DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 287

SURFACE WATER SUPPLY OF THE UNITED STATES

1910

PART VII. LOWER MISSISSIPPI BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. B. FREEMAN AND J. G. MATHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

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ILLUSTRATIONS.

SURFACE WATER SUPPLY OF THE LOWER MISSISSIPPI BASIN, 1910.

By W. B. FREEMAN and J. G. MATHERS.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with private or State organizations. The organic law of the Geological Survey (Stat. L., vol. 20, p. 394) contains the following paragraph:

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

As water is the most abundant and most valuable of the minerals the investigation of water resources is authorized under the provision for examining mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

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

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911	150,000

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor do they include all streams that might be advantageously studied. The scope of the

work is limited by the appropriations available. The field covered is the widest and the character of the work is believed to be the best possible under the controlling conditions. The work would undoubtedly have greater scientific importance and ultimately be of more practical value if the money now expended for wide areas were concentrated on a few small drainage basins, but such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be kept during a period of years long enough to determine within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum. The length of such a period manifestly differs for different streams. Experience has shown that the records for some streams should cover 5 to 10 years, and those for other streams 20 years or even more, the limit being determined by the relative importance of the stream and the interdependence of the results with other long-time records on adjacent streams.

In the performance of this work an effort is made to reach the highest degree of precision possible with a reasonable expenditure of time and a judicious expenditure of a small amount of money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-flow measurements. It is confidently believed that the stream-flow data presented in the publications of the Survey are in general sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of stations. All persons are cautioned to exercise the greatest care in using such incomplete records.

Records have been obtained at nearly 2,000 different points in the United States. The surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in Hawaii has also been investigated. During 1910 regular gaging stations were maintained by the Survey and cooperating organizations at about 1,100 points in the United States, and many discharge measurements were made at other points. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular surface water-supply papers and in special papers from time to time.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey have appeared in the annual reports, bulletins, and water-

supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications have varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1910. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1910.

Part.	No.	Title.
I	281	North Atlantic coast.
II	282	South Atlantic coast and eastern Gulf of Mexico.
III	283	Ohio River basin.
IV	284	St. Lawrence River basin.
V	285	Upper Mississippi River and Hudson Bay basins.
VI	286	Missouri River basin.
VII	287	Lower Mississippi River basin.
VIII	288	Western Gulf of Mexico.
IX	289	Colorado River basin.
X	290	Great Basin.
XI	291	California.
XII	292	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey, exclusive of special papers:

Stream-flow data in reports of the United States Geological Survey.

[A.=Annual Report; B.=Bulletin; W. S.=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A., pt. 2	Descriptive information only	
11th A., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th A., pt. 2	....do	1884 to June 30, 1891.
13th A., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 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. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
19th A., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 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. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	do	1903.
W. S. 124 to 135	do	1904.
W. S. 165 to 178	do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.
W. S. 261 to 272	do	1909.
W. S. 281 to 292	do	1910.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119.

The first table which follows gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1909. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1910.

	1899 [a]	1900 [b]	1901	1902	1903
Atlantic coast and eastern Gulf of Mexico:					
New England rivers	35	47	65, 75	82	97
Hudson River to Delaware River, inclusive	35	47, (48)	65, 75	32	97
Susquehanna River to York River, inclusive	35	48	65, 75	82	97
James River to Yadkin River, inclusive	(35), 36	48	65, 75	(82), 83	(97), 98
Santee River to Pearl River, inclusive	36	48	65, 75	83	98
St. Lawrence River	36	49	65, 75	(82), 83	97
Hudson Bay			66, 75	85	100
Mississippi River:					
Ohio River	36	48, (49)	65, 75	83	98
Upper Mississippi River	36	49	65, 75	83	98, (99)
Missouri River	(36, 37)	49, (50)	66, 75	84	99
Lower Mississippi River	37	50	(65), 66, 75	(83), 84	(98), 99
Western Gulf of Mexico	37	50	66, 75	84	99
Pacific coast and Great Basin:					
Colorado River	(37), 38	50	66, 75	85	100
Great Basin	38, (39)	51	66, 75	85	100
South Pacific coast to Klamath River, inclusive	(38), 39	51	66, 75	85	100
North Pacific coast	38	51	66, 75	85	100

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] 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.

Numbers of water-supply papers containing results of stream measurements, 1899–1910—Continued.

	1904	1905	1906	1907–8	1909	1910
Atlantic coast and eastern Gulf of Mexico:						
New England rivers	124	165	201	241	261	281
Hudson River to Delaware River, inclusive	125	166	202	241	261	281
Susquehanna River to York River, inclusive	126	167	203	241	261	281
James River to Yadkin River, inclusive	126	167	203	242	262	282
Santee River to Pearl River, inclusive	127	168	204	242	262	282
St. Lawrence River	129	170	206	244	264	284
Hudson Bay	130	171	207	245	265	285
Mississippi River:						
Ohio River	128	169	205	243	263	283
Upper Mississippi River	128, (130)	171	207	245	265	285
Missouri River	130, (131)	172	208	246	266	286
Lower Mississippi River	(128), 131	(169), 173	(205), 209	247	267	287
Western Gulf of Mexico	132	174	210	248	268	288
Pacific coast and Great Basin:						
Colorado River	133, (134)	175, (177)	211, (213)	249, (251)	269, (271)	289, (291)
Great Basin	133, (134)	176, (177)	212, (213)	250, (251)	270, (271)	290, (291)
South Pacific coast to Klamath River, inclusive	134	177	213	251	271	291
North Pacific coast	135	(177), 178	214	252	272	292

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	Yuma and Salton Sea stations repeated.
271	Great Basin	Owens River basin.
291		

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined by measuring or estimating the drainage area; that is, the headwater stream having the largest drainage area is considered the continuation of the main stream and local changes in name and lake surface are disregarded. Records for all stations from the source to the mouth of the main stem of the river are presented first, and records for

the tributaries in regular order from source to mouth follow, all records in each tributary basin being given before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated above, and in the record for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

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 which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. The units used in this series of reports are second-feet, and feet per square mile, and run-off in inches, and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents:

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

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

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches equals 96 Colorado miner's inches.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches equals 104 California miner's inches.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

For each drainage basin there is given a brief general description covering such items as area, source, tributaries, topography, geology, forestation, rainfall, irrigation, storage, power, and other interesting and important facts.

For each regular current-meter gaging station the following data, so far as available, are given: Description of station, list of discharge measurements, table of daily gage heights, table of daily discharges, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by the presence of ice in the streams or by backwater from obstructions are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

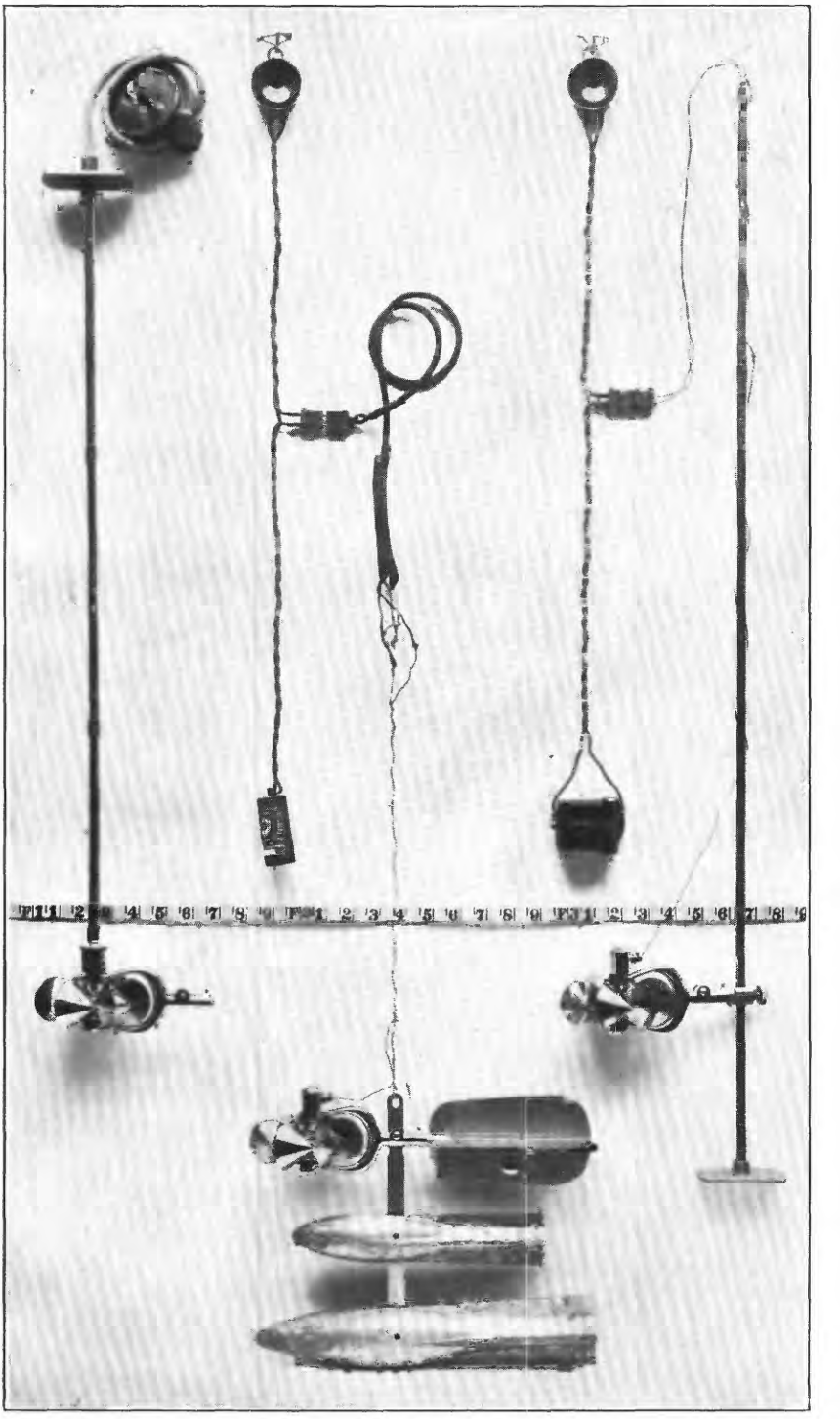
The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the daily gage

A. FOR BRIDGE MEASUREMENT.

B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.



SMALL PRICE CURRENT METERS.

heights and daily discharges, for the purpose of verifying the published results as follows:

First plot the discharge measurements for the current and earlier years on cross-section paper with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater conditions.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, 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 of "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 the computations for the remaining columns, which are defined on page 10, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plate I shows typical gaging stations and indicates the method of suspending the current meter; Plate II shows the various types of current meters [1] used in the work.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the

[1] See Hoyt, J. C., and others, Use and care of the current meter as practiced by the United States Geol. Survey; Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

degree of permanency of channel and of the relation of discharge to stage.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow; and, third, to errors due to misinterpretation of stage and flow data.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous experiments made to test the accuracy of current-meter work show that it compares very favorably with the results from standard weirs and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where the coefficient may be uncertain and conditions of flow are complicated.

The work is, of course, dependent on the reliability of the gage observers. With comparatively few exceptions, the observers perform their work honestly. The records are, however, closely watched, and the cause of any discrepancy is investigated. It is obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in the period of one month, although a single day's reading may, when taken by itself, be considerably in error.

An effort is made to visit every station at least once each year for the purpose of making a measurement to determine the constancy of conditions of flow since the last measurement made the preceding year and also to check the elevation of the gage. On account of lack of funds or for other causes some stations were not visited during the current year. If conditions of flow have been reasonably permanent up to the time of the last preceding measurement, it is considered best to publish estimates of discharge based on the latest verified rating curve rather than to omit them altogether, although it should be distinctly understood that such records are at times subject to considerable error. This is also true, although to a less degree, of the period of records since the date of the last measurement of the current year. As a rule, the accuracy notes are based on the assumption that the rating curve used is strictly applicable to the current year.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily-discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly-discharge table. 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" or "approximate," 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 accuracy column in the monthly-discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general, the base data which are collected in the field each year by the Survey engineers are published, not only to comply with the law but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may be seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the figures presented in these papers will verify all ratings and make such adjustments for earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for 5 or 10 year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The estimates in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

The daily discharges are published to allow a more detailed study of the variation in flow and to determine the periods of deficient flow.

COOPERATIVE DATA.

Cooperative data of various kinds and data regarding the run-off at many stations maintained wholly by private funds are incorporated in the surface-water supply reports of the United States Geological Survey.

Many stations throughout the country are maintained for specific purposes by private parties, who supply the records gratuitously to the United States Geological Survey for publication. When such records are furnished by responsible parties and appear to be reasonably accurate, they are verified, so far as possible, and estimated values of accuracy are given. Records clearly worthless or misleading are not published. As it is, however, impossible to completely verify all such records furnished—because of lack of funds or for other causes—they are published for what they are worth, as they are of value as a matter of record and afford at least approximate information regarding stream flow at the particular localities. The Survey does not, however, assume any responsibility for inaccuracies found in such records, although most of them are believed to be reasonably good.

COOPERATION AND ACKNOWLEDGMENTS.

Special acknowledgment is due to the following persons: Mr. Charles W. Comstock, State engineer of Colorado, who has paid the gage observers at most of the stations in the Arkansas River basin in Colorado and has been of much assistance to the work in other ways.

The Territorial engineer of New Mexico, Mr. Vernon L. Sullivan, who has assisted in maintaining the gaging stations on the Canadian River basin in New Mexico by bearing at least half of the expense of carrying on this work and also by giving special attention to it.

Thanks are also due to the Central Land & Irrigation Co. for bearing the expense of records received in the Big Sandy River basin, and to the United States Forest Service for records furnished on the upper areas of the Arkansas River basin.

The Tallahatchie drainage commission bore the expenses of stations in the Yazoo River basin.

The State geologist of Arkansas, A. H. Purdue, maintained several stations in the White River basin, the results being published by the United States Geological Survey.

DIVISION OF WORK.

Field data in the Arkansas River basin in Colorado were collected under the direction of W. B. Freeman, district engineer, assisted by J. B. Stewart, G. H. Russell, G. J. Lyon, E. O. Christiansen, Thomas Grieve, and other assistants furnished by the State engineer of Colorado.

The field data for the Canadian River basin were collected under the direction of W. B. Freeman, district engineer, assisted by J. B. Stewart, C. D. Miller, and W. W. Mills. Mr. V. L. Sullivan, Territorial engineer, gave special attention to the New Mexico work.

The field data for the Yazoo River basin were collected by engineers of the Tallahatchie drainage commission.

The field data in the White River basin were collected by W. N. Gladson.

The rating curves were made by W. B. Freeman, M. R. Hall, G. C. Stevens, and J. G. Mathers. The computations were made by J. G. Mathers, H. D. Padgett, J. J. Phelan, J. B. Stewart, and A. H. Tuttle. The completed data were prepared for publication by J. G. Mathers. The manuscript was edited by Mrs. B. D. Wood.

GAGING STATIONS MAINTAINED IN THE LOWER MISSISSIPPI RIVER BASIN.

The following list comprises the gaging stations maintained in the lower Mississippi River drainage basin by the United States Geological Survey and cooperative parties. Data for these stations have been published in the reports listed on page 9. The stations are arranged by river basins, in downstream order, tributaries of main streams being indicated by indention:

Meramec River basin.

Meramec River near Meramec, Mo., 1903–1906.
Meramec River near Eureka, Mo., 1903–1906.
Meramec River (Station No. 1) at Fenton, Mo., 1903.
Meramec River (Station No. 2) below Fenton, Mo., 1903.
  Meramec Spring near Meramec, Mo., 1903–1906.
  Courtois Creek at Scotia, Mo., 1905–6.

White River basin.

White River at Beaver, Ark., 1909–10.
White River near Branson, Mo., 1909–10.
White River near Lead Hill, Ark., 1909–10.
White River near Cotter, Ark., 1909–10.
White River at Walls Ferry, Ark., 1909–10.
  Buffalo River near Gilbert, Ark., 1909–10.
  North Fork River near Henderson, Ark., 1909–10.
  Greer Spring at Greer, Mo., 1904.
  Little Red River near Pangburn, Ark., 1909–10.

Arkansas River basin.

Arkansas River, East Fork, near Leadville, Colo., 1890, 1903.
Arkansas River at Granite, Colo., 1895, 1897–1899, 1901, 1910.
Arkansas River at Salida, Colo., 1895–1903, 1909–10.
Arkansas River at Canon City, Colo., 1888–1910.
Arkansas River near Rock Canyon, Colo., 1889.
Arkansas River above Pueblo, Colo., 1885–1887.
Arkansas River at Pueblo, Colo., 1894–1910.
Arkansas River near Nepesta, Colo., 1897–1903, 1910.
Arkansas River near Manzanola, Colo., 1898.
Arkansas River near Rocky Ford, Colo., 1897–1903.

Arkansas River at La Junta, Colo., 1889, 1893–1895, 1903, 1908.
Arkansas River near Las Animas, Colo, 1898.
Arkansas River near Prowers, Colo., 1900, 1901, 1903.
Arkansas River near Amity canal head-gates, Colo., 1898–99.
Arkansas River near Granada, 1898–1901, 1904.
Arkansas River near Barton (Byron), Colo., 1893–94, 1901–2.
Arkansas River at Holly, Colo., 1907–1910.
Arkansas River near Syracuse, Kans., 1903–1906.
Arkansas River near Coolidge, Kans., 1903.
Arkansas River near Dodge, Kans., 1902–1906.
Arkansas River near Hutchinson, Kans., 1895–1905.
Arkansas River near Arkansas City, Kans., 1902–1906.
Arkansas River, Tennessee Fork, near Leadville, Colo., 1890, 1903.
Arkansas River, Lake Fork, near Arkansas Junction, Colo., 1903.
Arkansas River, Lake Fork, near Leadville, Colo., 1890.
Lake Creek near Twin Lakes, Colo., 1899–1900.
Twin Lakes outlet near Twin Lakes, Colo., 1910.
Clear Creek near Granite, Colo., 1890, 1910.
Cottonwood Creek near Buena Vista, Colo., 1910.
Cottonwood Creek, Middle Fork, near Buena Vista, Colo., 1890.
Cottonwood Creek, South Fork, near Buena Vista, Colo., 1890.
Chalk Creek near Buena Vista, Colo., 1910.
Grape Creek near Canon City, Colo., 1907–1909.
Oil or Fourmile Creek near Canon City, Colo., 1910.
Huerfano River near Undercliffe, Colo., 1908.
Cucharas River at Walsenburg, Colo., 1907–8.
Purgatory River at Trinidad, Colo., 1896–1899, 1905–1910.
Purgatory River near Canon Entrance (Alfalfa), Colo., 1905–1907.
Purgatory River near J. J. ranch, Colo., 1898.
Purgatory River near Las Animas, Colo., 1889.
Big Sandy Creek at Hugo, Colo., 1910.
Big Sandy Creek at Kit Carson, Colo., 1910.
Big Spring Creek near Arena, Colo., 1910.
Walnut River near Arkansas City, Kans., 1902–3.
Arkansas River, Salt Fork, near Alva, Okla., 1904–5.
Arkansas River, Salt Fork, near Tonkawa, Okla., 1903–1905.
Medicine River near Kiowa, Kans., 1895–96.
Cimarron River near Arkalon, Kans., 1895–96, 1903–1905.
Cimarron River near Kenton, Okla., 1904–5.
Cimarron River near Garrett, Okla., 1905–1907.
Cimarron River near Waynoka, Okla., 1903–1905.
Verdigris River near Independence, Kans., 1904.
Verdigris River near Liberty, Kans., 1895–1903.
Verdigris River near Catoosa, Okla., 1903–1905.
Fall River near Fall River, Kans., 1904–5.
Neosho River near Neosho Rapids, Kans., 1904.
Neosho River near Iola, Kans., 1895–1903.
Neosho River near Humboldt, Kans., 1904.
Neosho River (or Grand River) near Fort Gibson, Okla., 1899, 1903–1905.
Canadian River near Logan, N. Mex., 1905, 1909–10.
Canadian River at Calvin, Okla., 1904–1908.
Chico Rico Creek near Raton, N. Mex., 1910.
Una del Gato Creek near Raton, N. Mex., 1910.

