to Dec. 2, 4-9, Jan. 8-13, 15-20, Feb. 25, Mar. 25-31, Apr. 3, May 5, Aug. 7 to Sept. 1, 24-29. Discharge Apr. 3-6, 24-27, and May 8-11 determined by applying to rating table gage heights for fractional parts of a day.

Monthly discharge of West Fork of Trinity River at Fort Worth, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	25	2.0	16.2	996
November	31	7.2	22.7	1,350
December	80	1.4	13.0	799
January	25	6.0	10.8	664
February	80	8.4	13.8	766
March	130	6.0	23.7	1,460
April	47,300	15	4,380	261,000
May	28,400	292	3,390	208,000
June	1,690	45	520	30,900
July	466	17	89.8	5,520
August	42	3.6	11.8	726
September	20	2.8	6.97	415
The year	47,300	1.4	708	513,000

TRINITY RIVER AT DALLAS, TEX.

LOCATION.—On Commerce Street viaduct in Dallas, Dallas County, 800 feet below Texas & Pacific Railway bridge, one block from county courthouse one block upstream from union station, 3 miles by air line and 5 miles by river below confluence of Elm Fork and West Fork of Trinity River.

DRAINAGE AREA.—5,920 square miles (measured on standard topographic maps; post-route maps; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

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, 1922. 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. From October 1, 1898, to December 31, 1899, gage was at Turtle Creek pumping plant, 2 miles above present gage. Relation between gages not known.

DISCHARGE MEASUREMENTS.—Made by wading, from upstream side of Commerce Street viaduct, or from "Millers 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 high, 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, 300 feet below gage. High-water control 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, seldom occurs.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 42.35 feet at 5.15 a. m. April 27 (discharge, 75,100 second-feet); minimum stage, 4.32 feet at 4.30 p. m. September 8 (discharge, 19 second-feet).

1898–99; 1903–1906; 1921–22: Maximum stage that of April 27, 1922; minimum stage that of September 8, 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 1917–18 discharge was practically zero.

ICE.—None reported during year.

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 gage and on Elm Fork, 6 miles above gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 20 to 75,000 second-feet. Gage read to hundredths twice daily, except as follows: February 18 to 21, Weather Bureau gage-height records of one reading daily used; April 5, seven readings used; April 25, five readings used, April 26, 19 readings used; and April 27, seven readings used. Daily discharge determined by applying mean daily gage height to rating table. Records good.

Discharge measurements of Trinity River at Dallas, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 23	C. E. Ellsworth	4.83	39.9	Apr. 26	C. E. McCashin	39.74	54,700
Dec. 28	R. G. West	4.58	28.6	27	do	42.12	73,100
Feb. 23	D. A. Dudley	5.06	52.2	Aug. 27	C. E. Ellsworth	4.70	33
Apr. 5	C. E. Ellsworth	36.15	29,200				

Daily discharge, in second-feet, of Trinity River at Dallas, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	28	33	36	75	75	137	13,200	1,200	121	51	22
2	22	26	33	33	66	69	220	10,800	1,280	113	48	24
3	33	30	30	28	63	66	145	9,440	1,420	775	30	24
4	72	43	30	38	81	57	10,900	8,150	1,810	1,350	40	28
5	63	46	30	46	81	54	29,500	3,900	2,620	2,260	40	28
6	48	43	28	33	78	54	18,600	3,260	5,000	680	38	24
7	48	43	28	30	66	51	12,500	1,810	6,900	460	38	24
8	43	40	26	30	63	43	8,600	2,900	6,180	340	36	20
9	40	40	24	30	60	48	6,080	66,300	5,800	310	33	20
10	38	43	24	51	54	46	5,300	58,400	3,460	265	30	22
11	46	43	26	57	43	46	3,580	34,800	2,050	200	28	22
12	38	40	30	46	40	43	2,170	20,200	1,840	154	28	22
13	38	46	36	40	40	43	1,570	11,700	1,600	129	28	22
14	38	43	36	40	40	43	1,250	8,020	950	118	33	22
15	38	43	30	40	40	43	1,200	6,130	700	105	36	24
16	40	43	28	40	40	43	1,200	4,480	680	94	36	22
17	43	43	26	36	38	43	1,250	3,740	600	78	28	22
18	46	46	22	38	43	43	1,250	3,100	460	51	28	24
19	43	48	22	36	33	43	1,250	2,320	310	46	33	30
20	46	46	22	30	38	46	1,250	1,480	310	154	33	28
21	43	57	22	30	38	43	340	1,150	325	113	36	26
22	43	46	22	33	40	43	190	2,200	265	63	36	22
23	40	43	24	38	46	43	230	4,120	200	57	38	24
24	40	40	24	43	57	30	230	3,060	190	54	33	24
25	40	40	26	48	60	36	7,020	2,290	190	51	30	24
26	38	40	26	54	63	54	62,300	1,930	181	51	26	24
27	38	40	28	63	63	63	72,100	1,630	190	48	26	22
28	48	38	30	63	69	94	39,600	1,200	181	51	26	26
29	40	33	40	63	------	105	20,800	825	163	51	28	26
30	40	33	40	63	------	102	15,000	825	154	51	28	26
31	38	------	38	66	------	102	------	800	------	51	24	------

Monthly discharge of Trinity River at Dallas, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	72	22	41.7	2,560
November	57	26	41.2	2,450
December	40	22	28.5	1,750
January	66	28	42.6	2,620
February	81	33	54.2	3,010
March	105	30	55.3	3,400
April	72,100	137	10,900	649,000
May	66,300	800	9,490	584,000
June	6,900	154	1,550	92,200
July	2,260	46	272	16,700
August	51	24	33.1	2,040
September	30	20	23.9	1,420
The year	72,100	20	1,880	1,360,000

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 Chicago, Rock Island & Gulf Railway bridge, 1.2 miles above confluence with West Fork, and 5 miles northwest of Dallas, Dallas County.

DRAINAGE AREA.—2,480 square miles (measured on post-route map of Texas).

RECORDS AVAILABLE.—October 17, 1920, to September 30, 1922.

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.

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, 20.20 feet at 10 a. m. April 27 (discharge not determined; backwater from Trinity River existed on this day which affected gage height); no flow during several periods.

1920–1922: Maximum stage recorded that of April 27, 1922; no flow during several periods.

ICE.—None reported.

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

REGULATION.—Flow regulated during extremely low stages by city of Dallas reservoir at Carrollton.

ACCURACY.—Stage-discharge relation permanent, except when affected by backwater from Trinity River. Rating curve well defined below 1,100 second-feet, and fairly well defined from 6,200 to 16,000 second-feet. No measurements between 1,100 and 6,200 second-feet, and this portion of rating may be slightly in error. Gage read to hundredths twice daily and oftener during floods. Daily discharge determined by applying mean daily gage height to rating table, except as noted in footnote to daily-discharge table. Records fair.

The following discharge measurement was made by D. A. Dudley:

February 23, 1922: Gage height, 2.96 feet; discharge, 22.1 second-feet.

Daily discharge, in second-feet, of Elm Fork of Trinity River near Dallas, Tex., for the year ending Sept. 30, 1922

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
1		3.8	21	25	635	9,820	670	18
2		.2	14	25	200	6,860	855	10
3		.8	14	21	110	6,050	1,050	892
4		14	15	21	10,100	4,330	1,650	1,490
5		17	34	17		1,810	742	1,490
6		.8	34	17	10,900	340	2,460	315
7		.3	10	10		268	3,310	180
8		.2	8.3	10	4,760	930	3,140	113
9		.5	6.1	10	1,970		2,050	76
10		14	21	8.3	1,330		1,330	192
11		15	6.1	6.1	818	18,100	540	45
12		10	4.4	6.1	368		330	27
13		8.3	6.1	4.4	268		290	12
14		5.0	4.4	6.1	160	3,560	200	8.3
15		6.1	6.1	8.3	116	780	152	5.0
16		6.1	6.1	8.3	106	395	120	5.0
17		4.4	18	8.3	110	395	113	.5
18		4.4	8.3	14	200	320	82	0
19		4.4	8.3	10	930	295	67	0
20		3.2	6.1	10	281	222	61	77
21		3.2	6.1	8.3	96	200	116	34
22		4.4	6.1	8.3	64	1,810	88	4.4
23		6.1	14	17	47	2,720	55	
24		7.2	25	17	37	1,730	45	
25		10	29	9.4	3,480	635	39	
26		21	21	14		340	25	
27	0.1	21	21	10		290	67	
28	5	21	29	45	18,600	160	21	
29	14	29		70		140	17	
30	17	21		55		236	25	
31	17	14		176		315		

NOTE.—Backwater from Trinity River existed Apr. 5–7, 26–30, and May 9–13; discharge estimated by studies of other data. No flow Oct. 1 to Dec. 26, July 18, 19, July 23 to Sept. 30; Dec. 27 (half a day), and July (one-fourth day). Stage probably somewhat affected by backwater Apr. 4, 8–10, 25, May 2–5, 14–16, and June 6–9; discharge on these days subject to some error.

Monthly discharge of Elm Fork of Trinity River near Dallas, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
December	17	0.0	1.71	105
January	29	.2	8.90	547
February	34	4.4	14.4	800
March	176	4.4	21.8	1,340
April		37	5,060	301,000
May		140	4,370	269,000
June	3,310	17	657	39,100
July	1,490	.0	161	9,900
The year		.0	859	622,000

NOTE.—See footnote to table of daily discharge.

BRAZOS RIVER BASIN

BRAZOS RIVER AT WACO, TEX.

LOCATION.—At Southern Traction Co.'s bridge in Waco, McLennan County, 2½ miles below mouth of Bosque River and 4½ miles above mouth of Cottonwood Creek.

DRAINAGE AREA.—25,500 square miles[3] (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of U. S. Geological Survey; scale, 1 inch=25 miles).

[3] Revised since publication of Water-Supply Paper 508.

RECORDS AVAILABLE.—September 14, 1898, to December 31, 1911; October 1, 1914, to September 30, 1922. Records of stage have been obtained by United States Weather Bureau since August 9, 1900.

GAGE.—Gurley graph water-stage recorder installed March 29, 1918, on downstream side of pier of Southern Traction Co.'s bridge, 100 feet upstream from suspension bridge; inspected by H. E. Isaacks. For history of gages used prior to March 29, 1918, see Water-Supply Paper 508, page 12.

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 stages. Channel straight above and below for several thousand feet. Location of control not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 35.9 feet at 2 a. m. May 10 (discharge, 122,000 second-feet); minimum discharge, 50 second-feet at 11 a. m. March 23.

1898–1922: Maximum stage recorded, 39.7 feet December 3, 1913 (discharge not determined); no flow August 20–21, 1918.

ICE.—None reported during year.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 15,000 second-feet and fairly well defined for all stages. Operation of water-stage recorder satisfactory from October 1 to May 5, except for short breaks in record January 1–8 and May 26–31, and from May 6 to September 30 when United States Weather Bureau record of one reading daily to tenths was used, except for May 10, 11, 12, and 23, when several readings were made. October 1 to May 5, mean daily gage heights obtained 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 fair.

COOPERATION.—Record of gage heights furnished by United States Weather Bureau May 6 to September 30.

Discharge measurements of Brazos River at Waco, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 24	C. E. Ellsworth	5.88	91.6	May 11	C. E. Ellsworth	29.2	[a] 85,100
Nov. 26	Trigg Twichell	5.90	100	12	do	25.4	[a] 54,300
Feb. 18	D. A. Dudley	5.92	78	23	H. E. Isaacks	15.05	13,200
Apr. 20	McCashin and Isaacks	8.37	2,050	June 21	do	7.25	1,810
27	H. E. Isaacks	30.2	[a] 85,000	Aug. 17	C. E. Ellsworth	4.45	122
May 10	C. E. Ellsworth	[b] 33.6	114,000	Sept. 23	H. E. Isaacks	4.25	161

[a] Surface velocity observed and coefficient of 0.96 used to reduce to mean velocity.
[b] Weather Bureau gage used beginning with this measurement.

Daily discharge, in second-feet, of Brazos River at Waco, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	417	67	134	81	121	117	455	32,000	1,660	875	161	117
2	360	66	134	81	106	90	275	30,700	1,890	800	161	117
3	318	63	108	81	102	84	1,960	29,800	1,460	730	161	161
4	292	62	100	98	98	81	73,500	25,700	2,900	3,050	138	138
5	265	63	98	67	100	81	63,300	17,800	2,300	2,300	138	138
6	242	63	96	67	93	74	15,400	14,800	1,770	1,890	138	138
7	230	63	104	67	91	71	12,500	17,800	16,400	1,110	117	138
8	217	62	111	67	100	73	9,800	15,800	20,600	800	117	138
9	245	61	106	70	102	74	12,200	66,400	13,100	660	138	138
10	239	60	98	90	95	68	10,100	117,000	7,850	660	117	138
11	211	60	96	83	90	65	27,700	85,300	4,900	543	98	138
12	186	60	96	77	86	62	24,500	55,200	4,900	600	98	117
13	178	60	95	74	77	62	15,800	26,500	3,950	1,370	98	117
14	171	59	93	73	77	61	11,300	23,300	3,800	1,110	98	117
15	164	60	91	74	77	59	7,600	40,400	3,200	1,030	98	117
16	154	62	88	73	73	56	4,200	38,500	2,900	875	98	138
17	150	61	86	67	67	55	3,650	15,400	2,900	730	98	138
18	143	62	80	73	77	63	4,900	7,600	2,600	600	117	138
19	132	66	80	65	78	60	2,450	4,900	2,450	600	117	161
20	119	63	78	62	74	55	1,890	3,650	2,020	490	138	161
21	109	62	75	61	73	55	1,510	2,900	1,770	440	117	186
22	100	70	84	63	71	54	1,250	24,500	1,560	394	117	161
23	98	70	75	73	71	52	1,090	15,400	1,460	394	98	161
24	93	74	75	75	70	55	1,280	5,300	1,280	314	98	186
25	90	78	75	77	81	50	8,100	3,350	1,190	278	98	161
26	84	91	74	77	98	214	54,700	2,750	1,030	278	98	161
27	77	91	74	78	102	138	74,600	2,300	1,030	245	117	161
28	81	78	74	86	95	117	52,600	2,300	1,030	245	117	138
29	75	73	75	125	-------	3,800	40,900	1,770	950	214	117	138
30	71	84	74	125	-------	1,190	30,200	1,660	1,030	214	117	138
31	67	-------	74	121	-------	1,890	-------	2,900	-------	186	117	-------

NOTE.—Owing to incomplete record discharge partly estimated Dec. 2, 3, 17, 23, 24, 30, 31, Jan. 21, Feb. 4, Mar. 24, 25, and Apr. 1. United States Weather Bureau record of stage used Jan. 1–8, Mar. 26–31, and May 6 to Sept. 30.

Monthly discharge of Brazos River at Waco, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	417	67	173	10,700
November	91	59	67.1	3,990
December	134	74	90.4	5,560
January	125	61	79.1	4,860
February	121	67	87.3	4,850
March	3,800	50	291	17,900
April	74,600	275	19,000	1,130,000
May	117,000	1,660	23,700	1,460,000
June	20,600	950	3,860	230,000
July	3,050	186	775	47,700
August	161	98	118	7,250
September	186	117	143	8,520
The year	117,000	50	4,040	2,930,000

BRAZOS RIVER NEAR COLLEGE STATION, TEX.

LOCATION.—At Jones Bridge, 4 miles below Munson Shoals, 6 miles southwest of College Station, Brazos County, 19 miles above mouth of Yegua River, and 30 miles above mouth of Navasota River.

DRAINAGE AREA.—35,400 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—February 23, 1918, to September 30, 1922.

GAGE.—Standard chain gage on upstream handrail of bridge installed April 18, 1922; read by Lamar McRae. Gage from February 23, 1918, to April 17, 1922, was vertical staff in two sections on fourth pier from right bank. Section 0 to 14 feet was attached to sheet piling around footing of pier. Section 14 to 52 feet was painted on same pier.

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

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, 49.0 feet 7 a. m. April 6 to 7 a. m. April 7 (discharge, 121,000 second-feet); minimum stage, 5.6 feet March 21–24 (discharge, 380 second-feet, subject to error owing to inability of observer to read gage accurately).

1918–1922: Maximum stage recorded, 53.0 feet, 1 to 3 a. m. September 12, 1921 (discharge not determined); minimum stage, 3.75 feet September 4, 1918 (discharge, 92 second-feet).

ICE.—None reported during year.

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 Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 13	J. T. L. McNew	5.65	565	Mar. 28	J. T. L. McNew	10.6	4,100
25	Twichell and Kerr	5.70	590	Apr. 19	C. E. McCashin	13.17	7,900
Dec. 15	J. T. L. McNew	6.00	551	30	J. T. L. McNew	46.85	*112,000
Jan. 22	do	6.30	474	July 8	C. E. Ellsworth	7.90	3,540
Feb. 19	do	6.00	518	Sept. 29	McCashin and Slack	4.76	456

* Surface velocities observed and coefficient of 0.95 used to reduce to mean velocities.

Daily discharge, in second-feet, of Brazos River near College Station, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						5,230	24,200	97,300	5,230	2,960	1,350	550
2						5,230	19,000	109,000	4,640	2,960	1,280	550
3						4,310	10,800	117,000	8,140	2,780	1,210	550
4						1,350	86,500	118,000	4,640	2,620	1,080	550
5						1,140	98,600	116,000	5,870	2,460	1,140	550
6						825	121,000	101,000	8,140	2,870	1,140	505
7		1,500	570			825	101,000	92,500	7,660	3,140	1,080	505
8						825	85,200	61,800	20,000	3,600	1,080	505
9						660	45,600	45,900	23,200	3,050	1,140	480
10					496	550	33,000	64,300	19,000	2,700	1,080	460
11				512		550	28,200	87,000	9,920	2,540	1,010	460
12						550	34,100	98,200	9,560	2,540	1,010	460
13		565				550	33,000	102,000	8,840	2,460	1,010	460
14						550	25,300	73,400	8,300	2,300	1,010	460
15			551			550	17,900	51,800	8,140	2,780	1,010	460
16	1,500					550	13,000	74,600	6,000	2,870	945	460
17						550	10,300	81,300	5,480	2,960	945	480
18						550	7,660	49,400	4,990	2,870	885	480
19		578			518	550	7,660	37,500	4,750	2,540	885	480
20						460	7,980	33,500	4,640	2,460	885	440
21						380	5,110	28,800	4,420	2,300	825	440
22				474	518	380	4,640	25,300	4,000	2,220	825	400
23						380	4,100	41,300	3,600	2,080	825	400
24			512			380	3,800	35,500	3,410	1,920	825	400
25		590				605	3,800	21,100	3,410	1,920	825	400
26					2,150	1,490	21,900	13,900	3,410	1,700	742	400
27				496	4,750	4,000	60,400	12,100	3,230	1,630	715	400
28		570			5,110	4,310	94,500	10,300	3,050	1,630	715	400
29					-------	4,310	114,000	8,840	2,870	1,630	715	400
30					-------	34,800	111,000	7,980	2,780	1,560	715	420
31					-------	38,800	-------	7,180	-------	1,420	715	-------

NOTE.—Braced figures show estimated mean discharge for periods included. Discharge Feb. 26 to Mar. 31 subject to some error owing to poor condition of gage.

Monthly discharge of Brazos River near College Station, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	-------	-------	1,500	92,200
November	-------	-------	945	56,300
December	-------	-------	539	33,200
January	-------	-------	506	31,100
February	-------	-------	877	48,700
March	38,800	380	3,760	231,000
April	121,000	3,800	39,300	2,340,000
May	118,000	7,180	58,800	3,620,000
June	23,200	2,780	7,040	419,000
July	3,600	1,420	2,430	150,000
August	1,350	715	955	58,700
September	550	400	463	27,600
The year	121,000	-------	9,810	7,100,000

CLEAR FORK OF BRAZOS RIVER AT CRYSTAL FALLS, TEX.

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

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—Gage height from November 12, 1921, to September 30, 1922.

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

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 STAGE.—Maximum stage during period November 12, 1921, to September 30, 1922, 18.25 feet at 10.30 p. m. April 30 (discharge, not determined). No flow during long period.

ICE.—None reported during period of record.

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 not developed. Gage read to hundredths twice daily. Daily discharge not determined.

No flow on November 12, 1921, when station was established. No discharge measurements have been made during the year.

Daily gage height, in feet, of Clear Fork of Brazos River at Crystal Falls, Tex., for the year ending Sept. 30, 1922

Day	Apr.	May	June	July	Aug.	Day	Apr.	May	June	July	Aug.
1	-------	16.40	0.31	0.17	0.07	16	0.17	1.01	0.29	0.10	-------
2	-------	4.22	.53	.19	-------	17	.16	1.57	.25	.10	-------
3	-------	2.82	.84	.36	-------	18	.15	2.04	.58	.09	-------
4	0.87	4.18	2.26	.59	-------	19	.14	1.50	.28	.09	-------
5	.43	4.65	3.06	.38	-------	20	.11	1.30	.24	.10	-------
6	.84	3.44	2.32	.32	-------	21	.06	.97	.42	.10	-------
7	.74	2.39	1.78	.30	.02	22	.06	.81	.43	.09	-------
8	6.99	2.49	1.30	.20	.04	23	.21	.68	.39	.05	-------
9	13.34	3.98	1.14	-------	.02	24	1.04	.57	.31	.0	-------
10	5.12	6.65	1.19	-------	.03	25	1.44	.57	.27	.06	-------
11	3.52	9.35	.95	-------	.03	26	9.38	.52	.24	.05	-------
12	1.06	9.70	.66	-------	-------	27	15.63	.43	.21	.03	-------
13	.60	5.10	.50	.11	-------	28	13.02	.40	.21	.03	-------
14	.38	1.21	.42	.12	-------	29	13.40	.40	.19	.02	-------
15	.27	1.00	.34	.12	-------	30	17.75	.45	.18	.01	-------
						31	-------	.37	-------	.01	-------

NOTE.—No flow Nov. 12 to Apr. 3, July 24, Aug. 2–6, and Aug. 12 to Sept. 30. No record July 9–12.

LITTLE RIVER AT CAMERON, TEX.

LOCATION.—200 feet below city pumping plant, half a mile south of Cameron, Milam County, 1 mile above Gulf, Colorado & Santa Fe Railway bridge, 6 miles below mouth of San Gabriel River, and 25 miles above confluence with Brazos River.

DRAINAGE AREA.—7,010 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—November 1, 1916, to September 30, 1922.

GAGE.—Vertical and inclined staff; three sections attached to trees on left bank a short distance below home of pumpman; read by M. H. Hayes or R. G. McClellan.

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

CHANNEL AND CONTROL.—Bed composed of rock, gravel, and sand; free from vegetation; shifts. Banks composed of clay and gravel; medium height; wooded; subject to overflow only during extreme stages. At a stage of about 18 feet (discharge, 6,950 second-feet), water begins to enter old channel a mile above gage and returns to main channel below the gage; consequently, all records of discharge greater than 6,950 second-feet, do not represent the total flow of the stream, but only that in the main channel. Rock and gravel shoal 100 feet below gage serves as control for low and medium stages; shifts. During extremely high stages on Brazos River, backwater may reach gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 34.7 feet on April 5 (discharge, 14,700 second-feet, determined by extension of rating curve and subject to error); minimum discharge, 122 second-feet on September 10.

1917–1922: 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. This was total discharge of river); minimum stage, 0.78 foot at 7 a. m. September 3, 5, and 7, 1918 (discharge, 2.6 second-feet).

ICE.—None reported.

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 the station. No diversions of consequence below the station. During time of low flow, water pumped by Cameron Power & Light Co. affects the flow at this station. See also "Channel and control."

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

ACCURACY.—Stage-discharge relation not permanent. Extremely high stages of Brazos River may cause backwater at this station. Rating curve well defined from 5 to 1,500 second-feet, and fairly well defined to 14,000 second-feet. However, this curve is for main channel only. Above a discharge of about 6,950 second-feet, water enters an old channel about a mile above gage and returns to river below the gage. Gage read to hundredths twice daily and oftener during floods. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Little River at Cameron, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 15	Trigg Twichell	3.90	520	Apr. 17	C. E. McCashin	9.61	2,470
Nov. 24	do	2.84	308	July 8	C. E. Ellsworth	5.01	791
Feb. 16	D. A. Dudley	2.45	218	Sept. 29	McCashin and Slack	2.24	165

Daily discharge, in second-feet, of Little River at Cameron, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,680		441	228	565	3,510	8,660	12,900	3,690	721	216	131
2	957		565	228	518	1,380	3,200	14,200	3,060	689	216	129
3	889		923	216	426	534	2,440	13,300	3,790	658	264	127
4	889		787	216	364	456	12,900	13,600	5,210	658	192	127
5	855		705	216	317	394	14,600	13,600	2,790	658	192	127
6	787		503	216	317	379	13,200	12,800	2,400	721	192	127
7	753		410	216	286	317	12,500	12,300	2,790	787	192	127
8	721		426	216	270	302	11,700	9,670	3,150	753	180	125
9	721		426	216	255	286	10,500	10,100	3,510	689	192	124
10	689		394	242	255	270	7,460	8,950	3,650	787	180	122
11	658		379	255	255	270	5,740	8,810	3,020	721	192	154
12	596	324	379	270	255	270	5,640	9,050	2,440	658	192	221
13	596		394	302	228	255	5,500	9,670	2,160	596	192	236
14	596		364	270	221	242	4,730	8,760	1,960	534	192	226
15	534		332	255	209	228	3,380	8,660	1,800	534	180	204
16	503		332	286	209	228	2,790	12,200	1,640	596	180	194
17	488		302	302	209	216	2,520	12,300	1,480	503	180	197
18	472		286	348	209	216	2,360	12,200	1,380	472	180	190
19	472		286	317	209	199	2,200	12,100	1,300	441	169	185
20	441		302	286	209	199	2,040	11,400	1,270	394	169	178
21	410		270	242	209	187	1,880	10,600	1,880	379	169	171
22	410		270	216	209	187	1,760	9,960	1,440	348	169	165
23	379		255	204	209	187	1,720	8,180	1,130	317	158	160
24	379	317	255	216	228	187	1,640	6,170	1,130	302	148	156
25	348	332	255	228	302	1,020	4,540	4,320	1,130	286	144	154
26	348	364	270	242	3,460	3,650	11,200	4,020	1,060	286	136	152
27	332	394	270	286	2,880	2,160	12,600	3,600	957	286	136	150
28		488	255	317	1,760	957	13,700	3,380	889	270	136	148
29		456	242	721		3,880	12,800	3,200	821	242	134	148
30	324	394	242	1,600		12,900	12,400	3,150	753	228	133	148
31			242	787		12,000		8,240		216	131	

NOTE.—Braced figures show estimated mean discharge for periods included.

Monthly discharge of Little River at Cameron, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,680		587	36,100
November			340	20,200
December	923	242	379	23,300
January	1,600	204	328	20,200
February	3,460	209	537	29,800
March	12,900	187	1,530	94,100
April	14,600	1,640	6,940	413,000
May	14,200	3,150	9,250	569,000
June	5,210	753	2,120	126,000
July	787	216	507	31,200
August	216	131	173	10,700
September	236	122	160	9,530
The year	14,600		1,910	1,380,000

COLORADO RIVER BASIN

COLORADO RIVER AT BALLINGER, TEX.

LOCATION.—At Hutchins Avenue highway bridge, 800 feet below Gulf, Colorado & Santa Fe Railway bridge at Ballinger, Runnels County, 1 mile above mouth of Elm Creek.

DRAINAGE AREA.—12,500 square miles (revised; measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of United States Geological Survey; scale, 1 inch= 25 miles).

RECORDS AVAILABLE.—December 11, 1915, to September 30, 1922. Records of stage have been obtained by the United States Weather Bureau since July 1, 1903; current-meter measurements were begun May 29, 1915.

GAGE.—Chain gage attached to downstream handrail of bridge; read by A. J. Voelkel. Zero of gage lowered 1 foot on May 4, 1921.

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, and gravel; shifting. Control is shoal 1,000 feet below gage; subject to change.

ICE.—None reported during year.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 26.0 feet, during night of April 26 (discharge, about 28,000 second-feet, determined from extension of rating curve and subject to large error). No flow October 1 to November 30, March 7–24, and April 18–23.

1916–1922: Maximum stage recorded that of April 26, 1922; no flow during several periods.

DIVERSIONS.—During low stages a large part of the flow is diverted a few miles above the station for irrigation. Records of the Board of Water Engineers for the State of Texas show that about 6,000 acres have been declared irrigated above the station.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined from 0 to 16,000 second-feet. Gage read to hundredths twice daily. Daily discharge determined by indirect method for shifting control, except from April 3 to August 9, when daily mean gage height was applied to rating table and as noted in footnote to daily-discharge table. Records poor.

Discharge measurements of Colorado River at Ballinger, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 8	Ellsworth and Dudley	[a]—.03	0.0	May 4	C. E. McCashin	7.66	4,710
Jan. 13	R. G. West	.24	.6	July 30	Trigg Twichell	.94	17.8
May 2	C. E. McCashin	16.50	[b]15,200				

[a] Below point of zero flow.
[b] Surface velocities taken for part of measurement and coefficient used to reduce to mean velocities.

Daily discharge, in second-feet, of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1922

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1					24	9,710	280	95	10	4.8
2					14	15,900	302	410	9.2	4.4
3					3,300	7,310	2,850	1,200	8.4	5.6
4				0.5	1,920	4,070	6,650	235	7.6	5.6
5					2,080	2,580	2,760	119	6.0	4.4
6					700	1,410	1,480	267	10	3.2
7					500	920	2,670	207	9.2	2.4
8					16,200	700	1,130	194	9.2	2.0
9					2,940	1,840	750	152	9.2	2.4
10					800	4,070	650	113	26	78
11					600	1,920	478	95	17	16
12					365	990	410	68	12	12
13					116	650	298	60	12	28
14					58	478	247	58	10	25
15	1.0	0.5	0.5		54	18,200	218	50	7.6	16
16					4	12,500	194	42	7.6	11
17					1	10,800	188	38	6.8	9.2
18						3,480	1,200	36	6.0	6.8
19						1,760	2,000	34	7.6	26
20						1,340	1,270	37	9.2	32
21						2,320	750	26	8.4	4.8
22						750	525	22	8.4	3.6
23						550	320	28	7.6	2.4
24					750	422	228	22	6.0	2.0
25				90	1,760	410	185	21	4.8	2.0
26				194	22,100	365	161	18	4.4	1.8
27				473	22,100	320	143	14	7.6	1.8
28				311	24,900	271	128	15	8.4	1.6
29				179	14,600	860	113	14	8.4	1.4
30				122	2,760	920	103	16	8.4	1.4
31				48		865		18	6.8	

NOTE.—Braced figures show estimated mean discharge for periods indicated. No flow for periods not recorded. Discharge Apr. 26–28 from extension of rating curve and subject to large error.

Monthly discharge of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
December			91.0	61
January			a.5	30
February			a.5	28
March	473	0	45.8	2,820
April	24,900	0	3,950	235,000
May	18,200	271	3,490	215,000
June	6,650	103	956	56,900
July	1,200	13	120	7,380
August	26	4.4	9.03	555
September	78	1.4	10.6	631
The year	24,900	0	716	518,000

a Estimated; see footnote to table of daily discharge.

NOTE.—No flow during October and November.

COLORADO RIVER NEAR CHADWICK, TEX.

LOCATION.—At Gulf, Colorado & Santa Fe Railway bridge half a mile below Chadwick dam, 1 mile above mouth of Elliott Creek, 2 miles west of Chadwick, on line between San Saba and Lampasas counties, and 2½ miles below mouth of San Saba River.

DRAINAGE AREA.—26,400 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—October 21, 1915, to October 31, 1922, when station was discontinued.

GAGE.—Vertical and inclined staff, in four sections on right bank, 75 feet upstream from railway bridge. A high-water section is painted on second concrete pier from left abutment of railway bridge; read by A. G. Walker. For history of gages used prior to April 1, 1920, see Water-Supply Paper 508, page 28.

DISCHARGE MEASUREMENTS.—Made either by wading or from railroad bridge at gage, or from Red Bluff highway bridge, 2½ miles below gage.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; shifts slightly. Channel straight above and below station for 1,000 feet. Left bank high, rocky, wooded, and not subject to overflow; right bank medium in height, wooded, composed of clay and gravel, and subject to overflow during extreme stages. Location of control not known, but current-meter measurements indicate that it shifts; affects stage-discharge relation at low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 51.5 feet at 3 p. m. April 26 (discharge not determined); minimum stage, 0.70 foot November 20 and 21 (discharge, 45 second-feet).

1916–1922: Maximum stage recorded that of April 26, 1922; minimum stage, 0.16 foot August 22 and 23, 1918 (discharge, 1.5 second-feet).

ICE.—None reported during year.

DIVERSIONS.—No large irrigation works have been completed in drainage basin above station, but tracts ranging in size from 5 to 1,500 acres adjacent to the main river and tributaries are irrigated by diversions. A large part of the irrigated area is in Runnels, Brown, and Mills counties and along Concho and San Saba rivers. Several small dams have been constructed in the drainage basin above station. Chadwick dam half a mile above creates a small pond and serves only to divert to a water wheel that has not been operated for some time. Records of the Board of Water Engineers for the State of Texas show that about 30,000 acres have been declared irrigated above the station.

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

ACCURACY.—Stage-discharge relation not permanent for low stages, but not seriously affected during medium or high stages. Rating curve well defined below 80,000 second-feet. Gage ordinarily read daily to hundredths during low and medium stages, and to tenths during high stages, but observer's readings subject to error. One reading a day may not be true index to discharge, owing to rapid fluctuations. Daily discharge determined by indirect method for shifting control during low stages and by applying gage heights to rating table for medium and high stages, except as noted in footnote to daily-discharge table. Records poor.

Discharge measurements of Colorado River near Chadwick, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 19	D. A. Dudley	0.70	45	July 28	Trigg Twichell	1.37	177
Jan. 11	R. G. West	.78	62	Oct. 6	Ellsworth and Slack	.87	101

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Daily discharge, in second-feet, of Colorado River, near Chadwick, Tex., for the period Oct. 1, 1921, to Oct. 31, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
1	91	54	54	85	81	64	1,180	67,300	3,230	200	169	105	109
2	99	54	54	81	77	68	705	63,700	1,320	230	167	105	105
3	202	57	51	77	77	70	575	50,400	1,250	1,460	159	103	105
4	305	54	48	77	75	70	17,300	59,700	5,820	9,300	155	103	105
5	235	54	48	62	75	74	26,800	56,100	10,400	11,000	139	103	105
6	195	54	48	62	75	74	7,220	54,300	8,520	4,540	125	103	101
7	151	54	51	62	77	72	6,460	4,870	7,350	1,680	125	103	101
8	107	52	57	62	77	70	4,650	6,370	3,050	1,250	121	105	101
9	91	51	72	64	77	70	4,210	7,870	3,320	900	125	105	105
10	75	52	75	64	75	69	18,600	9,430	1,840	758	141	103	103
11	66	52	79	68	77	68	26,600	6,000	1,390	615	311	103	101
12	63	51	75	68	77	64	6,120	5,660	1,120	535	283	105	101
13	60	48	72	64	77	62	2,240	4,010	900	465	143	104	101
14	60	48	69	64	75	58	900	2,870	800	395	143	103	105
15	63	48	69	64	70	56	705	14,800	705	341	139	103	105
16	60	50	75	68	68	54	615	34,700	705	277	139	105	105
17	57	50	74	68	64	52	335	37,800	615	264	139	105	121
18	57	48	74	70	64	50	305	46,100	615	250	137	105	121
19	57	46	72	69	62	50	305	25,200	465	235	125	103	117
20	54	45	69	68	62	50	245	6,340	1,600	230	125	101	117
21	54	45	69	68	62	50	210	6,340	1,840	225	107	103	113
22	54	48	66	70	63	52	205	5,310	1,390	210	107	103	113
23	54	51	66	70	64	52	200	4,760	1,060	147	105	103	109
24	54	57	66	70	64	50	198	3,810	900	103	103	107	109
25	54	57	66	70	63	81	17,300	3,610	705	195	103	111	113
26	51	60	69	74	62	70	86,000	1,250	575	190	103	117	113
27	51	60	69	77	62	342	81,800	900	500	184	105	117	117
28	51	57	70	79	64	615	88,400	750	395	178	103	121	117
29	51	57	72	81	------	1,250	77,900	705	335	173	103	141	121
30	51	54	75	70	------	8,260	68,900	5,310	277	173	101	121	117
31	52	------	83	74	------	2,600	--------	3,810	--------	169	101	-------	117

NOTE.—No record and discharge interpolated Oct. 3, 7, Nov. 11, 19, Dec. 17, 28, Jan. 7, 19, 28, Feb. 25, Mar. 10, 16, 27, May 8, June 4, July 10, 27, Aug. 23, 25, Sept. 5 and 13. Discharge Apr. 26, 27, and 28 from extension of rating curve and subject to error.

Monthly discharge of Colorado River near Chadwick, Tex., for the period Oct. 1, 1921, to Oct. 31, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1921–22				
October	305	51	87.9	5,400
November	60	45	52.3	3,110
December	83	48	66.4	4,080
January	85	62	70.0	4,300
February	81	62	70.2	3,900
March	8,260	50	474	29,100
April	88,400	198	18,200	1,090,000
May	67,300	705	19,400	1,190,000
June	10,400	277	2,100	125,000
July	11,000	103	1,190	73,100
August	311	101	137	8,430
September	141	101	107	6,380
The year	88,400	45	3,510	2,540,000
1922				
October	121	101	109	6,730

COLORADO RIVER AT MARBLE FALLS, TEX.

LOCATION.—At steel highway bridge one-fourth mile south of Marble Falls, Burnet County, 10 miles below mouth of Sandy Creek, 16 miles below mouth of Llano River, and 23 miles above mouth of Pedernales River.

DRAINAGE AREA.—32,200 square miles (measured on topographic and post-route maps.)

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1922. Miscellaneous discharge measurements were made in 1902. Records of stage have been obtained by the United States Weather Bureau since January 1, 1908.

GAGE.—United States Weather Bureau weight-and-tape gage on upstream side of bridge; read by M. M. Galloway.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock. Bank composed of rock, gravel, and clay; wooded, high, and not subject to overflow. Rapids just below gage serve as fairly permanent control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.3 feet at about 1 p. m. May 1 (discharge not determined); maximum stage, 1.10 feet at 7.30 a. m. October 30 and 31, and 7.30 a. m. to 5.30 p. m. November 20; (discharge, 63 second-feet, subject to error owing to influence of wind on tape).

1900–1922: Maximum stage,[4] 23.9 feet April 7, 1900 (discharge not determined); no flow August 7, 8, 11–25, 1918, caused by storing water above gage.

ICE.—None.

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 the station. Total amount diverted not known. Records of the Board of Water Engineers for the State of Texas show that approximately 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.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 0 to 4,000 second-feet and only fairly well defined above, owing to inability to read gage accurately, on account of surge and high velocities. Gage read to hundredths twice daily, though influence of wind on tape and surge of water at high stages may introduce some error. Daily discharge determined by applying mean daily gage height to rating table, except October 1 to April 3 when indirect method for shifting control was used and June 11 to July 19 when there was no record. Records good for low stages and poor for high stages.

The following discharge measurement was made by Ellsworth and Dudley: November 21, 1921: Gage height, 1.50 feet; discharge, 132 second-feet.

[4] United States Weather Bureau, Daily river stages.

Daily discharge, in second-feet, of Colorado River at Marble Falls, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	128	80	465	126	222	205	3,610	104,000	3,160	-------	236	154
2	156	97	242	118	228	195	1,640	68,000	5,470	-------	214	141
3	200	102	190	113	228	180	1,530	101,000	3,710	-------	255	148
4	195	107	148	113	216	180	56,900	69,400	3,180	-------	230	168
5	180	97	141	120	172	160	21,700	67,700	1,800	-------	187	156
6	170	114	139	128	185	180	23,900	65,600	6,890	-------	312	133
7	195	126	158	126	200	170	9,770	47,800	11,700	-------	208	129
8	288	111	246	139	200	175	5,080	9,340	5,960	-------	230	145
9	249	107	216	148	203	180	5,290	6,960	4,460	-------	362	150
10	249	90	152	320	195	170	5,320	10,300	4,790	-------	618	177
11	225	90	135	279	192	165	11,000	13,500	-------	-------	428	187
12	219	80	128	246	170	160	18,900	5,870	-------	-------	433	208
13	203	77	135	216	165	165	4,510	7,510	-------	-------	522	230
14	198	74	152	160	182	158	2,930	6,720	-------	-------	398	187
15	192	77	148	156	185	152	2,140	6,240	-------	-------	340	177
16	168	93	148	152	180	143	1,740	23,500	-------	-------	255	177
17	150	90	135	152	190	141	1,430	38,500	-------	-------	225	177
18	145	74	177	170	205	148	990	43,400	-------	-------	262	214
19	145	70	192	175	185	72	887	48,000	-------	-------	336	203
20	126	63	165	185	175	357	926	31,800	-------	141	328	198
21	111	124	156	180	185	93	1,010	16,800	-------	228	230	190
22	107	113	180	182	182	64	710	17,400	-------	200	230	195
23	93	120	190	195	175	85	618	14,300	-------	265	177	192
24	90	128	195	239	170	85	592	7,610	-------	353	177	205
25	90	128	219	208	177	109	4,850	3,980	-------	324	172	300
26	90	124	195	205	195	163	40,600	2,970	-------	324	158	540
27	80	116	170	195	216	423	102,000	2,560	-------	230	168	470
28	74	120	163	198	200	492	75,000	2,450	-------	180	168	418
29	74	143	156	233	-------	2,270	73,200	2,410	-------	203	158	219
30	66	148	156	228	-------	4,940	69,400	2,180	-------	195	163	152
31	66	-------	160	222	-------	10,400	-------	5,560	-------	230	156	-------

Monthly discharge of Colorado River at Marble Falls, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	288	66	152	9,370
November	148	63	103	6,120
December	465	128	179	11,000
January	320	113	182	11,200
February	228	165	192	10,700
March	10,400	64	728	44,800
April	102,000	592	18,300	1,090,000
May	104,000	2,180	27,500	1,690,000
June 1–10	11,700	1,800	5,110	101,000
July 20–31	353	141	239	5,700
August	618	156	269	16,500
September	540	129	211	12,600

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, 1 mile below mouth of Barton Creek, and 3½ miles below Austin dam.

DRAINAGE AREA.—34,200 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—February 15, 1898, to September 30, 1922. Records of stage have been obtained by United States Weather Bureau since July 1, 1903. See footnote to monthly-discharge table.

GAGE.—Stevens water-stage recorder installed April 26, 1918, on downstream side of pier of viaduct; inspected by engineers of United States Geological Survey. Record of depth of water on crest of dam, 3½ miles above Austin, was kept August 13, 1895, to April 7, 1900. Gage used February 15, 1898, to December 31, 1911, was a vertical staff attached to bathhouse on left bank of river 150 feet above Congress Avenue Bridge; during this period high-stage readings were made by means of a gage painted on first pier from left end of bridge and a chain gage attached to bridge. From January 1, 1912, to June 18, 1915, the vertical gage of United States Weather Bureau was read. Record from June 18, 1915, to April 25, 1918, was obtained by means of Dexter water-stage recorder installed at end of viaduct. All gages at or near bridge have been referred to same datum.

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 clean, improved by city, and subject to overflow; left bank resembles right bank, except that it is high and nearly vertical in places. Bed clean and 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, 22.6 feet at 11 p. m. May 1 (discharge, 120,000 second-feet); minimum stage, 0.42 foot at 5 p. m. March 22 (discharge, 135 second-feet).

1898–1922: Maximum stage recorded, 33.5 feet a few minutes after the failure of the 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 the depth of water over the crest of the dam was 11.07 feet, the computed discharge being 151,000 second-feet (a revision of previously published discharge). According to information obtained from persons living near Congress Avenue Bridge, the stage rose 6.1 feet as a result of failure of dam. From this, the gage height corresponding to a discharge of 151,000 second-feet was 27.4 feet. According to Mr. W. P. Johnson, who was in charge of the power plant at the dam, the flood appeared to be practically at crest stage when the dam failed. Minimum stage, −0.18 foot at 6 p. m. August 18, 1918 (discharge, 13.0 second-feet).

ICE.—None during year.

DIVERSIONS.—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 the 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 the Austin dam, about 3½ miles upstream. Neither sluice gates, crest gates, nor power plant at the dam were in operation during the years ending September 30, 1919–1922. Capacity of reservoir about 24,000 acre-feet.

ACCURACY.—Stage-discharge relation not permanent. Numerous measurements made throughout the year. 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. Mean daily gage height obtained from water-stage recorder chart by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, except as noted in footnote to daily discharge table. Records good.

From recent information it is thought that the discharge as published in Water-Supply Paper 408 for December 13–26, 1914, and February 9–17, 1915, is too low. Discharge on those days probably exceeded 20 second-feet. See also footnote to monthly-discharge table.

Discharge measurements of Colorado River at Austin, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	Trigg Twichell	1.10	563	Apr 28	Twichell and McKinney	20.93	97,500
25	do	.74	257	May 3	do	21.86	[a] 112,000
Nov. 28	do	.84	317	5	do	16.78	74,100
Dec. 28	do	.74	242	8	do	8.87	28,800
Jan. 26	do	.72	256	10	do	4.12	9,400
Feb. 27	do	.74	256	19	do	12.54	50,000
Mar. 25	do	.91	433	June 20	C. E. McCashin	1.60	1,420
Apr. 1	Ellsworth and McCashin	3.86	9,540	July 13	Trigg Twichell	1.56	1,500
3	Trigg Twichell	2.08	3,080	Aug. 9	do	.64	340
6	do	9.53	[a] 34,700	28	do	.44	249
13	C. E. McCashin	7.98	26,000	Sept. 19	Twichell and Slack	.41	238
27	Twichell and McKinney	19.2	[a] 87,900	20	do	.48	270

[a] Surface velocities observed for part of measurement and coefficient used to reduce to mean velocities.

Daily discharge, in second-feet, of Colorado River at Austin, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	400	206	294	206	336	250	8,680	94,700	5,010	986	352	234
2	376	206	262	191	336	233	5,740	97,700	2,980	886	320	227
3	376	200	436	200	328	228	2,190	99,900	5,990	900	314	220
4	830	196	510	228	328	224	15,600	89,900	5,120	858	294	214
5	1,110	191	392	206	328	220	45,500	73,000	4,420	1,050	307	207
6	791	186	320	206	360	216	32,000	65,700	3,240	6,100	320	200
7	645	196	307	206	250	212	21,100	60,500	4,590	11,000	294	196
8	481	191	307	211	250	208	10,900	34,800	8,840	7,220	314	186
9	418	206	255	211	268	204	6,300	13,800	6,720	4,170	328	200
10	392	182	250	300	262	200	4,760	10,400	8,880	2,840	320	274
11	520	186	244	262	250	196	6,410	11,400	5,500	2,140	520	244
12	560	191	250	222	262	206	22,700	12,000	4,520	1,750	858	200
13	500	200	244	244	250	255	22,800	9,000	3,510	1,490	634	200
14	454	206	250	250	238	255	8,160	8,680	2,870	1,250	520	211
15	445	200	238	274	238	216	3,920	8,760	2,410	1,070	570	262
16	427	211	238	320	191	200	2,770	9,320	2,080	956	560	307
17	400	211	268	262	200	186	2,310	26,200	1,860	900	490	300
18	409	244	196	268	216	222	1,860	37,800	1,690	830	436	268
19	376	228	211	268	216	250	1,690	46,000	1,530	752	384	268
20	307	191	228	267	222	168	1,470	42,200	1,410	678	366	262
21	281	186	233	266	196	164	1,320	24,800	1,320	634	368	244
22	262	191	233	266	216	160	1,320	14,100	1,550	612	384	222
23	262	206	244	265	244	178	1,300	13,700	2,560	580	368	228
24	255	211	288	264	244	178	1,200	13,500	2,870	540	328	228
25	255	206	216	263	262	307	1,220	9,440	2,540	510	294	238
26	250	222	211	262	268	314	3,210	6,130	2,050	481	274	238
27	233	300	233	262	255	250	71,800	4,660	1,690	445	268	255
28	250	314	238	274	307	244	103,000	3,890	1,450	436	261	600
29	216	294	244	274	-------	244	67,600	3,420	1,250	409	254	800
30	211	268	228	352	-------	970	86,200	3,300	1,100	384	248	500
31	206	-------	233	336	-------	3,750	-------	3,300	-------	368	241	-------

NOTE.—Owing to incomplete record, discharge partly estimated Jan. 18, 27, Mar. 2, 11, and 27–30, Aug. 28, and Sept. 6. No record and discharge interpolated Jan. 19–26, Mar. 3–10, and Aug. 29 to Sept. 5. Discharge estimated Sept. 28–30.

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1898				
February 15–28	1,150	374	635	17,600
March	505	322	367	22,600
April	7,200	348	1,590	94,600
May	17,000	374	2,110	130,000
June	30,200	348	7,350	437,000
July	4,050	348	996	61,200
August	2,800	348	636	39,100
September	7,900	322	1,190	70,800
The period				873,000
1898–99				
October	695	188	422	25,900
November	374	278	330	19,600
December	404	260	332	20,400
January	404	300	332	20,400
February	434	260	311	17,300
March	300	178	253	15,600
April	3,650	178	675	40,200
May	18,400	300	3,530	217,000
June	91,800	1,320	13,800	821,000
July	5,980	498	2,140	132,000
August	2,700	405	552	33,900
September	368	248	320	19,000
The year	91,800	178	1,910	1,380,000
1899–1900				
October	3,280	195	512	31,500
November	13,800	368	2,160	129,000
December	14,000	718	2,930	180,000
January	2,500	1,190	1,510	92,800
February	1,600	525	848	47,100
March	2,500	670	1,250	76,900
April	145,000	1,840	21,800	1,300,000
May	36,200	5,100	10,100	621,000
June	10,400	1,020	3,250	193,000
July	26,500	880	4,860	299,000
August	10,800	880	3,480	214,000
September	98,400	765	14,600	869,000
The year	145,000	195	5,600	4,050,000
1900–1901				
October	12,800	3,150	5,930	365,000
November	17,000	2,500	4,410	262,000
December	2,500	1,900	2,160	133,000
January	1,900	1,510	1,740	107,000
February	1,510	1,240	1,440	80,000
March	1,150	815	949	58,400
April	1,240	660	844	50,200
May	3,900	580	1,470	90,400
June	3,280	262	891	53,000
July	28,700	200	2,760	170,000
August	1,150	250	513	31,500
September	14,600	335	2,930	174,000
The year	28,700	200	2,170	1,570,000
1901–2				
October	660	370	431	26,500
November	5,280	370	1,040	61,900
December	580	410	454	27,900
January	488	390	423	26,000
February	488	410	445	24,700
March	4,050	352	797	49,000
April	11,600	314	1,870	111,000
May	22,400	370	3,200	197,000
June	7,720	180	918	54,600
July	35,900	335	7,330	451,000
August	27,800	290	2,910	179,000
September	8,250	290	1,630	97,000
The year	35,900	180	1,800	1,310,000

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1902–3				
October	7,200	262	1,090	67,000
November	30,900	275	5,890	350,000
December	7,020	460	1,410	86,700
January	2,700	515	1,040	64,000
February	33,700	660	4,890	272,000
March	17,600	2,000	4,750	292,000
April	9,300	815	1,980	118,000
May	7,720	760	2,360	145,000
June	12,600	870	2,400	143,000
July	9,650	305	1,410	86,700
August	3,020	275	768	47,200
September	3,400	275	715	42,500
The year	33,700	262	2,370	1,710,000
1903–4				
October	30,900	335	4,530	279,000
November	548	370	423	25,200
December	352	335	345	21,200
January	352	352	352	21,600
February	2,000	352	614	35,300
March	710	262	367	22,600
April	4,650	225	666	39,600
May	12,800	488	3,180	196,000
June	31,500	1,080	6,440	383,000
July	17,600	335	2,520	155,000
August	9,120	250	1,050	64,600
September	13,000	225	2,930	174,000
The year	31,500	225	1,950	1,420,000
1904–5				
October	10,200	305	1,430	87,900
November	1,600	370	540	32,100
December	515	335	397	24,400
January	370	305	337	20,700
February	515	320	366	20,300
March	11,400	335	1,560	95,900
April	52,900	515	6,670	397,000
May	31,100	1,510	8,360	514,000
June	4,050	488	1,350	80,300
July	12,200	335	1,970	121,000
August	5,620	180	746	45,900
September	1,320	180	408	24,300
The year	52,900	180	2,020	1,460,000
1905–6				
October	2,800		546	33,600
November	1,800		381	22,700
December	335		222	13,600
January	200		177	10,900
February	305		191	10,600
March	660		204	12,500
April	2,500		692	41,200
May	8,950		1,060	65,200
June	38,000		3,270	195,000
July	10,400		5,750	354,000
August	78,500		12,300	756,000
September	20,900		8,830	525,000
The year	78,500		2,820	2,040,000
1906–7				
October	760		335	20,600
November	410		268	15,900
December	1,700		698	42,900
January	306		217	13,300
February	260		225	12,500
March	260		203	12,500
April	543		145	8,630
May	28,100		3,400	209,000
June	18,400		3,100	184,000
July	27,800		4,680	288,000
August	840		266	16,400
September	613		156	9,280
The year	28,100		1,150	833,000

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1907–8				
October	20,700		3,480	214,000
November	27,000		3,920	233,000
December	1,849		949	58,400
January	1,260		515	31,700
February	3,120		885	50,900
March	1,680		589	36,200
April	100,000		11,600	690,000
May	64,600		11,600	707,000
June	7,090		2,070	123,000
July	8,260		2,030	125,000
August	8,640		1,580	97,200
September	6,320		1,610	95,800
The year	100,000		3,400	2,460,000
1908–9				
October	7,080		1,190	73,200
November	760		367	21,800
December	2,020		566	34,800
January	478		350	21,500
February	418		251	13,900
March	260		188	11,600
April	3,120		349	20,800
May	18,000		3,180	196,000
June	29,700		4,520	269,000
July	28,500		3,350	206,000
August	3,360		1,270	78,100
September	5,600		1,160	69,000
The year	29,700		1,400	1,020,000
1909–10				
October	11,000	478	2,610	160,000
November	1,530	418	768	45,700
December	11,800	478	2,120	130,000
January	478	183	298	18,300
February	543	306	417	23,280
March	306	183	263	16,200
April	18,000	478	3,840	228,000
May	15,700	306	2,090	129,000
June	543	61	238	14,200
July	2,650	96	444	27,300
August	478	40	130	7,990
September	27,400	61	1,770	105,000
The year	27,400	40	1,250	905,000
1910–11				
October	2,650		488	30,000
November	359		195	11,600
December	613		242	14,900
January	400		283	17,400
February	23,200		3,800	211,080
March	1,460		761	46,800
April	19,300		4,120	245,090
May	11,500		2,120	130,000
June	1,460		394	23,460
July	14,200		2,190	135,000
August	12,200		1,690	104,000
September	27,400		5,440	324,000
The year	27,400		1,790	1,290,000
1911–12				
October	1,100		549	33,800
November	400		245	14,600
December	17,400		1,600	98,400
January	1,280		594	36,500
February	5,060		701	40,300
March	4,040		999	61,400
April	7,200		1,040	61,900
May	8,970		1,490	91,600
June	7,780		1,560	92,800
July	1,100		343	21,100
August	2,670		793	48,800
September	3,100		592	35,200
The year	17,400		877	636,000

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1912–13				
October	11,500		1,370	84,200
November	1,100		398	23,700
December	940		630	38,700
January	680		568	34,900
February	680		577	32,000
March	480		480	29,500
April	6,100		812	48,300
May	40,300		5,410	333,000
June	20,500		2,930	174,000
July	13,900		2,130	131,000
August	2,460		676	41,600
September	16,000		2,140	127,000
The year	40,300		1,520	1,100,000
1913–14				
October	29,700		7,070	435,000
November	49,900		9,440	562,000
December	141,000		23,800	1,460,000
January	3,100		2,040	125,000
February	1,460		1,160	64,400
March	3,550		1,160	71,300
April	11,500		3,060	182,000
May	49,900		18,400	1,130,000
June	61,500		11,300	672,000
July	2,670		1,730	106,000
August	41,300		8,380	515,000
September	9,600		2,140	127,000
The year	141,000		7,530	5,450,000
1914–15				
October	7,340	355	1,920	118,000
November	6,540	840	1,950	116,000
December	7,070	2	1,730	106,000
January	2,010	1,010	1,390	85,500
February	3,640	4	944	52,400
March	4,980	300	1,630	100,000
April	68,000	255	10,300	613,000
May	21,400	255	5,430	334,000
June	4,170	125	678	40,300
July	1,280	560	986	60,600
August	1,280	580	966	59,400
September	84,000	85	8,230	490,000
The year	84,000	2	3,010	2,180,000
1915–16				
October	3,520	100	1,420	87,300
November	810	496	617	36,700
December	4,470	452	1,160	71,300
January	1,680	445	767	47,200
February	1,000	488	660	38,000
March	488	250	350	21,500
April	13,800	843	3,510	209,000
May	28,200	830	3,990	245,000
June	1,070	225	571	34,000
July	1,410	202	701	43,100
August	816	212	416	25,600
September	945	80	264	15,700
The year	28,200	80	1,200	874,000
1916–17				
October	9,750	138	1,020	62,700
November	510	200	301	17,900
December	500	220	306	18,800
January	360	220	273	16,800
February	360	236	302	16,800
March	880	200	323	19,900
April	800	165	277	16,500
May	5,840	220	1,180	72,600
June	5,000	260	1,210	72,000
July	1,440	88	390	24,000
August	88	52	70.3	4,320
September	7,840	75	1,420	84,500
The year	9,750	52	590	427,000

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1917–18				
October	196	128	148	9,100
November	196	128	159	9,460
December	354	142	209	12,900
January	3,880	212	565	34,700
February	292	156	193	10,700
March	220	78	143	8,790
April	38,400	135	3,220	192,000
May	9,690	392	1,420	87,300
June	22,400	232	2,950	176,000
July	1,010	36	520	32,000
August	996	22	131	8,060
September	3,050	105	775	46,100
The year	38,400	22	865	627,000
1918–19				
October	26,900	123	6,280	386,000
November	64,700	1,020	11,100	660,000
December	41,500	750	5,200	320,000
January	23,800	1,020	5,450	335,000
February	9,250	1,650	3,010	167,000
March	24,800	939	4,960	305,000
April	7,580	1,000	3,120	186,000
May	13,600	2,970	7,310	449,000
June	29,500	2,150	13,100	780,000
July	39,200	1,970	9,680	595,000
August	24,100	1,000	4,760	293,000
September	64,200	990	9,380	558,000
The year	64,700	123	6,950	5,030,000
1919–20				
October	44,600	4,350	14,200	873,000
November	27,400	3,760	7,050	420,000
December	6,990	1,920	3,410	210,000
January	15,100	2,120	5,460	336,000
February	4,230	2,440	3,340	192,000
March	3,140	1,650	2,120	130,000
April	1,880	765	1,190	70,800
May	20,600	664	6,450	397,000
June	3,060	939	1,600	95,200
July	1,700	405	806	49,600
August	28,100	599	6,720	413,000
September	24,400	664	5,260	313,000
The year	44,600	405	4,820	3,500,000
1920–21				
October	3,030	494	944	58,000
November	3,620	735	1,280	76,200
December	1,970	638	845	52,000
January	856	599	684	42,100
February	750	516	608	33,800
March	1,670	677	990	60,900
April	3,560	677	1,870	111,000
May	2,470	423	964	59,300
June	50,200	288	5,090	303,000
July	890	154	387	23,800
August	148	66	89.2	5,480
September	45,800	64	3,410	203,000
The year	50,200	64	1,420	1,030,000

Monthly discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1898–1922—Continued

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1921–22				
October	1,110	206	416	25,600
November	314	182	214	12,700
December	510	196	268	16,500
January	352	191	254	15,600
February	360	191	261	14,500
March	3,750	160	358	22,000
April	103,000	1,200	19,500	1,160,000
May	99,900	3,300	30,700	1,890,000
June	8,880	1,100	3,380	201,000
July	11,000	368	1,720	106,000
August	858	241	380	23,400
September	----------	186	274	16,300
The year	103,000	160	4,840	3,500,000

NOTE—Discharge records prior to Jan. 1, 1912, have been revised, as more information is now available than when first published. Discharge records from Jan. 1, 1911, to Sept. 30, 1914, not previously published have been computed from gage records furnished by the United States Weather Bureau, using rating curve based on discharge measurements made during 1910, 1914, and 1915. All daily-discharge figures and some minimum monthly-discharge figures prior to Sept. 30, 1914, have been withheld because of probability of large errors, due to changes in stage-discharge relation and insufficient discharge measurements. Such figures published in earlier reports should be used with caution. Records herewith published prior to Sept. 30, 1914, are considered fairly accurate, except during low stages when gross errors may be expected, particularly during the years 1906–1909 and 1911–1914 when no discharge measurements were made, except a series of high-stage measurements in June, 1906. Monthly-discharge records from October, 1914, to September, 1921, are the same as those published in previous reports, and are considered reliable.

Days of deficiency in discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1899–1922, revised in 1922

Discharge in second-feet	Days of deficient discharge											
	1898–99	1899–1900	1900–1	1901–2	1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10
100	-------	-------	-------	-------	-------	-------	-------	-------	45	-------	-------	36
200	17	1	-------	1	-------	-------	15	93	107	1	34	55
300	63	22	19	13	15	24	31	185	217	11	94	102
400	213	28	34	64	51	151	124	212	247	41	156	165
500	261	37	55	202	71	189	176	224	268	78	195	228
600	274	46	63	234	93	215	216	232	275	92	203	241
700	281	60	80	246	105	225	227	237	300	142	226	266
800	284	77	98	262	128	237	238	242	309	166	234	279
900	287	92	126	268	155	248	244	246	315	179	244	281
1,000	287	94	135	272	165	254	249	247	319	190	250	294
1,200	292	146	162	283	192	265	262	258	328	225	273	307
1,400	297	179	172	290	213	270	269	262	330	256	293	319
1,600	298	181	209	294	231	279	277	267	332	261	299	321
1,800	301	198	215	302	240	287	285	270	334	271	310	321
2,000	302	210	247	308	251	292	292	274	336	276	317	322
3,000	318	253	303	330	302	312	309	298	342	299	332	335
4,000	333	268	322	336	318	323	323	309	345	317	342	338
5,000	340	273	334	342	330	331	333	315	347	322	347	341
6,000	345	282	338	345	337	338	336	323	348	329	349	343
7,000	349	296	344	346	342	340	341	325	348	330	352	345
8,000	350	304	349	348	346	345	344	328	348	336	354	350
9,000	352	314	351	351	348	349	346	335	348	340	355	352
10,000	354	317	353	351	351	350	347	338	352	344	356	354
20,000	360	341	364	356	360	360	361	354	363	351	362	364
30,000	361	355	365	361	362	364	363	360	365	357	365	365
40,000	362	359	-------	365	365	366	364	362	-------	360	-------	-------
50,000	362	359	-------	-------	-------	-------	364	362	-------	362	-------	-------
60,000	363	360	-------	-------	-------	-------	365	364	-------	363	-------	-------
75,000	364	361	-------	-------	-------	-------	-------	364	-------	364	-------	-------
100,000	365	364	-------	-------	-------	-------	-------	365	-------	365	-------	-------
125,000	-------	364	-------	-------	-------	-------	-------	-------	-------	366	-------	-------
150,000	-------	365	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

NOTE.—Low stages 1906–1910 subject to error.