Arkansas River—Continued.
Canadian River—Continued.
Cimarron River at Ute Park, N. Mex., 1907–1910.
Cimarron River at Springer, N. Mex., 1907–1909.
Rayado River at Abreu's ranch, near Cimarron, N. Mex., 1909–10.
Rayado River near Springer, N. Mex., 1907–1909.
Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1910.
Mora River near Weber, N. Mex., 1903–4.
Mora River near Watrous, N. Mex., 1894–1896.
Sapello River at Sapello, N. Mex., 1903–4.
Sapello Mill tailrace at Sapello, N. Mex., 1903–4.
Sapello River at Los Alamos, N. Mex., 1903–1910.
Manuelitos River near Sapello, N. Mex., 1903–4.
Ute Creek near Logan, N. Mex., 1904–1906, 1909–10.
Beaver Creek at Beaver, Okla., 1904–5.
North Fork of Canadian River near Woodward, Okla., 1903–1906.
North Fork of Canadian River near El Reno, Okla., 1902–1908.
North Fork of Canadian River near Oklahoma, Okla., 1899.
North Fork of Canadian River near Eufaula, Okla., 1899.
Arkansas River canals:
Oxford Farmers canal near Nepesta, Colo., 1903.
Colorado-Kansas canal near Prowers, Colo., 1903.
Keese ditch near Prowers, Colo., 1903.

Yazoo River basin.

Tallahatchie River at Batesville, Miss., 1906–1910.
Tallahatchie River at Philipp, Miss., 1908–1910.
Yazoo River at Greenwood, Miss., 1908–1910.
Yazoo River at Yazoo City, Miss., 1900–1905.
Coldwater River at Savage, Miss., 1908–1910.
Yalobusha River at Grenada, Miss., 1906, 1908–1910.
Sunflower River at Ruleville, Miss., 1908–1910.
Sunflower River at Baird, Miss., 1908–1910.

Homochitto River basin.

Homochitto River at Rosetta, Miss., 1906.

Red River basin.

Red River at Arthur City, Tex., 1905–6.
Red River, Salt Fork, at Mangum, Okla., 1905–6.
Turkey Creek at Olustee, Okla., 1905–1908.
Red River, North Fork, near Granite, Okla., 1903–1908.
Red River, North Fork, near Snyder, Okla., 1905.
Red River, North Fork, near Headrick, Okla., 1905–1908.
Red River, Elm Fork, near Mangum, Okla., 1905–1908.
Elk Creek near Hobart, Okla., 1904–1908.
Otter Creek near Mountain Park, Okla., 1903–1908.
Horse Creek near Mountain Park, Okla., 1905–6.
Otter Creek, Dry Fork, near Mountain Park, Okla., 1905–6.
Wichita River at Wichita Falls, Tex., 1910.
Washita River near Anadarko, Okla., 1902–1908.
Ouachita River near Malvern, Ark., 1903–1905.
Ouachita River near Arkadelphia, Ark., 1905–6.

WHITE RIVER DRAINAGE BASIN.

DESCRIPTION.

White River rises in the Boston Mountains near the western border of Arkansas, nearly 50 miles south of the Arkansas-Missouri line, flows northward into Missouri, then bends southeastward and reenters Arkansas, continuing its general southeasterly course to the southeast corner of Arkansas County, where its channel divides, one part entering Arkansas River and the other Mississippi River. The natural discharge of White River is into the Mississippi. The length of the river from its source to its mouth is about 300 miles by general course, but the stream is very crooked, and, including the bends, it is probably not less than 400 miles long.

The important tributaries from the north are North Fork River, Black River, and Cache River; those from the south are Kings River, Buffalo River, and Red River.

The basin comprises 27,700 square miles, of which 10,000 square miles lie in Missouri and the remainder in northern and eastern Arkansas. Topographically, it consists of two parts—a highland area, 22,200 square miles in extent, lying west of the St. Louis, Iron Mountain & Southern Railway, and an area of lowlands, including 5,500 square miles, lying east of this railroad.

The topography of the highland portion of the basin is rough. The rocks are sandstone, limestone, and shale, lying horizontal. Through these the main stream and all its tributaries have cut ravines that range in depth from a few score feet to more than 1,200 feet. Elevations in the Boston Mountains exceed 2,000 feet above sea level. The elevation of the bed of White River ranges from 1,250 feet at the north base of the mountains to less than 250 feet at Batesville. Throughout the distance between these two points there are no falls and but a few rapids.

The lowland area of the basin is level, and stands only a few feet above the water of the river at average stage. It is cut by numerous sloughs which have been formed by the clogging of the streams and the partial filling of horseshoe lakes. Probably all of it is susceptible to drainage.

The entire area was originally forest covered, but a large proportion of the river bottoms and the level parts of the uplands is now under cultivation. The steep rock-covered slopes, which constitute a considerable part of the area, are still forest covered.

The records kept at the agricultural experiment station at Fayetteville from 1871 to 1907, inclusive, show that the annual rainfall at that place ranges from a minimum of 34.58 inches in 1871 to a maxi-

mum of 67.48 inches in 1905. The average for the 37 years was 45.609 inches. The rainfall at Fayetteville is probably fairly representative for that part of the basin that lies within the highland division.

The average snowfall is about 9 inches. Snow lies on the ground but a few days at most, and there is seldom ice enough on the ground to interfere with travel.

Irrigation has not been attempted in this basin, but it is practicable in a small way along the stream bottoms, where the water may be taken from the streams, and on a still smaller scale on the benches of the hill slopes, where water from springs may be stored.

As the valleys are narrow and the banks in most places high, there are many points along the streams where water could be stored without flooding much land. Such storage sites may be found along White River and all its highland tributaries. Numerous large springs of fine water occur throughout the highland area.

Buffalo River and that portion of White River above the mouth of Buffalo River can be utilized for logging or boating only during the rainy season. A series of Government dams above Batesville will, when completed, render White River navigable throughout the year as far up as the mouth of Buffalo River. In the lowland part of its course White River is navigable for small boats at all seasons.

A survey to determine the available water power along White River and its tributaries is now being conducted. The smaller of the numerous power sites can probably be made to furnish a few hundred horsepower and the larger ones several thousand horsepower.

WHITE RIVER AT BEAVER, ARK.

This station, which is located at the Missouri & North Arkansas Railroad bridge at Beaver, Ark., was established July 17, 1909, to obtain data for use in studying water power, water supply, flood control, storage, and navigation problems.

No important tributaries enter near the station.

The datum of the chain gage, which is fastened to the upstream guardrail of the bridge, has not been changed. Measurements at high water are made from this bridge; low-water measurements are made by wading.

The station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey since its establishment.

The following discharge measurement was made by W. N. Gladson:

May 24: Width, 182 feet; area of section, 1,330 square feet; gage height, 8.44 feet; discharge, 3,620 second-feet.

Daily gage height, in feet, of White River at Beaver, Ark., for 1910.

[Reno N. Lowe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	4.0	8.05	6.2	4.65	6.1	5.4	4.05	3.7	3.8	3.6	3.5
2	3.7	4.05	6.8	5.45	4.55	5.95	5.1	4.0	3.8	3.7	3.6	3.5
3	3.8	3.9	6.3	5.25	4.45	5.55	4.9	4.0	3.8	3.75	3.6	3.5
4	3.8	3.9	5.95	4.95	4.35	5.35	5.7	3.95	3.85	3.8	3.6	3.6
5	3.8	4.0	5.55	5.15	4.3	5.15	5.35	3.9	3.8	4.15	3.6	3.55
6	3.8	3.8	5.35	5.9	4.25	4.95	5.1	3.9	4.15	4.4	3.6	3.5
7	4.35	3.8	5.18	6.65	4.25	4.9	4.75	4.8	4.3	4.25	3.6	3.5
8	4.5	3.9	4.95	6.25	4.25	5.2	4.75	6.5	4.05	4.15	3.6	3.5
9	4.4	3.8	4.9	5.9	4.25	5.15	4.9	6.4	4.15	4.0	3.6	3.5
10	4.1	3.8	4.95	6.6	4.3	5.65	5.0	5.5	4.15	3.9	3.6	3.5
11	4.05	3.9	4.8	6.35	4.3	5.6	5.55	5.55	4.0	3.8	3.6	3.5
12	4.0	3.7	4.7	6.6	4.2	6.15	11.65	5.15	4.0	3.8	3.5	3.5
13	4.3	3.8	4.65	9.25	4.15	5.9	12.7	5.2	3.9	4.05	3.5	3.5
14	4.45	3.7	4.6	7.45	4.05	5.5	9.8	4.85	3.8	4.4	3.5	3.5
15	4.35	3.7	4.55	7.45	4.05	5.25	7.55	4.7	3.75	4.5	3.5	3.5
16	4.35	3.8	4.45	7.6	6.5	5.05	6.65	4.55	3.7	4.15	3.5	3.5
17	4.35	3.8	4.38	7.7	18.85	4.85	6.1	4.65	3.65	4.05	3.5	3.5
18	4.35	3.9	4.3	7.3	12.25	4.65	5.7	4.5	3.6	3.95	3.5	3.5
19	4.45	3.95	4.3	6.7	8.95	4.55	5.45	4.45	3.6	3.9	3.5	3.5
20	4.35	3.85	4.22	6.4	7.75	4.55	5.25	4.25	3.6	3.9	3.5	3.5
21	4.35	4.25	4.2	6.05	7.05	4.7	5.05	4.2	3.6	3.9	3.5	3.5
22	4.35	4.5	4.15	5.85	6.8	4.6	4.85	4.2	3.6	3.8	3.5	3.4
23	4.35	4.7	4.1	5.55	7.65	4.5	4.75	4.2	3.55	3.8	3.5	3.4
24	4.35	4.9	4.1	5.35	8.25	4.65	4.65	4.15	3.5	3.8	3.5	3.4
25	4.2	5.08	4.0	5.3	8.2	4.55	4.5	4.05	3.5	3.8	3.5	3.4
26	4.3	5.25	4.0	5.1	7.8	5.05	4.4	4.0	3.5	3.75	3.5	3.4
27	4.15	6.3	4.0	4.95	7.0	5.05	4.35	3.9	3.5	3.7	3.6	3.4
28	4.2	7.8	4.0	4.85	6.5	6.0	4.25	3.85	4.3	3.7	3.6	3.5
29	4.0	.....	3.95	4.8	6.05	6.75	4.15	3.8	4.2	3.7	3.6	3.5
30	4.1	.....	4.15	4.65	5.75	5.75	4.2	3.8	3.95	3.7	3.5	3.5
31	4.0	.....	5.3	.....	5.55	.....	4.15	3.75	.....	3.7	.....	3.5

WHITE RIVER NEAR BRANSON, MO.

This station, which is located at the St. Louis, Iron Mountain & Southern Railway bridge near Branson, Mo., was established July 19, 1909, to obtain data for use in studying water power, water supply, flood control, storage, and navigation problems.

Turkey Creek enters the river on the right bank about 600 feet below the section.

The datum of the gage, which is fastened to the downstream guard rail of the bridge, has remained unchanged. At high water, measurements are made from this bridge; at low water they are made by wading.

This station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey since its establishment.

Daily gage height, in feet, of White River near Branson, Mo., for 1910.

[J. A. Medley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.
1	2.95	3.0	7.35	2.6	2.95	4.05	4.2	3.3	2.25	2.55	2.4	2.2
2	2.95	3.0	7.15	4.2	3.0	4.0	4.0	3.2	2.5	2.5	2.45	2.2
3	2.95	3.0	6.6	3.9	2.95	4.1	4.0	3.0	3.15	2.6	2.4	2.2
4	2.9	2.9	5.7	3.85	2.55	4.35	4.25	3.0	3.05	2.7	2.4	2.2
5	3.0	2.8	5.55	3.8	2.35	5.9	4.45	3.0	2.9	3.1	2.35	2.2
6	3.0	2.9	4.55	4.15	2.5	6.05	4.15	2.85	3.6	4.45	2.3	2.1
7	3.0	2.9	4.05	4.05	2.7	5.45	4.45	2.85	3.6	4.9	2.2	2.2
8	3.0	2.85	3.8	4.6	3.0	7.2	4.35	3.45	3.5	5.05	2.2	2.3
9	3.2	2.85	3.3	4.45	3.9	8.9	3.85	5.1	3.3	4.6	2.15	2.3
10	3.2	2.7	3.35	4.85	3.85	10.25	3.55	6.5	3.2	3.7	2.2	2.3
11	3.15	2.8	4.1	4.8	3.3	9.45	4.4	5.6	3.2	3.4	2.2	2.3
12	3.1	2.8	3.6	4.0	2.9	7.9	9.1	4.55	2.95	3.3	2.3	2.3
13	3.12	2.75	3.4	4.05	2.65	6.35	11.8	4.15	2.6	3.6	2.3	2.3
14	3.25	2.7	3.3	6.35	2.95	6.0	9.95	3.9	2.7	3.9	2.3	2.2
15	3.4	2.6	3.35	5.45	2.9	5.3	8.0	3.85	2.55	3.5	2.4	2.2
16	3.5	2.7	3.15	5.1	3.05	4.7	5.95	3.8	2.5	3.3	2.4	2.2
17	4.0	2.7	2.9	5.5	11.55	4.15	5.3	3.7	2.4	3.1	2.4	2.1
18	3.8	2.7	2.85	5.0	15.2	4.15	5.0	3.05	2.5	3.0	2.4	2.1
19	3.65	2.7	2.9	5.2	9.9	3.6	4.25	3.35	2.5	3.0	2.3	2.1
20	3.6	3.05	2.8	4.7	7.55	3.35	4.0	3.6	2.45	3.0	2.3	2.1
21	3.6	3.9	2.8	4.35	6.4	3.5	3.85	3.45	2.4	3.15	2.3	2.2
22	3.5	5.05	2.5	3.85	6.0	3.4	3.75	3.3	2.5	2.95	2.3	2.2
23	3.4	5.8	2.3	3.55	5.4	3.45	3.7	3.15	2.5	2.65	2.2	2.1
24	3.35	5.9	2.3	3.2	5.35	3.35	3.7	3.0	2.5	2.85	2.2	2.0
25	3.35	4.8	2.35	3.35	6.25	3.1	3.95	2.9	2.45	2.8	2.25	2.0
26	3.2	3.75	2.35	3.05	6.7	3.4	3.5	2.9	2.4	2.8	2.3	2.0
27	3.2	5.25	2.4	3.1	6.55	3.5	3.3	2.85	2.65	2.85	2.3	2.0
28	3.2	6.25	2.3	2.95	5.7	3.8	3.0	2.7	3.0	2.7	2.3	2.05
29	3.2	.....	2.3	3.0	5.0	4.75	2.9	2.6	2.85	2.55	2.3	2.15
30	3.15	.....	2.4	2.95	4.65	5.05	2.95	2.6	2.6	2.5	2.3	2.3
31	2.9	.....	2.3	.....	4.3	.....	3.35	2.35	.....	2.5	.....	2.3

WHITE RIVER NEAR LEAD HILL, ARK.

This station, which is located at Bradley's ferry, 5 miles northeast of Lead Hill, Ark., was established October 1, 1909, to obtain data for use in studying water power, navigation, flood control, and storage problems.

Fishtrap Shoals are about 400 feet below the station.

The gage consists of two vertical sections on the right bank of the river about 100 feet below the ferry. Its datum has not been changed. Measurements are made from the ferryboat.

The station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey since its establishment.

The following measurement was made by W. N. Gladson:

May 17: Width, 370 feet; area of section, 2,140 square feet; gage height, 5.85 feet; discharge, 8,700 second-feet.

Daily gage height, in feet, of White River near Lead Hill, Ark., for 1910.

[Jerry Upshaw, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	2.0	6.4	2.25	2.6	3.7	3.9	2.7	1.7	1.9	1.7	1.4
2	1.9	2.0	6.8	2.6	2.5	3.6	3.6	2.5	2.0	2.0	1.7	1.4
3	1.8	1.9	6.1	3.2	2.4	3.4	3.15	2.3	2.3	2.0	1.7	1.3
4	1.7	1.9	5.35	3.0	2.3	3.2	3.2	2.2	2.7	2.4	1.6	1.3
5	1.8	1.9	4.8	3.0	2.2	3.85	3.55	2.1	2.5	2.6	1.6	1.3
6	1.4	1.9	4.45	3.6	2.2	4.85	3.45	2.0	2.95	5.5	1.6	1.3
7	1.8	1.8	4.05	4.0	2.3	4.8	3.35	2.0	3.3	4.2	1.6	1.3
8	1.8	1.8	3.8	4.1	2.3	4.95	3.2	2.0	3.0	4.3	1.6	1.3
9	1.9	1.8	3.6	4.45	3.2	7.7	3.1	5.65	2.8	3.7	1.5	1.3
10	1.9	1.7	3.7	4.2	3.45	9.7	3.1	6.75	2.7	3.3	1.5	1.3
11	2.2	1.7	4.4	4.0	3.3	9.8	3.05	5.75	2.6	3.05	1.5	1.3
12	2.0	1.7	4.25	4.05	3.1	7.45	8.8	4.75	2.45	2.8	1.5	1.3
13	2.0	1.7	4.0	4.0	3.0	5.85	10.3	3.95	2.25	2.8	1.5	1.3
14	2.0	1.7	3.9	4.55	2.8	5.55	10.75	3.65	2.2	3.05	1.5	1.3
15	2.55	1.6	3.75	5.05	2.6	4.7	8.5	3.6	2.1	3.15	1.5	1.3
16	2.95	1.6	3.55	4.6	2.85	4.2	6.35	3.3	2.0	2.75	1.5	1.3
17	3.1	1.6	3.4	4.75	5.2	4.0	5.75	3.1	1.9	2.65	1.4	1.3
18	3.1	1.6	3.15	4.8	13.2	3.7	5.7	3.55	1.8	2.5	1.4	1.3
19	2.9	1.6	3.0	4.7	12.5	3.45	4.75	3.3	1.8	2.3	1.4	1.3
20	2.8	1.7	2.9	4.6	7.75	3.2	4.1	3.05	1.7	2.2	1.4	1.3
21	2.7	2.0	2.8	4.25	6.65	3.1	3.65	2.8	1.7	2.2	1.4	1.3
22	2.6	2.45	2.7	3.95	5.3	3.0	3.3	2.95	1.6	2.4	1.4	1.3
23	2.6	3.0	2.6	3.7	4.8	3.0	3.2	2.55	1.6	2.3	1.4	1.3
24	2.5	3.2	2.5	3.5	4.5	2.9	3.3	2.45	1.5	2.2	1.4	1.3
25	2.5	3.15	2.4	3.3	4.6	2.7	3.2	2.4	1.5	2.1	1.4	1.3
26	2.4	3.35	2.4	3.15	5.0	2.7	3.2	2.25	1.5	2.0	1.4	1.3
27	2.3	5.05	2.3	3.0	5.1	2.7	3.0	2.1	1.9	1.9	1.4	1.3
28	2.2	6.1	2.2	2.9	4.5	2.75	2.75	2.0	1.85	1.8	1.4	1.3
29	2.2	.....	2.2	2.8	4.2	3.1	2.6	2.0	2.2	1.8	1.4	1.3
30	2.1	.....	2.2	2.7	4.0	4.0	2.5	1.9	2.0	1.8	1.4	1.3
31	2.0	.....	2.15	.....	3.75	.....	2.65	1.8	.....	1.8	.....	1.3

WHITE RIVER NEAR COTTER, ARK.