Days of deficiency in discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1899–1922, revised in 1922—Continued

Discharge in second-feet	Days of deficient discharge											
	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	1921–22
100	3	------	15	1	26	3	45	39	------	------	25	------
200	61	28	40	1	44	29	81	182	6	------	42	24
300	120	125	74	1	68	52	203	233	9	------	55	173
400	159	137	86	1	72	97	264	247	10	------	68	215
500	183	192	146	1	83	145	281	260	11	10	85	230
600	193	222	223	1	95	177	290	273	11	14	119	242
700	223	248	248	12	112	222	298	286	11	24	182	248
800	225	248	248	12	120	239	303	301	13	34	221	250
900	241	275	256	17	135	257	313	308	16	39	248	256
1,000	248	286	267	32	142	272	315	315	22	47	264	261
1,200	265	297	276	89	205	289	321	326	51	73	285	265
1,400	274	310	279	92	240	300	333	327	70	91	302	273
1,600	287	328	295	141	255	310	341	332	91	104	317	279
1,800	290	331	296	153	262	315	343	335	112	116	324	283
2,000	295	335	302	164	262	318	343	336	123	130	328	285
3,000	321	349	325	215	289	338	351	347	170	183	344	298
4,000	330	354	337	246	307	346	355	354	207	231	352	307
5,000	335	356	341	261	314	353	358	355	229	263	355	313
6,000	339	361	346	268	324	355	363	356	242	284	356	318
7,000	341	362	351	284	338	358	363	357	261	301	357	323
8,000	344	364	353	287	347	359	364	357	276	308	358	324
9,000	347	365	355	294	348	360	364	358	286	314	359	330
10,000	349	365	356	299	349	362	365	360	292	320	359	333
20,000	359	366	362	328	355	365	------	363	333	352	361	343
30,000	365	------	363	339	357	366	------	364	355	364	362	348
40,000	------	------	364	351	362	------	------	365	358	364	363	351
50,000	------	------	365	360	362	------	------	------	360	366	364	354
60,000	------	------	------	360	363	------	------	------	362	------	365	354
75,000	------	------	------	362	364	------	------	------	365	------	------	358
100,000	------	------	------	364	365	------	------	------	------	------	------	364
125,000	------	------	------	364	------	------	------	------	------	------	------	365
150,000	------	------	------	365	------	------	------	------	------	------	------	------

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, 1922.

EQUIPMENT.—Two evaporation pans, one floating on surface of reservoir 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 Sept. 30, 1922

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	81.5	52.0	66.8	66.3	59.5	81.2	1.2	Southwest	0.94	4.027	4.333
November	76.2	48.2	62.2	60.1	55.7	79.3	1.5	do	.30	2.663	3.129
December	67.2	39.3	53.2	51.6	47.4	83.0	2.6	do	1.48	2.140	2.692
January	51.9	35.2	43.6	45.4	42.6	87.5	3.8	North	3.14	2.359	2.471
February	64.6a	42.5	53.6	52.6	49.2	84.8	3.4	South	2.55	[a]2.654	3.349
March	68.1	43.6	55.8	58.5c	53.4b	71.2b	4.1	Southwest	2.75	[a]4.773	[a]5.596
April	73.9	57.0	65.4	67.1	64.0	83.5	2.4	North	7.21	[a]4.653	[a]4.962
May	------	64.8	------	75.5	73.2	81.3	1.0	South	4.80	[a]4.954	[a]6.626
June	92.7g	67.5	80.1d	80.6	77.4	78.8	.6	Southeast	2.83	[a]5.494	6.644
July	95.9	70.6	83.2	82.0	77.8	76.8	1.1	South	.38	8.115	[a]8.880
August	97.5	70.5	84.0	80.7	77.8	72.2	.7	do	.22	7.265	8.392
September	90.6	64.7	77.6	76.2	72.3	75.2	1.2	do	1.11	5.351	6.704
	------	54.7	------	66.4	62.5	78.7	2.0	------	27.71	54.448	63.778

[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 and 400 feet below Galveston, Harrisburg & San Antonio Railway bridge, in eastern edge of Columbus, Colorado County.

DRAINAGE AREA.—37,000 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch = 25 miles).

RECORDS AVAILABLE.—August 2, 1902, to December 31, 1911; May 22, 1916, to September 30, 1922. Records of stage have been obtained by the United States Weather Bureau since January 1, 1903.

GAGE.—Gurley graph water-stage recorder, inspected by J. H. Hastedt or L. Hastedt. From August 2, 1902, to December 16, 1907, gage heights were obtained by measuring with a tagged chain and lead weight from point on top of bridge pier to water surface. Mott tape-and-weight gage on downstream handrail of bridge, property of the United States Weather Bureau, was read from December 17, 1907, to February 9, 1917, when regulation United States Geological Survey chain gage was installed and used until April 30, 1919, when present Gurley water-stage recorder was installed. All gages referred to same datum.

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; subject to overflow above a gage height of 34 feet. Bed of stream clean and sandy; shifts. A sand and gravel section 350 feet below gage may serve as low-water control; the 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 from water-stage recorder, 38.3 feet 3 p. m. May 5 (discharge, 79,500 second-feet, determined from extension of rating curve and subject to error); minimum stage, 5.49 feet at 1 p. m. December 23 (discharge, 348 second-feet).

1902–1911; 1916–1922: Maximum stage recorded, that of May 5, 1922; 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 little water is diverted between Austin and Columbus. The station is above the 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. Two rating curves used. One from October 1 to April 27 well defined below 55,000 second-feet, and one from April 28 to September 30, fairly well defined below 65,000 second-feet. Operation of water-stage recorder not satisfactory. Daily gage heights obtained from recorder chart by inspection or by planimeter, except as noted in footnote to daily-discharge table. Daily discharge ascertained by indirect method for shifting control, except April 28 to September 30, when mean daily gage heights were applied to rating table. Records poor.

COOPERATION.—Record of gage heights furnished by United States Weather Bureau from August 20 to September 30.

Discharge measurements of Colorado River at Columbus, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 4	C. E. McCashin	7.00	1,270	Apr. 30	C. E. Ellsworth	33.55	[a] 63,400
Dec. 15	D. A. Dudley	5.88	527	July 19	Trigg Twichell	9.10	1,700
Mar. 8	C. E. McCashin	5.84	576	Aug. 19	do	[b] 8.11	905
Apr. 29	C. E. Ellsworth	31.7	[a] 57,300	Sept. 28	McCashin and Slack	7.40	402

[a] Surface velocity observed and coefficient of 0.95 used to reduce to mean velocity.
[b] Chain gage moved to other side of bed of stream as low water channel has left recorder well. Same datum.

Daily discharge, in second-feet, of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,140	530	794	422	1,720	1,180	6,550	68,700	4,780	2,460		535
2	2,650	515	999	418	1,230	1,200	5,800	71,800	4,900	2,300		535
3	1,700	505	1,430	427	843	1,150	7,190	75,100	5,750	2,200		535
4	1,290	495	888	450	740	1,100	12,000	78,800	6,820	2,100		535
5	1,080	485	634	440	722	966	49,300	78,800	8,180	2,010		535
6	947	495	575	445	656	740	50,600	77,100	6,050	1,960		535
7	914	495	590	475	606	639	43,100	75,100	5,030	1,880		535
8	1,540	495	740	515	590	576	32,600	71,800	5,160	3,060		465
9	1,530	505	662	455	595	565	22,300	68,400	5,030	7,140		535
10	1,300	495	612	698	612	495	15,600	49,800	7,820	5,600	900	535
11	1,120	475	580	515	570	545	11,400	23,800	6,820	4,150		535
12	973	450	570	450	540	525	8,930	18,300	5,600	3,220		535
13	882	455	555	436	510	520	9,290	17,000	4,900	2,670		535
14	876	460	530	440	495	525	23,200	17,600	4,520	2,300		535
15	980	450	530	450	470	525	20,100	13,800	4,280			535
16	986	436	565	954	465	490	11,800	13,400	4,020			535
17	914	432	510	758	470	445	8,040	12,700	3,660			535
18	862	422	470	1,170	475	445	6,100	15,800	3,440			535
19	818	409	465	634	470	436	5,080	33,100	3,220			400
20	782	422	465	704	465	414	4,670	42,600	3,160		895	400
21	740	422	450	540	455	404	4,150	48,500	3,160		820	535
22	734	418	388	495	460	400	3,380	42,000	3,220		820	535
23	728	427	364	460	455	414	2,900	23,800	3,060	900	745	535
24	680	432	440	455	530	432	2,650	16,800	2,890		675	400
25	662	422	440	450	1,900	1,020	2,550	15,400	3,060		675	400
26	644	418	436	440	2,140	1,970	2,500	13,800	3,660		675	400
27	622	418	436	432	1,600	1,090	3,280	10,400	3,900		675	400
28	611	418	440	999	1,280	1,820	28,600	7,480	3,550		675	400
29	590	418	450	1,230	-------	1,900	53,700	6,200	3,330		675	400
30	565	427	436	2,050	-------	23,900	63,000	5,750	2,890		605	400
31	555	-------	422	1,300	-------	13,100	-------	5,160	-------		605	-------

NOTE.—Owing to incomplete record discharge partly estimated Dec. 17, Jan. 16, Feb. 11, 24, 25, Mar. 8, 9, 11, Apr. 22, 29, May 13, 20, and June 10. Discharge determined from United States Weather Bureau gage records and by comparison with records for other stations, Jan. 29–31, Feb. 1, 2, Mar. 5–7, 10, 25–31, Apr. 1–21, May 21–31, June 1–9, Aug. 20 to Sept. 30. Discharge estimated July 15 to Aug. 19.

Monthly discharge of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	2,650	555	1,010	62,300
November	530	409	455	27,100
December	1,430	364	576	35,400
January	2,050	418	649	39,900
February	2,140	455	788	43,800
March	23,900	400	1,930	119,000
April	63,000	2,500	17,300	1,030,000
May	78,800	5,160	36,100	2,220,000
June	8,180	2,890	4,530	269,000
July	7,140	----------	1,880	116,000
August	----------	----------	827	50,900
September	535	400	492	29,300
The year	78,800	364	5,590	4,040,000

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.—37,400 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—July 12 to August 31, 1916; July 3 to August 18, 1917; July 11 to August 4, 1918; and March 19, 1919, to September 30, 1922.

GAGE.—Gurley graph water-stage recorder attached to pier of highway bridge near left bank, installed March 19, 1919. Prior to March 19, 1919, vertical staff on right bank 75 feet below bridge. Zero of this gage 1.93 feet higher than zero of recorder. Temporary chain gage at same datum as recorder attached to downstream guardrail of same bridge from July 18 to October 11, 1921.

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

CHANNEL AND CONTROL.—Channel straight above and below station for a few hundred feet. Bed composed of sand and clay; shifting. Banks medium in height, composed of clay, and subject to overflow during extreme 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 recorded during year, 40.7 feet from 9 a. m. to 6 p. m. May 6 (discharge not determined); minimum stage, 5.67 feet at 10 p. m. March 24 (discharge, 472 second-feet, ascertained from extension of rating curve and subject to error).

1916–1922: Maximum stage recorded during periods of record, that of May 6, 1922; 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).

ICE.—None reported.

DIVERSIONS.—Station is in area of rice irrigation; roughly estimated to cover about 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 diversion 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 well defined from 500 to 15,000 second-feet, and fairly well defined to 30,000 second-feet. Above this discharge, from extension of rating curve and subject to considerable error. See also "Channel and control." Operation of water-stage recorder from December 13 to September 30, satisfactory, except for short breaks in record as indicated in footnote to daily-discharge table. From October 1 to December 12, recorder not working and staff gage read to hundredths once daily, and oftener during floods. December 13 to September 30 mean daily gage height determined from recorder graph by inspection or by planimeter. Daily discharge ascertained by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records good except at extremely high and low stages.

Discharge measurements of Colorado River at Wharton, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 6	C. E. McCashin	7.34	1,250	July 19	Trigg Twichell	9.26	1,670
Dec. 14	D. A. Dudley	6.15	700	Aug. 21	do	7.91	773
Mar. 9	C. E. McCashin	6.34	734	Sept. 27	McCashin and Slack	7.34	554

Daily discharge, in second-feet, of Colorado River at Wharton, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,610	662	765	574	1,810	1,610	9,940	36,100	5,510	2,460	815	570
2	1,690	654	830	574	1,810	1,930	5,630	-------	5,270	2,330	790	514
3	2,640	642	1,080	582	1,650	1,340	4,050	-------	5,510	2,240	740	500
4	1,970	658	1,180	582	1,210	1,490	9,550	-------	6,110	2,020	740	504
5	1,490	654	1,290	578	994	1,490	26,000	-------	7,080	1,930	740	500
6	1,270	622	925	586	875	1,050	32,300	-------	7,730	1,810	715	538
7	1,120	622	780	602	825	845	35,200	-------	6,830	1,730	715	552
8	1,010	622	805	622	750	735	33,200	-------	6,350	1,730	740	570
9	1,270	602	805	695	720	710	25,400	-------	5,630	2,420	715	570
10	1,300	602	780	765	690	666	17,000	-------	6,230	7,080	690	570
11	1,340	602	805	745	582	646	12,300	-------	8,510	5,990	690	552
12	1,220	602	755	860	670	622	9,550	23,400	7,340	4,490	650	535
13	1,120	602	715	695	626	630	7,990	15,700	6,350	3,550	690	552
14	988	602	705	634	606	590	13,700	}	6,110	2,960	715	552
15	930	602	686	614	570	586	20,200	14,300	5,630	2,780	715	552
16	988	636	670	678	566	686	14,000	}	4,710	2,420	715	650
17	1,020	622	650	850	566	610	9,290	12,700	4,270	2,060	740	740
18	988	642	682	1,100	563	556	6,710	11,500	3,850	1,890	890	700
19	952	634	654	825	556	521	5,510	17,800	3,650	1,700	915	654
20	905	606	642	735	556	510	4,710	25,600	3,250	1,570	865	610
21	900	598	630	845	556	504	4,490	29,700	3,050	1,450	795	590
22	870	602	630	815	570	490	4,050	32,800	3,050	1,380	740	590
23	830	602	642	778	532	476	3,550	30,200	3,150	1,270	670	610
24	825	594	606	740	524	482	3,200	19,000	2,960	1,160	630	610
25	820	590	602	702	535	1,530	2,960	14,500	2,690	1,100	610	590
26	780	582	594	665	1,270	3,900	2,740	14,400	2,510	970	630	570
27	770	574	590	628	1,810	3,250	2,780	12,600	2,960	915	650	552
28	730	570	590	590	1,730	1,730	6,950	9,940	3,050	865	650	535
29	720	563	586	815	-------	2,200	26,000	7,860	2,960	865	670	532
30	700	678	586	3,250	-------	16,500	32,100	6,830	2,780	865	630	521
31	674	-------	590	3,350	-------	19,600	-------	6,110	-------	815	590	-------

NOTE.—Owing to incomplete record discharge partly estimated Jan. 22, 28, Mar. 30, May 10, 13, 19, 20, and July 8–13. No record and discharge interpolated Oct. 10. Dec. 4, and Jan. 23–27. Discharge estimated May 14–16. Stage beyond limits of rating curve and discharge not determined May 2–11; gage height, in feet, on respective days as follows: 35.1, 36.7, 39.2, 40.5, 40.7, 40.6, 40.3, 40.0 39.6, and 37.3.

Monthly discharge of Colorado River at Wharton, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	2,640	674	1,110	68,300
November	678	563	614	36,600
December	1,290	586	737	45,300
January	3,350	574	873	53,700
February	1,810	524	883	49,000
March	19,600	476	2,210	136,000
April	35,200	2,740	13,100	777,000
May		6,110		
June	8,510	2,510	4,840	288,000
July	7,080	815	2,160	133,000
August	915	590	718	44,100
September	740	500	573	34,100
The year		476		

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.—1,520 square miles (revised; measured on post-route map and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—October 27, 1915, to September 30, 1922.

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. Prior to this date vertical staff attached to same pier was used. Both recorder and staff gage referred to same datum.

DISCHARGE MEASUREMENTS.—Made from second highway bridge upstream from gage or by wading 400 feet below.

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, clean, 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 the Concho reaches a stage of 25 feet.

EXTREMES OF DISCHARGE.—Maximum stage for the year from water-stage recorder, 19.3 feet at 7.30 p. m. April 26 (discharge, not determined. Backwater from Concho River probably existed during this stage); no flow October 1 to April 2, August 6 to September 18, and September 24–30.

1916–1922: Maximum stage recorded that of April 26, 1922; no flow for several periods during record.

ICE.—None reported during year.

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, except during periods of backwater. Rating curve well defined below 125 second-feet, and extended to 7,400 second-feet by use of formula, $Q=CLH^{\frac{3}{2}}$, for broad-crested weirs, using a value of 2.20 for C and may be considerably in error. Operation of water-stage recorder satisfactory. 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, except at extremely low or high stages, when subject to large errors.

Discharge measurements of North Concho River at San Angelo, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 5	Ellsworth and Dudley		0
Jan. 13	R. G. West		0
July 31	Trigg Twichell	0.44	.6

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1922

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1		347	24	11	0.4		16	0.6	1,290	6.2	14		
2		391	17	848	.3		17	.4	775	58	12		
3	2.8	270	130	2,000	.2		18	.4	605	38	11		
4	.7	122	24	1,280	.2		19	.4	221	9.8	7.9		0.2
5	.5	77	85	342	.1		20	.2	118	7.2	7.2		1.7
6	.2	50	36	149			21	.2	118	52	6.6		.5
7	.2	33	16	91			22	.2	64	28	5.3		.2
8	1,420	26	13	67			23	.2	41	14	3.9		.1
9	73	20	14	58			24	121	36	9.8	3.9		
10	14	19	12	49			25	27	31	7.9	3.2		
11	6.6	19	9.8	40			26		28	6.2	2.3		
12	2.9	14	9.8	31			27		24	4.5	1.8		
13	1.7	14	9.2	22			28	790	20	3.2	1.2		
14	1.2	33	7.9	19			29	186	35	2.5	.8		
15	.8	2,540	6.6	14			30	106	22	5.0	.7		
							31		17		.6		

NOTE.—Owing to incomplete record, discharge partly estimated Apr. 13–18, July 8, 13, 17–31, and Aug. 1. Discharge determined by averaging discharge for fractional parts of a day Apr. 3, 9, 10, 25, 29, May 3, 4, 14–21, 29, June 3, 5, 6, 17, 18, 21, 30, July 1–6, and Sept. 19–21. Discharge interpolated July 9–12. Stage beyond limits of rating curve and discharge not determined; backwater probably existed as follows: Apr. 26, 7.2 feet, and Apr. 27, 6.4 feet. Backwater probably existed, amount unknown, on Apr. 8, 24, 28, May 1 and 2. No flow Oct. 1 to Apr. 2, Aug. 6 to Sept. 18, and Sept. 24–30.

Monthly discharge of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April		0		
May	2,540	14	239	14,700
June	130	2.5	22.2	1,320
July	2,000	.6	165	10,100
August	.4	0	.04	2.4
September	1.7	0	.09	5.4

NOTE.—See footnote to table of daily discharge.

CONCHO RIVER NEAR SAN ANGELO, TEX.

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

DRAINAGE AREA.—4,780 square miles (revised; measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—September 17, 1915, to September 30, 1922.

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. Prior to August 9, 1917, a vertical staff gage in several sections attached to trees on left bank was used. Water-stage recorder and vertical staff gage referred to same datum.

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 high, rocky, wooded, and not subject to overflow; left bank of medium height, composed of clay and gravel, covered with scattered growth of trees, and 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 for the year determined by leveling, 36.8 feet April 26 (discharge, not determined); no flow November 29.

1915–1922: Maximum stage, that of April 26, 1922; no flow November 29, 1922.

ICE.—None recorded during year.

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 the station, and about 3,500 acres by diversions below station.

REGULATION.—Storage at the dam of the 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. Rating curve well defined below 800 second-feet; above, it was determined by $A\sqrt{d}$ method, based on one measurement on July 8, 1919, at discharge of 40,500 second-feet and a stage of 26.6 feet, using Kutter's formula with the value of $n=0.045$ and may be considerably in error. Operation of water-stage recorder 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 for days of considerable fluctuation by use of planimeter, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Concho River near San Angelo, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 7	D. A. Dudley	0.46	2.2
Jan. 13	R. G. West	.50	1.8
July 31	Trigg Twichell	.60	3.6

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
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	785	2.3	2.2
3	1.9	1.6		1.2	7.4	1.8	21	------	416	5,180	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	1,560	485	--------	2.1	1.9
7	1.6	1.6		1.4	4.5	1.8	14	1,300	273	--------	2.1	1.6
8	1.6	1.8		1.6	7.4	1.7	11,300	1,150	182	--------	2.2	1.5
9	1.6	1.7		1.9	6.3	1.7	671	1,050	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	1,160	92	29	1.9	1.6
15	1.7	1.8		2.0	1.7	1.8	25	3,300	88	80	1.8	1.3
16	1.7	1.6		1.9	1.7	1.8	22	2,850	70	68	1.8	1.3
17	1.7	1.6		1.8	1.9	1.8	15	4,060	144	64	2.3	1.2
18	1.7	1.6		1.6	1.9	1.8	11	1,610	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	--------	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	28	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	------

NOTE.—Owing to incomplete record discharge partly estimated Oct. 4, 10, Nov. 7, 19, 22–24, Dec. 24, Jan. 16, 26, Feb. 3, Mar. 16, July 13, Aug. 1, 10, 15, Sept. 13 and 15. No record and discharge interpolated Oct. 1–3, 11–17, 19–25, 27–31, Nov. 1–6, 20, 21, 25–28, 30, Jan. 19–25, 27–31, Feb. 1–2, July 20–30, Aug. 11–14, and Sept. 14. No record and discharge estimated Dec. 2–23. Discharge ascertained by averaging discharge for fractional parts of a day Feb. 6, 8, 9, Apr. 3–11, 13, 17, May 14–21, 23, 24, 29, June 3–7, 17, 21, 28–30, July 1–3, Sept. 9–10, and 19–20. No record Apr. 24 to May 5 and July 4–12; gage read Apr. 24, 27.5 feet and April 26, 36.8 feet, and another maximum stage of 26.9 feet occurred between Apr. 26 and May 5.

Monthly discharge of Concho River near San Angelo, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
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 1–23	11,300	2.0	546	24,900
May 6–31	4,060	82	929	47,900
June	485	26	137	8,170
August	2.4	1.7	2.07	127
September	5.1	1.2	1.82	108

NOTE.—See footnote to table of daily discharge.

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.—5,790 square miles (revised; measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—September 20, 1915, to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder attached to downstream end of middle railroad bridge pier was installed September 16, 1920; inspected by engineers of the United States Geological Survey and by N. N. Skaggs. Prior to September 16, 1920, gage was vertical staff attached to same pier.

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

CHANNEL AND CONTROL.—Bed composed of solid rock, smooth, clean, free from vegetation, and permanent. Channel straight for 500 feet above and below gage. Right bank 30 feet high, solid rock, clean, and 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 at a shoal in solid rock, 400 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.5 feet at 11 a. m. April 27 (discharge, not determined); no flow October 13–17, October 30 to November 13, and August 23 to September 18.

1915–1922: Maximum stage recorded, that of April 27, 1922. The maximum stage previously recorded was 13.5 feet at 7.30 a. m. June 10, 1919 (discharge, 20,700 second-feet, revised in 1922); no flow during several periods of every year except 1920 and 1921.

ICE.—None reported during year.

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.

REGULATIONS.—Ten storage dams of small capacity are located between this station and San Angelo. An abandoned dam, 12 feet in height, known as Fourmile 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 permanent. Rating curve well defined below 6,000 second-feet and poorly defined to 19,000 second-feet. Operation of water-stage recorder 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 use of planimeter, except as noted in footnote to daily-discharge table. Records good, except for extremely high stages.

Discharge measurements of Concho River near Paint Rock, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 8	Ellsworth and Dudley	[a]0.52	0	May 3	C. E. McCashin	12.69	[c]18,300
Jan. 12	R. G. West	.80	[b].5	4	do	5.89	3,080
				July 30	Trigg Twichell	.94	1.3

[a] Below point of zero flow.
[b] Estimated.
[c] Surface velocities observed for part of measurement and coefficient used to reduce to mean velocity.

Daily discharge, in second-feet, of Concho River near Paint Rock, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.6		0.8	0.7	7.4	1.4	1.6		165	43	3.1	
2	.7		.7	.7	11	1.4	1.2		168	1,480	2.6	
3	.6		.6	.7	13	1.2	6.0	10,500	175		2.2	
4	.5		.6	.7	15	.8	4.4	2,240	178		1.8	
5	.4		.6	.7	15	.8	4.4	717	185		1.8	
6	.4		.7	.7	15	.8	4.1	443	188		1.6	
7	.3		.7	.7	13	.7	4.7	328	187		1.4	
8	.2		.7	.8	12	.7	11,500	267	186		1.4	
9	.1		.7	.8	11	.8	3,200	231	184		1.2	
10	.1		.7	.8	11	.6	407	205	182		1.0	
11	.1		.7	.8	10	.6	204	195	180		.7	
12	.1		.7	.8	9.7	.7	120	172	178		.5	
13			.7	.8	9.2	.8	67	217	176		.2	
14		0.1	.8	.7	8.3	.7	58	1,100	174		.1	
15		.1	1.0	.8	6.0	.7	40	6,000	172		.1	
16		.2	1.0	1.2	5.0	.6	36	5,920	170		.1	
17		.2	.8	1.2	3.8	.7	38	4,220	168		.1	
18	.1	.4	.7	1.2	3.8	.6	30	3,260	166		.1	
19	.1	.4	.7	1.0	3.8	.5	24	1,050	165		.1	2.1
20	.2	.4	.8	.8	3.4	.6	20	557	107		.1	7.3
21	.3	.6	1.0	.8	3.1	.7	17	740	86		.1	2.5
22	.3	.7	1.0	1.2	2.4	.6	13	419	106		.1	1.0
23	.4	1.0	1.0	1.4	2.0	.5	12	220	90			.5
24	.4	1.0	.8	1.4	1.8	.5	1,900	188	82			.4
25	.2	1.0	.8	1.6	1.8	1.0	17,700	168	71			.3
26	.2	.8	.8	1.8	1.6	1.0		165	58			.2
27	.1	.7	1.0	2.2	1.6	1.2		156	51			.2
28	.1	.7	1.0	2.8	1.4	1.2		147	45			.1
29	.1	.6	1.0	3.1		1.4		141	40	4.1		.1
30		.7	.8	5.4		1.6	810	147	35	4.1		.1
31			.8	6.5		1.8		165		3.1		

NOTE.—Owing to incomplete record, discharge partly estimated Jan. 2–11, Feb. 8–14, Apr. 30, May 3, June 6 and 19. No record Apr. 26–29 (high water), May 1, 2 (high water); July 3–28 (moderately high water first part). No record and discharge interpolated June 7–18. Mean daily discharge ascertained by averaging discharge for fractional parts of a day Apr. 3, 8–12, 18, 24, 25, May 4–6, 13–22, June 20, 22, 23, July 1, 2, and Sept. 19–21. No flow Oct. 13–17, Oct. 30 to Nov. 13, and Aug. 23 to Sept. 18.

Monthly discharge of Concho River near Paint Rock, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0.7	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	
May 3–31	10,500	141	1,390	79,900
June	188	35	137	8,170
July				
August	3.1	0	.66	40.5
September	7.3	0	.49	29.4

NOTE.—See footnote to table of daily discharge.

SAN SABA RIVER AT MENARD, TEX.

LOCATION.—At steel highway bridge in Menard, Menard County, 80 miles above mouth of stream.

DRAINAGE AREA.—1,140 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1922.

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

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

CHANNEL AND CONTROL.—Channel straight 800 feet above and 100 feet below station; somewhat obstructed by reeds and grass; water flows through a series of shoals and ponds; 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, 12.4 feet at 10.30 a. m. April 26 (discharge not determined. Observer reports higher stage during afternoon of April 26 and 27 but heights not known). Minimum stage, 1.62 feet March 16–18 and 21–26 (discharge, 1.6 second-feet). Gage heights not comparable, owing to shifting control.

1915–1922: Maximum stage recorded, 13.6 feet at 2.30 a. m. September 16, 1915 (discharge not determined); no flow July 12–14, 19–31, August 1–4, and 26–31, 1918.

ICE.—None reported.

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 the Board of Water Engineers for the State of Texas show that about 4,300 acres have been declared irrigated by diversions above the station, and about 7,700 acres by diversions below the station.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined from 0 to 250 second-feet. Gage read to hundredths 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 San Saba River at Menard, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 4	Ellsworth and Dudley	1.86	6.2	May 7	C. E. McCashin	2.46	71.8
Jan. 12	R. G. West	1.81	7.1	Aug. 3	Trigg Twichell	1.84	7.3

Daily discharge, in second-feet, of San Saba River at Menard, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	130	5.5	11	4.6	4.8	1.8	22	144	46	24	4.8	8.0
2	130	5.6	8.5	5.1	4.8	2.2	16	105	45	27	4.2	8.7
3	241	5.6	7.0	4.8	4.8	2.2	200	-------	306	91	4.2	9.5
4	64	5.7	14	5.1	4.8	2.2	111	174	88	38	4.8	9.0
5	29	5.5	20	5.1	4.8	2.2	34	121	55	31	4.8	8.0
6	23	5.3	19	5.1	3.6	2.2	17	81	50	31	4.8	8.5
7	21	5.2	20	5.1	3.9	2.2	14	65	130	31	4.8	7.5
8	21	5.0	21	5.2	4.8	2.2	38	65	57	29	5.4	10
9	22	4.8	21	5.4	4.8	2.2	13	59	47	26	8.5	10
10	22	3.6	21	6.0	4.8	2.2	10	59	48	25	8.5	10
11	21	2.9	21	5.7	4.2	1.8	8.5	57	47	25	7.5	10
12	21	2.2	21	6.0	4.2	1.8	8.5	56	46	25	7.5	10
13	22	2.2	21		4.5	2.0	9.5	-------	45	22	7.5	9.0
14	21	2.4	14		4.2	1.8	9.5	-------	42	19	8.0	11
15	21	2.6	9.5		4.2	1.8	9.0	255	40	10	8.5	11
16	19	2.4	9.0		4.2	1.6	8.0	153	38	12	9.5	12
17	21	2.6	9.0		4.8	1.6	8.0	-------	40	12	7.5	12
18	21	2.4	7.4		5.1	1.6	8.0	170	41	11	7.5	12
19	20	2.4	5.7		4.5	2.0	7.0	130	40	9.5	7.5	15
20	21	2.6	4.8		4.5	2.0	7.0	95	40	8.2	9.5	17
21	20	2.8	4.2	6.0	4.2	1.6	7.0	69	39	7.0	9.0	19
22	20	3.6	3.9		4.5	1.6	7.5	64	36	7.0	8.5	15
23	20	3.3	3.9		3.9	1.6	8.0	57	36	7.0	8.0	14
24	19	3.3	3.9		3.9	1.6	-------	54	35	7.0	7.0	14
25	18	3.3	4.4		3.9	1.6	-------	55	31	7.0	6.0	12
26	18	3.3	4.9		3.9	1.6	-------	51	29	7.0	5.7	12
27	17	3.3	5.4		3.6	2.0	-------	51	37	5.7	7.5	10
28	17	3.3	5.1		2.4	2.8	-------	51	30	5.4	6.5	10
29	17	3.0	4.8		-------	-------	92	49	23	4.8	5.7	10
30	11	3.9	4.5		-------	-------	-------	47	22	4.8	6.5	10
31	5.4	-------	4.2		-------	62	-------	51	-------	4.8	7.2	-------

NOTE.—No record and discharge interpolated Oct. 9, 30, Nov. 1–3, 5–8, 11, 20, 24, 27, Dec. 4, 11, 18, 25, 26, Jan. 1, 8, Mar. 4–7, July 18–20, Aug. 30 to Sept. 2. No record and discharge estimated Oct. 1, 2, and Jan. 13–31. No record May 13 and 14. Stage beyond limits of rating curve Mar. 29, 30, Apr. 24, 25, 26, 27, 28, 30, and May 17, with respective mean daily gage height, in feet, as follows: 10.25, 5.40, 6.60, 6.95, 12.35. 7.35, 4.20, 4.25, and 6.80.

Monthly discharge of San Saba River at Menard, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	241	5 4	35.3	2,170
November	5.7	2.2	3.65	217
December	21	3.9	10.8	663
January	-------	-------	5.72	351
February	5.1	2.4	4.31	239
March	-------	1.6	-------	-------
April	-------	7.0	-------	-------
May	-------	47	-------	-------
June	306	22	53.6	3,190
July	91	4.8	18.5	1,140
August	9.5	4.2	6.87	422
September	19	7.5	11.1	663

NOTE.—See footnote to table of daily discharge.

SAN SABA RIVER NEAR SAN SABA, TEX.

LOCATION.—200 feet above Beveridge highway bridge, 1 mile below mouth of China Creek, 2 miles northwest of San Saba, San Saba County, 3 miles below mouth of Richland Creek, and 4 miles above mouth of Simpson Creek.

DRAINAGE AREA.—3,040 square miles, revised (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—December 30, 1904, to December 31, 1906; September 11, 1915, to September 30, 1922. Miscellaneous discharge measurements previous to 1904.

GAGE.—Vertical and inclined staff on right bank; read by G. M. Pool. From December 30, 1904, to December 31, 1906, gage heights were obtained by measuring with a tape from a reference point on the bridge to the water surface. Relation between datum used 1904–1906 and that of present gage is not known.

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, clay, wooded, high, 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, about 37.0 feet on April 26 or 27, determined from flood marks on gage (discharge not determined); minimum stage, 1.30 feet at 6.15 p. m. March 22 and 5.40 p. m. March 24 (discharge, 25 second-feet).

1904–1906; 1915–1922: Maximum stage recorded, that of April 26 or 27, 1922; no flow August 9 and 10, 1918.

ICE.—None reported.

DIVERSIONS.—Considerable water is diverted from stream and tributaries above station. There are also diversions below the station but none in the vicinity of 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 not permanent. Rating curve well defined between 5 and 6,500 second-feet. Gage read to hundredths twice daily. Daily discharge determined by indirect method for shifting control. See also footnote to daily-discharge table. Records fair.

Discharge measurements of San Saba River near San Saba, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 18	Ellsworth and Dudley	1.44	34.5
Jan. 11	R. G. West	1.54	45.9
July 28	Trigg Twichell	1.73	64.3

Daily discharge, in second-feet, of San Saba River near San Saba, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	54	39	42	46	59	49	370	5,600	370	127	67	60
2	58	39	44	46	62	47	207	-------	384	129	65	58
3	50	37	40	46	61	52	38	-------	370	395	60	62
4	233	38	35	44	58	54	-------	6,140	485	353	60	58
5	233	38	35	41	59	55	2,140	2,240	761	467	63	58
6	127	37	37	40	59	60	545	1,400	426	209	71	58
7	88	38	43	40	54	54	291	1,070	485	168	63	58
8	68	35	44	40	54	51	777	841	515	152	59	58
9	58	32	45	42	58	49	682	1,610	575	139	74	58
10	51	31	51	44	58	46	213	809	384	138	268	60
11	45	31	55	46	55	43	182	745	317	127	96	73
12	43	33	58	45	51	49	147	651	292	116	80	69
13	43	32	58	45	46	44	132	809	268	110	73	61
14	40	33	54	48	48	40	122	2,660	244	110	70	60
15	40	32	59	50	48	42	119	4,700	244	106	69	60
16	38	33	61	52	46	43	112	2,310	220	111	69	60
17	40	33	55	52	48	41	98	1,240	244	114	68	60
18	41	35	55	54	47	40	87	2,450	256	111	69	74
19	39	35	61	53	46	47	84	1,440	207	101	68	70
20	38	32	55	50	52	41	82	841	203	92	70	69
21	36	34	50	50	51	33	82	841	194	84	75	71
22	37	37	49	52	50	30	79	1,400	188	82	67	71
23	36	38	47	56	47	31	75	590	178	80	64	68
24	38	49	45	59	46	30	85	470	172	78	63	67
25	38	45	41	62	49	65	6,050	398	170	73	63	71
26	37	48	41	63	52	67	-------	384	166	69	63	70
27	39	46	41	62	50	61	-------	356	154	68	65	74
28	39	38	41	56	50	54	6,860	343	147	67	60	70
29	38	38	41	56	-------	3,620	2,480	343	138	98	58	67
30	38	38	42	54	-------	6,590	1,400	330	127	102	58	69
31	39	-------	45	59	-------	971	-------	343	-------	73	58	-------

NOTE.—Discharge Apr. 25, 28, and May 4 determined from one staff gage reading only, as water was too high to reach gage for other readings; gage height Apr. 25, 18.2 feet (rising stage), Apr. 28, 20.0 feet (falling stage), and May 4, 18.4 feet (falling stage). No readings Apr. 26, 27, May 2 and 3, owing to high water; discharge not determined. Water reached a maximum stage of about 37 feet on Apr. 26 or 27. Gage height Apr. 4, 26.8 feet beyond limits of rating curve; discharge not determined.

Monthly discharge of San Saba River near San Saba, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	233	36	59.4	3,650
November	49	31	36.8	2,180
December	61	35	47.4	2,910
January	63	40	50.1	3,080
February	62	46	52.3	2,900
March	6,590	30	403	24,800
April	-------	38	-------	-------
May	-------	330	-------	-------
June	761	127	296	17,600
July	467	67	137	8,420
August	268	58	73.4	4,510
September	74	58	64.7	3,850

NOTE.—See footnote to table of daily discharge.

NORTH LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—500 feet above remains of old Wilson dam, 1 mile below mouth of Bear Creek, 2½ miles above North Llano highway bridge, 3 miles northwest of Junction, Kimble County, and 4 miles above confluence of North Llano and South Llano rivers.

DRAINAGE AREA.—803 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1922.

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 high, clean, and not subject to overflow; right bank low, wooded, and subject to overflow during high stages. One channel at all stages; current sluggish at gage during low and medium stages. A solid rock ledge of approximately 2 feet vertical fall at site of old dam serves as permanent control for medium and low stages, except slight effect from accumulation of moss during low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.7 feet at 6.45 p. m. April 3 (discharge not determined). (Observer reports highest stage occurred during night of May 2, stage unknown); minimum stage, 0.96 foot from 4.20 p. m. September 8 to 6 p. m. September 9 and 5.35 p. m. September 15 to 5.45 p. m. September 18 (discharge, 0.40 second-foot).

1915–1922: Maximum stage recorded 18.00 feet during night of September 15, 1915 (discharge not determined); no flow during several periods.

ICE.—None reported.

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 the station.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 120 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 good for low and medium stages.

Discharge measurements of North Llano River near Junction, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 5	C. E. Ellsworth	1.11	2.3
Aug. 3	Trigg Twichell	1.17	4.3

Daily discharge, in second-feet, of North Llano River near Junction, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.5	2.5	12	16	17	13	56	-------	33	16	6.4	1.0
2	2.5	2.5	12	16	17	13	47	165	32	16	6.4	1.0
3	6.4	2.5	12	16	17	15	-------	-------	-------	26	5.8	1.0
4	4.2	3.2	12	16	17	15	-------	-------	71	41	5.8	1.0
5	3.9	3.2	12	16	17	15	136	177	49	28	5.3	1.0
6	3.9	3.2	14	16	17	15	93	148	38	23	4.7	.7
7	3.9	3.2	14	16	17	15	68	122	-------	23	4.7	.6
8	3.9	3.9	14	16	15	13	-------	100	129	20	61	.5
9	3.9	3.9	14	16	15	13	114	86	75	20	25	.4
10	3.9	3.9	16	16	15	13	54	86	59	20	13	14
11	3.9	4.7	16	16	15	11	43	78	45	18	10	7.6
12	3.9	4.7	16	16	15	11	36	64	43	15	9.1	5.8
13	3.9	4.7	16	16	15	11	36	177	41	13	8.3	2.1
14	3.9	5.8	16	16	13	11	36	150	35	12	6.9	.6
15	3.9	5.8	16	16	13	11	36	100	35	33	6.9	.4
16	3.9	5.8	16	16	13	11	31	75	35	25	5.8	.4
17	3.9	6.9	16	16	13	11	31	-------	100	19	39	.4
18	3.2	6.9	16	16	11	11	31	150	59	18	12	.4
19	3.2	6.9	16	16	11	11	31	114	45	17	7.6	3.2
20	3.2	8.3	16	18	11	11	31	100	35	12	5.8	9.8
21	3.2	8.3	16	18	11	11	31	86	35	9.1	5.8	4.7
22	2.5	9.8	16	18	11	11	31	54	35	7.6	4.7	3.2
23	2.5	9.8	16	18	11	11	31	54	29	7.6	4.2	7.6
24	2.5	9.8	16	18	11	11	-------	45	29	6.4	3.5	6.4
25	2.5	11	16	18	11	43	-------	45	29	6.4	2.5	5.8
26	2.5	11	16	18	13	26	-------	41	29	6.4	2.1	5.8
27	2.5	11	16	18	13	24	-------	41	24	6.4	2.1	4.7
28	2.5	13	16	18	13	22	-------	38	22	6.4	1.6	4.7
29	2.5	13	16	18	-------	-------	181	38	22	6.4	1.6	4.7
30	2.5	13	16	18	-------	-------	192	35	19	6.4	1.3	3.9
31	2.5	-------	16	18	-------	78	-------	35	-------	6.4	1.3	-------

NOTE.—Gage heights, in feet, for days when stage was beyond limits of rating curve and discharge not determined as follows: Mar. 29, 4.03; Mar. 30, 2.13; Apr. 3, 5.62; Apr. 4, 2.68; Apr. 8, 2.05; Apr. 24, 2.10; Apr. 25, 2.94; Apr. 26, 2.82; Apr. 27, 4.07; Apr. 28, 2.45; May 1, 3.29; May 3, 4.01; May 4, 2.41; May 17, 2.62 June 3, 2.33; and June 7, 2.65.

Monthly discharge of North Llano River near Junction, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
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	----------	11	----------	----------
April	----------	31	----------	----------
May	----------	35	----------	----------
June	----------	19	----------	----------
July	41	6.4	15.8	973
August	61	1.3	9.04	556
September	14	.4	3.45	205

NOTE.—See footnote to table of daily discharge.

LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—100 feet north of Kerrville-Junction road, a quarter of a mile northeast of Oliver's ranch house, 3 miles below confluence of North Llano and South Llano rivers, 3½ miles east of Junction, Kimble County, and 4 miles above creek entering river from south.

DRAINAGE AREA.—1,700 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—September 13, 1915, to September 30, 1922.

GAGE.—Vertical staff, reading from 0 to 7.5 feet, attached to tree on right bank, and inclined staff graduated from 7.0 to 14.7 feet, and a vertical staff 14.6 to 20.3 feet; the two latter sections are 100 feet upstream from low-water vertical staff; read by Sadie 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, clean, and permanent. Channel straight for 700 feet above and 350 feet below gage. Left bank of medium height, slightly wooded, and subject to overflow during high water; right bank clean, high, and not subject to overflow. One channel at all stages, except during extreme floods, when a small part of the flow may follow a slough that leaves the river a short distance above the gage, passes to the south of Oliver's ranch house, and enters the main stream below the gage. Such conditions do not occur, however, at intervals more frequent than 10 to 15 years, and will not greatly affect records. Rock ledge 75 feet below gage, forming a fall of approximately 3 feet, serves as permanent control for low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 10.97 feet at 9.30 a. m. April 3 (discharge not determined); minimum stage, 1.50 feet at 2 p. m. October 30 and 31 (discharge, 52 second-feet).

1915–1922: Maximum stage recorded, 26.3 feet at 3 a. m. September 16, 1915 (discharge not determined); minimum stage, 1.32 feet during August 23–28, 1918 (discharge, 13 second-feet).

ICE.—None reported.

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 is permanent. Rating curve well defined from 24 to 250 second-feet. Any discharge above 250 second-feet is from extension of rating curve and subject to error. Gage read to hundredths once daily, but observer's work doubtful. Daily discharge ascertained by applying mean daily gage height to rating table, except as noted in footnote to daily-discharge table. Records good for low and medium stages.

Discharge measurements of Llano River near Junction, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 2	C. E. Ellsworth	1.51	50.4
Aug. 3	Trigg Twichell	1.54	62.8

Daily discharge, in second-feet, of Llano River near Junction, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jnne	July	Aug.	Sept.
1	69	55	60	60	63	60	129	330	138	80	58	58
2	69	55	60	60	63	60	-------	239	138	80	58	58
3	69	55	60	60	63	60	-------	-------	138	80	58	58
4	69	55	60	60	63	60	-------	505	138	-------	63	58
5	69	55	60	60	63	60	596	354	138	229	63	58
6	69	55	60	60	63	60	336	330	138	-------	63	58
7	69	55	60	60	63	60	336	295	138	198	63	58
8	69	55	60	60	63	60	336	283	138	170	63	58
9	63	55	60	60	63	60	244	239	138	160	94	58
10	63	55	60	60	63	60	224	229	138	151	74	63
11	58	55	60	60	63	60	165	218	147	142	63	63
12	58	55	60	60	63	60	147	189	138	134	63	63
13	58	55	60	60	63	60	138	189	138	80	63	63
14	58	55	60	60	63	60	129	631	138	80	63	63
15	58	55	60	63	63	60	120	631	129	80	69	63
16	58	55	60	63	63	60	120	479	129	80	69	63
17	58	55	60	63	63	60	112	415	129	80	69	63
18	58	55	60	63	63	60	105	330	129	80	69	69
19	58	55	60	63	63	55	84	295	120	74	69	63
20	58	60	60	63	63	55	72	239	120	74	63	63
21	58	60	60	63	63	55	60	239	112	74	63	63
22	58	60	60	63	63	55	55	234	105	69	63	63
23	58	60	60	63	63	55	112	229	105	69	63	63
24	58	60	60	63	63	55	112	189	105	69	63	63
25	58	60	60	63	63	72	112	179	98	63	63	63
26	58	60	66	63	63	72	-------	170	98	63	63	63
27	58	60	66	63	63	72	-------	160	98	63	63	63
28	58	60	66	63	63	72	301	160	91	58	63	63
29	58	60	66	63	-------	-------	301	151	91	58	63	63
30	52	60	66	63	-------	-------	336	151	91	58	63	63
31	52	-------	66	63	-------	156	-------	142	-------	58	58	-------

NOTE.—Gage heights, in feet, for days when stage is beyond limits of rating curve and discharge not determined, as follows: Mar. 29, 2.95; Mar. 30, 3.37; Apr. 2, 2.69; Apr. 3, 10.97; Apr. 4, 3.67; Apr. 26, 3.07; Apr. 27, 6.07; May 3, 4.96; July 4, 2.98; and July 6, 2.90.

Monthly discharge of Llano River near Junction, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
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	-------	55	-------	-------
April	-------	55	-------	-------
May	-------	142	-------	-------
June	147	91	123	7,320
July	-------	58	-------	-------
August	94	58	64.7	3,980
September	69	58	61.7	3,670

NOTE.—See footnote to table of daily discharge.

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 and Colorado River, and half a mile southwest of Austin, Travis County.

RECORDS AVAILABLE.—October 1, 1918, to September 30, 1922. 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 were 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 the following table:

Discharge measurements of Barton Creek and determination of discharge of Barton Springs at Austin, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Discharge (sec.-feet)			Date	Made by—	Discharge (sec.-feet)		
		Creek below springs	Creek above springs	Springs			Creek below springs	Creek above springs	Springs
Oct. 12	Trigg Twichell	59.2	[a] 1.0	58.2	Feb. 27	Trigg Twichell	29.4	0.0	29.4
25	do	54.6	.0	54.6	Mar. 11	do	29.4	.0	29.4
Nov. 10	do	47.6	.0	47.6	25	do	29.3	.0	29.3
28	do	41.3	.0	41.3	May 25	do	112	32	80
Dec. 13	Twichell and McDonald	38.8	.0	38.8	June 20	C. E. McCashin	70.2	3.2	67
28	Trigg Twichell	35.7	.0	35.7	July 13	Trigg Twichell	56.7	[a] .5	56.2
Jan. 11	do	32.3	.0	32.2	26	do	47.5	.0	47.5
26	do	30.7	.0	30.7	Aug. 9	do	46.4	.0	46.4
Feb. 10	do	29.6	.0	29.6	28	do	39.8	.0	39.8
					Sept. 19	Twichell and Slack	34.2	.0	34.2

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.—909 square miles (measured on topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—December 16, 1917, to September 30, 1922.

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

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

CHANNEL AND CONTROL.—Bed composed of rock, sand, and gravel. Left bank composed of clay, slightly wooded, and not subject to overflow; right bank low, wooded, and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.9 feet at 8 a. m. April 26 (discharge not determined); minimum stage during period of estimated discharge (discharge, probably about 25 second-feet).

1917–1922: Maximum stage about 41 feet on August 21, 1919, determined from flood marks near gage (discharge not determined); minimum stage, 0.80 foot August 2, 1918 (discharge, 0.4 second-foot); probably caused by diversions.

ICE.—None reported.

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 have been declared irrigated by diversions above the station.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined below 40 second-feet, well defined from 40 to 80 second-feet, and poorly defined from 80 to 270 second-feet. Gage read to hundredths once daily, but not regularly, and observer's work doubtful. One reading a day may not be true index to discharge at low periods, owing to storage and intermittent pumping above gage; and at high stages, owing to rapid fluctuations. Daily discharge ascertained by applying mean daily gage height to rating table, except as otherwise noted in footnote to daily-discharge table. Records poor.

Discharge measurements of Guadalupe River near Comfort, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 2	C. E. Ellsworth	1.80	48.6	Aug. 4	Trigg Twichell	1.67	42.6
Jan. 24	D. A. Dudley	1.88	58.0	Sept. 7	C. E. Ellsworth	1.66	42.1
Mar. 25	Ellsworth and McCashin	1.84	49.8				

Daily discharge, in second-feet, of Guadalupe River near Comfort, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	43	50	54	60	60	58	73	-------	73	48	43	
2	43	52	56	60	60	58	73	-------	73	48	40	
3	43	52	56	60	60	58	73	-------	73	48	39	
4	43	52	57	60	60	58	-------	-------	73	48	39	
5	43	52	58	60	60	58	172	244	73	47	37	
6	43	52	58	60	60	58	133	232	73	47	41	
7	43	52	58	60	60	58	100	226	71	45	45	
8	43	52	58	60	60	58	97	219	71	45	48	
9	44	52	58	60	60	58	92	219	71	44	48	
10	45	52	58	60	60	58	86	-------	71	43	47	
11	45	52	57	60	60	58	86	244	71	43	45	30
12	45	52	56	60	60	57	73	232	71	42	45	
13	48	53	56	60	60	56	73	219	69	40	44	
14	50	54	56	60	60	56	62	196	69	40	43	
15	50	54	56	60	60	56	62	172	69	39	42	
16	50	54	56	60	60	56	57	164	69	38	40	
17	50	54	54	60	60	56	52	152	100	37	39	
18	50	54	56	62	60	56	54	141	86	37	39	
19	48	54	58	62	60	56	56	137	73	37	37	
20	48	53	58	62	60	55	56	133	71	36	36	
21	48	52	58	62	60	55	58	124	69	35	35	36
22	48	52	58	61	60	54	58	116	66	35	34	36
23	48	52	58	60	60	54	59	106	62	34	32	36
24	48	52	58	60	60	53	60	97	62	34		34
25	48	52	59	60	60	54	62	92	61	34		31
26	48	52	60	62	59	53	-------	83	60	32		30
27	48	52	60	62	58	52	-------	76	58	30	30	30
28	48	52	60	62	58	52	244	74	56	34		31
29	48	52	60	61	-------	86	244	73	52	34		32
30	49	54	60	60	-------	78	-------	73	48	41		34
31	50	-------	60	60	-------	73	-------	73	-------	48		-------

NOTE.—No record and discharge interpolated, Oct. 2, 9, 16, 23, 30, Nov. 6, 13, 20, 27, Dec. 4, 11, 18, 25, Jan. 1, 2, 8, 15, 22, 29, Feb. 5, 12, 19, 26, Mar. 5, 12, 19, 26, Apr. 2, 9, 16, 23, May 7, 14, 21, 28, June 4, 11, 18, 25, July 2, 4, 9, 16, 23, 30, Aug. 6, 13, 20, and Sept. 24. Gage heights not used and discharge estimated by comparison with flow at other stations Aug. 24 to Sept. 20 and Sept. 26. Gage heights, in feet, for days when stage was beyond limits of rating curve and discharge not determined as follows: Apr. 4, 4.1; Apr. 26, 5.3; Apr. 27, 4.4; Apr. 30, no record; May 1, 5.7; May 2, 4.8; May 3, 4.2; May 4, 3.3; and May 10, 3.1.

Monthly discharge of Guadalupe River near Comfort, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	50	43	46.7	2,870
November	54	50	52.5	3,120
December	60	54	57.6	3,540
January	62	60	60.5	3,720
February	60	58	59.8	3,320
March	86	52	58.3	3,580
April		52		
May		73		
June	100	48	68.8	4,090
July	48	30	40.1	2,470
August	48		38.0	2,340
September			31.0	1,840

NOTE.—See footnote to table of daily discharge.

GUADALUPE RIVER NEAR SPRING BRANCH, TEX.

LOCATION.—At New Braunfels-Blanco City highway bridge, known as Esser Bridge, 350 feet above rock and gravel shoal, one-fourth of a mile from J. H. Jonas farmhouse, 4 miles below Spring Branch, Comal County, 6 miles below mouth of Curry Creek, and 22 miles by road above New Braunfels.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 28 (established) to September 30, 1922.

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

DISCHARGE MEASUREMENTS.—Made by wading or from upstream side of highway bridge to which gage is attached.

CHANNEL AND CONTROL.—Channel straight for 200 feet above and 700 feet below gage. Bed composed of solid rock and gravel; permanent. Right bank clay, high, wooded, and not subject to overflow; left bank clay and gravel, medium in height, 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 believed to be permanent.

EXTREMES OF DISCHARGE.—Maximum stage during the period June 28 to September 30, from water-stage recorder, 2.63 feet at 6 p. m. July 5 (discharge, 150 second-feet); minimum stage, 1.98 feet, 11 p. m. September 5 to 9 a. m. September 6, 8 a. m. September 7 to 4 a. m. September 8, and 4 a. m. to 4 p. m. September 10 (discharge, 27 second-feet).

ICE.—None.

DIVERSIONS.—None of consequence.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory, except for short breaks in record. Daily discharge determined by applying to rating table mean daily gage heights 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 Guadalupe River near Spring Branch, Tex., during the period June 28 to Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
June 28	Trigg Twichell	2.37	88.8
Aug. 5	do	2.15	45.9
Sept. 8	C. E. Ellsworth	1.99	25.5

Daily discharge, in second-feet, of Guadalupe River near Spring Branch, Tex., for the period June 28 to Sept. 30, 1922

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1		74	74	30	16		68	47	34
2		76	61	31	17		68	45	44
3		78	53	30	18		72	45	43
4		72	50	31	19		61	45	38
5		105	47	30	20		57	45	37
6		137	43	27	21		57	45	37
7		115	38	27	22		55	38	39
8		95	42	28	23		52	37	39
9		89	46	33	24		50	36	38
10		87	50	28	25		47	34	42
11		78	54	35	26		46	35	42
12		76	58	34	27		42	32	38
13		72	62	32	28	87	42	34	38
14		68	55	29	29	80	43	31	39
15		68	50	31	30	76	42	30	39
					31		50	30	

NOTE.—Discharge from mean of two staff gage readings daily on June 28 to July 1, July 3, and 4. Record incomplete and discharge interpolated July 2 and Aug. 8–12. Discharge partly estimated July 5–7, Aug. 7, and 13. Discharge determined by applying to rating table gage heights for fractional parts of a day July 31, Sept. 9 and 17.

Monthly discharge of Guadalupe River near Spring Branch, Tex., for the period June 28 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
June 28-30	87	76	81.0	482
July	137	42	69.1	4,250
August	74	30	44.9	2,760
September	44	27	34.8	2,070
The period				9,560

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.—1,760 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—March 13, 1898, to December 30, 1899; January 27, 1915, to September 30, 1922.

GAGE.—Stevens water-stage recorder, attached to downstream side of middle pier of highway bridge; inspected by engineers from Austin office. A vertical staff gage in three sections attached to trees on left bank 200 feet below highway bridge, and one section on east side of left pier of highway bridge, was read from January 27, 1915, to September 28, 1917, when recorder was installed. Gage used from March 13, 1898, to December 30, 1899, was an inclined staff gage near the present highway bridge; relation between datum of inclined gage and of the vertical staff gage not known. During normal flow, levels show 0.08 foot fall between intake of recorder and vertical staff gage location. Vertical staff gage in well of recorder set to read same as vertical staff downstream.

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, high, 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, 7.95 feet at 11.50 a. m. April 27 (discharge, 6,190 second-feet); no flow for two hours on each of the following days, owing to regulation at dam under construction 300 feet above gage, August 2, 4, 10, 18, September 3, 8, 14, 21, and 28.

1898–1899; 1915–1922: 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); minimum stage, that of August 2, 4, 10, 18, September 3, 8, 14, 21, and 28, 1922.

ICE.—None.

DIVERSIONS.—Some water diverted for irrigation above station in Kerr and Comal counties, and for water-power, water-works, 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. See footnote to daily-discharge table.

ACCURACY.—Stage-discharge relation not permanent, owing to construction operations on dam near gage. Rating curve well defined for all stages. Operation of water-stage recorder satisfactory, except for short breaks in record. Mean daily gage heights obtained from recorder graph by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records good.

Discharge measurements of Guadalupe River at New Braunfels, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 26	D. A. Dudley	2.11	491	July 31	C. E. McCashin	1.90	457
Jan. 5	do	2.03	454	Aug. 5	Trigg Twichell	1.86	413
Mar. 13	C. E. McCashin	2.00	435	Aug. 23	do	1.84	449
May 17	do	3.04	955				

Daily discharge, in second-feet, of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	665	512	530	458	466	435	548	4,380	710	534	448	415
2	665	512	516	458	462	435	502	3,370	710	530	375	411
3	665	512	520	453	462	431	507	2,020	732	530	458	359
4	650	507	512	462	458	440	1,410	3,340	737	520	433	399
5	635	516	502	458	453	448	2,220	2,370	720	530	423	451
6	610	512	502	458	458	448	1,350	1,850	737	525	419	403
7	602	516	489	448	453	444	964	1,400	720	570	464	399
8	588	520	494	448	448	442	842	1,240	715	570	431	352
9	588	516	484	427	444	441	770	1,150	700	538	431	395
10	579	520	480	444	444	440	732	1,090	680	525	392	427
11	570	520	489	458	444	438	695	1,060	837	512	440	465
12	561	525	484	458	444	436	645	1,030	685	512	431	407
13	552	538	489	458	444	435	630	988	670	502	440	407
14	556		484	462	431	430	610	1,150	660	502	491	359
15	570		480	466	435	425	602	1,200	660	498	466	403
16	574		484	462	435	420	570	1,030	650	502	458	403
17	570		484	435	435	415	566	958	650	502	458	434
18	570		484	440	435	415	551	958	650	507	395	395
19	561		476	444	431	419	538	958	630	502	453	399
20	552	516	471	448	427	419	525	958	660	507	458	419
21	543		471	462	427	415	516	880	710	489	504	366
22	548		471	458	435	407	512	847	660	489	458	407
23	552		471	448	435	395	507	1,020	625	484	453	403
24	543		476	448	444	399	538	847	620	476	440	407
25	552		462	453	435	423	507	803	602	476	436	457
26	538	494	466	453	431	431	520	776	588	476	431	403
27	534	498	458	458	427	444	2,500	759	574	476	431	399
28	534	489	458	458	431	431	3,030	742	570	471	423	355
29	525	471	462	476	------	762	4,500	742	552	471	423	403
30	520	484	458	476	------	561	4,750	742	543	458	415	399
31	520	------	458	458	------	574	------	715	------	458	415	------

NOTE.—Discharge Mar. 13 from measurement on that day. No record and discharge interpolated Mar. 8–12 and 14–16. Discharge partly estimated, owing to incomplete record, Oct. 1–3, Nov. 26, and Mar. 17. Discharge obtained by applying to rating table gage heights for fractional parts of a day on Mar. 29, Apr. 4–6, 27, 28, May 2–4, 14, 15, 23, June 11, Aug. 2, 4, 7, 10, 14, 18, and 21, Sept. 3, 5, 8, 11, 14, 17, 21, 25, and 28. Braced figures show estimated mean discharge for periods included.

Monthly discharge of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	665	520	574	35,300
November	------	------	512	30,500
December	530	458	483	29,700
January	476	427	455	28,000
February	466	427	442	24,500
March	762	395	448	27,600
April	4,750	502	1,120	66,800
May	4,380	715	1,330	82,100
June	837	543	665	39,600
July	570	458	505	31,000
August	504	376	438	27,000
September	465	352	403	24,000
The year	4,750	352	616	446,000

GUADALUPE RIVER NEAR GONZALES, TEX.

LOCATION.—Just below dam of Gonzales Water Power Co., 1 mile above Guadalupe highway bridge, in Gonzales, Gonzales County, and 1½ miles below mouth of San Marcos River.

DRAINAGE AREA.—3,620 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1922. The United States Weather Bureau has obtained records from this gage at the power house of Gonzales Water Power Co. since September 1, 1904.

GAGE.—United States Weather Bureau gage at tailrace of Gonzales Water Power Co.'s plant. From July 1, 1915, to September 30, 1920, vertical staff in three sections on right bank, just below bridge a mile downstream, was used. Curve showing relation between gage readings at the two sites has been developed.

DISCHARGE MEASUREMENTS.—Made from cable one-fourth of a mile below bridge and 1¼ miles below gage or by wading near bridge. Measurements made from highway bridge above stage of 22 feet when banks are overflowed at cable section.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; channel above and below station straight for 500 feet. Dam and power house just above gage. Banks composed of gravel and clay; right bank medium height, wooded, and subject to overflow; left bank high and not subject to overflow except at extremely high stages. At bridge, left bank protected by levee which does not overflow except during unusually high stages; right bank at bridge is overflowed at stage of about 27 feet. Control is rock and gravel shoal about 200 feet downstream from gage; shifts. At a stage of about 21.5 feet (discharge, 11,400 second-feet) water begins to enter an old channel, locally known as Cross Timbers, on right bank 1 mile above gage and returns to main channel below gage. Consequently, all records of discharge greater than 11,400 second-feet do not represent the total flow of the stream, but only that in the main channel.

EXTREMES OF DISCHARGE.—Maximum stage during year, 33.3 feet, April 5 (discharge, 40,300 second-feet, determined from extension of rating curve and subject to error); minimum stage, 1.0 foot August 27, September 17, and 24 (discharge, 430 second-feet).

1915–1922: Maximum stage from Weather Bureau records at Gonzales dam, 34.1 feet at 7 p. m. October 18, 1919 (discharge, 43,600 second-feet, determined from extension of rating curve and subject to error); minimum stage, 0.02 foot at 5.30 p. m. October 20, 1918 (discharge, 155 second-feet).

ICE.—None reported.

DIVERSIONS.—Some water diverted above the station for irrigation and municipal uses, but the amount is small in comparison with the total run-off. As rainfall is nearly sufficient for general farming, irrigation is intermittent and it is extremely difficult to estimate the amount of water used.

REGULATION.—Flow at this point regulated somewhat by operation of water-power plants. Power house of Gonzales Water Power Co. is just above gage.

ACCURACY.—Stage-discharge relation fairly permanent. However, measurements are made 1 mile below gage and owing to operation of turbines at Gonzales dam, at which gage is located, there may be discrepancies between the stage at the dam and discharge relation at the measuring section. Rating curve for main channel well defined from 400 to 10,000 second-feet, and poorly defined from 10,000 to 28,000 second-feet. Above 11,400 feet, some water enters old channel on right bank about 1 mile above gage, locally known as Cross Timbers, and returns to main channel below gage. United States Weather Bureau gage readings made to nearest tenth once daily. One reading daily may not be true index to discharge, owing to operation of turbines just above gage, and to rapid fluctuations. Daily discharge ascertained by applying daily gage heights to rating table. Records poor.

COOPERATION.—Gage heights furnished by United States Weather Bureau.