This station, which is located at the St. Louis, Iron Mountain & Southern Railway bridge near Cotter, Ark., was established July 21, 1909, to obtain data for use in studying water power, water supply, flood control, storage, and navigation problems.

The station is about three-fourths of a mile below the mouth of Falling Ash Creek.

The datum of the gage, which is fastened to the upstream guardrail of the bridge, has remained unchanged. Measurements are made from the bridge, from a ferry about 500 feet above, or by wading.

This station is maintained under the direction of the State geologist of Arkansas, and has not been visited by engineers of the United States Geological Survey since its establishment.

Daily gage height, in feet, of White River near Cotter, Ark., for 1910.

[S. Butterfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.15	2.4	7.55	2.5	3.25	4.85	5.15	3.5	2.65	.....	2.5	2.0
2	2.3	2.3	7.5	2.55	3.15	4.55	5.05	3.6	2.45	2.65	2.5	2.0
3	2.35	2.3	7.6	3.05	3.05	4.4	4.5	3.45	2.8	2.65	2.5	2.0
4	2.35	2.3	6.85	3.9	2.9	4.4	4.25	3.2	3.4	5.1	2.4	1.9
5	2.35	2.3	6.2	3.75	2.85	4.6	4.25	3.0	3.7	3.95	2.4	1.9
6	2.35	2.2	5.7	3.75	2.85	4.95	4.65	2.9	4.05	6.05	2.3	1.9
7	2.3	2.2	5.25	4.5	2.85	5.65	4.6	2.9	4.5	6.65	2.3	1.9
8	2.25	2.2	4.95	4.85	2.75	6.1	4.35	2.9	4.4	5.7	2.2	1.9
9	2.25	2.1	4.7	5.3	3.15	9.2	4.1	3.05	4.15	5.6	2.2	1.9
10	2.35	2.1	4.5	5.25	3.9	10.95	6.25	6.55	4.0	5.05	2.2	1.9
11	2.45	2.1	5.05	5.05	4.15	10.8	5.0	7.35	3.75	4.5	2.2	1.9
12	2.75	2.1	5.5	4.9	3.9	10.1	5.3	6.5	3.55	4.1	2.2	1.9
13	2.75	2.0	5.2	4.9	3.7	8.05	13.15	5.55	3.35	4.0	2.2	1.9
14	2.6	2.0	5.0	4.9	3.5	7.15	12.35	5.05	3.2	3.85	2.2	1.9
15	2.55	2.0	4.7	5.95	3.3	6.55	10.95	4.75	3.05	4.3	2.2	1.9
16	2.95	2.0	4.5	6.6	3.4	6.0	8.65	4.45	2.85	4.3	2.1	1.9
17	3.65	1.9	4.3	5.95	4.45	5.5	7.05	4.4	2.8	3.9	2.1	1.9
18	3.85	1.9	4.1	5.9	9.05	5.1	6.75	4.35	2.65	3.65	2.1	1.9
19	3.8	1.8	3.9	5.75	14.3	4.75	6.05	4.35	2.6	3.55	2.1	1.9
20	3.65	2.0	3.75	5.65	11.15	4.55	5.8	4.15	2.55	3.35	2.0	1.9
21	3.5	2.05	3.7	5.45	8.1	4.35	5.3	4.0	2.4	3.2	2.0	1.9
22	3.3	2.4	3.45	4.95	7.05	4.15	4.75	3.9	2.35	3.1	2.0	1.8
23	3.2	3.1	3.3	4.55	6.4	4.0	4.6	3.85	2.3	3.35	2.0	1.8
24	3.1	3.85	3.2	4.45	6.0	3.85	4.6	3.65	2.2	3.4	2.0	1.8
25	3.0	3.95	3.05	4.3	5.75	3.65	4.6	3.45	2.2	3.15	2.0	1.8
26	2.9	4.1	2.95	4.1	6.35	3.6	4.45	3.25	2.2	3.0	2.0	1.8
27	2.9	5.95	2.9	3.9	6.3	3.6	4.35	3.05	2.6	2.95	2.0	1.8
28	2.8	7.4	2.8	3.7	6.1	3.6	4.0	3.0	2.75	2.75	2.0	1.8
29	2.7	.....	2.7	3.5	5.55	3.75	3.75	2.85	2.6	2.55	2.0	1.8
30	2.6	.....	2.55	3.3	5.3	4.3	3.55	2.75	3.1	2.5	2.0	1.8
31	2.6	.....	2.5	.....	5.3	.....	3.5	2.7	.....	2.5	.....	1.8

WHITE RIVER AT WALLS FERRY, ARK.

This station, which is located at the Government dam at Walls Ferry, Ark., will furnish data necessary in studying water power, navigation, and flood control problems. The discharge of the stream will be computed from the records of the gage heights of the upper gage at the lock, considering the dam as a weir. Discharge measurements will be made in order to determine the proper coefficients to be used. The first measurement was made in November, 1909.

This station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey.

BUFFALO RIVER NEAR GILBERT, ARK.

This station, which is located at the Missouri & North Arkansas Railroad bridge near Gilbert, Ark., was established July 16, 1909, to obtain data for use in studying water power and storage problems.

Bear Creek is tributary to Buffalo River from the right bank about one-fourth mile above the station.

The datum of the chain gage, which is fastened to the upstream guardrail of the bridge, from which high-water measurements are

also made, has not been changed. Low-water measurements are made by wading. Measurements of high water may be complicated by the flow from Bear Creek.

This station is maintained under the direction of the State geologist of Arkansas, and has not been visited by engineers of the United States Geological Survey since its establishment.

Discharge measurements of Buffalo River near Gilbert, Ark., in 1910.

Date.	Hydrographer.	Width	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 23	W. N. Gladson	160	931	7.1	2,660
Aug. 1	do	68	131	2.97	137

NOTE.—Measurements not made at regular section.

Daily gage height, in feet, of Buffalo River near Gilbert, Ark., for 1910.

[Esther Williams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	3.2	6.9	3.2	3.5	4.6	4.0	2.9	3.2	3.0	3.1	2.9
2	2.9	3.0	6.3	3.1	3.4	4.5	4.3	2.8	3.3	2.9	3.1	2.8
3	2.9	3.1	5.7	3.1	3.4	4.4	7.2	2.8	3.3	2.9	3.1	2.8
4	2.9	3.1	5.2	6.5	3.4	4.1	6.6	2.8	3.2	6.5	3.1	2.8
5	2.9	2.9	4.8	9.3	3.3	4.3	7.2	2.8	3.2	11.0	3.1	2.9
6	3.2	3.0	4.6	8.1	3.2	4.3	6.2	2.9	7.2	9.6	3.1	2.9
7	3.8	3.0	4.4	6.6	3.2	4.1	5.4	4.2	7.0	7.7	3.1	2.9
8	3.7	2.9	4.1	5.8	3.2	4.0	4.9	7.0	5.2	6.2	3.0	2.8
9	3.6	2.8	4.0	5.3	3.3	5.4	4.4	6.1	4.6	5.4	3.0	2.8
10	3.5	2.8	4.1	5.2	3.2	8.3	4.3	9.3	4.2	4.8	3.0	2.8
11	3.5	2.8	4.9	5.0	3.2	8.2	4.0	6.7	3.9	4.5	3.0	2.8
12	3.4	2.7	4.7	4.9	3.2	7.4	7.1	5.7	3.7	4.2	3.0	2.8
13	3.4	2.8	4.6	5.1	3.1	6.2	8.9	5.1	3.6	5.4	3.0	2.8
14	3.4	2.8	4.4	5.2	3.1	5.6	6.5	5.3	3.5	5.5	3.0	2.8
15	3.4	2.7	4.2	9.9	3.0	5.0	5.9	15.3	3.4	5.0	3.0	2.8
16	3.3	2.8	4.0	7.9	11.25	4.6	5.2	7.1	3.3	4.6	2.9	2.8
17	3.4	3.6	4.0	7.5	18.3	4.3	4.7	5.8	3.2	4.4	2.9	2.8
18	3.5	3.1	3.8	6.6	11.4	4.1	4.4	6.9	3.1	4.3	2.9	2.8
19	4.0	2.9	3.8	5.9	8.3	4.0	4.0	10.3	3.1	4.0	2.9	2.8
20	4.0	2.9	3.6	5.6	7.2	3.9	3.9	7.3	3.0	3.9	2.9	2.8
21	4.2	2.9	3.5	5.0	6.6	3.8	3.7	6.3	3.0	3.8	2.9	2.8
22	4.0	3.0	3.5	4.9	6.0	3.6	3.5	5.5	2.9	3.7	2.9	2.8
23	3.9	3.3	3.5	4.7	3.9	3.5	3.5	4.9	3.1	3.6	2.9	2.8
24	3.8	3.9	3.3	4.4	10.3	3.5	4.0	4.5	3.1	3.5	2.9	2.8
25	3.6	4.1	3.3	4.2	8.1	4.0	4.0	4.2	3.0	3.4	2.9	2.8
26	3.6	4.0	3.4	4.2	7.6	3.9	3.7	4.0	2.9	3.4	2.9	2.8
27	3.5	7.9	3.3	4.0	6.9	4.4	3.5	3.8	3.1	3.4	2.9	2.8
28	3.4	8.4	3.2	3.9	6.1	4.3	3.3	3.6	3.1	3.3	2.9	2.8
29	3.3	.....	3.1	3.8	5.6	.....	3.1	3.5	3.1	3.2	2.9	2.9
30	3.2	.....	3.1	3.6	5.2	.....	3.1	3.4	3.0	3.2	2.9	2.9
31	3.2	.....	3.2	.....	4.9	.....	3.0	3.2	.....	3.2	.....	3.6

NORTH FORK RIVER NEAR HENDERSON, ARK.

This station, which is located at Smith's ferry, near Henderson, Ark., was established July 23, 1909, to obtain data for use in studying water power, storage, and navigation problems.

Bayou Creek enters on the left bank about 1¼ miles above the station.

The gage consists of three vertical sections on the left bank near the ferry. Its datum has not been changed. Measurements are made from the ferryboat or by wading at low water.

This station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey since its establishment.

The following measurement was made by W. N. Gladson:

May 19: Width, 275 feet; area of section, 868 square feet; gage height, 1.95 feet; discharge, 1,110 second-feet.

Daily gage height, in feet, of North Fork River near Henderson, Ark., for 1910.

[F. S. Field, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	1.7	3.45	1.7	1.9	.....	2.0	2.5	1.25	1.7	1.7	1.7
2	1.6	1.7	2.9	1.65	1.8	.....	1.85	2.25	1.15	1.7	1.7	1.7
3	1.7	1.7	2.75	1.6	1.8	.....	2.0	2.0	2.25	1.7	1.7	1.7
4	1.7	1.6	2.7	1.65	1.7	.....	2.3	1.9	2.9	4.75	1.7	1.7
5	1.7	1.6	2.65	1.8	1.6	.....	2.75	1 9	2.75	3.3	1 7	1 7
6	1 8	1.55	2.55	1.95	1.85	2.5	2.9	1.9	3.2	6.1	1.7	1.7
7	1.8	1.5	2.6	2.5	1.9	2.1	2.7	1.9	2.9	5.65	1.7	1.7
8	1.8	1.5	2.7	2.55	1.85	2.2	2.55	1.9	2.45	3.5	1.7	1.7
9	1.8	1.5	2.8	2.35	1.8	5.55	2.35	1.95	2.25	3.2	1.7	1.7
10	1.7	1.6	3.2	2.3	1.85	4.5	4.6	2.4	1.95	2.6	1.7	1.7
11	1.7	1.6	3.45	2.2	1.9	3.65	3.4	2.55	1.9	2.2	1.7	1.7
12	1.7	1.55	2.95	2.3	2.0	3.45	4.7	2.15	1.8	2.0	1.7	1.7
13	1.7	1.5	2.8	2.6	1.9	3.0	5.4	2.0	1.7	2.0	1.7	1.7
14	1.65	1.5	2.75	3.1	1.8	3.0	4.0	2.0	1.65	2.15	1.7	1.7
15	1.65	1.55	2.6	3.45	1.95	2.45	3.95	1.95	1.45	2.0	1.7	1.7
16	1.7	1.6	2.5	3.65	2.4	2.25	3.25	1.9	1.25	2.0	1.7	1.6
17	1.75	1.6	2.4	3.55	2.35	2.1	4.3	1.9	1.05	2.0	1.7	1.6
18	1.8	1.6	2.3	3.15	2.15	2.1	3.55	2.7	1.7	2.0	1.7	1.6
19	1.7	1.6	2.2	2.9	1.95	2.15	2.9	2.4	1.7	1.9	1.7	1.5
20	1.7	1.6	2.15	2.45	1.9	2.1	2.7	2.2	1.7	1.9	1.7	1.5
21	1.6	1.5	2.1	2.35	1.9	2.1	2.45	2.0	1.7	1.9	1.7	1.5
22	1.65	1.5	2.0	2.3	1.9	2.05	2.2	1.9	1.65	1.9	1.7	1.5
23	1.7	1.6	2.0	2.2	1.9	2.05	3.85	1.85	1.6	1.8	1.7	1.5
24	1.7	1.65	1.95	2.2	1.8	2.0	2.3	1.8	1.65	1.8	1.7	1.5
25	1.7	1.7	1.9	2.1	1.8	2.0	2.2	1.8	1.7	1.7	1.7	1.5
26	1.6	1.7	1.9	2.1	1.8	2.0	2.05	1.85	1.7	1.7	1.7	1.5
27	1.6	4.35	1.8	2.1	1.9	2.0	2.0	1.85	1.75	1.7	1.7	1.5
28	1.6	4.0	1.7	2.0	1.9	2.0	2.0	1.8	1.95	1.7	1.7	1.5
29	1.6	.....	1.7	1.95	.....	2.0	1.95	1.8	2.0	1.7	1.7	1.6
30	1.7	.....	1.8	1.9	.....	2.0	2.4	1.75	1.8	1.7	1.7	1.7
31	1.7	.....	1.8	.....	.....	.....	2.7	1.55	.....	1.7	.....	1.7

LITTLE RED RIVER NEAR PANGBURN, ARK.

This station, which is located at Skillern's ferry, near Pangburn, Ark., was established July 15, 1909, to obtain data for use in studying water power, water supply, storage, and navigation problems.

Big Red Creek joins Little Red River about half a mile below the station.

This stream is used to considerable extent for running logs. Log jams above and below the station affect the gage for short periods. Ice rarely, if ever, forms on this stream.

The gage consists of three vertical sections on the right bank near the ferry. Its datum has not been changed. Measurements are made from a ferryboat or by wading at low water.

This station is maintained under the direction of the State geologist of Arkansas and has not been visited by engineers of the United States Geological Survey since its establishment.

The following measurement was made by W. N. Gladson:

May 21: Width, 222 feet; area of section, 1,980 square feet; gage height, 8.1 feet; discharge, 3,380 second-feet.

Daily gage height, in feet, of Little Red River near Pangburn, Ark., for 1910.

[A. J. Stolz, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	3.7	16.4	3.5	3.7	6.2	3.9	3.1	2.8	2.5	2.7	2.3
2	3.1	3.6	11.4	3.3	3.5	5.3	4.1	3.0	2.8	2.6	2.7	2.3
3	3.0	3.4	9.2	3.5	3.4	4.5	9.6	2.9	2.8	2.5	2.6	2.3
4	3.0	3.3	7.9	4.1	3.3	4.8	10.5	2.7	2.9	2.5	2.6	2.3
5	3.1	3.2	7.1	6.7	3.2	4.7	12.4	2.6	2.9	2.4	2.6	2.3
6	3.4	3.0	6.5	24.3	3.1	4.5	9.3	2.6	2.8	32.1	2.5	2.4
7	6.4	3.0	6.1	16.0	3.1	4.3	7.5	2.5	2.7	38.5	2.5	2.4
8	6.3	3.1	5.6	12.6	2.9	4.6	6.4	2.6	2.6	25.9	2.4	2.4
9	5.7	3.0	5.3	9.4	2.9	5.4	5.5	2.8	3.7	8.9	2.4	2.3
10	5.4	3.0	5.1	7.5	2.8	12.0	4.7	4.1	3.3	7.3	2.4	2.3
11	5.1	2.9	6.6	7.1	2.8	18.5	4.4	6.6	2.8	6.3	2.5	2.3
12	4.9	2.9	8.6	6.7	2.7	16.4	9.1	5.3	2.8	5.8	2.4	2.3
13	4.8	2.8	7.3	6.5	2.7	11.9	7.4	4.4	2.7	5.4	2.4	2.3
14	5.1	2.8	6.5	6.3	2.6	8.7	7.3	4.5	2.6	5.2	2.3	2.3
15	5.5	2.7	6.0	6.0	2.6	6.8	7.1	4.8	2.5	5.5	2.3	2.3
16	5.4	2.7	5.6	14.0	2.9	5.9	6.7	5.6	2.4	5.3	2.3	2.3
17	5.2	2.8	5.2	14.2	4.6	5.4	6.0	6.0	2.4	4.9	2.4	2.3
18	5.1	2.8	4.8	11.8	20.1	4.8	5.5	5.2	2.3	4.5	2.4	2.3
19	5.4	2.9	4.5	9.4	13.6	4.3	5.0	4.8	2.3	4.1	2.4	2.3
20	7.5	2.8	4.3	8.0	9.8	4.0	4.4	4.6	2.2	3.8	2.3	2.2
21	7.1	2.8	4.3	7.0	8.4	3.8	4.0	6.0	2.2	3.6	2.3	2.2
22	6.3	2.8	4.2	6.4	7.8	3.6	3.6	5.2	2.1	3.5	2.3	2.5
23	5.8	3.0	4.4	5.9	14.7	3.5	3.4	4.7	2.1	3.4	2.3	2.5
24	5.4	3.9	4.7	5.4	22.45	3.5	3.3	4.4	2.1	3.3	2.3	2.4
25	5.1	4.8	4.5	4.9	25.4	3.8	8.1	3.8	2.1	3.2	2.3	2.4
26	4.8	5.2	4.3	4.5	14.1	3.6	6.4	3.4	2.0	3.1	2.3	2.4
27	4.6	10.8	4.1	4.4	9.7	3.5	5.0	3.4	2.0	3.0	2.3	2.4
28	4.5	24.4	4.0	4.2	7.9	3.8	4.5	3.6	2.2	2.9	2.4	2.5
29	4.2	.....	3.8	4.0	6.6	4.9	4.0	3.3	2.3	2.9	2.4	3.5
30	4.0	.....	3.7	3.9	6.0	4.5	3.6	3.1	2.4	2.8	2.4	6.7
31	3.8	.....	3.9	.....	5.6	.....	3.3	3.0	.....	2.8	.....	7.8

ARKANSAS RIVER DRAINAGE BASIN.