Discharge measurements of Guadalupe River near Gonzales, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 15	D. A. Dudley	1.70	671	Aug. 22	Trigg Twichell	1.60	692
Apr. 10	C. E. McCashin	4.28	1,780	Sept. 25	McCashin and Slack	1.40	642
July 18	Trigg Twichell	1.85	757				

Daily discharge, in second-feet, of Guadalupe River near Gonzales, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	990	710	950	590	910	830	3,120	2,180	1,620	1,170	790	670
2	950	710	1,900	710	870	830	1,400	3,120	1,490	870	790	550
3	950	830	870	510	830	830	1,400	8,900	1,490	1,080	790	510
4	950	830	710	710	830	830	2,090	27,700	1,440	870	790	510
5	950	830	830	710	750	670	40,300	19,300	1,530	990	750	510
6	910	670	830	710	830	830	21,300	9,990	1,490	910	710	510
7	910	830	830	710	830	830	5,900	4,530	1,900	870	790	510
8	870	830	830	630	790	830	2,650	3,500	1,440	830	790	510
9	830	830	830	710	790	830	2,090	2,980	1,710	830	790	510
10	830	830	830	710	790	790	1,940	2,700	1,400	830	790	510
11	830	670	670	710	790	790	1,710	2,370	1,260	830	790	750
12	1,900	670	790	710	670	630	1,580	2,820	1,440	830	790	710
13	910	670	790	710	790	750	1,480	2,370	1,900	830	670	630
14	830	830	750	710	790	710	1,400	2,790	1,300	830	750	710
15	830	830	750	630	790	710	1,260	3,970	1,300	830	750	710
16	790	830	750	710	790	710	1,260	3,030	1,300	790	830	710
17	790	830	750	710	790	710	1,260	2,790	1,300	830	790	430
18	790	830	630	710	790	710	1,220	2,420	1,220	830	790	630
19	790	830	750	710	670	550	1,220	2,130	1,260	830	750	630
20	790	630	710	710	790	710	1,350	1,900	1,260	830	550	630
21	790	830	710	710	790	710	1,170	1,710	1,260	830	790	710
22	790	790	710	630	790	710	1,080	1,710	1,260	830	750	630
23	790	790	710	710	790	710	1,040	1,710	1,260	710	750	630
24	790	790	590	710	790	710	1,170	2,230	1,260	830	750	430
25	750	790	590	710	830	710	1,120	1,800	1,040	750	710	630
26	750	750	590	710	710	1,170	1,120	1,580	1,220	830	710	630
27	750	670	590	710	870	1,760	1,350	1,530	1,220	750	430	630
28	750	790	590	710	830	750	9,350	1,400	1,220	830	750	630
29	710	790	590	630	-------	710	16,500	1,580	1,220	790	750	630
30	710	790	590	990	-------	18,500	4,480	1,990	1,220	710	710	630
31	710	-------	590	910	-------	18,400	-------	1,940	-------	830	710	-------

Monthly discharge of Guadalupe River near Gonzales, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,900	710	861	52,900
November	830	630	777	46,200
December	1,900	590	761	46,800
January	990	510	705	43,300
February	910	670	796	44,200
March	18,500	550	1,930	119,000
April	40,300	1,040	4,480	266,000
May	27,700	1,400	4,200	258,000
June	1,900	1,040	1,370	81,800
July	1,170	710	845	52,000
August	830	430	744	45,700
September	750	430	601	35,700
The year	40,300	430	1,510	1,090,000

GUADALUPE RIVER BELOW CUERO, TEX.

LOCATION.—Three-fourths mile upstream from Heards Bridge on Arneckville road, 1 mile south of Dietze farmhouse, 2 miles below Clinton Bridge, 2½ miles southeast of Cuero, Dewitt County, 4 miles below Schleicher Bridge, and 8 miles below dam used for power development.

DRAINAGE AREA.—5,020 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—August 6, 1916, to September 30, 1922. (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 Bridge, 4 miles above this point. Discharge at two sites practically the same.

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

DISCHARGE MEASUREMENTS.—Made from cable 40 feet upstream from gage or by wading near gage.

CHANNEL AND CONTROL.—Channel straight above and below station for 1,000 feet. Bed composed of gravel and small rock; clean and shifts slightly. Left bank composed of sand and dirt, covered with brush and open timber, and is 20 feet high, but at stages above a gage height of 20 feet is overflowed, the water submerging an area for one-fourth 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 auxiliary gage, 26.5 feet at 7.40 p. m. April 7 (discharge, 36,000 second-feet); minimum stage, owing to regulation, probably about 0.80 foot for short time during morning of November 8 (discharge, 195 second-feet).

1916–1922: Maximum stage occurred about October 20, 1919, when recorder was not in operation, and reached a height of about 32.15 feet as determined from flood marks 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).

ICE.—None reported.

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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 permanent during the year. Curve well defined between 200 and 15,000 second-feet, and fairly well defined to 36,000 second-feet. Operation of water-stage recorder not satisfactory. 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 fair.

Discharge measurements of Guadalupe River below Cuero, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	C. E. McCashin	2.06	949	Apr. 9	C. E. McCashin	11.85	[a] 8,230
Nov. 30	D. A. Dudley	1.89	859	10	do	4.55	2,780
Mar. 10	C. E. McCashin	1.40	515	July 20	Trigg Twichell	1.90	852
Apr. 6	do	20.50	[a] 18,000	Aug. 22	do	1.69	668
7	do	26.04	[a] 35,400	Sept. 26	McCashin and Slack	1.58	616
8	do	22.83	[a] 18,600				

[a] Surface velocity observed for part of measurement and coefficient used to reduce to mean velocity.

Daily discharge, in second-feet, of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,710	766	792	714	838	734	11,200	10,900			760	623
2	1,520	760	1,240	818	903	780	13,400	5,020		1,300	728	611
3	1,240	773	1,940	740	806	728		8,500			702	581
4	1,130	754	1,260	760	766	605	9,500	10,400	1,500		695	599
5	1,090	754	942	747	760	629		11,400		916	689	665
6	1,100	728	877	754	903	806	10,900	15,000			671	599
7	1,060	581	812	665	799	623	27,400	19,200			659	593
8	1,050	372	806	605	760	734	26,100	13,700	2,350		721	617
9	1,020	728	812	864	754	671	10,700	5,340	1,490		714	617
10	997	766	665	825	721	683	2,800		1,500		702	611
11	962	708	708	773	641	569	2,240				728	581
12	962	728	870	747	702	569	1,980		1,450		702	659
13	1,640	728	806	702	884	659	1,790		1,600	870	702	942
14	1,490	760	747	641	740	677	1,680				623	766
15	1,050	792	760	677	747	629	1,600				714	683
16	948	773	721	1,710	734	629	1,520				702	641
17	896	792	641	786	714	653	1,450				708	623
18	916	740	677	825	599	587	1,490				754	557
19	916	617	884	766	635	575	1,340				714	635
20	910	734	721	780	851	683	1,380	1,900		818	714	653
21	877	838	754	629	728	695	1,380		1,300	812	635	653
22	844	714	740	659	695	563	1,340			792	695	617
23	851	760	575	844	695	527	1,200			773	695	605
24	812	623	714	747	702	599	1,160			740	689	593
25	825	870	677	695	617	527	1,900			786	702	527
26	812	677	695	728	587	504	1,100			766	671	605
27	806	695	714	728	838	1,230	2,910			780	659	587
28	806	680	728	647	740	1,710	5,020			708	593	593
29	792	786	728	806	-------	1,250	8,160			747	659	593
30	780	773	728	962	-------	3,100	11,000			734	635	587
31	773	-------	728	890	-------	8,240	-------		-------	695	641	-------

NOTE.—Owing to incomplete record discharge partly estimated Nov. 7, 8, Apr. 6–9, May 2, 9, June 8, 12, July 5, and 20. No record and discharge estimated by comparison with other stations Apr. 3–5, May 10 to June 7, 10, 11, June 14 to July 4, and July 6–19. Mean daily discharge by averaging discharge from fractional part of a day Dec. 4, Mar. 27, 29, and Apr. 27.

Monthly discharge of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,710	773	1,020	62,600
November	870	372	729	43,400
December	1,940	575	821	50,500
January	1,710	605	782	48,100
February	903	587	745	41,400
March	8,240	504	1,040	63,800
April	27,400	1,100	6,090	362,000
May	19,200	----------	4,560	280,000
June	----------	----------	1,420	84,300
July	----------	----------	885	54,400
August	760	593	690	42,400
September	942	527	625	37,200
The year	27,400	----------	1,620	1,170,000

SAN MARCOS RIVER AT OTTINE, TEX.

LOCATION.—At highway bridge one-fourth mile southwest of Ottine, Gonzales County, 4 miles below mouth of Plum Creek, and 10 miles above confluence of San Marcos and Guadalupe rivers.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—June 22, 1915, to September 30, 1922.

GAGE.—Chain gage attached to upstream handrail of bridge; read by J. H. Kaine. Gage used from June 22 to October 12, 1915, was a vertical staff under the highway bridge, but gage heights have been reduced to datum of succeeding gage by means of a curve showing relation between readings of the two gages. Gage used from October 13, 1915, to March 15, 1920, was vertical staff in four sections attached to trees on left bank about 400 feet above bridge.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading at shoal 200 feet above bridge.

CHANNEL AND CONTROL.—Bed composed of sand, rock, and gravel; shifts. Banks high and wooded; right bank is overflowed at 28.7 feet gage height and left bank at 34.0 feet gage height. Channel straight above and below station for 150 feet. Low-stage control formed by shoal 150 feet below gage. During high stages in Guadalupe River backwater affects stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 37.0 feet at 6 p. m. April 4 (discharge, not determined); minimum stage, 1.48 feet at 10.30 a. m. July 17 (discharge, 10 second-feet, owing to regulation at dam short distance above gage). Minimum mean daily discharge February 11, March 13, 20, 21 (discharge, 132 second-feet).

1915–1922: Maximum stage recorded, 37.5 feet at 7.30 a. m. May 16, 1920 (discharge not determined); minimum discharge, that of July 17, 1922. Stages not comparable, owing to shifting control and changes in datum of gages.

ICE.—None reported.

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

REGULATION.—Flow regulated by the operation of a small cotton gin a short distance above the station. The 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. Two rating curves used. One from October 1 to April 4 well defined from 150 to 15,000 second-feet and one from April 5 to September 30 well defined between 0 and 15,000 second-feet. Gage read to hundredths twice daily, but mean of two readings daily may not be true mean, owing to power regulation above gage. Daily discharge ascertained by applying mean daily gage height to rating table, except October 1 to March 28 and September 5 to 30 when indirect method of shifting control was used. Records good.

Discharge measurements of San Marcos River at Ottine, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	C. E. McCashin	4.46	518	Apr. 11	C. E. McCashin	4.82	497
Dec. 16	D. A. Dudley	2.66	193	July 17	Trigg Twichell	1.91	68.6
Apr. 5	C. E. McCashin	31.66	14,500	21	do	3.16	240
5	do	29.17	11,300	Aug. 22	do	3.01	224
6	do	14.63	2,170	Sept. 25	McCashin and Slack	2.59	152

Daily discharge, in second-feet, of San Marcos River at Ottine, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	383	246	479	190	200	190	353	998	503	308	234	185
2	338	234	413	190	200	190	368	2,770	473	293	227	171
3	324	234	190	180	190	190	338	11,700	443	278	220	171
4	324	234	190	190	180	180	13,600	11,600	668	278	213	171
5	324	234	200	190	180	180	13,500	3,680	608	293	213	171
6	353	246	200	180	180	170	1,600	1,790	773	278	213	171
7	324	258	200	190	170	170	803	1,120	788	278	199	171
8	324	246	200	180	160	150	653	953	698	278	206	157
9	283	234	200	180	160	150	593	908	503	278	206	157
10	296	234	200	170	150	150	533	743	443	263	206	157
11	622	222	200	170	132	150	488	818	713	263	206	192
12	831	222	200	160	180	150	458	743	698	263	199	178
13	338	222	200	160	180	132	398	1,350	668	263	192	150
14	324	222	200	170	180	150	428	1,810	533	263	192	142
15	283	234	190	180	170	150	413	893	398	278	199	157
16	283	234	190	190	160	150	383	1,450	398	278	206	178
17	283	234	200	190	160	150	368	878	398	164	220	157
18	283	246	200	190	160	150	368	893	383	248	206	142
19	283	234	200	200	160	150	338	773	398	248	206	164
20	296	222	200	190	160	132	518	698	548	263	171	164
21	283	211	200	170	170	132	383	623	398	248	178	157
22	283	211	190	150	170	141	398	578	398	248	206	143
23	258	211	190	150	170	150	338	968	398	234	206	143
24	270	211	190	180	180	150	338	983	383	227	192	143
25	270	222	200	180	246	200	308	683	338	227	171	150
26	270	211	200	190	234	1,480	293	608	323	227	164	157
27	270	211	200	200	211	270	2,380	608	308	234	171	157
28	270	211	190	200	190	211	10,900	638	308	234	171	143
29	258	222	190	310	------	4,620	1,490	1,220	308	234	185	143
30	258	211	190	211	------	13,000	728	728	308	234	199	136
31	258	------	190	211	------	1,290	------	533	------	227	192	------

Monthly discharge of San Marcos River at Ottine, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	831	258	324	19,900
November	258	211	227	13,500
December	479	190	212	13,100
January	310	150	187	11,500
February	246	132	178	9,880
March	13,000	132	801	49,200
April	13,600	293	1,800	107,000
May	11,700	533	1,770	109,000
June	788	308	483	28,800
July	308	164	256	15,700
August	234	164	199	12,200
September	192	136	159	9,480
The year	13,600	132	551	399,000

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, 1922. Miscellaneous discharge measurements were made from 1895 to 1906.

GAGE.—Gurley graph water-stage recorder on right bank at downstream side of bridge. Gage used from January 26, 1915, to February 28, 1916, was vertical staff attached to downstream side of middle pier of Commerce Street Bridge. Gage used from February 29, 1916, to April 8, 1920, was vertical staff, attached to upstream side of second bend of Presa Street Bridge. Relation of readings of different gages not determined. Discharge at various gages is probably not materially different.

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

CHANNEL AND CONTROL.—Channel 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 and minimum stages not determined, owing to work on bridge which interfered with operation of recorder.

1914–1922: Maximum stage recorded, 20.14 feet about 3 a. m. September 10, 1921, determined from flood mark 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).

ICE.—None reported.

DIVERSIONS.—Quantity of water diverted above gage not known but it is believed to be immaterial. Considerable land is irrigated from diversions below gage.

REGULATION.—The operation of water wheels at the Guenther flour mill just above the gage causes frequent but unimportant fluctuations in stage.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used during year. One used from October 1 to January 28, and one from June 10 to September 30; both fairly well defined for all stages during the year. Operation of water-stage recorder not satisfactory 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 that shifting-control method was used October 6 to January 28 and as noted in footnote to daily-discharge table. Records fair.

The normal flow of San Antonio River comes from springs within the city limits, but two tributaries from the north furnish considerable run-off at times of heavy precipitation. Changes in 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 it is thought that the wells draw from the underground reservoir that feeds the river by springs.

Discharge measurements of San Antonio River at San Antonio, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 4	Dudley and West	2.90	117	Mar. 29	C. E. Ellsworth	[a] 2.40	156
Nov. 26	D. A. Dudley	2.62	97.2	31	do	[a] 2.20	71.7
Dec. 16	R. G. West	2.67	85.1	May 6	do	[a] 1.90	130
Jan. 6	D. A. Dudley	[a] 2.68	77.2	June 16	do	2.46	120
24	do	[a] 2.51	71.9	July 19	C. E. McCashin	2.26	85.3
Feb. 8	C. E. Ellsworth	(a)	68.0	Sept. 5	C. E. Ellsworth	2.10	72.0
Mar. 12	C. E. McCashin	(a)	53.3				

[a] Work on bridge to which gage is attached affected stage-discharge relation.

Daily discharge, in second-feet, of San Antonio River at San Antonio, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	116		101	82						100	78	72
2	112		90	83						99	76	72
3	135	100	89	82						100	74	72
4	118		85	80						99	74	73
5	116	112	86	79	70				101	99	76	76
6	116	110	87	78		61				95	76	69
7	114	107	85	78						95	78	67
8	110	102	83	77						94	77	65
9	110	99	81	80						89	76	62
10	113	96	81	81					124	92	78	74
11	116	93	80	86					136	92	80	69
12	112	93	81	73		53			120	90	83	68
13	110		81	80					118	89		69
14	109		80	78					117	90		70
15	109		82	77					118	92		70
		98					101	101			78	
16	109		84	77					134	89		72
17	112			76					172	89		70
18	108			74	61	62				89		70
19	108	94		73						88	82	70
20	107	93	75	71					120	84	83	72
21	107	96		71						84	80	70
22	108	96		71						83	77	69
23	105	97		72						78	77	69
24	102	99	69	72					115	83	76	65
25	95	97	68	70					109	82	74	67
26	93	98	69	68					113	80	74	63
27	92	95	70	66		65			113	78	74	64
28	91	94	86	67					109	74	74	64
29		95	86						106	82	73	65
30	100	95	85	70					104	80	73	64
31			85			72				82	73	

NOTE.—Work on bridge to which recorder is attached caused numerous periods of incomplete record. Braced figures show estimated mean discharge for periods included. Discharge partly estimated Nov. 5, 12, 19, Dec. 24, Jan. 28, June 10, 17, 24, Aug. 12, and 19

Monthly discharge of San Antonio River at San Antonio, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	135		108	6,650
November			98.3	5,850
December	101		80.6	4,960
January	83		75.0	4,610
February			63.6	3,530
March			62.3	3,830
April			101	6,010
May			101	6,070
June			115	6,820
July	100	74	88.4	5,430
August			76.9	4,730
September	74	62	68.5	4,080
The year			86.4	62,600

NOTE.—See footnote to daily-discharge table.

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, and 10 miles below mouth of Medina River.

DRAINAGE AREA.—1,870 square miles (measured on topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—March 12, 1918, to September 30, 1922.

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 below gage.

CHANNEL AND CONTROL.—Bed composed of sand and clay and free from vegetation; shifts. Channel straight above and below station for 150 feet. Left bank high, 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 semipermanent low-water control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.4 feet during night of May 3 (discharge, 7,440 second-feet); minimum stage, 1.90 feet September 3, 8, and 9 (discharge, 83 second-feet).

1918–1922: Maximum stage recorded, 42.0 feet at 4 a. m. September 11, 1921 (discharge, not determined); minimum stage, 0.14 foot, at 8.30 a. m. September 14, 1918 (discharge, 15 second-feet).

ICE.—None reported.

DIVERSIONS.—The Medina dam and reservoir, with a storage capacity of 254,000 acre-feet, is located on Medina River about 50 miles above its confluence with the San Antonio. The diversion works, having a capacity of 850 second-feet, are 4 miles below the Medina dam. Probably about 5,000 acres were 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 fairly well defined between 30 and 1,500 second-feet and extended above this by use of $A\sqrt{d}$ method with measurement No. 10 at a discharge of 11,000 second-feet as a basis; subject to error. Gage read to hundredths twice daily and oftener during floods. Mean of two readings a day may not be true index to discharge, owing to rapidly changing stages. Daily discharge ascertained by indirect method for shifting control and partly estimated January 15–19. 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 Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 28	D. A. Dudley	3.62	182	Mar. 12	C. E. McCashin	3.05	131
Jan. 23	do	3.25	166	July 30	do	2.52	124

Daily discharge, in second-feet, of San Antonio River at Calaveras, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	348	170	934	179	179	361	348	790	262	198	122	89
2	310	170	678	179	170	179	240	854	310	198	122	86
3	558	170	484	179	162	138	229	5,200	298	179	115	83
4	470	170	286	179	162	146	5,360	5,110	298	179	112	86
5	387	170	179	179	162	146	1,790	1,570	361	179	112	86
6	208	170	179	179	162	146	442	633	335	188	112	86
7	218	170	179	179	154	146	374	387	286	188	112	86
8	208	179	179	179	154	138	310	400	286	179	112	83
9	198	170	179	188	154	146	240	400	274	179	108	83
10	188	170	179	442	154	138	229	387	251	179	112	108
11	188	170	179	218	146	138	208	374	663	170	108	146
12	188	170	179	179	146	130	208	348	387	162	108	108
13	188	170	170	179	146	130	198	348	335	162	104	108
14	188	170	170	170	146	130	198	400	262	154	104	112
15	188	179	170	170	146	122	188	400	251	154	104	108
16	198	179	188	170	146	122	188	374	251	154	104	108
17	188	179	179	170	146	115	179	348	414	162	108	104
18	188	170	179	170	154	115	170	322	374	162	104	104
19	179	162	179	179	146	115	162	322	274	146	108	104
20	179	162	179	240	146	115	170	310	262	146	104	101
21	170	162	179	374	146	115	162	310	387	146	104	101
22	170	170	170	374	146	115	154	322	298	138	104	98
23	179	170	170	162	146	115	162	456	251	138	101	98
24	179	179	170	162	154	115	154	918	240	138	98	92
25	179	179	170	162	170	322	154	470	229	130	95	89
26	179	179	170	162	162	240	154	310	218	130	95	89
27	179	179	170	162	162	130	1,010	298	218	130	92	89
28	170	179	170	162	218	130	4,060	274	208	130	92	89
29	170	179	170	310	-------	2,600	1,510	262	198	130	89	86
30	170	179	170	251	-------	3,330	918	298	198	122	92	86
31	170	-------	170	188	-------	870	-------	322	-------	122	92	-------

Monthly discharge of San Antonio River at Calaveras, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	558	170	222	13,600
November	179	162	172	10,300
December	934	170	229	14,100
January	442	162	206	12,600
February	218	146	157	8,700
March	3,330	115	355	21,800
April	5,360	154	662	39,400
May	5,200	262	759	46,600
June	663	198	296	17,600
July	198	122	157	9,660
August	122	89	105	6,440
September	146	83	96.5	5,740
The year	5,360	83	285	207,000

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 railway terminal, 200 feet south of Arsenal Street crossing, four blocks south of city hall, 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, 1922.

GAGE.—Gurley seven-day water-stage recorder installed March 14, 1921, attended by engineers of city of San Antonio. Prior to that date a vertical staff, attached to wall of building No. 713 Commerce Street, on upstream side of bridge on left bank was used.

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

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. Channel straight above and below station.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.25 feet at 9.10 p. m. May 2 (discharge, 788 second-feet, determined from an extension by use of Kutter's formula and subject to error); minimum stage, 0.44 foot at 8 p. m. April 12 (discharge, 4.8 second-feet).

1916–1922: Maximum stage recorded, 8.6 feet at 11.30 p. m. September 9, 1921, when backwater from Alazan 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.—Partly regulated by dam at swimming pool at San Pedro Springs.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 7 to 11 second-feet; poorly defined from 11 to 200 second-feet, and extended above by means of Kutter's formula with a value of n of 0.014 at gage height 6.0 feet. Daily discharge ascertained by applying to rating table mean daily gage height obtained from recorder chart by inspection or by use of planimeter. 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 Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 26	D. A. Dudley	0.51	7.5	Jan. 25	D. A. Dudley	0.50	8.1
Dec. 16	R. G. West	.52	7.3	Mar. 12	C. E. McCashin	.50	7.0
Jan. 6	D. A. Dudley	.49	7.0	June 16	C. E. Ellsworth	.54	9.5

Daily discharge, in second-feet, of San Pedro Creek at San Antonio, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11	9.0	11	7.5	9.6	9.0	8.0	13	11	9.0	9.6	7.5
2	10	8.5	8.5	8.0	9.0	8.5	8.5	47	11	9.0	10	8.0
3	14	8.5	8.0	8.0	8.5	8.0	11	17	19	9.0	8.5	8.0
4	11	8.5	8.0	8.0	8.5	7.5	21	10	11	9.0	9.0	8.0
5	11	8.5	8.0	7.5	8.5	7.0	9.6	9.6	11	8.5	9.6	7.5
6	11	8.5	7.5	7.5	8.5	7.0	12	11	10	9.0	11	7.5
7	10	8.0	7.0	7.5	8.0	7.0	9.6	12	9.6	9.0	9.6	7.5
8	10	8.0	7.0	7.5	8.0	7.5	9.0	12	9.0	9.6	9.0	7.5
9	10	8.0	7.0	7.5	8.0	7.5	8.5	12	9.0	11	9.0	7.5
10	10	8.0	7.0	7.5	8.0	7.5	8.0	11	12	10	9.0	11
11	10	7.5	7.5	7.5	8.0	7.5	8.0	10	18	9.0	9.0	9.0
12	10	7.5	8.0	7.5	8.0	7.5	8.5	9.6	11	9.0	8.5	8.5
13	9.6	7.5	8.5	7.5	8.0	7.0	7.5	9.6	10	9.6	8.5	8.0
14	9.6	7.5	9.0	7.5	8.0	7.0	8.0	9.6	9.6	9.0	9.0	7.5
15	9.6	7.5	9.0	7.5	8.0	7.0	8.5	10	9.6	14	9.0	7.5
16	9.6	7.0	9.0	7.5	8.0	7.0	8.5	10	12	13	8.5	8.0
17	9.6	7.0	9.6	7.5	8.0	7.0	8.5	11	24	11	8.5	8.5
18	9.6	7.0	9.6	7.5	8.0	7.5	9.6	9.6	14	9.0	8.5	8.0
19	9.0	7.0	9.0	7.5	8.5	7.5	8.5	9.6	13	8.0	7.5	8.5
20	9.0	7.0	9.0	7.5	9.0	7.5	8.0	9.6	15	8.5	7.5	8.0
21	9.0	7.0	8.5	7.5	9.0	7.5	8.0	9.6	12	9.6	7.5	7.5
22	9.0	7.0	8.0	7.5	9.6	6.5	8.0	16	10	9.6	7.5	7.5
23	9.0	6.5	8.0	7.5	10	5.6	8.0	14	9.6	8.0	7.5	7.5
24	9.0	7.0	7.5	7.5	16	6.0	8.0	10	9.6	11	7.5	7.5
25	9.0	7.5	7.5	7.5	13	13	8.0	9.6	9.6	7.5	7.5	7.5
26	9.0	8.5	7.5	7.5	10	9.0	13	9.6	9.6	5.6	7.5	7.5
27	9.0	8.0	7.5	7.5	9.6	8.5	33	9.6	9.6	6.5	7.5	7.5
28	9.0	8.0	7.5	8.5	11	7.5	9.6	9.0	9.6	8.0	7.5	7.5
29	9.0	8.0	7.5	14	-------	37	8.5	13	9.6	10	7.5	7.5
30	9.0	8.5	7.5	10	-------	9.6	19	14	9.0	9.0	7.5	7.5
31	9.0	-------	7.5	10	-------	8.5	-------	11	-------	9.0	7.5	-------

Monthly discharge of San Pedro Creek at San Antonio, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	14	9.0	9.76	600
November	9.0	6.5	7.73	460
December	11	7.0	8.12	499
January	14	7.5	7.95	489
February	16	8.0	9.08	504
March	37	5.6	8.64	531
April	33	7.5	10.4	619
May	47	9.0	12.2	751
June	24	9.0	11.6	688
July	14	5.6	9.26	569
August	11	7.5	8.43	518
September	11	7.5	7.88	469
The year	47	5.6	9.25	6,700

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, and 32 miles west of San Antonio.

DRAINAGE AREA.—Not measured.

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

GAGE.—Gurley graph water-stage recorder, attached to right upstream side of diversion dam; inspected 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. Both banks composed of rock and earth, high, and not subject to overflow. Control consists of concrete spillway of dam; permanent. Point of zero flow over dam is 0.60 foot.

EXTREMES OF DISCHARGE.—Maximum stage during the period January 21 to September 30, from water-stage recorder, 0.74 foot from 4 p. m. May 5 to 11 p. m. May 6 (discharge, 28 second-feet); no flow over dam for the period, except May 4 to 12.

ICE.—None.

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. Rating curve well defined for all stages this year. Curve is for flow over dam only. A seepage curve giving relation between height of water behind dam and seepage past dam, measured 1 mile below, fairly well defined for all lake levels this year. Operation of water-stage recorder satisfactory. Daily discharge over dam determined by applying to rating table mean daily gage height obtained from recorder graph by inspection. Mean monthly seepage flow determined by applying to seepage rating table mean monthly lake levels obtained by averaging Medina Valley Irrigation Co.'s daily gage readings. Records good.

COOPERATION.—Medina Valley Irrigation Co. furnishes daily gage readings of lake level.

Discharge measurements of Medina River near Riomedina, Tex., during the period Jan. 21 to Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 21	D. A. Dudley	−4.93	[a]19.8	May 6	C. E. Ellsworth	0.74	[b]53.0
Mar. 30	C. E. Ellsworth	−.50	[a]24.2	Sept. 7	do	−2.71	[a]25.6

[a] No flow over dam; discharge represents the seepage inflow between dam and measuring section.
[b] Discharge includes flow over the dam and the seepage inflow between dam and measuring section.

NOTE.—Elevation of crest of dam, gage height 0.60 foot

Daily discharge, in second-feet, of Medina River over diversion dam near Riomedina, Tex., during the period Jan. 21 to Sept. 30, 1922

Date	Discharge	Date	Discharge	Date	Discharge
May 4	0.7	May 7	26	May 10	20
5	26	8	23	11	15
6	28	9	23	12	6

NOTE.—No flow over dam during period of record except May 4–12. Total discharge, 333 acre-feet.

Monthly seepage of Medina River past diversion dam near Riomedina, Tex., for the period Feb. 1 to Sept. 30, 1922

[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
February	22	1,220	July	24	1,480
March	23	1,410	August	23	1,410
April	24	1,430	September	23	1,370
May	25	1,540			
June	24	1,430	The period		11,300

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 to September 30, 1922. Station was 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 during period March 30 to September 30 from water-stage recorder, 1.93 feet for several hours on July 3 (discharge, 92 second-feet); no flow March 30. Canal ordinarily carries a small flow during nonirrigation season for domestic and stock water uses.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined by measurements made during 1920–1922. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying mean daily gage height to rating table; the mean daily gage height determined from recorder graph or, for days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. 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 period Mar. 30 to Sept. 30, 1922

[Made by C. E. Ellsworth]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Mar. 30	−0.20	*0.05
May 6	.26	5.1
Sept. 7	1.47	55.9

* Estimated.

Daily discharge, in second-feet, of Medina canal near Riomedina, Tex., for the period Mar. 30 to Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1		2.5	6.2	24	80	74	64
2		2.0	7.8	24	88	56	63
3		1.5	6.2	24	89	56	65
4		2.5	6.0	20	74	45	62
5		5.9	6.5	19	68	45	55
6		6.5	6.5	19	63	48	56
7		4.3	6.5	19	63	47	55
8		12	6.5	19	64	46	55
9		19	7.8	31	67	46	56
10		14	12	36	68	47	50
11		13	16	36	71	46	45
12		12	24	36	68	46	51
13		12	24	36	68	44	54
14		12	30	36	68	51	53
15		12	35	36	71	51	52
16		32	36	36	76	57	46
17		40	34	28	79	62	46
18		48	32	20	79	65	44
19		44	28	20	78	62	42
20		36	24	20	70	59	36
21		36	16	25	66	59	39
22		38	12	40	64	62	38
23		38	13	42	63	62	39
24		38	13	46	63	62	37
25		37	16	54	64	63	37
26		35	18	61	68	64	37
27		3.0	18	66	71	63	37
28		3.3	22	63	71	62	38
29		3.4	26	55	74	64	30
30		5.2	28	72	74	65	29
31	2.2		25		74	65	

NOTE.—No record and gage height determined from Medina Valley Irrigation Co.'s gage by comparison curve July 29 to Aug. 5. Gage heights for fractional parts of a day applied to rating table Mar. 31, Apr. 5, 6, 8, and 16. No flow Mar. 30.

Monthly discharge of Medina canal near Riomedina, Tex., for the period Mar. 30 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 30-31	2.2	0	1.1	4
April	48	1.5	19.0	1,130
May	36	6.0	18.1	1,110
June	72	19	35.4	2,110
July	89	63	71.1	4,370
August	74	44	56.3	3,460
September	65	29	47.0	2,800
The period				15,000

NUECES RIVER BASIN

NUECES RIVER NEAR CINONIA, TEX.

LOCATION.—Just below suspension bridge near Oswald ranch, 2 miles east of Cinonia, Zavalla County, 8 miles northeast of Crystal City, and 20 miles above dam on Winter Garden ranch.

DRAINAGE AREA.—2,060 square miles (measured on standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—July 5, 1915, to September 30, 1922.

GAGE.—Vertical staff in six sections installed May 6, 1918, on right bank, 200 feet below highway bridge; read by C. C. Oswald. From July 5, 1915, to September 23, 1917, gage used was vertical staff in seven sections on right and left banks. September 24, 1917, to May 5, 1918, Dexter water-stage recorder near concrete control. All gages set at same datum and at approximately the same location.

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

CHANNEL AND CONTROL.—Bed composed of clay and gravel; free from vegetation; subject to shift prior to September 23, 1917. Banks high and wooded and not subject to overflow, except during extremely high water. Channel straight above and below station. An artificial concrete control was completed at the site of the gage on September 23, 1917; point of zero flow, 0.85 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 23.94 feet at 7 p. m. June 13 (discharge, 3,530 second-feet, determined from extension of rating curve and subject to error); minimum stage, 1.16 feet from 7 a. m. October 1 to 7 a. m. October 13 (discharge, 2.6 second-feet).

1915–1922: Maximum stage recorded, 49.1 feet September 23, 1919, determined by leveling from flood marks (discharge not determined). According to local residents, the greatest flood on record occurred in 1913, when the river reached a stage of about 53 feet by present gage datum. No flow during several periods of record.

ICE.—None reported.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Curve well defined below 700 second-feet, and extended above by means of area-velocity curves. Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage heights to rating table. Records for low and medium stages good, and for high stages fair.

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 the flow of the river is known to seep into the bed just below Uvalde and return to the surface just above the station. The condition of the underground water may have an effect on this return water and thus help to equalize the flow.

The following discharge measurement was made by Dudley and West:

October 5, 1921: Gage height, 1.18 feet; discharge, 2.67 second-feet.

Daily discharge, in second-feet, of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.6	3.5	7.4	6.6	8.1	7.4	19	1,120	36	112	22	7.4
2	2.6	3.5	7.7	6.6	8.1	7.4	17	1,470	32	100	20	7.4
3	2.6	3.5	7.4	6.6	8.1	7.4	24	1,150	28	94	20	6.6
4	2.6	3.5	6.6	6.6	8.1	7.4	1,770	694	28	152	19	6.6
5	2.6	4.7	6.0	6.6	8.1	7.4	264	560	28	173	19	6.6
6	2.6	5.3	6.3	6.6	7.4	7.4	48	458	26	280	18	6.3
7	2.6	6.0	7.4	6.6	7.4	7.4	25	393	24	264	18	6.0
8	2.6	6.0	7.4	6.6	7.4	7.4	19	264	23	216	17	6.0
9	2.6	6.0	7.0	7.4	7.4	7.4	16	240	21	180	17	5.3
10	2.6	6.0	6.6	7.4	4.4	7.0	14	208	21	131	16	5.0
11	2.6	6.0	6.6	7.4	7.4	6.6	14	180	26	94	16	27
12	2.6	6.0	6.6	7.4	7.4	6.6	14	152	894	91	16	21
13	2.8	5.3	6.6	7.4	7.4	6.6	13	145	3,200	79	16	17
14	3.3	5.3	6.6	7.4	7.4	6.6	12	131	1,710	67	15	10
15	3.5	5.0	6.6	7.4	7.4	6.6	12	194	881	64	15	8.5
16	4.1	4.7	6.6	7.4	7.4	6.6	12	124	670	58	15	7.4
17	4.7	4.7	6.6	7.4	7.4	6.6	12	100	604	53	15	7.4
18	4.7	4.7	6.6	7.4	7.4	6.6	11	85	498	48	15	7.4
19	4.7	4.7	6.6	7.4	7.4	6.6	10	67	384	43	14	15
20	4.7	4.7	6.6	7.4	7.4	6.6	9.7	58	348	40	14	21
21	4.7	4.7	6.6	7.4	7.4	6.6	8.9	53	321	36	13	15
22	4.1	4.7	7.4	7.4	7.4	6.6	8.1	48	280	33	12	12
23	4.1	4.7	8.1	7.4	7.4	6.6	10	85	240	28	11	10
24	4.1	4.7	8.1	7.4	7.4	6.6	10	88	216	27	10	9.7
25	4.1	4.7	7.4	7.4	7.4	7.4	9.7	64	201	27	8.9	8.9
26	4.1	4.7	7.4	7.4	7.4	6.6	1,310	43	187	26	8.1	8.9
27	4.1	5.3	6.6	7.4	7.4	6.6	894	33	180	25	7.4	8.9
28	4.1	5.3	6.6	7.4	7.4	6.6	1,910	30	173	24	7.4	8.5
29	4.1	5.3	6.6	7.7	------	216	1,000	27	166	24	7.4	8.1
30	4.1	5.3	6.6	8.1	------	180	1,060	26	145	23	7.4	8.1
31	3.8	------	6.6	8.1	------	43	------	30	------	22	7.4	------

Monthly discharge of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	4.7	2.6	3.52	216
November	6.0	3.5	4.95	295
December	8.1	6.0	6.90	424
January	8.1	6.6	7.25	446
February	8.1	7.4	7.52	418
March	216	6.6	20.4	1,250
April	1,910	8.1	285	17,000
May	1,470	26	268	16,500
June	3,200	21	386	23,000
July	280	22	85.0	5,220
August	22	7.4	14.1	867
September	27	5.0	10.1	601
The year	3,200	2.6	91.5	66,200

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 standard topographic maps; post-route map; and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1922.

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

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

CHANNEL AND CONTROL.—Bed composed of adobe shale; does not change greatly. Channel straight above and below station. Banks wooded, high, 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 ending September 30, 1920, 36.1 feet during morning of October 19 (discharge, 13,600 second-feet, determined from extension of rating curve); minimum stage (supersedes minimum published in Water-Supply Paper 508), 0.9 foot at 9 a. m. September 29, and 8.30 a. m. September 30 (discharge, 15 second-feet).

Maximum stage during year ending September 30, 1921 (supersedes maximum published in Water-Supply Paper 528), 28.5 feet at 8.50 a. m. September 10 (discharge, 9,800 second-feet, determined from extension of rating curve and subject to error); no flow, August 8 to 29 and September 6 to 7.

Maximum stage for the year ending September 30, 1922, 35.4 feet at 8 a. m. May 5 (discharge, 13,200 second-feet, determined from extension of rating curve and subject to error); minimum stage, 0.50 foot November 3–6, 11–14, and December 2 (discharge, 0.9 second-foot).

1915–1922: Maximum stage recorded, 46.0 feet at 5 a. m. September 18, 1919 (discharge not determined, probably backwater due to Gulf storm); no flow during several periods of record.

ICE.—None reported.

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 the stream above the station.

REGULATION.—None of consequence.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 7,000 second-feet and extended by means of area velocity curve above and subject to error. Gage read to nearest tenth October 1, 1919, to September 30, 1921, and to half-tenths once a day thereafter. Daily discharge determined by indirect method of shifting control. Records fair.

Records for 1920 and 1921 published herewith and supersede those published in Water-Suppy Papers 508 and 528.

Daily measurements of Nueces River near Three Rivers, Tex., during the years ending Sept. 30, 1920–1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
1920		*Feet*	*Sec.-ft.*	1921		*Feet*	*Sec.-ft.*
Jan. 31	D. A. Dudley	3.51	296	Feb. 11	R. G. West	0.70	8.8
Mar. 13	McCashin and Pritchett	2.44	141	May 5	do	4.98	661
May 9	D. A. Dudley	3.02	252	July 28	Trigg Twichell	.58	3.8
June 26	Trigg Twichell	1.85	67.1	Sept. 21	R. G. West	2.14	104
Sept. 10	McCashin and West	1.80	87.3	Nov. 29	D. A. Dudley	.64	1.86
Nov. 8	D. A. Dudley	1.30	56.2	1922			
				Mar. 11	C. E. McCashin	.72	3.94
				July 20	McCashin and Hemphill	2.46	144

NOTE.—Measurements made during 1920 and 1921 supersede those published in Water-Supply Papers 508 and 528.

Daily discharge, in second-feet, of Nueces River near Three Rivers, Tex., for the years ending Sept. 30, 1920–1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919–20												
1	11,600				295	192	101	51	539	60	149	248
2	9,850				295	177	101	70	395	43	80	170
3	9,100				295	177	101	80	222	35	51	118
4	8,400				276	177	101	163	539	28	43	96
5	7,910				276	163	90	106	517	6,540	35	85
6	8,550				276	163	90	96	517	9,650	35	75
7	10,800				276	163	90	80	719	7,190	101	75
8	11,600				276	149	90	136	561	6,120	163	75
9	10,800				276	149	80	214	517	4,350	163	96
10	9,350				257	149	90	539	239	2,800	276	87
11	7,670				257	149	80	335	149	1,770	51	85
12	6,450				257	149	90	335	112	1,590	51	65
13	6,580				1,030	136	80	230	90	1,510	51	65
14	7,620				605	136	70	295	80	475	101	56
15	9,250				355	136	70	230	517	177	355	56
16	11,400				315	136	70	2,840	1,110	124	163	47
17	12,400				276	136	60	2,620	177	101	136	47
18	13,200				276	136	60	860	101	90	222	39
19	13,500				257	136	60	561	70	80	435	39
20	12,600				257	124	60	788	70	60	395	32
21	11,200				239	124	51	1,060	60	51	395	32
22	10,400				239	124	51	812	60	51	435	25
23	10,600				239	124	51	495	222	43	495	25
24					222	124	51	192	177	43	583	56
25					207	124	51	163	112	35	673	56
26					207	124	60	149	72	35	1,240	39
27					192	112	90	136	90	35	1,140	25
28					192	112	70	136	90	28	1,160	20
29					192	112	70	257	70	28	1,290	15
30						101	51	517	51	28	1,510	15
31						101		335		22	1,290	

Daily discharge, in second-feet, of Nueces River near Three Rivers, Tex., for the years ending Sept. 30, 1920–1922—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920–21												
1	12	605	25	9.2	12	12	605	1,570	43	124	0.9	2.2
2	12	517	20	12	12	1,570	495	561	35	101	.9	.9
3	9.2	214	15	12	12	1,480	335	248	22	60	.6	.6
4	9.2	130	15	12	12	1,830	170	355	28	35	.6	.1
5	9.2	106	15	12	12	435	1,400	672	17	28	.6	.1
6	9.2	85	15	12	12	239	7,430	455	14	22	.6	-------
7	6.8	75	12	12	12	517	8,650	395	14	1,510	.2	-------
8	6.8	65	12	12	12	435	3,290	248	10	222	-------	1.6
9	6.8	56	12	12	12	239	3,670	184	14	101	-------	6,720
10	6.8	47	12	12	12	375	1,510	455	1,480	60	-------	9,800
11	5.0	39	12	12	8.9	455	1,190	539	517	43	-------	8,950
12	5.0	47	12	12	9.2	539	812	435	3,590	35	-------	2,100
13	5.0	39	12	12	9.2	455	956	177	2,130	276	-------	1,240
14	5.0	47	12	12	9.2	257	1,010	136	1,980	90	-------	908
15	5.0	39	9.2	12	9.2	156	1,010	517	583	70	-------	1,110
16	3.4	39	9.2	12	9.2	106	1,060	1,140	276	149	-------	1,540
17	35	39	9.2	12	9.2	85	1,160	1,320	375	112	-------	1,270
18	17	39	9.2	12	9.2	65	435	2,160	696	35	-------	980
19	14	39	9.2	12	9.2	56	170	1,450	1,060	17	-------	355
20	10	32	9.2	12	12	47	118	673	1,160	10	-------	163
21	7.9	39	9.2	12	12	39	85	239	742	7.9	-------	101
22	7.9	32	12	12	12	32	75	177	696	5.8	-------	60
23	5.8	25	12	12	12	6,820	65	136	742	4.1	-------	43
24	5.8	20	12	12	12	4,470	56	124	884	2.7	-------	28
25	14	20	9.2	12	12	2,940	56	112	1,080	1.6	-------	28
26	51	20	9.2	12	12	1,240	56	90	1,290	43	-------	28
27	60	239	9.2	12	12	836	47	70	1,650	10	-------	22
28	60	65	9.2	12	12	539	39	60	1,770	4.0	-------	22
29	51	39	9.2	12	-------	415	32	43	1,370	2.7	-------	17
30	315	32	9.2	12	-------	375	25	35	149	1.6	355	276
31	475	-------	9.2	12	-------	455	-------	51	-------	1.2	6.8	-------
1921–22												
1	1,210	1.6	1.5	4.0	9.2	3.7	3,670	7,380	1,110	2,840	22	5.0
2	276	1.6	.9	4.0	6.8	3.7	812	11,600	980	2,220	20	5.0
3	70	.9	156	3.8	6.8	3.7	980	12,400	1,110	719	20	4.1
4	35	.9	65	3.8	6.8	3.7	7,760	12,600	1,370	1,740	17	4.1
5	28	.9	47	3.7	5.0	3.7	12,400	13,200	788	4,910	17	3.4
6	22	.9	20	3.7	5.0	3.7	12,800	12,400	1,080	3,220	17	3.4
7	17	1.6	12	3.4	4.1	3.7	9,750	10,900	1,140	2,160	17	2.7
8	14	1.6	9.2	3.4	4.1	3.7	6,960	10,200	627	1,210	15	2.7
9	10	1.6	9.2	3.4	4.1	3.7	6,170	8,650	517	1,140	15	2.2
10	7.9	1.6	6.8	5.0	4.1	3.7	5,500	6,820	435	1,110	15	2.2
11	5.8	.9	6.0	4.1	3.7	3.7	4,590	5,500	836	673	10	124
12	5.8	.9	5.6	5.0	3.7	3.7	2,870	4,750	3,550	395	10	207
13	4.1	.9	5.3	5.0	3.7	3.7	2,040	4,190	2,130	375	9.2	149
14	4.1	.9	5.0	5.0	3.7	3.7	1,650	5,360	742	355	9.2	80
15	4.1	1.6	5.0	5.0	3.7	3.7	1,800	4,230	788	355	9.2	28
16	2.7	1.6	5.0	5.0	3.7	3.7	1,510	3,950	956	415	5.8	17
17	2.7	1.6	5.0	5.0	3.7	3.7	1,030	3,470	1,370	517	5.8	207
18	43	1.6	5.0	5.0	3.7	3.7	415	2,250	2,160	415	5.8	124
19	17	1.6	5.0	5.0	3.7	3.7	149	1,240	3,430	315	112	1,340
20	14	1.6	4.4	5.0	3.7	3.7	101	765	4,670	149	90	1,920
21	10	1.6	4.4	5.0	3.7	3.7	80	650	4,350	101	149	1,510
22	7.9	1.6	4.3	5.0	3.7	3.3	60	836	4,670	43	101	627
23	7.9	1.6	4.3	5.0	3.7	3.3	43	932	5,580	39	60	622
24	5.8	1.6	4.3	5.0	3.7	3.3	35	1,060	6,040	39	28	163
25	5.8	1.6	4.3	5.0	3.7	3.3	28	1,320	5,990	38	17	112
26	4.1	1.6	4.3	5.0	3.7	3.7	25	1,570	5,990	36	14	70
27	4.1	1.6	4.1	5.0	3.7	3.7	25	1,590	5,940	33	10	51
28	2.7	1.6	4.1	5.0	3.7	33	3,120	1,540	4,790	31	7.9	28
29	2.7	1.5	4.1	12	-------	495	3,910	719	3,670	28	7.9	60
30	2.7	1.5	4.1	12	-------	4,350	1,110	932	3,320	25	5.8	112
31	1.6	-------	4.1	9.2	-------	4,430	-------	980	-------	22	5.8	-------

NOTE.—No record Oct. 24, 1919, to Jan. 31, 1920. No flow Aug. 8–29 and Sept. 6–7, 1921. Daily discharge for the years ending Sept. 30, 1920 and 1921, supersede those published in Water-Supply Papers 508 and 528

Monthly discharge of Nueces River near Three Rivers, Tex., for the years ending Sept. 30, 1920–1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919–20				
October 1–23	13,500	6,450	10,000	456,000
February	1,030	192	297	17,100
March	192	101	139	8,560
April	101	51	743	4,420
May	2,840	51	480	29,500
June	1,110	51	275	16,400
July	9,650	22	1,390	85,700
August	1,510	35	428	26,300
September	248	15	65.5	3,900
1920–21				
October	475	3.4	40.2	2,470
November	605	20	94.3	5,610
December	25	9.2	11.8	726
January	12	9.2	11.9	732
February	12	8.9	11.1	616
March	6,820	12	888	54,600
April	8,650	25	1,200	71,400
May	2,160	35	478	29,400
June	3,590	10	814	48,400
July	1,510	12	103	6,320
August	355	0	11.8	726
September	9,800	0	1,190	70,900
The year	9,800	0	403	292,000
1921–22				
October	1,210	1.6	59.6	3,670
November	1.6	.9	1.41	83.7
December	156	.9	13.7	844
January	12	3.4	5.18	318
February	9.2	3.7	4.38	243
March	4,430	3.3	303	18,700
April	12,800	25	3,050	181,000
May	13,200	650	4,970	305,000
June	6,040	435	2,670	159,000
July	4,910	22	828	50,900
August	149	5.8	27.4	1,680
September	1,920	2.2	240	14,300
The year	13,200	.9	1,020	736,000

NOTE.—See footnote to table of daily discharge. Monthly figures for the years ending Sept. 30, 1920 and 1921, supersede those published in Water-Supply Papers 508 and 528.

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, 8 miles above Nueces Bay, and half a mile above edge of tidewater and breakwater dam.

DRAINAGE AREA.—16,700 square miles (measured on post-route map and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—August 12, 1915, to September 30, 1922.

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

DISCHARGE MEASUREMENTS.—Made by wading at the 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. The 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 the crest.

EXTREMES OF STAGE.—Maximum stage recorded, 9.60 feet at 8 a. m. May 9 to 8 a. m. May 10; minimum stage, 1.20 feet, 4 p. m. November 1 to 4 p. m. November 2, and 8 a. m. November 8 to 4 p. m. November 12, and 4 p. m. September 12 to 4 p. m. September 16.

1915–1922: During September, 1919, the river reached a stage of about 12 feet, as determined from flood marks on the gage. This was not only the highest stage reached during the 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 being overflowed for a width of several miles. No flow August 23–28, 1918.

ICE.—None reported.

DIVERSIONS.—Considerable water taken from river for irrigation immediately above station, and river water is also used for irrigation throughout the drainage above. The city of Corpus Christi pumps water just below the 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 the breakwater dam. Rating curve is 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 were made at this station during the years 1920, 1921, and 1922.

Daily gage height, in feet, of Nueces River at Calallen, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	------	1.22	1.38	1.50	1.60	1.55	4.52	4.85	3.10	7.50	1.60	1.42
2	2.35	1.20	1.35	1.50	1.60	1.55	5.28	5.00	3.25	7.15	1.55	1.40
3	3.05	1.25	1.38	1.50	1.60	1.55	5.92	5.25	3.12	7.00	1.55	1.40
4	3.00	1.25	1.40	1.50	1.60	1.55	4.50	6.30	3.05	6.70	1.50	1.35
5	2.52	1.25	2.25	1.50	1.60	1.55	3.80	7.20	3.22	3.60	1.50	1.35
6	1.82	1.25	2.05	1.50	1.65	1.55	4.82	8.05	3.45	4.35	1.50	1.35
7	1.72	1.25	1.82	1.55	1.60	1.55	6.10	8.90	3.42	5.45	1.45	1.35
8	1.60	1.20	1.78	1.55	1.60	1.55	7.02	9.32	3.20	6.00	1.42	1.32
9	1.58	1.20	1.70	1.30	1.58	1.50	7.82	9.60	3.05	5.75	1.40	1.30
10	1.60	1.20	1.60	1.55	1.55	1.55	8.88	9.58	3.00	3.60	1.38	1.30
11	1.55	1.20	1.50	1.55	1.55	1.55	9.05	9.45	3.00	3.10	1.35	1.30
12	1.50	1.20	1.50	1.55	1.55	1.55	8.80	9.25	3.20	2.85	1.35	1.25
13	1.45	1.25	1.48	1.55	1.55	1.50	8.45	9.00	3.50	2.50	1.35	1.20
14	1.40	1.28	1.48	1.55	1.55	1.50	7.95	8.80	4.05	2.35	1.35	1.20
15	1.40	1.30	1.48	1.55	1.55	1.50	7.20	8.30	4.50	2.30	1.38	1.20
16	1.45	1.32	1.50	1.55	1.55	1.45	5.78	7.92	3.25	2.28	1.40	1.55
17	1.42	1.32	1.50	1.55	1.52	1.45	4.82	7.80	2.95	2.30	1.42	2.00
18	1.35	1.40	1.45	1.55	1.50	1.45	4.50	7.55	3.05	2.30	1.48	2.50
19	1.35	1.38	1.45	1.55	1.50	1.45	4.20	7.30	3.70	2.30	1.50	2.30
20	1.30	1.30	1.45	1.55	1.50	1.45	3.10	6.70	4.12	2.30	1.55	2.00
21	1.30	1.40	1.50	1.55	1.50	1.45	2.20	4.20	4.62	2.18	1.65	2.50
22	1.42	1.40	1.50	1.55	1.50	1.42	2.02	2.85	5.45	1.98	1.70	3.30
23	1.48	1.40	1.55	1.55	1.50	1.40	1.95	2.80	5.90	1.88	1.75	3.30
24	1.42	1.38	1.55	1.55	1.55	1.40	1.90	2.85	6.45	1.82	1.90	2.58
25	1.40	1.35	1.55	1.55	1.55	1.40	1.85	2.95	6.70	1.80	1.95	2.50
26	1.40	1.35	1.50	1.55	1.55	1.50	1.78	3.05	7.05	1.75	1.85	2.45
27	1.35	1.35	1.50	1.55	1.55	1.85	1.70	3.42	7.25	1.70	1.75	2.00
28	1.35	1.35	1.45	1.55	1.55	1.85	1.65	3.60	7.45	1.70	1.65	1.70
29	1.35	1.35	1.48	1.55	------	1.68	1.65	3.60	7.58	1.70	1.55	1.60
30	1.25	1.35	1.50	1.55	------	2.32	4.05	3.48	7.60	1.70	1.50	1.60
31	1.25	------	1.50	1.58	------	4.92	------	2.92	------	1.62	1.45	------

FRIO RIVER NEAR DERBY, TEX.

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

DRAINAGE AREA.—3,500 square miles (measured on post-route map and topographic map of Texas, compiled in 1899 by Robert T. Hill, of the United States Geological Survey; scale, 1 inch=25 miles).

RECORDS AVAILABLE.—August 1, 1915, to September 30, 1922.

GAGE.—Vertical staff attached to railway bridge pier; read by E. L. Willingham or 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 not subject to overflow. 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 the year, 11.4 feet 7.30 p. m. May 2 (discharge, not determined); no flow during several periods.

1915–1922: Maximum stage recorded, 18.5 feet September 18, 1919 (discharge not determined); no flow during several periods of each year.

ICE.—None reported.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 2,000 second-feet. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage height to rating table, except as noted in footnote to daily-discharge table. Records good.

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

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1			0.7	1.2	312		126	11	0.9
2			.7	.5	183		49	11	.9
3			.5	.5	44		79	16	.9
4			.5	.5	16		41	12	.5
5			.7	.5	1,180	2,860	49	9.3	.5
6			.9	.5	1,860	1,180	51	17	.5
7			.5	.5	610	592	35	20	.5
8			.5	.5	162	382	23	16	.5
9			.5	.5	57	267	16	12	.5
10			.5	.5	22	237	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	418	1,680	4.0	.0
16	16		.9	.5	4.0	170	860	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	435	21	1.4	
25			.9	1.8	.9	348	16	.9	
26			.9	1.4	630	68	16	.9	
27			.5	1.4		63	14	.9	
28			1.4	1.4		32	12	.9	
29				14		19	12	.9	
30				260		16	11	.9	
31		0.3		540		418		.9	

NOTE.—Gage height, in feet, for days when stage was beyond limits of rating curve, as follows: Apr. 27, 8.1; 28, 8.4; 29, 9.8; 30, 8.0; May 1, 8.0; 2, 10.9; 3, 9.6; and 4, 8.2. No flow Oct. 1–13, Oct. 22 to Jan 30, Aug. 15, and Aug. 21 to Sept. 30.

Monthly discharge of Frio River near Derby, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	18	0.0	1.95	120
January	.3	.0	.01	.6
February	1.4	.1	.65	35.9
March	540	.1	26.8	1,650
April 1–26	1,860	.9	199	10,300
May 5–31	2,860	16	318	17,000
June	1,680	11	131	7,770
July	20	.9	6.03	371
August	.9	.0	.29	18.0

NOTE.—See footnote to table of daily discharge.

RIO GRANDE BASIN

RIO GRANDE BELOW ELEPHANT BUTTE DAM, N. MEX

LOCATION.—In T. 13 S., R. 4 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, 1922.

GAGE.—Stevens water-stage recorder on left bank, 1 mile below dam.

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, and reduced to three significant figures by United States Geological Survey.

Daily discharge, in second-feet, of Rio Grande below Elephant Butte dam, N. Mex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,080	1,400	3	3	1,040	940	1,280	1,820	2,120	2,190	2,800	1,970
2	2,080	1,200	3	3	1,040	913	1,330	1,820	2,080	1,890	2,830	2,100
3	1,840	1,080	3	3	1,030	910	1,470	1,820	2,060	1,920	2,850	2,100
4	1,310	1,080	2	3	1,020	918	1,490	1,820	2,040	2,010	2,870	2,100
5	1,310	1,080	3	3	1,020	903	1,520	1,820	2,000	1,990	2,900	2,100
6	1,310	1,080	3	3	1,020	901	1,540	1,820	351	1,990	2,930	2,100
7	1,310	1,080	3	3	1,020	900	1,540	1,820	10	1,970	2,960	2,100
8	1,310	1,080	3	3	1,010	898	1,570	1,890	1,930	1,960	3,000	2,100
9	1,310	1,080	3	3	1,010	1,090	1,570	1,990	1,900	1,900	2,780	2,100
10	1,310	1,080	3	3	1,000	1,130	1,560	1,990	1,880	1,820	2,090	2,100
11	1,310	1,080	100	3	1,000	1,340	1,760	1,990	1,860	1,750	2,090	2,100
12	1,310	1,080	600	3	998	1,330	1,880	1,990	1,830	1,710	2,080	2,100
13	1,310	1,080	600	3	996	1,320	1,910	1,990	1,810	1,660	2,070	2,100
14	1,310	1,080	600	3	994	1,320	1,910	1,990	1,780	1,600	2,060	2,100
15	1,160	1,080	600	3	990	1,310	1,920	1,990	1,750	1,550	2,050	2,100
16	1,060	1,080	600	3	988	1,300	1,940	1,990	1,780	1,500	2,090	2,040
17	1,060	1,080	600	3	984	1,300	1,940	2,200	2,010	1,450	2,070	2,000
18	1,060	1,080	600	3	978	1,290	1,970	2,360	2,350	1,440	2,060	1,820
19	1,060	876	761	3	970	1,290	1,980	2,360	2,400	1,510	2,050	1,730
20	1,060	670	900	3	970	1,290	2,000	2,360	2,450	1,550	2,040	1,730
21	1,320	919	900	3	978	1,290	2,010	2,340	2,490	2,500	1,990	1,560
22	1,360	1,350	900	3	940	1,290	2,020	2,310	2,550	2,440	1,870	1,510
23	1,360	1,180	900	3	935	1,290	2,020	2,280	2,570	2,470	1,870	1,520
24	1,360	783	900	356	930	1,290	2,040	2,250	2,630	2,520	1,870	1,650
25	1,360	919	900	978	932	1,290	2,010	2,220	2,660	2,550	1,430	1,650
26	1,360	919	900	975	931	1,300	1,940	2,200	2,680	2,580	1,840	1,650
27	1,360	919	900	1,000	942	1,320	1,900	2,180	2,700	2,610	1,840	1,540
28	1,360	919	900	1,010	940	1,320	1,840	1,940	2,770	2,640	1,820	1,660
29	1,360	919	289	1,030	-------	1,300	1,800	1,920	2,320	2,690	1,850	1,660
30	1,360	361	6	1,040	-------	1,280	1,810	1,880	2,640	2,730	1,850	1,660
31	1,360	-------	7	1,060	-------	1,280	-------	1,850	-------	2,770	1,850	-------

NOTE.—Gates closed Dec. 1–10 and Dec. 30 to Jan. 23. Discharge June 7 represents leakage. Quantities changed slightly to conform to computation rules used by the U. S. Geol. Survey.

Monthly discharge of Rio Grande below Elephant Butte dam, N. Mex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	2,080	1,060	1,350	83,000
November	1,400	361	1,020	60,700
December	900	2	435	26,700
January	1,060	3	243	14,900
February	1,040	930	986	54,800
March	1,340	898	1,190	73,200
April	2,040	1,280	1,780	106,000
May	2,360	1,820	2,040	125,000
June	2,770	10	2,080	124,000
July	2,770	1,440	2,060	127,000
August	3,000	1,430	2,220	136,000
September	2,100	1,510	1,890	112,000
The year	3,000	2	1,440	1,040,000

NOTE.—Monthly means computed by engineers of the U. S. Geol. Survey.

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, 1922.

GAGE.—Stevens water-stage recorder on right bank; installed August 27, 1914, at same site and datum as staff gage installed September 7, 1905. Original gage, which was 100 feet below the mouth of Penasco River and half a mile below present gage, was washed out September 6, 1905.

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; both banks overflowed at stage of about 11.5 feet. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 1,980 second-feet June 5; minimum mean daily discharge, 33 second-feet, August 10–13.

1905–1922: 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, 2.45 feet July 26 and 27, 1916 (discharge, 23 second-feet).

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 in the vicinity of Carlsbad and stores part of the water used near Carlsbad in Lake McMillan, 10 miles below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent, but periods of change are covered by frequent discharge measurements. Two rating curves used One used from October 1 to June 30 well defined from 80 to 500 second-feet, and one used from July 1 to September 30 well defined from 30 to 600 second-feet; both extended parallel to previous curve to cover range of stage for the year. Mean daily gage height determined from recorder graph. Daily discharge determined by applying mean daily gage height to rating table except for October 21 to February 26, May 11 to June 30, and July 15 to August 31, when shifting-control method was used. Records good.

COOPERATION.—Daily discharge record furnished by the United States Bureau of Reclamation.

Discharge measurements of Pecos River near Dayton, N. Mex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 5	J. R. Yates	5.68	94	Feb. 21	United States Bureau of Reclamation engineers	6.25	176
20	do	5.82	113				
26	H. I. Haralson	5.70	113	Mar. 28	do	5.90	122
Nov. 9	J. R. Yates	6.05	176	Apr. 24	do	5.80	108
17	Haralson and Hamill	5.92	155	May 24	do	6.00	112
Dec. 8	J. R. Yates	6.25	173	June 8	do	8.20	575
Jan. 3	do	6.70	252	July 7	do	7.20	313
30	United States Bureau of Reclamation engineers	7.20	294	Aug. 3	do	5.55	34
				23	do	5.55	41
				Sept. 26	do	6.45	165

Daily discharge, in second-feet, of Pecos River near Dayton, N. Mex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	101	128	172	237	237	194	123	302	456	115	56	35
2	101	128	165	237	237	221	111	279	1,457	115	46	35
3	94	131	169	243	227	204	110	247	923	139	35	39
4	94	131	167	243	227	199	218	227	1,392	208	35	41
5	94	131	169	243	227	194	172	214	1,980	290	35	41
6	88	136	186	243	227	172	158	190	1,169	375	35	41
7	81	139	183	243	237	172	147	176	1,169	290	45	48
8	81	142	170	233	237	314	139	264	695	208	52	43
9	81	163	164	233	233	290	111	1,800	456	172	44	43
10	81	158	181	235	237	227	108	923	352	155	33	39
11	81	165	190	235	208	227	118	625	314	123	33	37
12	81	183	197	227	176	217	112	489	279	94	33	41
13	81	174	197	227	181	208	94	380	290	139	33	41
14	81	174	197	231	181	208	94	302	290	147	39	43
15	81	174	197	237	181	199	91	243	247	1,698	44	71
16	88	174	197	239	190	199	69	237	208	671	37	48
17	88	162	197	233	190	199	71	237	208	395	39	46
18	88	157	197	237	181	190	81	237	181	253	48	46
19	88	157	197	237	181	185	75	214	456	199	50	46
20	88	165	197	237	185	176	75	186	380	163	48	46
21	97	163	197	227	177	169	75	155	247	139	48	46
22	101	163	199	227	181	169	79	150	314	108	39	108
23	111	172	204	227	181	165	86	139	217	94	39	345
24	123	170	210	227	181	162	98	123	190	87	35	257
25	123	169	213	227	187	155	155	101	172	90	35	227
26	126	167	216	217	181	131	302	101	147	75	37	163
27	112	174	221	217	181	136	247	101	131	66	45	139
28	112	181	221	217	181	139	227	94	139	58	53	112
29	114	177	225	247	-------	164	275	104	155	51	51	87
30	114	179	231	290	-------	158	326	108	123	46	41	71
31	115	-------	241	247	-------	164	-------	172	-------	51	37	-------

Monthly discharge of Pecos River near Dayton, N. Mex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	126	81	96.4	5,930
November	183	128	160	9,520
December	241	164	196	12,100
January	290	217	235	14,400
February	237	176	201	11,200
March	314	131	191	11,700
April	326	69	138	8,210
May	1,800	94	294	18,100
June	1,980	123	491	29,200
July	1,690	46	219	13,500
August	56	33	41.3	2,540
September	345	35	80.8	4,810
The year	1,980	33	195	141,000

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, 1922.