DESCRIPTION.

The western rim of the Arkansas basin is formed by three of the highest mountain ranges of Colorado—the Saguache, Sangre de Cristo, and Culebra, each having summits more than 14,000 feet in altitude. The melting of the almost perpetual snow that mantles the high peaks near the north end of this rim furnishes water for three small creeks, the East, Lake, and Tennessee forks, which unite near Leadville to form the Arkansas.

From the junction of the forks the river flows a little east of south for about 75 miles, then turns to the east and cuts through a canyon whose perpendicular walls attain elevations of more than 2,000 feet above the water's edge, emerging finally into the plains region near Canon City. From Canon City to the Colorado-Kansas State line its

general course is eastward for about 200 miles. Entering Kansas the river runs for 140 miles by general course a little south of east; it then makes a bold curve to the north, forming what is known as the Great Bend, below which it flows southeastward across Oklahoma to its junction with the Mississippi in northeastern Arkansas. The entire length of the stream from source to mouth is about 1,500 miles and its drainage basin includes 177,500 square miles.

In its upper course the Arkansas is fed by numerous small streams, generally short, which lie wholly in or have their sources in the mountains. Those that head in the mountains and flow out onto the prairies are used more or less for irrigation. The most important of these tributaries are Greenhorn, Huerfano, Apishapa, and Purgatory rivers. The plains tributaries include Black Squirrel, Horse, Two Butte and Big Sandy creeks, Salt Fork, Cimarron, Verdigris, Grand, and Canadian rivers, and scores of smaller streams. The largest of these tributaries is Canadian River.

Above Pueblo, Colo., the drainage basin is as a whole mountainous, but toward the south the elevation decreases and the country is well marked by stream channels that trend in a general northeasterly direction. The streams on the north flow generally southward when they emerge from the mountains.

At the base of the mountains are the foothills, irregular and seared by canyons, and marked by disconnected mesas and buttes of different but moderate altitudes; beyond are great level plains, extending far to the east and constituting a portion of what was formerly known as the Great American Desert. East of the foothills and north of the river the topography is that typical of the Great Plains region, but to the south the surface of the plains is generally more accented. That part of the drainage basin that extends from the mountains to the Colorado-Kansas line embraces an area of about 25,000 square miles. Beyond this is the flat semiarid section of western Kansas, and then the more humid country in eastern Kansas, Oklahoma, and Arkansas.

The rocks exposed in the mountainous area present great variety, ranging from the metamorphic granites of Pikes Peak and the Royal Gorge of the Arkansas to the glacial drift in the upper valley of the Arkansas from Salida to Leadville and in the upper Grape Creek Range. Next to the granites the eruptive rocks are most common, and sedimentary rocks are found over wide areas.

In the plains region the principal rock exposures seen along the heavily eroded stream channels are shales, sandstone, and limestone in alternating layers. The soil cover, which is necessarily rather meager in the mountainous section, varies in the plains region from the upland sands and gravels of the mesas to the sandy loams and adobe clays of the river valleys. The adobe soils are very friable and

dry and melt away rapidly under the action of water. Many of the dry intermittent channels, usually termed arroyos, are narrow and have high vertical walls, and are cut deeper by each succeeding flood. The vegetation is scanty, consisting of native grasses, sagebrush, chico, and cactus pads. The ranges have been very closely pastured, making conditions conducive to an excessive flood run-off.

Above Canon City the fall of the river is about 40 feet to the mile. The elevation at Canon City is 5,300 feet; at the Colorado-Kansas State line, 220 miles below, the elevation is 3,350 feet, making the average fall about 9 feet per mile. At the mouth the river has an elevation slightly exceeding 100 feet above sea level.

The drainage basin of Arkansas River contains about 1,000 square miles of merchantable timber land and considerably more than that amount of woodland; the rest, except for the considerable area under cultivation, may be classed as barren and sagebrush land.

The principal source of the water which the river bears to the plains is the precipitation along the crest of the high ranges. This is mainly in the form of snow, and amounts to 20 or 30 inches each year. From the foothills to Arkansas City the precipitation ranges from 12 to 35 inches, being 25 to 35 inches in the last 100 miles below Hutchinson. The natural storage in the basin is limited to a few mountain lakes of glacial origin.

The streams of this drainage area are subject to floods of two kinds—the annual spring floods caused by the melting of the snows in the headwater regions and floods caused by the violent storms, locally known as cloudbursts, in the foothills and plains regions. Occasionally, too, the river runs dry, and many of the tributaries are intermittent in character.

As altitudes within this basin range from 14,000 feet almost down to sea level, the climatic conditions vary greatly. In the mountainous sections the winters are severe, the snowfall is heavy, and the rivers have a thick ice cover for several months. As the altitude decreases the winters become milder.

About half a million acres of land are under irrigation on Arkansas River and its tributaries in Colorado, but beyond the Colorado line only a very few thousand acres are irrigated. The Garden City project of the United States Reclamation Service will eventually provide for the irrigation of probably 15,000 acres in the Arkansas Valley in western Kansas, principally by pumping the underflow.

Numerous reservoirs now in operation along the Arkansas, together with direct diversions for irrigation, provide for the use of the greater part of the flow of Arkansas River in Colorado. The largest reservoirs are in the system of the Great Plains Reservoir Co., on the north side of the river in the eastern part of the State. The reservoirs of this system are supplied by feeder canals, and have a com-

bined capacity of almost 200,000 acre-feet. Other reservoirs now contemplated or under construction, on the tributaries of the Arkansas, will provide for the irrigation of a large additional area. These reservoirs are necessitated by the intermittent character of the streams upon which they are situated. The basin contains many excellent reservoir sites. The flood on the Arkansas in October, 1908, illustrates the possibility for additional storage in some of them.[1]

On account of the use of water for irrigation in the open country, power development is necessarily confined to the upper reaches of the Arkansas and its tributaries. It seems probable that, with proper storage, about 100,000 horsepower can be developed. Somewhat over 5,000 horsepower is now being used.

The years of greatest average flow on the upper Arkansas since the beginning of measurements seem to have been 1891 and 1899. The flow in 1905 was also very high and that in 1906 and 1907 was nearly as great. The year of lowest flow is 1902, while 1908 is second.

ARKANSAS RIVER AT GRANITE, COLO.

This station, which was established April 6, 1910, by the State engineer of Colorado, by whom it is maintained, is located below the mouth of Lake Creek and above mouths of Lost Canon and Clear creeks. The discharge is affected by the Twin Lakes reservoir and by a flume used by a placer mine at Granite, taking water out of Lake Creek and returning it to the Arkansas below the station.

A Bristol automatic and a slope gage, both at the same datum, are located on the left bank of stream about 500 feet above the Denver & Rio Grande Railroad depot at Granite. Measurements are made from a car and cable, about one-third mile above the depot. The measuring section is good, as the bed of the stream consists of gravel and small bowlders and is permanent. Banks are composed chiefly of gravel and are not liable to overflow except at extreme high stages. Gage heights are affected by ice during the winter.

Discharge measurements of Arkansas River at Granite, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 7	Thos. Grieve	68	82	1.70	150
May 6	C. L. Chatfield	77	203	3.04	1,033
28	Thos. Grieve	74	180	[a] 2.83	804
Aug. 5	Grieve and Christiansen	71	108	2.00	267
8	A. A. Weiland	72	119	2.25	355
Sept. 19[b]	Thos. Grieve	66	65.9	1.58	116
Oct. 28[b]	....do	57	58.5	1.32	74

[a] Twin Lakes stopped flowing during this measurement. Area and velocity would indicate that gage height was about 2.83.
[b] By wading at various sections

[1] For report on this flood see Water-Supply Paper U. S. Geol. Survey No. 247, p. 35.

Daily gage height, in feet, of Arkansas River at Granite, Colo., for 1910.

[Geo. Morrison, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.6	3.65	3.1	2.25	2.6	1.7	1.8	1.3
2	.....	2.65	3.5	3.1	2.2	2.6	1.7	1.7	1.3
3	.....	2.75	3.5	3.05	2.15	2.1	1.7	1.7	1.4
4	.....	2.95	3.5	3.05	2.05	1.6	1.6	1.7	1.3
5	.....	2.95	3.5	3.0	1.85	1.6	1.6	1.75	1.2
6	1.8	3.05	3.45	3.0	1.8	1.55	1.6	1.4	1.35
7	1.75	3.05	3.4	2.2	1.7	1.5	1.6	1.45	1.35
8	1.85	2.95	3.2	2.2	1.75	1.45	1.55	1.4	1.4
9	2.0	3.1	3.2	2.5	1.75	1.5	1.6	1.4	1.4
10	2.05	3.2	3.2	2.4	1.85	1.45	1.3	1.4	1.4
11	2.05	3.2	3.2	2.25	1.9	1.5	1.3	1.4	1.4
12	2.05	3.25	3.1	2.1	1.95	1.5	1.45	1.4	1.4
13	2.05	3.5	3.1	2 1	1.85	1.5	1.3	1.35	1.4
14	1.95	3.2	3.1	2.1	1.85	1.4	1.5	1.4	.....
15	1.95	3.0	3.1	2.2	1.7	1.4	1.45	1.35	.....
16	1.9	2.7	3.2	2.15	1.65	1.55	1.6	1.35	.....
17	1.9	2.65	3.1	2.05	1.65	1.6	1.5	1.3	.....
18	1.9	2.6	2.85	2.05	1.80	1.65	1.45	1.35	.....
19	1.95	2.5	2.8	2.1	1.85	1.6	1.6	1.35	.....
20	2.6	2.6	2.85	2.1	1.85	1.6	1.4	1.3	.....
21	2.9	2.65	3.0	2.35	1.80	1.8	1.65	1.35	.....
22	2.9	3.25	3.0	2.35	1.75	1.65	1.9	1.4	.....
23	2.5	3.2	3.1	2.2	1.75	1.7	1.4	1.3	.....
24	2.45	3.1	3.1	2.1	1.7	1.6	1.4	1.3	.....
25	2.95	3.05	3.1	2.05	1.65	1.6	1.4	1.35	.....
26	2.75	2.9	3.1	2.0	1.65	1.9	1.4	1.4	.....
27	2.3	3.05	3.2	1.95	1.65	2.15	1.35	1.4	.....
28	3.0	3.1	3.1	2.0	1.55	1.8	1.35	1.35	.....
29	2.2	2.95	3.05	2.25	1.8	1.6	1.35	1.35	.....
30	2.4	3.45	3.05	2.5	2.4	1.7	1.35	1.35	.....
31	.....	3.65	.....	2.2	2.55	.....	1.45	.....	.....

Daily discharge, in second-feet, of Arkansas River at Granite, Colo., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	595	1,745	1,090	372	595	150	180	70
2	.....	638	1,550	1,090	345	595	150	150	70
3	.....	728	1,550	1,035	322	300	150	150	85
4	.....	925	1,550	1,035	278	120	120	150	70
5	.....	925	1,550	980	198	120	120	165	55
6	180	1,035	1,490	980	180	110	120	85	78
7	165	1,035	1,430	345	150	100	120	92	78
8	198	925	1,200	345	165	92	110	85	85
9	255	1,090	1,200	520	165	100	120	85	85
10	278	1,200	1,200	455	198	92	70	85	85
11	278	1,200	1,200	372	215	100	70	85	85
12	278	1,255	1,090	300	235	100	92	85	85
13	278	1,550	1,090	300	198	100	70	78	85
14	235	1,200	1,090	300	198	85	100	85	.....
15	235	980	1,090	345	150	85	92	78	.....
16	215	680	1,200	322	135	110	120	78	.....
17	215	638	1,090	278	135	120	100	70	.....
18	215	595	822	278	180	135	92	78	.....
19	235	520	775	300	198	120	120	78	.....
20	595	595	822	300	198	120	85	70	.....
21	870	638	980	428	180	180	135	78	.....
22	870	1,255	980	428	165	135	215	85	.....
23	520	1,200	1,090	345	165	150	85	70	.....
24	488	1,090	1,090	300	150	120	85	70	.....
25	925	1,035	1,090	278	135	120	85	78	.....
26	728	870	1,090	255	135	215	85	85	.....
27	400	1,035	1,200	235	135	322	78	85	.....
28	980	1,090	1,090	255	110	180	78	78	.....
29	345	925	1,035	372	180	120	78	78	.....
30	455	1,490	1,035	520	455	150	78	78	.....
31	.....	1,745	.....	345	558	.....	92	.....	.....

NOTE.—These discharges were obtained from a rating curve which is well defined between 70 and 980 second-feet.

Monthly discharge of Arkansas River at Granite, Colo., for 1910.

[Drainage area, 425 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
Apr. 6-30	925	165	417	0.981	0.91	20,700
May	1,745	520	990	2.33	2.69	60,900
June	1,745	775	1,180	2.78	3.10	70,200
July	1,090	235	475	1.12	1.29	29,200
August	558	110	212	.498	.58	13,100
September	595	85	166	.391	.44	9,880
October	215	70	105	.247	.29	6,460
November	180	70	93	.219	.24	5,530
Dec. 1-13	85	70	78	.184	.09	2,010
The period						218,000

ARKANSAS RIVER AT SALIDA, COLO.

A station was maintained on Arkansas River at Salida under the direction of the United States Geological Survey from 1895 to 1903.[1] The station was reestablished November 3, 1909, by the State engineer of Colorado, who placed a Bristol automatic gage with an auxiliary slope gage about a block below the concrete bridge on the road from town to the Denver & Rio Grande Railroad depot. The records furnish data concerning the amount of water available for irrigation.

The new and old stations bear the same relation to tributaries and diversions, but are at different sections.

The gage has no determined relation to the gage used in 1903. Discharge measurements are made from the concrete bridge.

On account of springs in the vicinity of the station, the channel is open throughout the winter months, making a very favorable location for the gage.

Discharge measurements of Arkansas River at Salida, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 19[a]	Thos. Grieve	66	104	0.70	221
Feb. 26[a]	....do	66	100	.70	226
May 5	....do	81	226	2.75	1,270
25	....do	83	259	2.92	1,600
Aug. 4	Grieve and Christiansen	69	140	1.35	478
Sept. 18[a]	Thos. Grieve	68	103	.76	267

[a] Made by wading.

[1] For description see Water-Supply Paper U. S. Geol. Survey No. 99, p. 301.

Daily gage height, in feet, of Arkansas River at Salida, Colo., for 1910.

[Howard Snedden, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	0.75	0.75	1.3	2.9	3.55	2.85	1.35	1.5	0.95	0.8	0.6
2	.9	.7	.8	1.45	2.55	3.65	2.75	1.3	1.85	.7	.75	.6
3	.8	.65	.8	1.45	2.2	3.9	2.6	1.25	1.85	.7	.75	.6
4	.75	.6	.85	1.35	2.7	3.8	2.6	1.35	1.25	.65	.75	.65
5	.6	.6	.9	1.25	2.75	3 8	2.55	1.5	1.15	.65	.8	.5
6	.55	.6	.95	1.1	2.8	4.1	2.45	1.4	1.05	.6	.8	.5
7	.55	.65	95	1.05	2.85	3.8	1.95	1.2	1.0	.65	.75	.55
8	.7	.65	1.0	1.05	2.9	3.55	1.7	1.15	.95	.7	.75	.6
9	.7	.6	1.0	1.2	3.0	3.35	1.7	1.2	.9	.8	.75	.6
10	.75	.6	.8	1 3	3.35	3.15	1.8	1.2	.55	.7	.7	.6
11	.75	.6	75	1.35	3.55	3.05	1.65	1.2	.4	.6	.7	.6
12	.75	.65	.75	1.35	3.8	2.95	1.5	1.2	.45	.65	.7	.55
13	.65	.6	.75	1.4	3.85	3.05	1.5	1.2	.45	.65	.75	.5
14	.7	.7	.75	1.35	3.35	3.2	1.4	1.2	.5	.65	.7	.45
15	.75	.65	.8	1.2	2.95	3.25	1.55	1.15	.45	.7	.75	.4
16	.8	.6	.8	1.2	2.5	3.35	1.55	1.0	.55	.75	.7	.45
17	.8	.6	.8	1.25	2.35	3.25	1.3	1.0	.6	.85	.65	.4
18	.7	.65	.85	1.2	2.25	3.0	1.05	1.1	.75	.75	.65	.....
19	.75	.65	.9	1.2	2.1	3.1	1.2	1.25	.95	.85	.7	.....
20	.7	.7	1.0	1.3	2.05	3.15	1.2	1.3	.95	.8	.65	.....
21	.75	.7	1.0	1.4	2.25	3.0	1.4	1.2	1.0	.75	.65	.....
22	.8	.7	1.1	1.4	3.05	2.85	1.4	1.15	1.15	1.2	.7	.....
23	.8	.7	1.2	1.45	3.1	3.05	1.3	1.25	.95	.95	.7	.....
24	.8	.7	1.15	1.5	3.1	3.0	1.25	1.2	.95	.8	.7	.....
25	.8	.8	1.15	1.7	2.9	2.95	1.2	1.1	.9	.75	.7	.....
26	.65	.75	1.2	2.0	2.75	2.9	1.1	1.1	.85	.75	.7	.....
27	.65	.65	1.1	2.3	2.75	2.95	.95	1.1	1.25	.7	.65	.....
28	.65	.65	1.15	2.6	3.0	2.95	1.1	1.15	1.25	.7	.6	.....
29	.75	.....	1.15	3.25	3.4	2.85	1.5	.95	.8	.7	.65	.....
30	.65	.....	1.05	3.15	3.95	2.8	1.8	1.1	.95	.7	.6	.....
31	.7	.....	1.2	.....	3.9	.....	1.55	1.4	.....	.75	.....	.....

Daily discharge, in second-feet, of Arkansas River at Salida, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	275	238	238	415	1,375	2,200	1,535	480	555	325	280	225
2	275	225	250	478	1,115	2,300	1,445	455	758	250	265	225
3	250	212	250	478	880	2,555	1,315	435	758	250	265	225
4	238	200	262	435	1,225	2,450	1,315	480	435	238	265	238
5	200	200	275	395	1,262	2,450	1,272	555	395	238	280	205
6	190	200	292	340	1,310	2,665	1,190	505	358	225	280	205
7	190	212	292	325	1,360	2,450	822	415	340	238	265	215
8	225	212	310	325	1,410	2,200	665	395	325	250	265	225
9	225	200	310	375	1,450	2,003	665	415	310	280	265	225
10	238	200	250	415	1,820	1,813	725	415	215	250	250	225
11	238	200	238	435	2,000	1,718	635	415	185	225	250	225
12	238	212	238	435	2,240	1,625	555	415	195	238	250	215
13	212	200	238	455	2,280	1,718	555	415	195	238	265	205
14	225	225	238	435	1,840	1,860	530	415	205	238	250	195
15	238	212	250	375	1,500	1,908	580	395	195	250	265	185
16	250	200	250	375	1,160	2,003	580	340	215	265	250	195
17	250	200	250	395	1,070	1,908	455	340	225	295	238	185
18	225	212	262	375	1,010	1,670	358	375	265	265	238	185
19	238	212	275	375	920	1,765	415	435	325	295	250	185
20	225	225	310	415	900	1,813	415	455	325	280	238	185
21	238	225	310	455	1,040	1,670	505	415	340	265	238	185
22	250	225	340	455	1,670	1,535	505	395	395	415	250	185
23	250	225	375	478	1,720	1,718	455	435	325	325	250	180
24	250	225	358	500	1,740	1,670	435	415	325	280	250	180
25	250	250	358	600	1,580	1,625	415	375	310	265	250	180
26	212	238	375	760	1,445	1,580	375	375	295	265	250	180
27	212	212	340	945	1,445	1,625	325	375	435	250	238	175
28	212	212	358	1,150	1,670	1,625	375	395	435	250	225	175
29	238	.....	358	1,640	2,050	1,535	555	325	280	250	238	175
30	212	.....	325	1,562	2,608	1,490	725	375	325	250	225	175
31	225	.....	375	.....	2,255	.....	580	505	.....	265	.....	175

NOTE.—These discharges were obtained as follows:
Jan. 1 to May 5, from a rating curve which is well defined between 225 and 1,080 second-feet.
May 6 to 24, indirect method for shifting channels.
May 25 to Dec. 17, from a rating curve which is well defined between 200 and 1,700 second-feet.
Dec. 18 to 31, estimated.

Monthly discharge of Arkansas River at Salida, Colo., for 1910.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January	275	190	232	0.200	0.23	14,300
February	250	200	215	.185	.19	11,900
March	375	238	295	.254	.29	18,100
April	1,640	325	553	.477	.53	32,900
May	2,608	880	1,530	1.32	1.52	93,900
June	2,665	1,490	1,910	1.64	1.83	115,000
July	1,535	325	686	.591	.68	42,200
August	555	325	417	.359	.41	25,600
September	758	185	341	.294	.33	20,300
October	415	225	265	.228	.26	16,300
November	280	225	253	.218	.24	15,100
December	238	.....	198	.171	.20	12,200
The year	2,665	.....	575	.496	6.71	418,000

ARKANSAS RIVER AT CANON CITY, COLO.

This station, which was established April 17, 1889, is located at the mouth of the canyon, just below the suspension footbridge at Hot Springs Hotel, about 1½ miles above the Denver & Rio Grande Railroad depot at Canon City, Colo.

The records at this point show the greater part of the run-off of the river and are valuable both for power and irrigation projects.

Grape Creek enters about one-eighth of a mile above the station and Oil Creek comes in about 5 miles below. The drainage area comprises about 3,000 square miles. North and South Canyon ditches divert water above the station, and their flow is not included in the run-off. No accurate records have been kept of the discharge in these canals, but the combined flow is from 50 to 100 second-feet during the irrigation season. Some water is also diverted for the irrigation of a few thousand acres on the upper Arkansas and its tributaries.

The flow of the river is affected by ice for three or four months during the winter season.

On October 4, 1895, a new rod gage was established on the left bank, opposite the original gage and at the same datum. This gage read 0.4 foot lower than the old gage at low stages, but at high water both gages read the same. This new gage was used until August 26, 1902, when another gage was established on the right bank at the datum of the original gage, though it is situated a short distance farther downstream. The present chain gage is a few feet upstream from the cable. In September, 1909, the State engineer established a Bristol self-recording gage near the location of the chain gage, but with a datum 2 feet higher. Both gages have been read since that time. Measurements are made from a cable, or by wading at low stages.

As the stream bed is rough it is difficult to obtain very accurate measurements at high stages. Moreover, the channel is subject to considerable shifting, which makes the estimates of daily discharge rather uncertain, especially after violent flood.

Discharge measurements of Arkansas River at Canon City, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 19[a]	Thos. Grieve	86	132	3.9	402
Feb. 23	....do	95	158	4.04	496
26	Lyon and Russell	96	159	4.0	477
Apr. 4	G. H. Russell	97	168	4.32	611
10	Thos. Grieve	97	180	4.18	559
30	Lyon and Lamb	101	359	5.82	2,290
May 5	Thos. Grieve	104	286	5.35	1,540
29	....do	107	347	5.82	2,110
June 10	Bolster and Lyon	104	336	5.57	1,770
23	G. H. Russell	103	300	5.28	1,500
July 22	....do	95	158	4.15	520
Aug. 3	Thos. Grieve	93	151	4.1	572
12	G. J. Lyon	99	122	3.95	453
17	Thos. Grieve	87	105	3.71	343
17[b]	....do	93	107	3.71	360
Sept. 16[b]	G. H. Russell	80	92	3.62	249
20	Thos. Grieve	92	121	3.86	345
Oct. 1	S. T. Harding	92	129	3.83	407
28[c]	....do	72	107	3.7	345
Nov. 24[b]	Padgett and Miles	76	104	3.7	284

[a] Discharge slightly affected by ice. [b] Made by wading. [c] Made from suspension bridge.

Daily gage height, in feet, of Arkansas River at Canon City, Colo., for 1910.

[S. R. McKissick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	3.9	3.85	4.3	5.65	6.55	5.1	4.3	4.25	3.8	3.6	3.55
2	4.3	3.8	4.0	4.25	5.45	6.5	5.1	4.15	4.3	3.7	3.85	3.5
3	4.05	3.75	4.0	4.35	5.15	6.5	5.05	4.2	4.3	3.5	3.8	3.5
4	3.85	3.7	4.05	4.25	5.25	6.45	5.0	4.15	4.05	3.5	3.8	3.55
5	3.9	3.7	4.05	4.3	5.35	6.35	5.0	4.35	3.8	3.4	3.85	3.5
6	3.7	3.75	4.3	4.1	5.3	6.2	4.9	4.35	3.8	3.5	3.8	3.45
7	3.65	3.85	4.3	4.05	5.3	6.05	4.75	4.05	3.7	3.5	3.6	3.55
8	3.8	3.95	4.3	4.1	5.4	5.85	4.3	3.95	3.6	3.5	3.6	3.65
9	3.95	3.75	4.3	4.1	5.4	5.65	4.3	4.3	3.6	3.55	3.6	3.75
10	4.05	3.8	4.15	4.15	5.65	5.6	4.3	4.05	3.5	3.55	3.6	3.65
11	4.0	3.8	4.05	4.2	5.9	5.5	4.25	3.95	3.5	3.45	3.6	3.65
12	4.05	3.85	4.05	4.25	6.05	5.45	4.2	3.95	3.5	3.4	3.6	3.7
13	4.0	3.9	4.00	4.35	6.3	5.45	4.05	4.0	3.5	3.5	3.6	3.75
14	4.0	3.95	4.05	4.55	6.1	5.55	4.0	3.95	3.55	3.4	3.6	3.7
15	4.1	3.9	4.05	4.35	5.9	5.45	3.9	3.9	3.6	3.5	3.6	3.7
16	4.05	3.5	4.05	4.35	5.55	5.5	3.9	3.8	3.6	3.5	3.65	3.65
17	4.1	3.5	4.05	4.3	5.35	5.6	3.85	3.7	3.65	3.7	3.65	3.7
18	3.95	3.65	4.1	4.25	5.3	5.3	3.8	3.75	3.65	3.75	3.55	3.65
19	3.9	3.9	4.15	4.2	5.1	5.15	3.8	3.85	3.95	3.7	3.6	3.65
20	3.95	3.9	4.2	4.2	5.1	5.1	4.0	3.85	3.9	3.95	3.65	3.8
21	3.9	3.9	4.25	4.25	5.15	5.15	3.95	3.8	3.75	3.7	3.6	3.8
22	3.95	4.0	4.25	4.3	5.8	5.15	4.15	3.8	3.75	3.7	3.6	3.75
23	4.0	4.05	4.3	4.35	5.75	5.15	4.1	3.8	3.8	4.15	3.6	3.65
24	4.05	3.9	4.3	4.4	5.6	5.4	4.0	3.9	3.65	3.7	3.65	3.7
25	4.0	3.95	4.3	4.5	5.5	5.2	3.9	3.8	3.7	3.7	3.7	3.7
26	3.8	4.0	4.25	4.7	5.45	5.2	3.8	3.8	3.7	3.7	3.65	3.7
27	3.8	3.8	4.3	4.9	5.5	5.2	3.7	3.75	3.75	3.7	3.6	3.7
28	3.75	3.85	4.2	5.3	5.65	5.3	3.7	3.75	4.15	3.7	3.6	3.65
29	3.85	.....	4.25	5.85	5.6	5.15	4.95	3.75	3.85	3.6	3.6	3.55
30	3.85	.....	4.15	5.8	6.45	5.1	4.4	3.7	3.55	3.55	3.6	3.55
31	3.75	.....	4.25	.....	6.65	.....	4.6	4.0	.....	3.5	.....	3.5

NOTE.—Gage heights affected by ice, Jan. 1–19.

Daily discharge, in second-feet, of Arkansas River at Canon City, Colo., for 1910.

Day.	Jan.[a]	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	340	410	385	640	1,920	3,160	1,310	640	608	360	275	258
2	340	360	460	608	1,680	3,090	1,310	545	640	315	385	240
3	340	338	460	675	1,360	3,090	1,260	575	640	240	360	240
4	340	315	488	675	1,460	3,020	1,210	545	488	240	360	258
5	340	315	488	575	1,570	2,880	1,210	675	360	208	385	240
6	340	338	640	515	1,520	2,670	1,120	675	360	240	360	224
7	340	385	640	488	1,520	2,460	982	488	315	240	275	258
8	340	435	640	515	1,620	2,180	640	435	275	240	275	295
9	340	338	640	515	1,620	1,920	640	640	275	258	275	338
10	340	360	545	545	1,920	1,860	640	488	240	258	275	295
11	340	360	488	575	2,250	1,740	608	435	240	224	275	295
12	340	385	488	608	2,460	1,680	575	435	240	208	275	315
13	340	410	460	675	2,810	1,680	488	460	240	240	275	338
14	340	435	488	822	2,530	1,800	460	435	258	208	275	315
15	340	410	488	675	2,250	1,680	410	410	275	240	275	315
16	340	240	488	675	1,800	1,740	410	360	275	240	295	295
17	340	240	488	640	1,570	1,860	385	315	295	315	295	315
18	340	295	515	608	1,520	1,520	360	338	295	338	258	295
19	410	410	545	575	1,310	1,360	360	385	435	315	275	295
20	435	410	575	575	1,310	1,310	460	385	410	435	295	360
21	410	410	608	608	1,360	1,360	435	360	338	315	275	360
22	435	460	608	640	2,120	1,360	545	360	338	315	275	338
23	460	488	640	675	2,050	1,360	515	360	360	545	275	295
24	488	410	640	710	1,860	1,620	460	410	295	315	295	315
25	460	435	640	785	1,740	1,410	410	360	315	315	315	315
26	360	460	608	940	1,680	1,410	360	360	315	315	295	315
27	360	360	640	1,120	1,740	1,410	315	338	338	315	275	315
28	338	385	575	1,520	1,920	1,520	315	338	545	315	275	295
29	385	.....	608	2,180	1,860	1,360	1,160	338	385	275	275	258
30	385	.....	545	2,120	3,020	1,310	710	315	258	258	275	258
31	338	.....	608	.....	3,300	.....	860	460	.....	240	.....	240

[a] 340 second-feet estimated mean per day Jan. 1 to 18.

NOTE.—These discharges are based on a rating curve which is fairly well defined between 250 and 2,400 second-feet. Discharge Jan. 1 to 18 estimated on account of ice.

Monthly discharge of Arkansas River at Canon City, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	367	22,600	D.
February	488	240	378	21,000	B.
March	640	385	553	34,000	A.
April	2,180	488	783	46,600	A.
May	3,300	1,310	1,890	116,000	A.
June	3,160	1,310	1,890	112,000	A.
July	1,310	315	675	41,500	A.
August	675	315	441	27,100	A.
September	640	240	355	21,100	B.
October	545	208	287	17,600	B.
November	385	258	295	17,600	B.
December	360	224	293	18,000	C.
The year	3,300	.....	685	495,000	

ARKANSAS RIVER AT PUEBLO, COLO.

This station was established September 30, 1894, at the Santa Fe Avenue Bridge, Pueblo, Colo. On July 10, 1898, another gage was established on the east side of Main Street Bridge, which was used until March 3, 1900. Then a staff gage fastened to the retaining wall, a short distance below the Union Avenue Bridge, was used to July 14,

1902. From July 14, 1902, until July 7, 1905, readings were taken at a rod gage, having a different datum, located just above this bridge. The present chain gage on the Main Street Bridge has been in use since July 7, 1905. Measurements are made from this bridge.

As this station is near the head of the principal irrigated portion of the Arkansas Valley and above the head gates of the larger canals, the data are especially valuable to water superintendents and the State water commissioners in making distribution of water to the canals below.

No important tributaries enter within several miles above the station. Fountain Creek enters just below, and the Huerfano, the most important tributary in that vicinity, comes in about 20 miles below.

At various points above this station water is diverted for the irrigation of about 70,000 acres of land. The diversion for the Pueblo water supply also takes out above. Additional filings for irrigation above this station on the Arkansas are impossible, except for storage on some of the minor tributaries.

Slush and flowing ice are usually found at this station during the winter months and sometimes the river is frozen over or affected by ice jams below, but the results are rarely influenced by ice conditions for more than two months during the year. As noted above, numerous changes have been made in the datum of the gage.

Very good measurements can be obtained at this point, although the channel sometimes shifts considerably during floods.

Discharge measurements of Arkansas River at Pueblo, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 20[a]	Thos. Grieve	72	147	2.55	478
Feb. 23	....do	75	147	2.80	[b]444
25	G. H. Russell	114	178	2.65	575
Mar. 3	Thos. Grieve	150	228	2.88	835
16[c]	....do	69	104	2.24	351
22	....do	150	164	2.55	556
31[d]	C. L. Chatfield	75	124	2.45	478
Apr. 5	G. H. Russell	136	181	2.58	606
28	A. A. Weiland	151	275	3.28	1,220
29	Lyon and Lamb	150	339	3.62	1,560
30	A. A. Weiland	151	422	4.07	2,170
May 14	....do	151	445	4.50	2,500
31	....do	151	511	4.86	3,020
June 9	Bolster and Lyon	151	377	3.93	1,760
9	....do	151	374	3.91	1,760
23	G. H. Russell	151	310	3.46	1,260
July 23	....do	74	161	2.40	396
Aug. 16	....do	70	136	2.20	322
Sept. 16	....do	64	98	1.87	185
Oct. 4	S. T. Harding	64	89	1.88	160
Nov. 23	Padgett and Miles	122	129	2.10	313

[a] Made at Victoria Avenue Bridge. Ice along bank.
[b] Discharge liable to error; meter froze.
[c] Made at Victoria Avenue Bridge.
[d] Made at Union Avenue Bridge.

Daily gage height, in feet, of Arkansas River at Pueblo, Colo., for 1910.

[David J. Cox, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.25	2.6	2.5	2.6	3.9	5.05	3.6	2.6	2.5	2.0	2.2	2.0
2	3.0	2.5	2.55	2.6	3.75	4.9	3.45	2.6	2.7	2.0	2.2	2.0
3	2.9	2.45	2.65	2.85	3.65	4.75	3.4	2.3	2.7	1.85	2.2	2.05
4	2.6	2.4	2.65	2.75	3.35	4.7	3.4	3.85	2.6	1.9	2.15	2.05
5	2.8	2.4	2.7	2.65	3.6	4.6	3.35	3.25	2.2	1.9	2.2	2.1
6	2.9	2.5	2.9	2.55	3.65	4.5	3.25	2.95	2.1	1.75	2.2	2.05
7	3.05	2.45	2.85	2.5	3.5	4.3	3.2	2.8	2.05	1.85	2.25	2.0
8	3.25	2.45	2.7	2.4	3.65	4.05	3.0	2.6	1.95	1.9	2.2	2.05
9	3.6	2.45	2.7	2.4	3.7	3.95	2.6	2.45	1.85	1.7	2.15	2.0
10	3.75	2.4	2.6	2.6	3.95	3.9	2.75	2.65	1.85	1.85	2.15	2.2
11	3.9	2.45	2.4	2.6	4.1	3.8	2.7	2.55	1.8	2.05	2.15	2.05
12	3.95	2.4	2.25	2.6	4.25	3.8	2.7	2.45	1.8	1.85	2.15	2.05
13	3.7	2.4	2.25	2.75	4.5	3.85	3.2	2.75	1.85	2.0	2.1	2.0
14	3.3	2.45	2.3	2.75	4.55	3.8	2.5	2.6	2.3	2.05	2.15	2.05
15	3.15	2.5	2.35	2.65	4.4	3.85	2.25	2.6	1.85	1.9	2.2	1.95
16	3.1	2.35	2.3	2.55	3.9	3.9	2.3	2.35	1.9	2.1	2.3	1.9
17	3.05	2.1	2.3	2.5	3.7	4.1	2.3	2.0	1.8	2.1	2.25	1.85
18	2.85	2.3	2.3	2.7	3.55	3.8	2.25	2.2	1.9	2.15	2.25	2.0
19	2.8	2.35	2.25	2.55	3.55	3.5	2.2	1.95	1.9	2.2	2.25	2.05
20	2.7	2.5	2.45	2.6	3.5	3.4	2.3	2.1	2.3	2.25	2.25	1.9
21	2.6	2.5	2.6	2.65	3.6	3.45	2.2	2.4	2.15	2.25	2.25	2.0
22	2.7	2.5	2.6	2.75	3.95	3.5	2.3	2.25	2.1	2.3	2.15	2.2
23	2.7	2.6	2.65	2.75	4.15	3.5	2.4	2.15	2.1	2.35	2.1	2.05
24	2.8	2.7	2.7	2.75	4.0	3.5	2.35	2.15	2.05	2.3	2.1	2.1
25	2.8	2.65	2.65	2.85	3.9	3.65	2.3	2.2	1.95	2.35	2.05	2.15
26	2.65	2.8	2.6	3.0	3.85	3.65	2.2	2.15	1.95	2.35	2.15	2.1
27	2.6	2.5	2.7	3.15	3.7	3.6	2.1	2.15	1.9	2.25	2.15	2.05
28	2.6	2.55	2.6	3.3	3.8	3.65	2.0	2.05	2.1	2.3	2.15	2.05
29	2.55	.....	2.6	3.6	4.1	3.7	2.95	2.05	2.1	2.3	2.15	2.05
30	2.6	.....	2.6	4.1	4.4	3.6	4.1	2.0	2.1	2.2	2.05	2.05
31	2.55	.....	2.5	.....	4.95	.....	3.0	2.1	.....	2.3	.....	2.1

NOTE.—Gage heights probably affected by ice Jan. 1 to 20. Ice may also have existed at times during December, but the gage heights were probably not materially changed thereby.