GAGE.—Stevens eight-day water-stage recorder, attached to downstream end of middle bridge pier, installed June 1, 1920; inspected by J. R. Yates. Gage used from May 28, 1903, to October, 1904, was inclined staff gage at the present site. From October, 1904, to March 31, 1908, vertical staff gage at the same site used, and from May 18, 1914, to June 1, 1920, gage was vertical staff, attached to upstream side of middle pier of bridge.

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, 1.60 feet at 6.30 p. m. October 14 (discharge, 590 second-feet); minimum stage, 0.57 foot at 7 p. m. August 22 (discharge, 73 second-feet).

1903–1908; 1914–1922: Maximum stage recorded, about 21.0 feet August 7, 1916 (discharge, 85,700 second-feet[5]); 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 the river between the storage reservoirs and the gaging station, the quantity depending on the amount being used for irrigation between the two points.

[5] Discharge at Avalon dam; reported by engineers of the United States Bureau of Reclamation.

REGULATION.—Flow at this point completely controlled by storage reservoirs of the Carlsbad project, except during extreme floods.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined for all stages. Operation of water-stage recorder satisfactory. 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.

COOPERATION.—Gage-height record and discharge measurements furnished by United States Bureau of Reclamation.

Discharge measurements of Pecos River at Carlsbad, N. Mex., during the year ending Sept. 30, 1922

[Made by J. R. Yates]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Nov. 16	0.88	157	June 13	0.70	99
Jan. 4	.69	92	Aug. 8	.74	118
Feb. 1	1.10	260	Sept. 16	.66	96
Mar. 23	.66	86.5			

Daily discharge, in second-feet, of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	103	148	156	186	260	87	97	100	110	107	103	107
2	123	156	156	190	260	90	97	100	103	107	103	103
3	116	148	160	178	260	90	100	100	103	103	103	107
4	119	145	156	117	260	95	100	157	103	100	103	107
5	119	145	160	97	255	90	100	332	107	110	103	107
6	110	152	181	113	250	90	100	292	103	100	107	103
7	116	156	203	85	255	90	97	182	103	100	110	110
8	133	152	203	85	255	90	97	113	103	107	110	103
9	133	152	203	87	255	90	92	103	103	100	110	103
10	113	148	177	90	260	87	85	103	100	107	107	100
11	95	152	177	90	260	90	87	100	100	103	110	103
12	141	148	177	87	250	90	90	100	107	107	107	100
13	125	148	181	87	250	92	90	100	100	110	103	100
14	185	148	177	90	250	90	87	97	100	107	110	100
15	172	148	177	92	250	92	92	100	97	103	107	100
16	116	152	190	90	255	92	92	100	97	103	107	97
17	148	156	212	92	255	92	85	100	95	107	107	92
18	164	156	209	95	250	87	90	97	90	107	103	97
19	156	156	206	90	250	92	90	95	95	107	107	97
20	123	145	203	92	246	97	90	97	92	113	100	95
21	168	148	199	90	186	85	90	95	95	113	107	92
22	177	172	186	215	149	95	107	97	95	110	100	95
23	116	164	186	231	100	87	158	100	95	100	107	92
24	164	164	181	241	95	95	126	97	95	110	100	92
25	160	177	186	271	95	95	133	97	92	110	107	92
26	168	168	181	260	92	90	123	100	97	110	107	90
27	164	152	168	260	95	92	107	103	95	113	100	90
28	160	152	172	265	87	97	107	100	95	110	103	87
29	152	152	172	265	-------	95	100	107	95	113	107	87
30	148	152	172	265	-------	95	100	107	100	103	107	87
31	148	-------	172	265	-------	92	-------	107	-------	107	107	-------

NOTE.—Gage heights applied to rating table for fractional parts of a day Oct. 12–14, Jan. 3, 4, 22, 25, Feb. 22, Apr. 23, 24, May 4, and 7. No record and discharge interpolated Nov. 13, 14, and Dec. 18, and 19. Discharge partly estimated, owing to incomplete record, Oct. 29, Nov. 15, 27, Dec. 20, Apr. 9, May 14, June 11, July 30, and Aug. 6.

Monthly discharge of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	185	95	140	8,610
November	177	145	154	9,160
December	212	156	182	11,200
January	271	85	154	9,470
February	260	87	214	11,900
March	97	85	91.3	5,610
April	158	85	100	5,950
May	332	95	119	7,320
June	110	90	98.8	5,880
July	113	100	107	6,580
August	110	100	106	6,520
September	110	87	97.8	5,820
The year	332	85	130	94,000

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, 1922.

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 near gage.

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 by sand, 500 feet below gage; shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.0 feet at 2 a. m. April 25 (discharge, 1,790 second-feet); minimum stage, 3.40 feet at 6 p. m. June 25 (discharge, 53 second-feet, determined from extension of rating curve and subject to error).

1920–1922: Maximum stage from water-stage recorder, 12.85 feet at 1 a. m. June 8 (discharge, 22,000 second-feet, determined from extension of curve and subject to error); minimum stage that of June 25, 1922.

In September, 1919, the river reached a stage of 26.4 feet (discharge not determined.)

ICE.—None reported.

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 the stream by seepage from lands in the vicinity of Carlsbad. In addition to the water used by the Carlsbad project, some diversions are made for irrigation in the basin above the storage reservoirs of the Carlsbad project.

REGULATION.—The 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 waters, but during the winter the flow depends on water released at the reservoirs.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used. One used from October 1 to December 31 is well defined from 140 to 300 second-feet, and one used from January 1 to September 30 is well defined from 100 to 400 second-feet; both curves extended parallell to previous curves to cover range of stage. Operation of water-stage recorder satisfactory. Daily discharge determined by applying to rating table mean daily gage height obtained from recorder graph by inspection, by planimeter, or by averaging gage heights for fractional parts of a day, except as noted in footnote to daily-discharge table. Records good.

COOPERATION.—Daily-discharge record furnished by United States Bureau of Reclamation.

Discharge measurements of Pecos River near Malaga, N. Mex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 17	Ellsworth and West	4.05	268	Mar. 22	J. R. Yates	3.90	198
Nov. 8	Yates and Robbins	4.12	309	May 10	do	3.90	219
Dec. 9	J. R. Yates	4.15	312	June 21	do	3.65	129
Jan. 4	do	4.05	242	Aug. 7	do	3.62	117
Feb. 1	do	4.18	319	Sept. 15	do	3.81	184

Daily discharge, in second-feet, of Pecos River near Malaga, N. Mex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	201	321	297	292	316	228	113	480	212	133	117	133
2	205	329	293	308	332	208	104	333	700	169	117	117
3	225	333	297	308	332	188	89	323	320	248	117	120
4	257	341	293	252	324	184	240	244	276	192	117	126
5	269	317	297	224	320	208	212	344	316	150	117	130
6	269	289	293	296	320	232	192	447	280	143	130	127
7	269	313	273	224	324	196	180	380	236	150	123	126
8	245	321	249	154	324	196	143	280	220	550	133	127
9	285	329	301	162	324	204	136	256	200	248	120	143
10	289	321	329	147	316	220	98	224	200	204	117	143
11	281	333	301	162	312	188	113	196	184	188	110	147
12	245	349	305	169	304	188	110	204	147	169	117	188
13	281	349	305	169	300	200	107	192	550	196	133	180
14	245	357	305	224	300	200	98	240	296	165	126	180
15	269	374	305	224	292	192	75	320	208	154	127	180
16	269	333	305	224	300	208	89	296	188	154	133	173
17	269	277	329	200	304	208	89	272	196	162	154	184
18	289	265	337	173	304	224	98	260	143	192	133	136
19	313	257	341	120	300	216	101	252	133	192	123	204
20	305	265	341	176	296	173	95	248	123	192	133	204
21	289	253	329	165	264	169	113	228	123	192	133	180
22	273	253	325	180	248	169	147	173	120	192	150	180
23	289	253	313	240	276	200	232	184	143	150	150	180
24	257	269	293	304	232	200	208	180	147	117	136	184
25	273	265	297	308	200	162	680	147	75	123	133	126
26	293	265	305	340	184	208	725	136	104	123	133	140
27	305	277	301	332	192	212	370	143	110	117	133	154
28	273	281	301	324	216	165	276	158	154	117	107	169
29	297	289	301	312	-------	140	389	120	110	113	107	176
30	301	297	301	212	-------	117	344	150	110	113	117	169
31	309	-------	301	320	-------	110	-------	165	-------	113	133	-------

NOTE.—Indirect method for shifting control used Oct. 1 to Apr. 24 and Sept. 21–30. Discharge for Apr. 25, 26, 27, May 1, 2, 3, June 2, 13, and July 8 determined by applying to rating table gage heights for fractional parts of a day.

Monthly discharge of Pecos River near Malaga, N. Mex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	313	201	272	16,700
November	374	253	302	18,000
December	341	249	305	18,800
January	340	120	237	14,600
February	332	184	288	16,000
March	232	110	191	11,700
April	725	75	199	11,800
May	480	120	244	15,000
June	700	75	211	12,600
July	550	113	175	10,800
August	154	107	127	7,790
September	204	117	158	9,370
The year	725	75	225	163,000

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, 2¼ miles southeast of Red Bluff, Eddy County, N. Mex., and 8½ miles northwest of Angeles, Reeves County, Tex.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 27, 1914, to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder, at first outcropping of rock on right bank about 600 feet below railroad bridge and mouth of Delaware Creek; inspected by United States Geological Survey engineers.

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, 5.62 feet at 11.30 a. m. April 25 (discharge, 9,200 second-feet, determined from extension of rating curve and subject to slight error); minimum stage, 0.01 foot 10 a. m. to 4 p. m. June 26 (discharge, 97 second-feet, determined from extension of rating curve and subject to slight error).

1914–1922: Maximum stage recorded, 21.5 feet at 10 a. m. August 8, 1916, measured by leveling from flood marks (discharge not determined); minimum discharge, 80 second-feet February 27, 1919.

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, the reservoirs of which have a total 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.—The 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 water 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. Rating curve well defined for all stages. Operation of water-stage recorder not satisfactory. Mean daily gage height obtained from recorder chart by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, or as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Pecos River near Angeles, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 17	Dudley and West	0.39	260	May 29	R. G. West	0.21	147
Nov. 15	R. G. West	.57	363	June 23	do	.15	134
Dec. 8	do	.41	252	July 5	do	.23	161
Jan. 17	do	.37	224	25	do	.12	121
Feb. 4	do	.50	287	Aug. 11	do	.09	121
23	do	.41	259	Sept. 15	do	.22	159
Mar. 23	do	.27	172	28	do	.20	154
Apr. 12	do	.18	149				

Daily discharge, in second-feet, of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	268	304		298	304		138		234	114	117	122
2	262	292		298	304		148	480	1,180	232	112	119
3	250	310		317	304		145		530	642	112	122
4	304		280	317	292		182	244	250	186	112	122
5	310				286	210	292	222	244	160	112	119
6	317				286		222	401	268	145	117	122
7	310				280		217	429	222	138	125	125
8	292		256		298		195	331	200	329	132	122
9	292	320	244		304		169	244	186	512	132	151
10	304		310	270	304	200	169	217	177	234	125	145
11	345		324		286	200	145	195	177	191	122	135
12	286		304		292	186	151	182	169	186	119	132
13	286		310		292	191	138	186	777	191	125	155
14	280		310		286	206	138	182	786	186	145	148
15	280	366	304		286	200	138	286	482	160	138	151
16	286	359	310		286	195	125	373		148	135	148
17	274	298	304	222	286	200	145	310		148	132	141
18	274	268	331	195	292	200	148	244		164	145	148
19	298		338	182	292	228	151	244	200	173	135	135
20	310		352	186	292	206	151	234		173	132	173
21	304		352	186	292	177	155	222		169	145	164
22	292		352	182	256	169	268	200	125	164	141	155
23	292		331	186	250	173	359	182	129	169	148	155
24	280		324	234	244	200	244	182	148	145	151	160
25	262	280	304	292		182	2,310	169	138	119	145	160
26	280		310	298	200	169	1,120	151	105	119	135	125
27	298		324	317		212		180	117	117	135	138
28	286		310	317		212	480		132	114	129	148
29	280		298	310	-------	169		147	141	114	112	151
30	274		298	298	-------	151		151	119	112	109	155
31	286	-------	298	298	-------	141	-------	195	-------	114	114	-------

NOTE.—Record incomplete and braced figures show estimated mean for periods included. Record incomplete and discharge partly estimated Nov. 15, Dec. 8, Jan. 17, Mar. 10, Apr. 26, May 4, 26. Discharge from staff gage readings May 29 to June 2. Mean daily discharge determined by applying to rating table gage heights for fractional parts of a day on Apr. 22, 25, June 13, July 2, 8, and 9.

Monthly discharge of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	345	250	289	17,800
November			303	18,000
December	352	244	305	18,800
January	317	182	264	16,200
February	304		275	15,300
March		141	195	12,000
April	2,310	125	323	19,200
May		147	256	15,700
June	1,180	105	275	16,400
July	642	112	189	11,600
August	151	109	129	7,930
September	173	119	142	8,450
The year	2,310	105	245	177,000

PECOS RIVER NEAR PORTERVILLE, TEX.

LOCATION.—At highway bridge on Pecos-Porterville road, half a mile east of Arno station on Atchison, Topeka & Santa Fe Railway, 2 miles west of Porterville, Loving County, and 20 miles north of Pecos.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 1 to September 30, 1922.

GAGE.—Chain gage attached to downstream side of highway bridge; read by Tom Wright.

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

CHANNEL AND CONTROL.—Composed of silt, sand, and gravel; shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period February 1 to September 30, 5.80 feet at 10.10 a. m. April 26 (discharge, 1,660 second-feet); minimum stage, 1.35 feet August 31 to September 2 (discharge, 82 second-feet).

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

DIVERSIONS.—The Carlsbad project of the United States Bureau of Reclamation, the reservoirs of which have a total 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.—The 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 the winter, the flow depends on water released at the reservoirs.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined for all stages. Gage read to hundredths once daily. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records good.

Discharge measurements of Pecos River near Porterville, Tex., during the period Feb. 1 to Sept. 30, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Feb. 2	2.88	314	May 18	2.67	305	Aug. 5	1.56	94.8
24	2.66	237	June 7	2.50	242	26	1.65	121
Mar. 24	2.21	161	24	1.80	103	Sept. 13	1.70	122
Apr. 11	2.06	136	25	1.81	113	27	1.72	132
25	2.50	229	26	1.95	137			
26	5.32	1,390	July 12	2.11	181			

Daily discharge, in second-feet, of Pecos River near Porterville, Tex., for the period Feb. 1 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	300	219	143	356	219	157	82	114
2	300	180	136	420	219	168	82	108
3	300	240	130	437	1,030	180	94	108
4	314	209	130	342	600	262	94	108
5	300	186	180	287	300	209	90	114
6	287	164	209	219	240	180	96	108
7	287	189	209	224	240	150	103	108
8	314	189	164	229	229	114	114	108
9	314	189	154	229	229	310	103	180
10	314	172	143	229	209	387	108	168
11	300	172	143	219	204	240	103	157
12	300	172	157	157	199	180	103	143
13	300	172	136	164	199	274	100	130
14	262	172	130	176	209	199	98	130
15	262	180	124	189	372	172	98	130
16	274	180	124	189	262	161	94	136
17	274	180	124	420	262	150	94	133
18	287	180	124	314	230	150	94	130
19	280	184	124	300	199	130	98	130
20	274	189	124	229	164	143	98	164
21	274	189	130	219	124	150	98	150
22	274	180	130	209	103	136	103	164
23	274	180	228	209	98	136	108	143
24	240	157	327	164	98	136	108	143
25	262	164	229	150	108	136	108	143
26	240	164	1,560	150	136	124	119	136
27	219	164	1,560	180	119	90	116	130
28	219	157	530	221	94	90	114	130
29	------	189	327	262	98	90	108	124
30	------	180	230	219	143	86	108	124
31	------	143	------	229	------	82	108	------

NOTE.—No record and discharge estimated Apr. 23, 30, June 4, and July 9. Discharge partly estimated, owing to uncertainty of gage heights Sept. 16 and 18–21. No record and discharge interpolated Feb. 5, 12, 19, 26, Mar. 5, 12, 19, 26, Apr. 2, 9, 16, 23, May 7, 14, 21, 28, June 4, 11, 18, July 2, 16, 23, 30, Aug. 6, 13, 20, 27, Sept. 3, 10, 17, and 24.

Monthly discharge of Pecos River near Porterville, Tex., for the period Feb. 1 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
February	314	219	280	15,600
March	240	143	180	11,100
April	1,560	124	272	16,200
May	437	150	243	14,900
June	1,030	94	231	13,700
July	387	82	167	10,300
August	119	82	101	6,210
September	180	108	133	7,910
The period				95,900

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PECOS RIVER ABOVE BARSTOW, TEX.

LOCATION—400 feet below dam and diversion of Barstow canal (Ward County Irrigation District No. 1), 4 miles below former location, and 10 miles northwest of Barstow, Ward County, Tex.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 1, 1916, to May 11, 1921, and March 22 to September 30, 1922.

GAGE.—Gurley eight-day water-stage recorder on left bank; attended by R. G. Hamilton or United States Geological Survey engineers. From February 1, 1916, to May 11, 1921, gage was Stevens continuous water-stage recorder, located 4 miles upstream. Relation between gages not known.

DISCHARGE MEASUREMENTS.—Measurements made by wading, 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, clean, steep. Left bank is high and not subject to overflow. Right bank high and subject to overflow at extremely high stages. Low-water control is rock ledge, 150 feet below gage; permanent. Point of zero flow about 1.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 7.90 feet at 9 a. m. April 26 (discharge, 1,900 second-feet, determined from extension of rating curve and subject to error); minimum stage, 1.40 feet August 27 to September 4 (discharge, 0.30 second-feet, due to regulation just above present location).

1915–1922: Maximum stage from water-stage recorder, 12.1 feet (by datum of former location) at 6 a. m. August 10, 1916 (discharge not determined); minimum stage, that of August 27 to September 4, 1922.

ICE.—None reported.

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 permanent for the period. Rating curve well defined from 0 to 200 second-feet and extended above. Operation of water-stage recorder not satisfactory. 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 fair.

Discharge measurements of Pecos River above Barstow, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 19	Dudley and West	[a] 2.66	97.3	June 16	R. G. West	3.08	213
Nov. 30	R. G. West	2.58	80.8	27	do	1.53	.8
Mar. 25	do	1.83	4.2	July 24	do	1.52	.5
Apr. 1	do	1.65	1.1	Aug. 25	do	1.40	[b] 3
May 8	do	3.08	212	Sept. 9	do	1.47	.5

[a] Gage at new location. [b] Estimated

Daily discharge, in second-feet, of Pecos River above Barstow, Tex., for the period Mar. 22 to Sept. 30, 1922

	Mar.	Apr.	May	June	July	Aug.	Sept.
1		1.3	227	60	0.9	0.7	0.3
2		2.3	240	1.5		.7	.3
3		2.6	265	298		.7	.3
4		3.4	183	331	1.0	.7	.3
5		3.0	174	149		.7	.4
6		3.0	115	119		.7	.4
7		3.0	37	64	1.5	.7	.5
8		3.0	102	72	1.3	.7	.5
9		2.8	73	47	1.3	.7	.5
10		3.2	35	3.4	41	.7	1.0
11		2.8	28		1.3	.7	1.0
12		2.8	24		1.1	.7	1.0
13		2.3	23		1.1	.7	.9
14		1.9	99	5.0	1.2	.7	.9
15		2.3	92		1.2	.6	.9
16		2.3	77		1.0	.4	.9
17		3.4	106	110	.9	.4	.9
18		4.1	158	84	.9	.5	.9
19		3.2	55		.9	.6	.9
20		2.1	20		.8	.7	.9
21		2.3	31	10	.8	.7	4.6
22	5.1	2.6	22		.9	.5	1.9
23	5.1	3.6	15		.8	.4	1.0
24	5.1	185	3.2	1.5	.7	.4	.4
25	5.1	131	2.6	1.0	.7	.3	.6
26	5.1	973	2.1		.7	.3	1.0
27	4.1	767	3.0	.7	.7	.3	3.0
28	1.7	549	3.2	.7	.7	.3	2.1
29	1.3	330	3.0	.8	.7	.3	1.4
30	1.2	255	89	.8	.7	.3	1.4
31	1.2	-------	20	-------	.7	.3	-------

NOTE.—Discharge partly estimated, owing to incomplete record, Mar. 24–27, 28 to Apr. 8, 15, 22, May 6, 14–27, 25, 26, June 2, 10, 17, 27, July 7, 22–24, Aug. 17–20, Aug. 27 to Sept. 3, and Sept. 21–23. No record and discharge estimated June 11–16, 19–23, 25, 26, July 2–6, Sept. 21, and 22. Discharge determined by applying to rating table, gage heights for fractional parts of a day Apr. 24–26, May 4, 5, 7–10, 17–23, May 30 to June 1, 3–9, and July 10.

Monthly discharge of Pecos River above Barstow, Tex., for the period March 22 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 22–31	5.1	1.2	3.50	69.4
April	973	1.3	108	6,430
May	265	2.1	75.1	4,620
June	331	.7	47.5	2,830
July	41	.7	2.24	138
August	.7	.3	.55	33.8
September	4.6	.3	1.04	61.9
The period				14,200

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 Imperial Irrigation Co., 3 miles south of Grandfalls, Ward County, 4½ miles above diversion dam of Zimmerman project, and 21 miles south of Monahans.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 6, 1915, to September 30, 1922. Records were taken at Iron Bridge, 1½ miles downstream, from November 6, 1915, to August 3, 1917. 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 waters edge; inspected by A. J. Adcock, and an engineer from the United States Geological Survey office. Prior to August 3, 1917, a Stevens water-stage recorder at Iron Bridge. Backwater from Zimmerman dam compelled the relocation of the station.

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 clean, smooth, solid rock, and permanent, except 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, both banks, which are dirt and wooded, subject to overflow. Rock ledge extending diagonally across stream just below gage serves as low-water control.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.55 feet at 12.15 p. m. April 27 (discharge, 1,310 second-feet); minimum stage, 0.30 foot at 7 p. m. March 17 (discharge, 2.0 second-feet).

1915–1922: 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.

ICE.—None reported.

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 (17,000 acre-feet capacity), 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 approximately 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 diversion 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 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 permanent for the year. Rating curve well defined from 2 to 15,000 second feet. Operation of water-stage recorder not satisfactory. Daily discharge determined by applying to rating table mean daily gage heights obtained from recorder graph by inspection or by use of planimeter, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Pecos River near Grandfalls, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	Dudley and West	0.78	49.4	Apr. 28	R. G. West	2.28	602
27	D. A. Dudley	.75	41.4	June 20	do	.98	84.8
Dec. 7	R. G. West	1.28	166	July 11	do	.50	11.0
Jan. 16	do	.48	8.4	Aug. 18	do	.62	23.6
Apr. 4	do	.38	3.8	Sept. 21	do	.48	10.5

Daily discharge, in second-feet, of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1				6.5	3.8	3.8	199	23	16	21	9.5
2				6.5	3.8	4.1	130	23	16	20	9.5
3				6.0	3.8	4.4	153	8.9	15	20	9.0
4				7.0	3.8	4.4	165	215	15	19	9.0
5				7.0	3.8	4.1	145	162	14	19	9.0
6				4.7	3.5	3.8	78	147	15	19	9.0
7		156		4.4	3.8	3.5	68	188	18	19	9.0
8	26	88		4.4	3.2	3.8	60	162	11	18	9.0
9	30	77		4.4	3.8	3.2		153	11	19	8.5
10	37			4.4	2.9	3.5	51	153	9.5	19	9.0
11	44			4.4	3.2	2.9	64	162	9.0	19	8.5
12	49			4.1	2.9	3.5	20	553	9.5	20	8.5
13	48			4.4	3.5	3.5		290	9.0	23	8.0
14	49			4.7	2.9	3.8		96	9.0	23	8.5
15	58			4.7	2.6	3.2	11	49	9.0	21	8.5
16	58		9.0	4.4	2.6	3.5	10	37	9.0	21	8.5
17	48			4.7	3.2	3.5	6.5	30	9.0	23	9.0
18	48			4.4	3.2	3.5	10	64	9.0	23	9.0
19	51			4.4	2.9	3.8	22	334	9.0	23	9.0
20	58			4.4	3.2	3.2	25	103	8.5	24	9.0
21	49			4.4	2.9	3.5	13	65	17	24	9.0
22	42			5.0	3.2	3.5	7.5	58	24	23	9.5
23	41			3.8	7.5	3.8	7.0	44	20	23	9.5
24	41			4.1	3.2	12	17	37	15	23	9.0
25	39			4.1	4.1	125	21	31	13	21	8.0
26	48		8.0	4.1	3.5	90	20	27	13	20	7.5
27	51		8.0	4.1	3.8	896	20	23	15	18	7.5
28	53		8.9	4.4	4.1	740	20	17	15	11	7.5
29	55		30		4.1	531	20	16	31	10	7.5
30	58		14		4.4	400	21	16	31	9.5	7.5
31			8.5		3.8		20		26	9.5	

NOTE.—No records for periods not shown. Maximum discharge during missing period, as follows: Oct. 31 to Dec. 6, 357 second-feet; Dec. 10 to Jan. 15, 192 second-feet; and Jan. 17–25, 27 second-feet. Discharge partly estimated owing to incomplete record Oct. 8, Dec. 7, 9, Jan. 16, 26, May 10, 11, 15, and July 29. Discharge estimated May 8, 9, 12–14, and 16. Gage heights for fractional parts of a day applied to rating table Jan. 28, 30, Apr. 24–27, 29, May 1, 2, 5–7, 18–21, June 3, 11–14, and 18–20.

Monthly discharge of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 8–30	58	26	47.0	2,140
February	7.0	3.8	4.78	265
March	7.5	2.6	3.58	220
April	896	2.9	95.9	5,710
May	199	6.5	47.5	2,920
June	553	8.9	110	6,550
July	31	8.5	14.5	892
August	24	9.5	19.5	1,200
September	9.5	7.5	8.65	515

NOTE.—See footnote to table of daily discharge.

PECOS RIVER NEAR BUENA VISTA, TEX.

LOCATION.—At highway bridge on Fort Stockton-Midland road, 4½ miles east of Buena Vista, Pecos County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 5, 1921, to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder attached to left abutment at downstream side of bridge.

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

CHANNEL AND CONTROL.—Composed of silt, sand, and gravel; shifts. Banks are overflowed during extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage during period December 5 to September 30, from water-stage recorder, 3.55 feet at 3.30 a. m. April 28 (discharge, 914 second-feet, determined from extension of rating curve and subject to error); minimum stage, 0.30 foot from 3 to 7 p. m. September 17, 4 to 8 p. m. September 18, and 2 to 6 p. m. September 28 (discharge, 26 second-feet).

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

DIVERSIONS.—Station is located below all diversions. During much of time practically the only flow past the station is waste and seepage water from the irrigated area above the 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. Operation of water-stage recorder satisfactory, except for short breaks in records. 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.

Discharge measurements of Pecos River near Buena Vista, Tex., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	Dudley and West	0.87	98	May 15	R. G. West	0.70	82.1
Nov. 5	R. G. West	.88	108	June 19	do	.84	105
Dec. 6	do	1.35	186	July 10	do	.48	46.4
Jan. 16	do	.62	66.4	29	do	.40	38.6
Feb. 18	do	.68	73.8	Aug. 17	do	.36	34.0
Apr. 5	do	.58	59.7	Sept. 6	do	.35	31.3
28	do	2.65	561	21	do	.34	30.6

Daily discharge, in second-feet, of Pecos River near Buena Vista, Tex., for the period Dec. 5, 1921, to Sept. 30, 1922

Day	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		131	72	113	64	240	108	56	38	28
2		143	65	111	64	124	75	55	38	30
3		182	59	104	64	82	127	60	37	30
4		190	55	94	64	78	99	61	37	31
5	169	172	56	108	64	78	266	56	36	31
6	184	163	55	94	60	75	326	51	36	31
7	186	144	59	104	63	72	184	56	37	32
8	172	148	58	88	65	71	151	50	38	32
9	119	134	60	65	63	70	96	46	38	32
10	110	96	55	61	65	70	75	46	38	31
11	104	88	59	71	64	70	78	43	37	31
12	102	80	54	65	67	70	100	39	37	31
13	110	71	61	64	71	72	118	48	36	28
14	108	77	75	65	70	74	116	48	36	28
15	122	60	86	72	70	78	110	47	34	28
16	131	65	72	65	71	70	81	47	34	28
17	126	60	82	71	75	72	254	46	34	27
18	118	55	82	75	70	68	163	47	34	27
19	119	56	77	63	67	65	116	42	34	30
20	121	58	99	60	64	77	84	42	34	30
21	108	56	84	63	64	77	70	39	33	30
22	100	56	74	55	65	84	63	38	30	30
23	102	65	74	56	68	67	59	38	31	28
24	104	71	77	60	170	59	56	37	31	28
25	106	58	86	64	87	58	55	37	31	28
26	104	60	90	61	229	58	51	38	31	27
27	93	59	80	59	264	279	51	39	30	27
28	78	55	90	55	682	229	50	38	30	27
29	77	65	------	68	522	155	48	38	30	28
30	78	60	------	71	324	108	55	39	30	28
31	77	60	------	63	------	127	------	38	28	------

NOTE.—Record incomplete and discharge partly estimated Dec. 5, Apr. 1–5, and Aug. 15, 17. No record and discharge interpolated Aug. 16. Discharge determined by applying to rating table gage heights for fractional parts of a day Jan. 1, Apr. 24–28, 30, May 1, 27, June 5–7, and 16. Indirect method for shifting control used Apr. 30 to July 1.

Monthly discharge of Pecos River near Buena Vista, Tex., for the period Dec. 5, 1921, to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in inches
	Maximum	Minimum	Mean	
December 5–31	186	77	116	6,210
January	190	55	91.5	5,630
February	99	54	71.3	3,960
March	113	55	73.8	4,540
April	682	60	127	7,560
May	279	58	96	5,900
June	326	48	110	6,550
July	61	37	45.3	2,790
August	38	28	34.1	2,100
September	32	27	29.2	1,740
The period				47,000

PECOS RIVER NEAR SHEFFIELD, TEX.

LOCATION.—At highway bridge on Fort Stockton-Ozona road, 3½ miles east of Sheffield, Pecos County, 41 miles west of Ozona, 60 miles downstream from Buena Vista, and 76 miles east of Fort Stockton.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 10, 1921, to September 30, 1922.

GAGE.—Chain gage attached to upstream side of bridge. Auxiliary staff gage attached to pier near left bank; read by R. C. St. Clair, H. B. Smith, or Kyle Smith.

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

CHANNEL AND CONTROL.—Composed of silt, sand, and gravel; shifts. Right bank is not overflowed; left bank is overflowed during extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record 4.95 feet at 9 a. m. Mar. 25 (discharge, 1,820 second-feet, determined from extension of rating curve and subject to error); minimum stage, 1.84 feet from 7 a. m. to 6 p. m., September 17 (discharge, 28 second-feet, determined from extension of rating curve and subject to error).

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

DIVERSIONS.—Station is below all diversions. During much of the time practically the only flow past the station is waste and seepage water from the irrigated area above.

REGULATION.—Flow partly regulated by storage and diversion dams in New Mexico and Texas.