Daily discharge, in second-feet, of Arkansas River at Pueblo, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	350	515	520	590	1,740	3,250	1,400	590	520	220	330	220
2	350	450	555	590	1,560	3,040	1,240	590	670	220	330	220
3	350	422	630	795	1,460	2,840	1,190	390	670	150	330	245
4	350	395	630	710	1,140	2,770	1,190	1,860	590	170	300	245
5	350	395	670	630	1,400	2,640	1,140	1,180	330	170	330	270
6	375	450	840	555	1,460	2,500	1,040	885	270	110	330	245
7	375	422	795	520	1,290	2,240	990	750	245	150	360	220
8	375	422	670	455	1,460	1,920	810	590	195	170	330	245
9	375	422	670	455	1,510	1,800	515	488	150	90	300	220
10	375	395	590	590	1,800	1,740	615	630	150	150	300	330
11	400	422	455	590	1,980	1,620	580	555	130	245	300	245
12	400	395	360	590	2,180	1,620	580	488	130	150	300	245
13	400	395	360	710	2,500	1,680	990	710	150	220	270	220
14	400	422	390	710	2,570	1,620	450	590	390	245	300	245
15	400	450	422	630	2,370	1,680	315	590	150	170	330	195
16	450	368	390	555	1,740	1,740	340	422	170	270	390	170
17	450	240	390	520	1,510	1,980	340	220	130	270	360	150
18	450	340	390	670	1,340	1,620	315	330	170	300	360	220
19	450	368	360	555	1,340	1,290	290	195	170	330	360	220
20	480	450	487	590	1,290	1,190	340	270	390	360	360	195
21	515	450	590	630	1,400	1,240	290	455	300	360	360	220
22	580	450	590	710	1,800	1,290	340	360	270	390	300	330
23	580	515	630	710	2,040	1,290	395	300	270	422	270	245
24	650	580	670	710	1,860	1,290	368	300	245	390	270	270
25	650	548	630	795	1,740	1,460	340	330	195	422	245	300
26	548	650	590	930	1,680	1,460	290	300	195	422	300	270
27	515	450	670	1,080	1,510	1,400	240	300	170	360	300	245
28	515	482	590	1,230	1,620	1,460	200	245	270	390	300	245
29	482	.....	590	1,560	1,980	1,510	768	245	270	390	300	245
30	515	.....	590	2,180	2,370	1,400	1,980	220	270	330	245	245
31	482	.....	520	.....	3,110	.....	810	270	.....	390	.....	270

NOTE.—These discharges were obtained as follows:
Jan. 1 to 20 estimated on account of ice.
Jan. 21 to Feb. 28 and May 1 to July 31 based on a rating curve which is well defined between 250 and 3,000 second-feet.
Mar. 1 to Aug. 30 based on a rating curve which is well defined between 250 and 2,700 second-feet.
Aug. 1 to Dec. 31 based on a rating curve which is not well defined.

Monthly discharge of Arkansas River at Pueblo, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	650	.....	450	27,700	C.
February	650	240	438	24,300	B.
March	840	360	556	34,200	A.
April	2,180	455	752	44,700	A.
May	3,110	1,140	1,770	109,000	B.
June	3,250	1,190	1,820	108,000	A.
July	1,980	200	667	41,000	A.
August	1,860	195	505	31,100	B.
September	670	130	274	16,300	B.
October	422	90	272	16,700	B.
November	390	245	315	18,700	B.
December	330	150	240	14,800	C.
The year	3,250	90	672	486,000	

ARKANSAS RIVER NEAR NEPESTA, COLO.

This station, which is located at the dam of the Oxford Farmers Canal Co., about 1½ miles above Nepesta, has been maintained at various times and was reestablished in 1909 by the State engineer, by whom it is maintained.

A vertical staff gage is spiked to a pile above upper face of dam near right bank. On August 23, 1910, a Bristol automatic gage was installed. Both gages are at the same datum. Measurements are made from the highway bridge seven-eighths of a mile below the dam during high water and by wading at low water.

The section is fair, the bed of the stream is sandy and shifting. Gage heights are affected by ice during winter.

Discharge measurements of Arkansas River near Nepesta, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 24	Thos. Grieve	134	338	[a] 8.30	1,070
Mar. 2	.....do	159	175	.80	574
Apr. 9	.....do	152	.....	.60	422
30	C. L. Chatfield	.....	398	1.50	1,680
Sept. 1[b]	A. A. Welland	47	384	.44	90

[a] Distance from top of cylindrical pier, right, upstream side, to water surface.
[b] Made by wading.

Daily gage height, in feet, of Arkansas River near Nepesta, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.0	0.7	0.7	1.4	1.7	1.0	1.1	0.45	0.0	0.7	.....
2	.....	1.0	.8	.7	1.4	1.7	.9	1.8	.55	.0	.55	.....
3	.....	1.0	.9	.7	1.3	1.5	.9	.7	.55	.0	.75	.....
4	.....	1.0	1.0	.9	1.3	1.5	.9	1.7	.5	.0	.75	.....
5	.....	1.0	.8	.9	1.4	1.4	.8	2.8	.4	.25	.75	.....
6	.....	.8	.8	.7	1.4	1.4	.7	1.5	.3	.0	.6	.....
7	.....	.8	.9	.8	1.1	1.2	.7	1.0	.5	.0	.45	.....
8	.....	.8	.9	.6	1.2	1.2	.7	.7	.45	.0	.5	.....
9	.....	.7	.9	.6	1.25	1.1	.5	.7	.4	.2	.4	.....
10	.....	.7	.7	.6	1.2	1.1	.4	2.0	.35	.0	.1	.....
11	.....	.7	.7	.6	1.4	1.1	1.7	.5	.4	.0	.0	.....
12	.....	.7	.6	.6	1.4	1.2	.8	.7	.4	.05	.0	.....
13	.....	.7	.6	.6	1.5	1.1	.8	2.0	.4	.1	.0	.....
14	.....	.7	.6	.9	1.4	1.25	.7	2.0	.4	.0	.4	.....
15	.....	.7	.6	.9	1.2	1.3	.9	1.0	.5	.2	.4	.....

Daily gage height, in feet, of Arkansas River near Nepesta, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.....	0.7	0.6	0.6	1.0	1.25	0.5	0.7	0.5	0.0	0.5	.....
17	.....	.8	.6	.4	1.0	1.3	.6	.6	.4	.4	.45	.....
18	.....	.8	.6	.8	.8	1.25	.6	1.4	.4	.45	.45	.....
19	.....	.8	.6	.7	.7	1.2	.6	.4	.4	.2	.5	.....
20	.....	.8	.6	.7	1.2	1.05	.6	.5	.9	.3	.75	.....
21	.....	.8	.6	.7	1.3	1.0	.6	.6	.6	.75	.75	.....
22	.....	.7	.6	.95	1.1	1.1	.5	.6	.6	.65	.6	.....
23	.....	.7	.6	.9	1.0	1.1	.4	.6	.5	.75	.5	.....
24	.....	1.0	.7	.9	.9	1.2	.6	.6	.5	.8	.4	.....
25	.....	1.0	.7	.9	1.1	1.2	.6	.6	.35	.75	.0	.....
26	.....	1.0	.6	.9	1.25	1.0	.6	.6	.2	.75	.0	.....
27	0.9	.9	.6	.8	1.1	1.1	.4	.8	.15	.85	.0	.....
28	.9	.8	.7	1.1	1.1	1.0	.4	.6	.0	.95	.0	.....
29	.9	.....	.7	1.1	1.1	1.0	.4	.65	.0	.85	.0	.....
30	.9	.....	.7	1.5	1.1	1.0	.5	.5	.0	.75	.0	.....
31	.8	.....	.7	.....	1.4	.....	.5	.4	.....	.75	.....	.....

ARKANSAS RIVER AT HOLLY, COLO.

This station, which was established October 15, 1907, is located at the pile highway bridge one-half mile southeast of Holly, Colo., about 4 miles above the Colorado-Kansas line.

As no important diversions are made between the two points, the data obtained at this station have special value as showing the amount of surface water passing from Colorado to Kansas.

The station is just above the mouth of Wild Horse Creek and about 1 mile below the mouth of Two Butte Creek. The drainage area is about 25,000 square miles.

As nearly half a million acres of land are under irrigation above this point, most of the ordinary flow of the stream is diverted during the irrigation season, while during the winter months it is used to fill up the numerous storage reservoirs in the basin. Except during periods of heavy flood, the flow at Holly consists chiefly of return waters. The stream flow is little affected by ice.

The gage heights here published have all been referred to the same datum, though a rod gage at a different datum was used during part of 1908. During high stages measurements are made from highway bridge and during low stages by wading at miscellaneous sections.

Fairly good measurements can be taken at this point, but in order to obtain accurate records of daily discharge it is necessary to take them frequently on account of the extremely shifting character of the channel.

Discharge measurements of Arkansas River near Holly, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 22	Thos. Grieve	.....	274	.....	684
Feb. 28	do	238	410	2.80	1,050
Apr. 28	C. L. Chatfield	.....	43	1.45	54
30	G. H. Russell	60	27	1.31	32
May 9	do	30	6.8	1.05	6.6
Aug. 6	G. J. Lyon	.....	1,540	4.55	5,290
Sept. 2	do	38	9.2	.....	7.5

Daily gage height, in feet, of Arkansas River at Holly, Colo., for 1910.

[S. W. Jones, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	4.05	2.65	1.4	1.3	1.6	1.1	6.35	1.4	1.1	1.1	1.1
2	2.45	4.0	2.35	1.3	1.2	1.6	1.2	3.6	1.3	1.1	1.1	1.1
3	3.95	4.0	2.2	1.3	1.2	1.5	1.0	3.15	1.2	1.1	1.1	1.1
4	6.1	3.8	2.2	1.3	1.2	1.5	1.0	3.1	1.1	1.1	1.1	1.1
5	5.4	3.9	2.1	1.35	1.2	1.8	1.0	3.0	1.1	1.1	1.1	1.1
6	5.65	3.55	2.1	1.3	1.2	1.95	.9	4.2	1.1	1.1	1.1	1.1
7	5.7	3.45	2.0	1.3	1.2	1.75	.9	3.55	1.1	1.1	1.1	1.2
8	5.65	3.3	1.9	1.3	1.2	1.6	.9	3.15	1.1	1.1	1.1	1.3
9	5.35	3.2	1.9	1.3	1.05	1.5	.9	2.65	1.1	1.1	1.1	1.2
10	5.15	3.2	1.8	1.3	1.05	1.5	.9	2.5	1.1	1.1	1.1	1.2
11	5.5	3.1	1.8	1.3	1.05	1.4	.9	2.9	1.1	1.1	1.1	1.2
12	5.45	3.05	1.8	1.55	1.05	1.4	1.0	2.9	1.1	1.1	1.1	1.2
13	5.2	3.0	1.75	1.6	1.05	1.3	2.15	2.35	1.1	1.1	1.1	1.2
14	4.9	2.95	1.7	1.6	1.05	1.3	1.7	2.05	1.1	1.1	1.1	1.2
15	4.35	2.9	1.6	1.85	1.05	1.25	1.5	2.3	1.1	1.1	1.1	1.2
16	5.6	2.8	1.6	2.3	1.05	1.2	1.45	3.05	1.1	1.1	1.1	1.2
17	5.4	2.8	1.6	2.6	1.05	1.0	1.4	2.3	1.1	1.1	1.1	1.2
18	5.45	2.65	1.6	2.45	1.05	.9	1.0	2.0	1.1	1.1	1.1	1.35
19	5.25	2.6	1.5	2.3	1.05	1.0	1.0	2.0	1.1	1.1	1.1	1.4
20	4.8	2.95	1.6	1.95	1.05	1.0	1.0	1.9	1.1	1.1	1.1	1.3
21	4.75	2.75	1.6	1.7	1.05	1.0	1.0	1.8	1.1	1.1	1.1	1.3
22	4.75	2.7	1.5	1.7	1.35	.9	1.0	1.8	1.1	1.1	1.1	1.3
23	4.85	2.8	1.4	1.7	1.6	.9	1.0	1.65	1.1	1.1	1.1	1.3
24	4.75	2.8	1.4	1.6	2.25	.9	1.0	1.45	1.1	1.1	1.1	1.3
25	4.85	2.8	1.4	1.6	2.1	1.0	1.0	1.3	1.1	1.1	1.1	1.3
26	5.05	2.75	1.4	1.5	2.0	1.0	.9	1.3	1.1	1.1	1.1	1.35
27	4.85	3.0	1.4	1.5	2.0	1.0	.9	1.3	1.1	1.1	1.1	1.3
28	4.95	2.85	1.3	1.4	2.0	1.0	.9	1.4	1.1	1.1	1.1	1.35
29	4.55	.....	1.3	1.3	1.95	1.0	.8	1.4	1.1	1.1	1.1	1.3
30	4.45	.....	1.4	1.3	1.7	1.0	.8	1.35	1.1	1.1	1.1	1.3
31	4.25	.....	1.4	.....	1.6	.....	2.1	1.4	.....	1.1	.....	1.3

NOTE.—Gage heights Jan. 1 to Feb. 15 affected by ice.

Daily discharge, in second-feet, of Arkansas River at Holly, Colo., for 1910.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	838	46	29	100	8	12,000	46	8	8	8
2	.....	550	29	17	100	17	2,480	29	8	8	8
3	.....	437	29	17	69	2	1,560	17	8	8	8
4	.....	437	29	17	69	2	1,470	8	8	8	8
5	.....	369	38	17	186	2	1,310	8	8	8	8
6	.....	369	29	17	272	0	4,140	8	8	8	8
7	.....	304	29	17	162	0	2,360	8	8	8	17
8	.....	241	29	17	100	0	1,560	8	8	8	29
9	.....	241	29	5	69	0	838	8	8	8	17
10	.....	186	29	5	69	0	675	8	8	8	17
11	.....	186	29	5	46	0	1,160	8	8	8	17
12	.....	186	84	5	46	2	1,160	8	8	8	17
13	.....	162	100	5	29	403	549	8	8	8	17
14	.....	139	100	5	29	139	336	8	8	8	17
15	.....	100	214	5	23	69	509	8	8	8	17
16	1,020	100	509	5	17	58	1,390	8	8	8	17
17	1,020	100	780	5	2	46	509	8	8	8	17
18	838	100	632	5	0	2	304	8	8	8	38
19	780	69	509	5	2	2	304	8	8	8	46
20	1,240	100	272	5	2	2	241	8	8	8	29
21	958	100	139	5	2	2	186	8	8	8	29
22	895	69	139	38	0	2	186	8	8	8	29
23	1,020	46	139	100	0	2	120	8	8	8	29
24	1,020	46	100	473	0	2	58	8	8	8	29
25	1,020	46	100	369	2	2	29	8	8	8	29
26	958	46	69	304	2	0	29	8	8	8	38
27	1,310	46	69	304	2	0	29	8	8	8	29
28	1,090	29	46	304	2	0	46	8	8	8	38
29	.....	29	29	272	2	0	46	8	8	8	29
30	.....	46	29	139	2	0	38	8	8	8	29
31	.....	46	.....	100	.....	369	46	.....	8	.....	29

NOTE.—These discharges were obtained from a rating curve which is well defined below 5,500 second-feet.

Monthly discharge of Arkansas River at Holly, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Feb. 16-28	1,310	780	1,010	26,000	B.
March	838	29	186	11,400	B.
April	780	29	147	8,750	B.
May	473	5	84.4	5,190	B.
June	272	0	50.2	2,990	C.
July	403	0	36.5	2,240	C.
August	12,000	29	1,150	70,700	C.
September	46	8	10.3	613	D.
October	8	8	8.0	492	D.
November	8	8	8.0	476	D.
December	46	8	22.5	1,380	D.
The period				130,000	

NOTE.—During the period Jan. 1 to Feb. 15, 1910, the gage heights were distorted by ice to such an extent that no estimates for this period have been made.

TWIN LAKES OUTLET NEAR TWIN LAKES, COLO.

This station was established August 6, 1910, by the State engineer, by whom it is maintained.

A Bristol automatic gage is located at the timber rating flume half a mile below the outlet of Twin Lakes. The flume is of trapezoidal section.

Discharge measurements of Twin Lakes Outlet near Twin Lakes, Colo., in 1910.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
May 5	A. A. Weiland	133	5.13	627
26	Thos. Grieve	125	4.85	548
Aug. 19	A. A. Weiland	37	1.65	76

Daily gage height, in feet, of Twin Lakes Outlet near Twin Lakes, Colo., for 1910.

Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		4.55	16	0.1	0.85
2		4.5	17	.3	.8
3		2.2	18	1.25	1.3
4		.4	19	1.55	.75
5		.35	20	1.5	.7
6	0.15	.3	21	1.2	1.7
7	.1	.2	22	1.25	.75
8	.6	.25	23	.95	1.4
9	.9	.2	24	.8	.8
10	1.2	.2	25	.75	.8
11	1.6	.2	26	.65	1.6
12	1.25	.15	27	.8	
13	1.25	.3	28	.15	
14	1.15	.05	29	1.90	
15	.1	.35	30	3.9	
			31	4.45	

Daily discharge, in second-feet, of Twin Lakes Outlet near Twin Lakes, Colo., for 1910.

Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	487	16	3	28
2	.....	477	17	8	26
3	.....	120	18	49	52
4	.....	11	19	68	24
5	.....	10	20	65	22
6	4	8	21	46	22
7	3	5	22	49	24
8	18	6	23	32	58
9	30	5	24	26	26
10	46	5	25	24	26
11	72	5	26	20	72
12	49	4	27	26	.....
13	49	8	28	4	.....
14	43	2	29	94	.....
15	3	10	30	357	.....
			31	467	.....

NOTE.—These estimates were furnished by the State engineer of Colorado.

Monthly discharge of Twin Lakes Outlet near Twin Lakes, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Aug. 6–31	467	3	63.7	3,280
Sept. 1–26	487	2	59.3	3,060

CLEAR CREEK NEAR GRANITE, COLO.

This station was established May 27, 1910, by the State engineer and is maintained by him.

A Bristol automatic gage is located at the rectangular concrete rating flume one-fourth mile below the reservoir outlet.

Discharge measurements of Clear Creek near Granite, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 5	A. A. Weiland	20	10.2	[a] 0.62	30.6
22	Thos. Grieve	20	28.5	1.40	22.5
June 12	A. A. Weiland	20	32.2	1.58	27.1

[a] Gage height may be in error.

Daily gage height, in feet, of Clear Creek near Granite, Colo., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.45	1.45	0.0	0.2	0.2	0.25
2	.....	1.5	1.45	.1	.25	.2	.25
3	.....	1.5	1.35	.25	.25	.15	.25
4	.....	1.55	1.3	.25	.2	.2	.25
5	.....	1.5	1.3	.2	.2	.15	.25
6	.....	1.5	1.2	.0	.2	.25	.25
7	.....	1.55	1.2	.0	.25	.25	.25
8	.....	1.5	1.1	.2	.3	.25	.25
9	.....	1.55	1.0	.3	.3	.2	.2
10	.....	1.5	.85	.3	.3	.2	.2
11	.....	1.5	.75	.3	.3	.2	.25
12	.....	1.5	.7	.3	.25	.2	.25
13	.....	1.5	.65	.3	.25	.25	.2
14	.....	1.5	.65	.2	.3	.25	.2
15	.....	1.5	.65	.0	.25	.25	.25
16	.....	1.5	.6	.0	.3	.2	.2
17	.....	1.5	.6	.0	.3	.2	.2
18	.....	1.5	.6	.05	.25	.2	.25
19	.....	1.5	.55	.25	.25	.2	.25
20	.....	1.5	.6	.2	.2	.2	.2
21	.....	1.5	.6	.2	.2	.25	.2
22	.....	1.5	.65	.2	.2	.25	.2
23	.....	1.5	.55	.2	.2	.25	.2
24	.....	1.45	.45	.2	.3	.2	.2
25	.....	1.45	.45	.2	.3	.2	.2
26	.....	1.4	.4	.25	.35	.2	.2
27	1.35	1.4	.4	.25	.3	.25	.2
28	1.35	1.4	.45	.2	.35	.25	.2
29	1.35	1.4	.5	.2	.3	.25	.2
30	1.35	1.35	.2	.2	.2	.2	.2
31	1.4	.....	.0	.2	.....	.2	.....

Daily discharge, in second-feet, of Clear Creek near Granite, Colo., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	238	238	0	5	5	8
2	.....	250	238	2	8	5	8
3	.....	250	212	8	8	4	8
4	.....	263	200	8	5	5	8
5	.....	290	200	5	5	4	8
6	.....	250	176	0	5	8	8
7	.....	263	176	0	8	8	8
8	.....	250	152	5	11	8	8
9	.....	263	128	11	11	5	5
10	.....	250	96	11	11	5	5
11	.....	250	76	11	11	5	8
12	.....	250	66	11	8	5	8
13	.....	250	57	11	8	8	5
14	.....	250	57	5	11	8	5
15	.....	250	57	0	8	8	8
16	.....	250	48	0	11	5	5
17	.....	250	48	0	11	5	5
18	.....	250	48	1	8	5	8
19	.....	250	40	8	8	5	8
20	.....	250	48	5	5	5	5
21	.....	250	48	5	5	8	5
22	.....	250	57	5	5	8	5
23	.....	250	40	5	5	8	5
24	.....	238	26	5	11	5	5
25	.....	238	26	5	11	5	5
26	.....	225	20	8	16	5	5
27	212	225	20	8	11	8	5
28	212	225	26	5	16	8	5
29	212	225	32	5	11	8	5
30	212	212	5	5	5	5	5
31	225	.....	0	5	.....	5	.....

NOTE.—These discharges were furnished by the State engineer of Colorado.

Monthly discharge of Clear Creek near Granite, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 27–31	225	212	215	2,130
June	263	212	246	14,600
July	238	0	85.8	5,280
August	11	0	5.3	326
September	11	5	8.7	518
October	8	4	6.1	375
November	8	5	6.3	375
The period				23,600

COTTONWOOD CREEK NEAR BUENA VISTA, COLO.

This station, which was established September 23, 1910, is located 7 miles west of Buena Vista, 1½ miles west of Hot Springs Hotel, 1 mile below the junction of South and Middle forks, and 5 miles below the junction with North Fork. It is above all diversions.

The gage is a vertical rod fastened on the left bank 100 feet downstream from the Hot Springs tunnel.

Measurements are made by wading at various sections.

The bed of the stream is rocky with some gravel and fairly permanent.

Discharge measurements of Cottonwood Creek near Buena Vista, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.ft.*	*Feet.*	*Sec.-ft.*
Sept. 23	G. H. Russell	22	28	1.33	37
Oct. 24	S. T. Harding	24	21	1.28	33
Nov. 19	G. H. Russell	24	22	1.23	32
Dec. 28	do	20.5	26	1.15	21

Daily gage height, in feet, of Cottonwood Creek near Buena Vista, Colo., for 1910.

[C. A. Mack, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1				1.20	16				
2			1.35		17			1.20	
3					18				
4					19			1.23	1.25
5					20		1.30		
6					21				
7					22				
8		1.20			23	1.33			
9					24		1.28		
10					25			1.20	
11			1.30		26		1.30		
12					27				
13					28				1.15
14		1.25		1.25	29				
15					30	1.25			
					31				

CHALK CREEK NEAR BUENA VISTA, COLO.

This station, which was established September 6, 1910, is located near Heywood Hot Springs, about 11 miles southwest of Buena Vista, Colo. It is below all tributaries and above all ditches except two.

A vertical rod gage is located on the right bank about 1,000 feet below the New Heywood Hotel and directly in front of the old hotel.

Measurements are made by wading at various sections.

The bed of the creek is of bowlders and very rough but fairly permanent.

The discharge is affected by ice for about four months each year.

Discharge measurements of Chalk Creek near Buena Vista, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 24	G. H. Russell	26.5	21	0.44	39
Oct. 24	S. T. Harding	25	18	.38	31
Nov. 19	G. H. Russell	22	16	.32	29
Dec. 29	do	19	17	.26	20

Daily gage height, in feet, of Chalk Creek near Buena Vista, Colo., for 1910.

[C. A. Mack and H. C. Hayes, observers.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1					16				
2					17				
3					18				
4					19			0.32	
5		0.40			20			.30	
6	0.45				21				0.35
7					22				
8			0.40		23				
9					24	0.45	0.38		
10					25				
11					26			.30	
12					27				
13	.45		.40		28		.40	.30	.35
14					29	.45			.26
15					30				
					31				

OIL OR FOURMILE CREEK NEAR CANON CITY, COLO.

This station, which was established April 12, 1910, is located 2 miles from Canon City, Colo., on the highway bridge about 200 feet from the main line of the Denver & Rio Grande Railroad.

The station is maintained by the State engineer of Colorado, who furnishes the records to the United States Geological Survey.

High-water measurements are made from the highway bridge and low-water measurements are made by wading at the same section.

A staff gage is attached to a pile on the downstream side of the right abutment of the highway bridge. The datum of the gage has not been changed.

On account of the shifting character of the channel and the absence of data the results at this station have not been entirely satisfactory.

Discharge measurements of Oil or Fourmile Creek near Canon City, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 12	Thos. Grieve	37	9.5	0.65	21.3
Sept 20	.....do	26	9.7	.22	27.9
Oct. 31	.....do	28	18.8	.10	50.7

NOTE.—Wading at various sections.

Daily gage height, in feet, of Oil or Fourmile Creek near Canon City, Colo., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.75	0.7	0.3	0.5	0.5	0.5
2	.....	.9	.7	.3	1.0	.4	.5
3	.....	.85	.8	.3	.5	.4	.5
4	.....	.9	.7	.3	1.5	.4	.5
5	.....	.95	.7	.3	1.0	.4	.5
6	.....	.8	.65	.2	1.0	.4	.5
7	.....	.8	.65	.2	1.0	.4	.5
8	.....	.8	.5	.2	1.0	.3	.5
9	.....	.8	.5	.2	1.0	.3	.5
10	.....	.8	.5	.2	1.0	.3	.6
11	.....	.8	.4	.2	1.0	.3	.6
12	.....	.85	.3	.2	1.0	.3	.6
13	.....	.9	.5	.2	1.0	.3	.6
14	.....	.95	.6	.2	.7	.3	.6
15	.....	.9	.45	.25	.7	.3	.6
16	.....	.8	.4	.3	.8	.3	.....
17	0.8	.75	.4	.2	.8	.3	.....
18	.9	.75	.4	.3	.7	.7	.....
19	.9	.7	.4	.3	1.0	.7	.....
20	.9	.7	.4	.3	.8	.7	.....
21	.95	.9	.3	.3	.95	.7	.....
22	.95	.9	.2	.2	.85	.7	.....
23	1.0	.9	.25	.2	.85	.6	.....
24	1.0	.95	.2	.2	.85	.6	.....
25	.85	.85	.35	.3	.8	.6	.....
26	.85	.75	.3	.3	.8	.7	.....
27	.75	.9	.3	.3	.75	.7	.....
28	.85	.8	.3	.4	.5	.6	.....
29	.85	.8	.3	1.25	.5	.5	.....
30	.85	.7	.3	1.75	.5	.5	.....
31	.....	.7	.....	.5	.5	.....	.....

PURGATORY RIVER DRAINAGE BASIN.

DESCRIPTION.

Purgatory [1] River, the principal tributary of Arkansas River in Colorado, rises in the Culebra Mountains and flows northeastward across the plains for a distance of 165 miles. In the spring the channel carries a moderate volume of water, but as summer approaches the amount is greatly diminished by irrigation and natural conditions until the channel is practically dry. The volume of water contributed to the Arkansas is so small that it has no appreciable effect on the

[1] This stream is often termed Las Animas, especially along its lower course, and sometimes it is called Picket Wire. It is sometimes spelled Purgatoire.

discharge of that river except at times of excessive rainfall, when it may discharge a large volume for a short time.

The drainage basin of Purgatory River is long and narrow. The total area is 3,400 square miles. The 742 square miles lying above Trinidad are mountainous and the surface is much broken by stream channels, which are normally dry. The lower basin is foothill country, merging into rough plains farther east. Drainage lines are well defined throughout part of the area. For 60 miles of its length, commencing 25 miles below Trinidad, Purgatory River flows in a deep canyon. Many small tributary canyons enter at various angles to the main channel.

In the mountainous portion the Weather Bureau records at Clearview for 15 years give a mean annual rainfall of 23 inches; at Trinidad, 10 years' record, 17 inches. The plains drainage has approximately a mean annual precipitation of 12 inches.

No storage is practiced on this stream. No power has been developed, and because of the abundance of coal in the vicinity of Trinidad it is doubtful if power development would be feasible, even under very favorable circumstances.

The basin contains about 100 square miles of merchantable timber land and a small amount of woodland, all of which is included in the Las Animas National Forest.

Some 20,000 acres of land are now being irrigated along Purgatory River.

PURGATORY RIVER AT TRINIDAD, COLO.

This station has been maintained at the Animas Street Bridge, Trinidad, Colo., from May 1, 1896, to July 31, 1899; from August 25, 1905, to December 31, 1905; from November 7, 1906, to March 10, 1907; and from October 14, 1907, to date.

The records furnish information as to flood discharge and are valuable also for irrigation projects.

The South Fork joins the upper Purgatory about 14 miles above Trinidad. Chaquaqua River, the first important tributary below, enters about 60 miles below Trinidad. Considerable water is being diverted for irrigation above the station and some below.

The flow at this point is affected to some extent by ice, though the winter discharge is usually small.

The datum of the present chain gage, which has been used since August 25, 1905, is 1.70 feet below the datum of the old rod gage formerly used. The chain gage is located on the upstream side of the Animas Street Bridge.

Low-water measurements are usually made by wading. Measurements at higher stages are made from the bridge, where conditions are not favorable. The stream bed is shifting in character.

Discharge measurements of Purgatory River at Trinidad, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 26	G. H. Russell	18	10	3.35	9.4
Feb. 8	.....do	25	25	a3.90	10.7
Mar. 2	.....do	11	12	a5.10	27
2	.....do	11	12	a5.10	27
3	.....do	11	12	a5.10	26.5
18	.....do	12	14	a5.30	40
Apr. 29	.....do	56	75	4.70	306
May 25	W. B. Freeman	48	55	4.28	150
June 23	G. H. Russell	32	35	3.81	68
July 26	J. B. Stewart	27	17	3.20	22
Aug. 4	W. B. Freeman	23	27	3.52	48
16	J. B. Stewart	32	18	3.50	33
Oct. 4	G. H. Russell	29	10	3.25	9.7
23	.....do	32	17	3.50	25.5

a Gage heights distorted by backwater from temporary dam below.

NOTE.—Measurements made at various sections.

Daily gage height, in feet, of Purgatory River at Trinidad, Colo., for 1910.

[H. D. Albertson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.8	3.55	5.35	5.35	4.65	4.5	3.7	3.9	3.7	3.25	3.4	3.35
2	3.85	3.55	5.35	5.35	4.6	4.55	3.7	3.6	3.65	3.25	3.4	3.35
3	3.55	3.5	5.45	5.4	4.45	4.5	3.7	3.5	3.6	3.25	3.4	3.35
4	3.55	3.55	5.4	5.4	4.45	4.5	3.7	3.55	3.5	3.25	3.4	.....
5	3.5	3.7	5.4	5.5	4.55	4.45	3.6	3.7	3.5	3.2	3.4	.....
6	3.45	3.65	5.4	5.35	4.6	4.4	3.5	3.7	3.5	3.2	3.4	.....
7	3.5	3.7	5.35	5.3	4.6	4.45	3.45	3.7	3.5	3.2	3.4	....
8	3.45	3.7	5.35	5.3	4.55	4.4	3.45	3.7	3.45	3.15	3.4	.....
9	3.5	3.65	5.35	5.3	4.5	4.35	3.35	3.85	3.45	3.15	3.4	.....
10	3.5	3.65	5.35	5.4	4.6	4.3	3.35	4.0	3.45	3.15	3.4	.....
11	3.5	3.7	5.35	5.4	4.6	4.25	3.35	4.2	3.4	3.15	3.4	.....
12	3.55	3.75	5.35	5.4	4.6	4.25	3.95	4.2	3.35	3.1	3.35	.....
13	3.35	3.75	5.35	4.75	4.75	4.2	3.85	3.95	3.45	3.1	3.35	.....
14	3.35	3.75	5.35	4.7	4.95	4.2	3.75	4.35	3.45	3.1	3.35	.....
15	3.5	3.75	5.35	4.5	4.85	4.15	3.55	3.75	3.4	3.1	3.35	.....
16	3.6	3.75	5.4	4.5	4.7	4.15	3.35	4.75	3.65	3.1	3.35	.....
17	3.6	3.6	5.4	4.35	4.7	4.1	3.3	3.35	3.4	3.1	3.35	.....
18	3.55	3.55	5.4	4.3	4.5	4.05	3.2	3.8	3.4	3.1	3.35	.....
19	3.6	3.6	5.4	4.35	4.5	4.05	3.1	3.65	3.45	3.4	3.35	.....
20	3.6	3.55	5.4	4.45	4.45	4.05	3.65	3.4	3.5	3.55	3.35	.....
21	3.6	3.55	5.4	4.65	4.4	4.0	3.95	3.35	3.65	3.5	3.35	.....
22	3.6	3.55	5.45	4.5	4.45	3.9	3.95	3.35	3.5	3.5	3.35	.....
23	3.6	3.6	5.5	4.35	4.5	3.8	3.3	3.7	3.4	3.5	3.35	.....
24	3.5	3.45	5.5	4.35	4.45	3.8	4.85	3.65	3.4	3.5	3.4	.....
25	3.55	3.5	5.5	4.4	4.5	3.8	3.25	3.7	3.4	3.5	3.4	.....
26	3.5	3.5	5.5	4.4	4.45	3.8	3.2	3.7	3.35	3.5	3.4	.....
27	3.55	3.5	5.5	4.45	4.4	3.75	3.15	3.65	3.3	3.5	3.4	.....
28	3.5	3.5	5.4	4.6	4.4	3.7	3.2	3.8	3.25	3.45	3.35	.....
29	3.55	.....	5.4	4.8	4.4	4.1	3.4	3.7	3.2	3.45	3.35	.....
30	3.55	.....	5.35	4.7	4.5	3.75	5.0	3.7	3.2	3.4	3.35	.....
31	3.55	.....	5.3	.....	4.45	.....	5.0	3.7	.....	3.4	.....	.....

NOTE.—Discharge affected by ice at times during January, February, and December. Gage heights Feb. 8–Mar. 18 distorted by construction and removal of cofferdams immediately below the gage.

Daily discharge, in second-feet, of Purgatory River at Trinidad, Colo., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	40	280	225	56	115	50	10	20	16
2	40	260	242	56	62	44	10	20	16
3	40	210	225	56	48	39	10	20	16
4	40	210	225	56	55	29	10	20	.....
5	40	242	210	46	75	29	8	20	.....
6	40	260	195	35	75	29	8	20	.....
7	40	260	210	30	70	29	8	20	.....
8	40	242	195	30	70	24	6	20	.....
9	40	225	180	23	92	24	6	20	.....
10	40	260	165	23	120	24	6	20	.....
11	40	260	154	23	160	20	6	20	.....
12	40	260	154	107	160	16	4	16	.....
13	320	320	142	92	100	24	4	16	.....
14	300	408	142	75	195	24	4	16	.....
15	225	362	131	47	62	20	4	16	.....
16	225	300	131	30	338	44	4	16	.....
17	180	300	120	24	16	20	4	16	.....
18	165	225	109	16	65	20	4	16	.....
19	180	225	109	10	44	24	20	16	.....
20	210	210	109	55	20	29	34	16	.....
21	280	195	98	129	16	44	29	16	.....
22	225	210	80	129	16	29	29	16	.....
23	180	225	65	28	50	20	29	16	.....
24	180	210	65	460	44	20	29	20	.....
25	195	225	65	26	50	20	29	20	.....
26	195	210	65	22	50	16	29	20	.....
27	210	195	58	16	44	13	29	20	.....
28	260	195	50	19	65	10	24	16	.....
29	340	195	120	37	50	8	24	16	.....
30	300	225	58	515	50	8	20	16	.....
31	.....	210	.....	515	50	.....	20	.....	.....

NOTE.—These discharges were obtained as follows: Apr. 1–12, estimated; Apr. 13–June 23 and Aug. 16–Dec. 3, from a rating curve which is fairly well defined; July 1–Aug. 15, indirect method for shifting channels.