ACCURACY.—Stage-discharge relation not permanent. Curve fairly well defined from 100 to 700 second-feet, and extended above and below this to cover the range of stage. Gage read twice daily to hundredths, October 10 to February 10 and June 18 to September 30, and once daily to hundredths the remainder of the time, when read. Daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Pecos River near Sheffield, Tex., during the period Oct. 10, 1921, to Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 10	Dudley and West	2.00	135	Apr. 30	R. G. West	3.18	661
Nov. 6	R. G. West	2.00	126	June 19	do	2.20	165
Dec. 11	do	2.20	197	July 19	do	1.90	67.8
Jan. 15	do	1.98	127	Aug. 15	do	1.91	52.1
Feb. 20	do	1.88	105	Sept. 20	do	2.00	58.5
Apr. 6	do	1.87	105				

Daily discharge, in second-feet, of Pecos River near Sheffield, Tex., for the period Oct. 10, 1921, to Sept. 30, 1922

Date	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	-------	101	226	131	95	106	95	377	200	113	45	38
2	-------	101	226	126	95	106	176	373	203	113	45	38
3	-------	101	219	115	95	108	268	373	209	115	45	38
4	-------	101	200	115	95	123	187	193	97	118	43	38
5	-------	101	178	175	95	116	113	152	97	120	43	38
6	-------	113	172	200	95	110	108	147	95	113	41	34
7	-------	101	184	230	95	108	110	212	95	118	43	34
8	-------	101	203	219	95	108	144	278	311	106	43	34
9	-------	101	219	213	92	106	131	120	290	103	43	34
10	136	106	213	200	92	103	118	97	240	101	43	45
11	131	115	181	187	90	103	113	88		101	41	62
12	131	118	163	169	90	102	106	82		88	41	62
13	133	123	161	152	88	102	106	82		74	40	43
14	131	136	158	141	88	101	106	82	200	72	40	43
15	136	169	152	131	88	101	103	82		74	46	38
16	133	187	150	126	88	100	103	84		76	43	33
17	133	187	150	120	88	100	103	84		78	46	38
18	133	187	152	115	88	99	103	88	172	68	45	48
19	133	181	158	110	97	99	103	90	172	66	45	74
20	133	178	163	106	106	99	103	90	244	68	45	54
21	126	175	163	106	106	101	108	85	282	68	43	52
22	118	203		131	108	99	108	80	166	64	43	52
23	110	223		126	110	95		82	141	62	40	52
24	110	230		120	106	95		86	126	58	40	54
25	108	244		108	103	1,820	180	90	118	52	40	52
26	103	262	150	101	104	870		84	113	50	40	52
27	103	262		101	106	101	494	84	115	48	40	48
28	103	255		101	103	97	286	95	118	48	40	42
29	103	240		99	-------	95	213	106	115	48	40	50
30	103	226		101	-------	95	672	206	115	48	40	50
31	103	-------		97	-------	97	-------	240	-------	48	40	-------

NOTE.—No record and discharge interpolated Feb. 19, 26, Mar. 5, 11–19, 26, Apr. 2, 9, 16, May 7, 14, 21, and 28. No record and discharge estimated, Dec. 22–31, Apr. 23–26, and June 4–6.

Monthly discharge of Pecos River near Sheffield, Tex., for the period Oct. 10, 1921, to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 10–31	136	103	120	5,240
November	262	101	164	9,760
December	226	-------	171	10,500
January	230	97	138	8,480
February	110	88	96.5	5,360
March	1,820	95	183	11,300
April	672	95	170	10,100
May	377	80	142	8,730
June	311	95	174	10,400
July	120	48	80	4,920
August	46	40	42.3	2,600
September	74	28	45.3	2,700
The period	-------	-------	-------	90,100

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, 18 miles east of Langtry, and 14 miles by stream above confluence with Rio Grande; below all tributaries.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1900, to September 30, 1922. (Also gage heights for 1898.)

GAGE.—Vertical staff attached to downstream side of bridge pier on left bank; read by W. A. Clare.

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; banks not subject to overflow. Stage-discharge relation at low stages changes slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.16 feet at noon June 18 (discharge not determined); minimum stage, 0.30 foot 8 a. m. to 5 p. m. September 6 (discharge, 220 second-feet).

1900–1922: 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 the station for irrigation. Lakes McMillan and Avalon of the Carlsbad project of the United States Bureau of Reclamation which have a combined capacity of 58,500 acre-feet, are located 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. There are no diversions below the 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 from 260 to 13,000 second-feet and fairly well defined to 40,000 second-feet. 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 Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Oct. 8	Dudley and West	0.58	324
Nov. 18	McCashin and Clark	.64	333
Dec. 18	R. G. West	.74	380

Daily discharge, in second-feet, of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	402	269	402	286	269	259	269	7,530	402	360	252	252
2	402	276	402	286	269	259	269	3,970	322	341	252	259
3	360	276	402	286	269	252	9,800	1,590	322	360	252	269
4	360	276	381	286	269	236	1,350	1,590	471	900	236	252
5	341	276	381	304	259	269	655	1,270	2,090	495	246	236
6	322	286	360	279	252	269	628	628	1,270	341	252	220
7	322	286	341	322	252	276	447	545	740	360	252	236
8	322	286	341	322	252	269	447	520	545	322	252	252
9	304	286	341	360	252	286	1,190	545	471	322	269	236
10	304	286	360	360	252	279	545	495	495	322	259	246
11	322	286	381	360	252	286	447	447	402	322	252	322
12	322	286	381	360	252	279	360	402	402	304	252	259
13	304	304	360	360	246	286	360	495	970	304	252	236
14	286	304	341	360	246	279	341	447	360	286	252	252
15	304	304	322	341	246	269	322	402	322	286	252	252
16	286	304	322	322	246	252	304	360	322	286	252	252
17	286	304	304	304	246	252	304	360	360	286	252	269
18	286	322	341	304	249	252	304	322	43,600	286	252	269
19	286	322	322	286	246	259	286	360	1,000	286	252	269
20	286	322	322	286	246	246	286	341	545	279	252	286
21	286	341	322	286	246	246	286	341	655	269	259	286
22	286	322	322	279	252	246	286	322	572	269	269	279
23	286	322	322	286	252	236	304	322	495	269	252	269
24	286	360	322	279	252	246	304	304	402	252	252	259
25	286	360	322	279	252	246	4,100	304	424	252	269	269
26	286	360	304	279	269	868	2,360	286	402	252	269	252
27	283	381	304	269	269	970	3,450	286	360	252	269	259
28	279	402	304	269	266	447	2,660	286	341	252	252	236
29	276	402	304	269	-------	402	1,590	286	322	252	259	236
30	269	402	304	279	-------	341	1,270	286	360	269	259	252
31	272	-------	304	269	-------	304	-------	286	-------	252	269	-------

Monthly discharge of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	402	269	307	18,900
November	402	269	317	18,900
December	402	304	340	20,900
January	360	269	304	18,700
February	269	246	255	14,200
March	970	236	318	19,600
April	9,800	269	1,180	70,200
May	7,530	286	836	51,400
June	43,600	322	1,990	118,000
July	900	252	318	19,600
August	269	236	256	15,700
September	322	220	257	15,300
The year	43,600	220	555	401,000

FARMERS INDEPENDENT CANAL NEAR PORTERVILLE, TEX.

LOCATION.—200 feet east of track of Atchison, Topeka & Santa Fe Railway, 300 feet below head gates of canal in Reeves County, and 5 miles southwest of Porterville, Loving County.

RECORDS AVAILABLE.—February 9 to September 30, 1922.

GAGE.—Stevens eight-day water-stage recorder; attended by Otis Harrell.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed composed of sand and clay. Control not known; shifts.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during period February 9 to September 30, 160 second-feet on June 14; minimum mean daily discharge, 12 second-feet July 30.

ICE.—None. Canal runs water during winter for stock.

DIVERSIONS.—Above all diversions.

REGULATION.—Regulated by head gates and by height of river.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined from 10 to 80 second-feet. Operation of water-stage recorder not satisfactory. Mean daily discharge 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 fair.

Discharge measurements of Farmers Independent canal near Porterville, Tex., during the period Feb. 9 to Sept. 30, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Feb. 10	1.82	38.9	May 7	2.57	63.2	Aug. 5	1.15	28.2
24	1.50	25.4	18	2.71	71.0	26	1.66	47.4
Mar. 24	1.21	15.0	June 9	2.12	56.8	Sept. 13	1.46	40.6
Apr. 11	2.24	41.7	26	1.39	31.0	27	1.47	41.4
13	2.06	36.0	July 12	1.93	51.9			

Daily discharge, in second-feet, of Farmers Independent canal near Porterville, Tex., for the period Feb. 9 to Sept. 30, 1922

Date	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		18	38	88	27	52	13	24
2		16	35	92	33	42	16	26
3		25	36	91	126	38	19	31
4		23	38	78	104	93	24	30
5		19	54	74	83	118	25	31
6		14	63	61	71	101	25	31
7		17	71	66	71	66	35	32
8		23	58	81	67	48	56	32
9	39	21	54	74	56	41	56	74
10	38	18	48	62	53	113	50	55
11	37	20	43	56	48	67	47	46
12	34	22	42	51	47	55	41	41
13	34	19	37	49	54	74	40	37
14	34	19	37	48	160	69	39	40
15	33	21	36	49	134	56	45	45
16	34	21	34	57	90	49	55	44
17	34	19	32	71	72	38	50	46
18	35	21	32	62	63	34	46	42
19	35	21	31	55	58	34	47	51
20	34	23	36	53	55	37	49	71
21	34	24	35		42	43	42	58
22	34	18	36		34	39	40	62
23	32	16	37		32	35	44	53
24	26	15	45		27	36	45	51
25	32	17	91	50	26	36	50	50
26	27	19	86		30	26	47	46
27	23	23	85		29	19	41	41
28	18	45			20	16	37	25
29		62	83	47	24	14	39	31
30		53	81	32	34	12	36	37
31		43		37		14	27	

NOTE.—No record Apr. 27, 28, and May 21–28; discharge estimated. No record and discharge interpolated Apr. 18, Sept. 24, and 25. Discharge partly estimated, owing to incomplete record, Feb. 9, Apr. 10, 19, 26, 29, May 20, 29, June 3, 13–15, Aug. 25, 26, and Sept. 26. Discharge obtained by applying to rating table gage heights for fractional parts of a day, Mar. 3, 28, Apr. 24, May 30, 31, June 2, 28, 29, July 4, 7, 10, 13, 26, Aug. 7–9, Sept. 9, 14, 19, 20, and 27. Discharge determined from extension of rating curve and subject to error June 3, 4, 14, 15, 16, July 4, 5, 6, and 10.

Monthly discharge of Farmers Independent canal near Porterville, Tex., for the period Feb. 9 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in inches
	Maximum	Minimum	Mean	
February 9–28	39	18	32.4	1,290
March	62	14	23.7	1,460
April	91	31	50.6	3,010
May	92	32	59.2	3,640
June	160	20	59.0	3,510
July	118	12	48.9	3,010
August	56	13	39.5	2,430
September	74	24	42.8	2,550
The period				20,900

NOTE.—See footnote to daily-discharge table.

CEDARVALE CANAL NEAR BARSTOW, TEX.

LOCATION.—At highway bridge across canal near Barstow canal head gates, below Boxley canal pumping plant, 8 miles northwest of Barstow, Ward County.

RECORDS AVAILABLE.—February 12 to September 30, 1922.

GAGE.—Stevens eight-day water-stage recorder on downstream side of bridge; 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.

ICE.—None.

DIVERSIONS.—The Boxley canal diverts water from this canal between river and gages but only at times when there is no flow past the gage.

REGULATION.—Regulated by canal head gates.

ACCURACY.—Stage-discharge relation not permanent. Recorder operation not satisfactory, owing principally to improper attendance. Discharge not determined on account of backwater of varying and unknown amount the entire period except as noted below. No record Feb. 12, 13, May 31 to June 8, and August 28, 29. Canal was known to be flowing, February 14 to March 8, March 27 to April 2, April 24–26, May 14–30, June 9 to July 5, July 24–28, August 23–27, and September 21–26.

Canal diverts from left bank of Pecos River between Farmers Independent canal and Barstow canal. Total amount of water diverted by the Cedarvale canal from February 12 to September 30, 1922, estimated at 10,000 acre-feet.

Discharge measurements of Cedarvale canal near Barstow, Tex., during the period Feb. 12 to Sept. 20, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Feb. 15	1.64	61.7	May 19	2.62	105	Aug. 25	1.90	45.8
25	2.05	62.8	June 27	2.46	75.6	Sept. 26	2.36	78.4
Apr. 1	.45	2.6	July 24	2.50	76.3			

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 to September 30, 1922.

GAGE.—Stevens eight-day water-stage recorder attached to footbridge.

DISCHARGE MEASUREMENTS.—Made by wading near gage, or from bridge about 2,500 feet downstream.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; shifts. Low-water control rock and gravel shoal 150 feet below gage. Point of zero flow about 0.75 foot.

EXTREMES OF DISCHARGE.—Maximum stage during the period February 12 to September 30, from water-stage recorder, about 6 feet on July 10 (discharge not determined); no flow 3 p. m. July 27 to 7 a. m. July 28.

ICE.—None during year. Water is run during winter for stock.

DIVERSIONS.—Above all diversions.

REGULATION.—Regulated by head gates.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 12 to 145 second-feet, and extended above and below. Operation of water-stage recorder not satisfactory as noted in footnote to daily-discharge table. Mean daily gage heights obtained from recorder chart by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records good.

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 period Feb. 12 to Sept. 30, 1922

[Made by R. G. West.]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Feb. 16	3.16	104	May 8	2.92	104	July 13	2.65	86.7
25	3.05	103	19	2.65	82.1	Aug. 7	1.96	41.8
Mar. 25	3.52	133	June 16	3.19	130	Sept. 9	2.12	52.1
Apr. 1	2.66	74.3	27	1.38	14.2	26	1.77	29.5
15	2.75	81.7						

Daily discharge, in second-feet, of Barstow canal near Barstow, Tex., for the period Feb. 12 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		56	72	63	105	50	61	34
2		75	100	83	106	75	61	34
3		80	97	85	113	68	60	36
4		117	97	89	113	192	51	39
5		130	103	111	113	140	45	46
6		107	135	124	92	108	42	48
7		107	159	106	107	88	41	51
8		166	154	103	117	87	43	52
9		180	113	116	106	77	47	53
10		165	90	135	126	210	42	94
11		159	113	122	113	246	40	79
12	1.0	174	93	135	99	135	39	74
13	61	152	88	113	93	97	37	72
14	94	139	82	103	106	103	34	68
15	96	159	83	89	129	101	34	81
16	113	169	79	82	126	92	36	80
17	154	169	64	70	102	84	40	80
18	61	159	64	83	80	77	38	78
19	55	159	65	72	87	80	37	76
20		169	64	81	87	69	40	
21	65	169	68	64	85	68	45	50
22		154	70	81	83	71	32	
23	77	140	82	101	60	60	7.1	35
24	80	135	96	122	16	8.1	6.0	26
25	94	130	100	108	11	6.3	5.8	30
26	103	135	24	85	13	6.0	5.8	45
27	101	130	27	20	13	1.7	15	86
28	73	62	73	34		30	39	76
29		61	27	35	20	48	37	65
30		66	22	94		56	39	72
31		59		90		61	38	

NOTE.—Owing to incomplete record, discharge partly estimated Feb. 12, Mar. 25, May 14, 27, July 7, 8, 10, Aug. 6, 7, 20, Sept. 3, 16, 19, 23, and 30. No record Feb. 20–22, June 28 to July 1, and Sept. 20–22; discharge estimated. Discharge obtained by applying to rating table gage heights for fractional parts of days, Feb. 13, 17–19, Mar. 13, 14, 27, Apr. 1, 7, 8, 24–30, May 5, 6, 9, 17, 20, 21, 23, 26, 27, 30, 31, June 3, 7, 15, 23, July 3, 4, 11, 23, 28, 29, Aug. 22, 27, and Sept. 26.

Monthly discharge of Barstow canal near Barstow, Tex., for the period Feb. 12 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-ft.
	Maximum	Minimum	Mean	
February 12–28	154	1.0	79.9	2,690
March	180	56	130	7,990
April	159	22	83.5	4,970
May	135	20	90.3	5,550
June	129	11	82.0	4,880
July	246	1.7	83.7	5,150
August	61	5.8	36.7	2,260
September	94	26	58.7	3,490
The period				37,000

GRANDFALLS-BIG VALLEY CANAL NEAR BARSTOW, TEX.

LOCATION.—At head gates, 10 miles southeast of Barstow, Ward County.

RECORDS AVAILABLE.—March 2 to September 30, 1922.

GAGE.—Stevens eight-day water-stage recorder March 2 to May 13. Stevens continuous water-stage recorder May 13 to September 30. Both attended by United States Geological Survey engineers.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed composed of clay. Control not known, but shifts. Point of zero flow, −0.40 foot.

EXTREMES OF DISCHARGE.—Maximum stage during the period March 2 to September 30, from water-stage recorder, 2.96 feet at 8 a. m. May 31 (discharge, 242 second-feet, determined from extension of rating curve and subject to error); no flow April 25 to May 9, June 15 to 25, and July 17 to August 21.

ICE.—None.

DIVERSIONS.—Above all diversions.

REGULATION.—Regulated by head gates.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 0 to 160 second-feet. Operation of water-stage recorder not satisfactory prior to May 13. Mean daily gage heights determined from recorder graph by inspection or by use of planimeter. Mean daily discharge determined by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records fair.

Discharge measurements of Grandfalls-Big Valley canal near Barstow, Tex., during the period Mar. 2 to Sept. 30, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Mar. 4	2.16	144	Apr. 16	1.22	65.4	June 28	0.81	45.4
26	1.51	87.5	May 10	.83	50.3	Sept. 7	.37	19.7
26	1.50	89.3	23	1.64	106	23	.57	29.9

Daily discharge, in second-feet, of Grandfalls-Big Valley canal near Barstow, Tex., for the period Mar. 2 to Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	------	53	------	20	47	------	18
2	174	60	------	19	49	------	18
3	161	65	------	19	54	------	18
4	144	61	------	19	45	------	18
5	145	56	------	19	57	------	18
6	144	59	------	54	49	------	18
7	78	60	------	33	44	------	19
8	64	------	------	116	44	------	21
9	------	------	------	122	42	------	22
10	------	------	53	134	41	------	23
11	------	------	78	134	61	------	24
12	------	------	76	134	52	------	26
13	------	------	81	134	48	------	24
14	------	63	90	85	46	------	24
15	------	79	105	------	50	------	26
16	108	------	106	------	35	------	32
17	90	------	108	------	------	------	28
18	84	------	93	------	------	------	24
19	82	------	105	------	------	------	26
20	88	------	106	------	------	------	31
21	87	------	104	------	------	------	32
22	77	------	102	------	------	8	34
23	13	------	106	------	------	18	30
24	53	------	105	------	------	18	28
25	70	------	108	------	------	18	28
26	87	------	102	2.3	------	18	28
27	92	------	90	39	------	19	28
28	87	------	90	46	------	19	28
29	63	------	94	52	------	20	31
30	54	------	108	45	------	20	32
31	51	------	110	------	------	19	------

NOTE.—Discharge partly estimated owing to incomplete record Mar. 2-6, 16, 23-25, Apr. 14, May 10, June 8-14, and 28. No record, Mar. 9-15, Apr. 8-13, and 16-24. Discharge obtained by applying to rating table gage heights for fractional parts of a day, May 30, 31, June 6, 7, 26, July 11, 16, and Aug. 22. No flow Apr. 25 to May 9, June 15-25, and July 17 to Aug. 21.

Monthly discharge of Grandfalls-Big Valley canal near Barstow, Tex., for the period May 1 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-ft
	Maximum	Minimum	Mean	
May (22 days)	110	53	96.3	4,200
June (19 days)	134	2.3	64.5	2,430
July (16 days)	61	35	47.8	1,520
August (10 days)	20	8.0	17.7	351
September	34	18	25.2	1,500

NOTE.—See footnote to daily-discharge table.

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 to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder installed March 14; attended by United States Geological Survey engineers.

DISCHARGE MEASUREMENTS.—Measurements made by wading near gage or from bridge, 300 feet above gage.

CHANNEL AND CONTROL.—Bed composed of coarse gravel. Banks of earth. Control not known; shifts. Point of zero flow, 0.20 foot gage datum.

EXTREMES OF DISCHARGE.—Maximum stage during the period March 14 to September 30 from water-stage recorder, 6.08 feet at 9 a. m. April 27 (discharge, 332 second-feet, determined from extension of rating curve and subject to error); no flow August 23 to September 30.

ICE.—None.

DIVERSIONS.—Above all diversions. Sand gates, 300 feet above, are opened occasionally for a short time to clean canal.

REGULATION.—Regulated by head gates.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 0 to 150 second-feet and extended above. Operation of water-stage recorder satisfactory except for short breaks in record. 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 good.

Discharge measurements of Imperial high-line canal near Grandfalls, Tex., during the period Mar. 14 to Sept. 30, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Mar. 14	0.74	14.7	May 3	3.60	152	July 15	0.28	1.3
31	.57	8.0	June 20	1.80	49.2	29	1.04	17.7
Apr. 14	.56	6.8	28	.44	3.53	Aug. 18	.83	10.7

Daily discharge, in second-feet, of Imperial high-line canal near Grandfalls, Tex., for the period Mar. 14 to Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Aug.	Day	Mar.	Apr.	May	June	July	Aug.
1	-------	7.5	162	-------	2.1	16	16	14	6.8	47	-------	1.2	11
2	-------	9.0	152	-------	2.1	15	17	14	6.2	66	-------	37	11
3	-------	11.0	152	-------	7.8	14	18	13	6.2	107	-------	36	11
4	-------	8.8	152	-------	3.8	13	19	-------	6.5	104	-------	31	11
5	-------	7.8	145	-------	2.5	13	20	-------	6.0	84	49	27	11
6	-------	6.8	145	-------	1.9	12	21	-------	6.2	70	44	27	10
7	-------	6.5	132	-------	1.9	12	22	-------	8.2	62	46	25	5.8
8	-------	6.8	132	-------	1.7	12	23	-------	13	7.7	53	24	------
9	-------	5.8	142	-------	1.5	12	24	-------	69	3.5	49	24	------
10	-------	6.8	131	-------	1.4	12	25	-------	187	3.1	43	23	------
11	-------	5.2	105	-------	1.2	12	26	-------	215	2.9	41	22	------
12	-------	6.2	102	-------	1.0	11	27	-------	312	2.5	15	21	------
13	-------	6.2	50	-------	1.2	11	28	-------	257	2.5	3.5	21	------
14	15	6.5	82	-------	1.2	11	29	-------	204	2.1	4.2	19	------
15	14	6.0	62	-------	1.2	12	30	-------	190	1.0	3.3	17	------
							31	7.8	-------	1.2	-------	17	------

NOTE.—Owing to incomplete record, discharge partly estimated on Mar. 14, 31, May 31, and June 20. No record Mar. 19–30 and June 1–19. No flow Aug. 23 to Sept. 30. Mean daily discharge determined by applying to rating table gage heights for fractional parts of a day Apr. 22–25, May 10, 13–16, 18–20, 22, 23, June 27, and July 17.

Monthly discharge of Imperial high-line canal near Grandfalls, Tex., for the period Mar. 14 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April	312	5.2	53.3	3,170
May	162	1.0	77.8	4,780
June 20–30	53	3.3	31.9	696
July	37	1.0	13.1	806
August (22 days)	16	5.8	11.8	515

NOTE.—See footnote to daily-discharge table.

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 to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder installed March 29; attended by United States Geological Survey engineers.

DISCHARGE MEASUREMENTS.—Measurements by wading or from footbridge near gage.

CHANNEL AND CONTROL.—Bed of canal consists of clay, gypsum, and silt. Banks of earth. Control not known but shifts. Point of zero flow about 0.66 foot.

EXTREMES OF DISCHARGE.—Maximum stage during period March 29 to September 30, from water-stage recorder, 3.87 feet at 1.30 p. m. April 27 (discharge, 215 second-feet, determined from extension of rating curve and subject to error). No flow July 25 to September 30.

ICE.—None.

DIVERSIONS.—Above all diversions. Sand gates 1½ miles above opened occasionally for short periods.

REGULATION.—Flow regulated by head gates.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined from 0 to 160 second-feet and extended above. Operation of water-stage recorder not satisfactory. Mean daily gage height determined from recorder graph by inspection or by use of planimeter. Daily discharge ascertained by indirect method for shifting control, except as noted in footnote to daily-discharge table. Records poor.

Discharge measurements of Imperial low-line canal near Grandfalls, Tex., during the period Mar. 29 to Sept. 30, 1922

[Made by R. G. West]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Apr. 4	1.08	13.3	May 15	1.44	23.5
17	.85	5.0	June 20	1.87	33.5
28	3.34	162			

Daily discharge, in second-feet, of Imperial low-line canal near Grandfalls, Tex., for the period Mar. 29 to Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Day	Mar.	Apr.	May	June	July
1		7.2	123		1.8	16		5.0	20	64	0.5
2		8.0	114	5.8	2.8	17		4.8	18	34	.5
3		14	118	5.8	3.5	18		4.8	38	33	2.8
4		14	119	7.5	3.2	19		5.0	32	34	4.0
5		10	118	8.5	1.8	20		4.8	38	34	2.5
6		8.0	107	8.8	1.8	21		5.0	23	38	1.5
7		6.8	102	8.5	1.5	22		5.2	8.5	29	1.5
8		6.5	106	11	1.5	23		9.3		10	1.2
9		5.8	98	8.8	1.5	24		41		7.8	.5
10		5.2	98	7.8	1.0	25		106		5.8	
11		4.8	66	8.5	1.2	26		106		4.8	
12		5.0	90	9.7	1.2	27		193		3.8	
13		5.0	66	12	1.0	28		178		2.2	
14		5.2	41	19	1.0	29	8.0	163		2.2	
15		4.8	25	34	.8	30	7.8	148		2.0	
						31	7.5				

NOTE.—Owing to incomplete record, record doubtful May 5–14, June 2 to July 10. Record partly estimated Mar. 29. No record May 23 to June 1. No flow July 25 to Sept. 30. Gage heights applied to rating table for fractional part of a day April 3, 23, 24, May 12, 13, 18–20, June 22, and 23.

Monthly discharge of Imperial low-line canal near Grandfalls, Tex., for the period Mar. 29 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March (3 days)	8.0	7.5	7.77	46.2
April	193	4.8	36.3	2,160
May 1–22	123	8.5	71.3	3,110
June 2–30	64	2.0	15.9	914
July (24 days)	4.0	.5	1.69	80.4

NOTE.—See footnote to table of daily discharge.

MISCELLANEOUS MEASUREMENTS

Miscellaneous discharge measurements in western Gulf of Mexico drainage basins during the year ending Sept. 30, 1922

Date	Stream	Tributary to or diverting from—	Locality	Gage height	Discharge
				Feet	*Sec-ft.*
Oct. 9	Sabine River	Gulf of Mexico	Logansport, La., at gage	[a] 2.40	169
9	do	do	Logansport, La., 1 mi. above gage.	[a] 2.40	168
7	Neches River	do	Evadale, Tex.	[a] 7.90	721
8	do	do	do	[a] 7.78	592
10	Trinity River	do	Riverside, Tex.	[a] 8.42	329
Nov. 16	Brazos River	do	Granbury, Tex., 200 feet below highway bridge.		14.2
Oct. 5	do	do	Rosenberg, Tex.	[a] 6.97	5,450
Aug. 31	do	do	do	[a] 2.96	1,216
Sept. 27	do	do	do	[a] 2.12	848
Nov. 6	Middle Fork of Concho River.	Concho River	Near San Angelo, Tex., at 7 mile crossing.		1.9
5	South Concho River	do	½ mile below Christoval, Tex.		2.9
5	Christoval ditch	Diverts from South Concho River.	½ mile above Christoval, Tex., at road crossing.		5.9
4	San Saba River	Colorado River	Fort McKavett - Menard road crossing at Fort McKavett, Tex.		12.4
17	do	do	Dam site at Doran's ranch, 20 miles above San Saba, Tex.		25
4	Clear Creek	San Saba River	Menard - Fort McKavett road crossing near Menard, Tex.		15.7
4	Noyes canal	Diverts fron San Saba River.	4 miles above Menard, Tex.		21.6
18	Fleming Spring	San Saba River	Fleming ranch near San Saba, Tex.		[b] 3
18	Sloans Spring	do	Road crossing near San Saba, Tex.		5.3
18	Wallace Creek	do	Near San Saba, Tex.		2.1
10	Mill Spring	Barton Creek	Near Austin, Tex.		3.6
Dec. 13	do	do	do		1.3
Jan. 11	do	do	do		[b] .7
Feb. 10	do	do	do		[b] .1
27	do	do	do		.0
Mar. 11	do	do	do		.0
25	do	do	do		.0
May 25	do	do	do		7.6
June 20	do	do	do		6.0
July 13	do	do	do		5.0
26	do	do	do		3.0
Aug. 9	do	do	do		.8
28	do	do	do		[b] 5
Sept. 19	do	do	do		[b] .05
Aug. 29	Spring	Sandy Creek	300 feet above pumping plant Elgin, Tex.		.09
Mar. 24	Gaudalupe River	Gulf of Mexico	Storage dam site near Bergheim, Tex.		62.4
Sept. 8	do	do	do		31.5
Oct. 3	San Marcos River	Gaudalupe River	San Marcos-Austin crossing at San Marcos, Tex.		219
Nov. 25	do	do	do		194
Jan. 5	do	do	do		172
25	do	do	do		170
Mar. 13	do	do	do		152
31	do	do	do		[c] 187
May 17	do	do	do		286
June 12	do	do	do		275
July 8	do	do	do		228
21	do	do	do		202
Aug. 5	do	do	do		168
23	do	do	do		182
Sept. 6	Medina River	San Antonio River	Weir above reservoir, near Bandera, Tex.		10.4
June 21	Rio Grande	Gulf of Mexico	Roma, Tex.		[d] 240,000
25	Campacuas drain	do	Mile 13½ N., Mercedes, Tex.		[d] [e] 58,400
25	Rio Colorado	do	Harlingen, Tex.		[d] [e] 72,600
Oct. 18	Pecos River	Rio Grande	Sand Lake dam site 1½ miles above Riverton, Tex.		249

[a] U. S. Weather Bureau gage.
[b] Estimated.
[c] Discharge more than flow of springs. Turbines above opened during measurement.
[d] Slope measurement.
[e] Caused by Rio Grande overflow of June.

Miscellaneous discharge measurements in western Gulf of Mexico drainage basin during the year ending Sept. 30, 1922—Continued

Date	Stream	Tributary to or diverting from—	Locality	Gage height	Discharge
				Feet	*Sec-ft.*
June 14	Pecos River	Rio Grande	Bankhead highway near Pecos, Tex.	[a] 3.28	443
Aug. 8	do	do	do	[a] .45	11.6
Apr. 7	do	do	20 miles southeast of Sheffield, Tex., below mouth of Independence Creek.		166
Mar. 25	Boxley canal	Diverts from Pecos River.	Pump near Barstow, Tex		12.5
July 13	do	do	do		12.5
27	Moore's canal	Diverts from a spring	Near Balmorhea, Tex		5.9
20	San Solomon Springs	Pecos River	do		37.0
Apr. 8	Comanche Springs	do	Fort Stockton, Tex		45.6
July 28	Troy's Johnson Well No. 1.	do	Near Stockton, Tex		5.6
28	Grants-Devlin Well No. 4.	do	do		3.3
Apr. 7	Independence Creek	do	20 miles southeast of Sheffield, Tex.		27.0
Oct. 9	Goodenough Spring	Rio Grande	Near Comstock, Tex		197
Nov. 18	do	do	do		181
Oct. 6	Devils River	do	Proposed dam site, 10 miles above mouth and 15 miles from Del Rio, Tex.		292
7	do	do	Del Rio-Comstock highway bridge near Del Rio, Tex.		290
Dec. 13	do	do	do		278
Oct. 7	do	do	Railroad bridge ½ mile above old gage at Devils River, Tex.		342
7	do	do	300 feet below location of old gage at Devils River, Tex.		344
5	San Felipe Springs	do	Del Rio, Tex		84.8

[a] U. S. Weather Bureau gage.

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