Monthly discharge of Purgatory River at Trinidad, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 10	615	D.
February	.....	.....	[a] 10	555	D.
March	.....	.....	[a] 35	2,150	D.
April	.....	.....	155	9,220	D.
May	408	195	246	15,100	B.
June	242	50	137	8,150	B.
July	515	10	89.9	5,530	C.
August	338	16	78.3	4,810	C.
September	50	8	25.0	1,490	C.
October	34	4	14.9	916	C.
November	20	16	18.0	107	C.
December	.....	.....	.....	.....	
The year	.....	.....	.....	48,600	

[a] Estimated on account of backwater from construction work below the station.

BIG SANDY CREEK AT HUGO, COLO.

This station, which was established April 10, 1910, is located at the highway bridge half a mile south of Hugo, a town on the Union Pacific Railroad in eastern Colorado.

The gage is a vertical rod attached to highway bridge.

Measurements are made from the bridge to which gage is attached, or, during low stages, by wading at various sections.

The bed is sandy and very shifting. The channel is usually dry during the winter months.

Discharge measurements of Big Sandy Creek at Hugo, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 10	G. H. Russell	35	6.8	2.44	8.5
July 29	C. E. Turner	70	26	2.75	46
30	do	88	44	2.95	88
30	do	68	48	2.98	108
30	do	148	191	4.2	543
31	do	115	45	3.02	108
31	do	130	75	3.4	180
Nov. 27	W. B. Freeman				[a] 0.2

[a] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Big Sandy Creek at Hugo, Colo., for 1910.

[C. E. Turner, observer.]

Day.	Apr.		May.		July.		Aug.		Sept.		Oct.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1							2.8	53				0.5
2			2.5	13			2.55	20		0.5		0.5
3			2.5	13				4				0.5
4			2.4	5				4		0.5		0.5
5							2.55	20		1.0		0.5
6							2.95	80		1.5		0.5
7							2.6	26		1		0.5
8								3		1		0.5
9								2		1		0.5
10	2.45	9						1		1		0.5
11	2.4	5						0.5		1		0.5
12	2.4	5										0.5
13	2.6	26										0.5
14	2.7	39										0.5
15	2.7	39						1				0.5
16	2.7	39						1				0.5
17	2.6	26						0.5		0.5		0.5
18	2.6	26								0.5		0.5
19	2.6	26								0.5		0.5
20	2.5	13								0.5		0.5
21	2.5	13			2.35	25				0.5		0.5
22	2.5	13			2.5	13				0.5		0.5
23	2.4	5								0.5		0.5
24										0.5		0.5
25										0.5		0.5
26										0.5		0.5
27										0.5		0.5
28										0.5		0.5
29					2.55	20				0.5		0.5
30					3.55	236				0.5		0.5
31					3.25	150						0.5

NOTE.—These discharges were obtained from a rating curve which is fairly well defined. Discharges estimated for days when gage was not read. The creek was dry on days between Apr. 24 and Oct. 31 for which no discharges are given.

BIG SANDY CREEK AT KIT CARSON, COLO.

This station, which was established April 15, 1910, is located at the highway bridge 1 mile above Kit Carson and the same distance above the mouth of Wildhorse Creek.

A vertical rod gage is attached to the highway bridge. Measurements are made from the bridge to which gage is attached and by wading at various sections.

The channel is sandy and shifting and is dry during a greater part of the year.

Discharge measurements of Big Sandy Creek at Kit Carson, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 19	G. H. Russell	.....	.....	.....	(a)
June 16	do	.....	.....	.....	(a)
July 31	H. D. Padgett	.....	.....	.....	(a)
Aug. 5	C. E. Turner	315	216	2.14	430
6	do	320	223	2.18	454
Nov. 27	W. B. Freeman	.....	.....	.....	(a)

a Dry.

Daily gage height, in feet, of Big Sandy Creek at Kit Carson, Colo., for 1910.

[Cyrus Platner, observer.]

Day.	Apr.	Aug.	Day.	Apr.	Aug.
1	.....	0.95	16	1.40	.....
2	.....	1.45	17	1.6	.....
3	.....	1.3	18	1.45	.....
4	.....	1.15	19	1.4	.....
5	.....	2.35	20	1.35	.....
6	.....	2.05	21	1.35	.....
7	.....	1.5	22	1.35	.....
8	.....	1.3	23	1.3	.....
9	.....	1.3	24	1.2	.....
10	.....	1.25	25	1.0	.....
11	.....	1.15	26	.....	.....
12	.....	.95	27	.....	.....
13	.....	.....	28	.....	.....
14	.....	.....	29	.....	.....
15	1.65	.....	30	.....	.....
			31	.....	.....

NOTE.—Dry from Apr. 11 to 14, 26 to July 31, Aug. 13 to Dec. 31.

BIG SPRING CREEK NEAR ARENA, COLO.

This station, which was established April 11, 1910, about 2 miles south of Arena and about 7 miles from Kit Carson, stations on the Kansas City & Denver branch of the Union Pacific Railroad, is about 3 miles above the mouth of the creek and is below all tributaries.

The gage is a vertical rod fastened to the left bank. Measurements of discharge are made by wading near the gage.

The channel at moderate stages is crooked and made up of a series of holes and riffles. At high stages the water overflows both banks and spreads over a wide flat valley. The stream bed is of clay and sand.

The gage is at a pool and, therefore, when there is no flow the reading varies owing to evaporation. The gage was read from April 11 to November 5, but as no discharge measurements were made the readings are of little value. From the observer's notes as to dry periods, and estimates of the few observed floods on this stream the flow for the following periods is estimated by C. E. Turner:

June 15 to July 9, no flow.
July 31 to August 1, 100 second-feet, mean for the 2 days.
August 2 to August 18, 7.35 second-feet, mean for the 17 days.
August 19 to September 19, no flow.
September 20 to September 29, 10 second-feet, mean for the 10 days.
September 30 to November 5, no flow.

The total run-off for above periods is 850 acre-feet. The flow for periods April 11 to June 14 and July 9 to 30 have not been estimated, but it is probable if there was any flow it was very small.

Daily gage height, in feet, of Big Spring Creek near Arena, Colo., for 1910.

[W. E. Misner and James Cook, observers.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.4	1.4	1.2	1.5	1.2	1.4	1.5
2	.....	.....	1.4	1.2	1.45	1.2	1.4	1.5
3	.....	1.4	.....	.....	1.4	1.2	1.4	1.5
4	.....	1.4	1.4	.....	1.4	1.2	1.4	1.5
5	.....	.....	1.4	1.2	1.55	1.2	1.4	1.5
6	.....	1.4	1.4	1.2	2.3	1.2	1.4	.....
7	.....	1.4	1.4	.....	1.3	1.2	1.4	.....
8	.....	1.4	1.4	1.2	1.3	1.2	1.4	.....
9	.....	1.4	1.4	1.2	1.3	1.2	1.4	.....
10	.....	1.4	1.4	1.4	1.3	1.2	1.4	.....
11	1.4	1.4	1.4	1.4	1.3	1.2	1.4	.....
12	1.4	1.4	1.4	1.4	1.25	1.2	1.4	.....
13	1.4	1.4	1.4	.....	1.3	1.2	1.4	.....
14	1.4	1.4	.....	1.4	1.3	1.2	1.5	.....
15	1.4	1.4	1.3	.....	1.3	1.2	1.5	.....
16	1.4	1.4	.....	1.4	1.3	1.2	1.5	.....
17	1.4	.....	1.3	1.4	1.3	1.2	1.5	.....
18	1.4	1.4	.....	.....	1.3	1.2	1.5	.....
19	1.4	1.4	1.3	.....	1.2	1.2	1.5	.....
20	1.4	.....	.....	1.3	1.2	1.3	1.5	.....
21	1.4	1.4	1.3	1.3	1.2	1.3	1.5	.....
22	1.4	1.4	.....	.....	1.2	1.3	1.5	.....
23	1.4	1.4	1.3	1.3	1.2	1.7	1.5	.....
24	1.4	1.4	.....	.....	1.2	1.7	1.5	.....
25	1.4	1.4	1.2	1.3	1.2	1.7	1.5	.....
26	.....	1.4	1.2	1.3	1.2	1.7	1.5	.....
27	1.4	1.4	1.2	.....	1.2	1.7	1.5	.....
28	1.4	1.4	.....	1.3	1.2	1.6	1.5	.....
29	1.4	1.4	.....	.....	1.2	1.5	1.5	.....
30	1.4	1.4	1.2	.....	1.2	1.4	1.5	.....
31	.....	1.4	.....	1.5	1.2	.....	1.5	.....

CANADIAN RIVER DRAINAGE BASIN.

DESCRIPTION.

Canadian River (frequently called Red River in New Mexico) rises in the Cimarron Mountains in Colfax County, N. Mex., flows southward across Mora and San Miguel counties, then turns and flows eastward across northern Texas and through Oklahoma, uniting with Arkansas River about 80 miles above Fort Smith, Ark. The total length of the river from Raton Pass, N. Mex., to the mouth is about 750 miles. Altitudes within the basin range from about 9,000 feet at the head to 460 feet at the mouth. Some of the highest peaks in the Cimarron Range are more than 12,000 feet in elevation.

Cimarron, Mora, and Sapello rivers and Ute Creek, all in New Mexico, are the principal perennial tributaries, but many of the intermittent tributaries, such as the Sweetwater, carry large quantities of flood water. The total drainage area of the river in New Mexico is about 13,000 square miles. The North Fork of the Cimarron (frequently called Beaver Creek at its head) is the most important of the lower tributaries. Its drainage area lies just south of the Cimarron (Dry). Along the headwaters of the Canadian in New Mexico is a considerable area of timberland and woodland, and the drainage area in eastern Oklahoma is also wooded. The remainder of the area in New Mexico, Texas, and Oklahoma consists of dry plains.

The annual precipitation ranges from 20 inches or more in the mountainous sections to 12 inches or less on the plains of New Mexico and Texas; in Oklahoma the range is from 20 inches in the western part to 35 inches near the mouth of the stream. Except along the lower course the run-off is very uncertain and the river bed is frequently dry for long periods; at other times it carries very disastrous floods. The winters along this stream are mild, and the stream flow is rarely affected by ice, except at the higher altitudes.

Many tracts of land are irrigated along the upper Canadian and tributaries, although the aggregate area is only a few thousand acres; the number and acreage of these tracts are, however, rapidly being increased. Good storage sites are afforded by a number of natural lakes and basins, and reservoirs will eventually be constructed on the Cimarron, Vermejo, Ute Creek, Sapello, Mora, and other tributaries, which will provide for the irrigation of hundreds of thousands of acres.

Owing to the intermittent character of the stream, opportunities for water-power development are not very good except on the upper reaches of the mountain streams, but these opportunities will be somewhat increased by storage reservoirs. It may eventually be possible to develop commercially over 25,000 horsepower in New Mexico. At present no important water-power plants are in operation.

CANADIAN RIVER AT LOGAN, N. MEX.

This station, which was reestablished December 22, 1908, for the purpose of determining the amount of water available for storage and irrigation, is located at the Chicago, Rock Island & Pacific Railway bridge, 1 mile south of the depot at Logan, N. Mex. It is near the location of the bridge and gage used by the United States Reclamation Service from June 29, 1904, to February 26, 1905, which were washed out by flood, but the present gage has no determined relation to that gage.

The station is about 5 miles below the mouth of Ute Creek and 3 miles above the mouth of Arroyo Largo. The drainage area is about 12,000 square miles.

The stream flow is not affected by ice and very little by artificial control above. The extremely shifting nature of the stream bed makes it necessary to obtain a large number of discharge measurements in order to obtain the best results. It is usually difficult to make discharge measurements at higher stages on account of the sudden rise and equally rapid subsidence of the river during floods. High-water measurements must be made by floats, because of a large amount of drift in the river. Low-water measurements are made by wading, and those at ordinary stages from a cable 450 feet upstream from the railroad bridge, which is 140 feet high.

Numerous rod gages, secured to old piling under the bridge, were used during 1909, but all gage readings have been referred to the datum of the two railroad gages, which are at the same datum and are painted on the third concrete pier from each bank. On August 5, 1910, a Friez automatic gage was installed about three-fourths of a mile above the old gage. The datum of the Friez gage bears no relation to that of the rod gage.

Discharge measurements of Canadian River at Logan, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 31	G. H. Russell	81	77	3.45	107
Mar. 15	do	86	113	.....	134
May 7	J. B. Stewart	115	144	4.28	323
June 18	do	275	239	4.10	612
18	do	249	227	3.98	540
Aug. 24	W. W. Mills	137	111	.....	230
Oct. 14	G. H. Russell	8	2.5	[a] 3.75	1.8
Dec. 21	W. B. Freeman	.....	.....	[a] 3.8	[b] 5

[a] From automatic gage. [b] Estimated.

Daily gage height, in feet, of Canadian River at Logan, N. Mex., for 1910.

[I. F. Romine, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.35	3.25	3.05	.....	4.1	3.8	2.6	.....	.....	4.5	4.1	3.8
2	4.95	3.25	3.05	3.4	4.4	3.8	3.3	.....	.....	4.6	4.1	3.8
3	5.25	3.25	3.05	3.7	4.4	3.95	4.0	.....	6.45	4.5	4.0	3.8
4	5.35	3.25	3.05	3.8	4.4	4.15	3.05	.....	6.45	4.2	4.0	3.8
5	5.25	3.25	3.1	3.8	4.4	4.5	2.9	.....	6.35	4.1	4.0	3.8
6	5.05	3.25	3.1	3.8	4.4	4.8	2.9	7.2	6.25	4.0	4.0	3.8
7	5.05	3.15	3.1	3.8	4.3	4.2	2.9	7.4	6.1	3.8	4.0	3.8
8	5.05	3.15	3.15	3.8	3.9	3.8	3.3	7.15	6.0	3.8	4.0	3.8
9	4.95	3.20	3.15	2.9	3.6	3.7	4.2	7.3	5.9	3.8	4.0	3.8
10	4.95	3.2	3.2	2.9	3.6	3.6	4.85	8.3	5.8	3.75	4.0	3.8
11	5.05	3.25	3.25	2.9	3.6	3.4	4.0	7.6	5.7	3.85	4.0	3.8
12	5.05	3.25	3.25	3.6	3.5	3.4	3.8	8.15	5.6	3.85	4.0	3.8
13	5.05	3.25	3.35	3.6	3.6	3.1	3.5	7.15	5.6	3.8	4.0	3.8
14	5.1	3.25	3.45	3.6	3.8	3.0	3.5	9.5	5.6	3.75	4.0	3.8
15	5.25	3.35	.....	3.6	3.6	6.8	3.35	8.9	5.6	3.8	4.0	3.8
16	5.25	3.35	.....	3.6	3.5	7.6	2.4	7.6	5.65	3.8	4.0	3.8
17	5.05	3.35	.....	3.4	3.7	4.1	3.15	6.9	.....	3.8	4.0	3.8
18	5.05	3.35	.....	3.4	3.9	3.8	2.9	9.5	.....	3.8	4.0	3.8
19	5.15	3.25	.....	3.4	3.6	3.8	2.9	7.7	.....	3.8	4.0	3.8
20	5.15	3.25	.....	3.6	3.5	3.7	2.8	.....	.....	3.8	4.0	3.8
21	5.05	3.2	.....	3.6	3.5	3.05	2.6	.....	.....	3.8	4.0	3.8
22	4.95	3.15	.....	3.9	3.5	2.9	2.2	.....	.....	3.8	4.0	3.8
23	4.95	3.1	.....	3.9	3.4	2.55	1.9	.....	.....	3.75	4.0	3.8
24	4.95	3.1	.....	3.9	3.4	2.5	1.9	.....	3.9	3.75	4.0	3.8
25	4.65	3.1	.....	4.0	3.3	2.5	3.0	.....	3.9	3.75	4.0	3.8
26	4.45	3.05	.....	4.0	3.3	2.65	2.9	.....	3.8	3.8	3.9	3.8
27	4.2	3.05	.....	3.9	3.3	2.8	2.8	.....	3.8	3.9	3.8	3.8
28	4.05	3.05	.....	4.0	3.3	2.8	2.35	.....	3.8	4.1	3.8	3.8
29	3.85	.....	.....	3.85	3.3	2.9	2.9	.....	5.2	4.2	3.8	3.8
30	3.75	.....	.....	3.85	3.55	2.65	2.9	.....	4.9	4.2	3.8	3.8
31	3.3	.....	.....	.....	3.65	.....	6.0	.....	.....	4.2	.....	3.8

NOTE.—Gage out Mar. 15–Apr. 2 and June 15–17. Gage heights recorded from railroad gage June 15–17. Gage heights after July 31 were taken on automatic gage and are not comparable with those previous to that date.

Daily discharge, in second-feet, of Canadian River at Logan, N. Mex., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	352	76	48	100	260	178	80
2	805	76	48	100	375	178	220
3	1,180	76	48	155	375	216	540
4	1,340	76	48	178	375	278	160
5	1,180	76	55	178	375	425	130
6	920	76	55	178	375	650	130
7	920	62	55	178	330	295	130
8	920	62	62	178	202	178	220
9	805	69	62	32	135	155	710
10	805	69	69	32	135	135	1,640
11	920	76	76	32	135	100	540
12	920	76	76	135	116	100	410
13	920	76	92	135	135	55	280
14	980	76	108	135	178	42	280
15	1,180	92	.....	135	135	6,550	235
16	1,180	92	.....	135	116	10,800	53
17	920	92	.....	100	155	620	185
18	920	92	.....	100	202	420	130
19	1,040	76	.....	100	135	420	130
20	1,040	76	.....	135	116	370	110
21	920	69	.....	135	116	300	80
22	805	62	.....	202	116	130	30
23	805	55	.....	202	100	75	10
24	805	55	.....	202	100	65	10
25	525	55	.....	230	84	65	150
26	400	48	.....	230	84	90	130
27	295	48	.....	202	84	115	110
28	245	48	.....	230	84	115	47
29	190	.....	.....	190	84	130	130
30	166	.....	.....	190	126	90	130
31	84	.....	.....	.....	145	.....	3,400

NOTE.—These discharges are based on a rating curve which is well defined.

Monthly discharge of Canadian River at Logan, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	1,340	84	790	48,600	A.
February	92	48	70.8	3,930	A.
Mar. 1–14	108	48	64.4	1,790	A.
April	230	32	149	8,870	A.
May	375	84	177	10,900	A.
June	10,800	42	778	46,300	B.
July	3,400	10	340	20,900	C.
The period				141,000	

NOTE.—Sufficient measurements, referred to the Friez gage, have not been obtained to make estimates after July.

CHICO RICO CREEK NEAR RATON, N. MEX.

This station, which was established July 29, 1910, is located on the St. Louis, Rocky Mountain & Pacific Railway bridge, 10 miles southeast of Raton, N. Mex.

A Friez automatic gage is secured to the bridge, and measurements are made by wading at low stages and from the bridge at high stages.

Discharge measurements of Chico Rico Creek near Raton, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 26	W. W. Mills	8.8	4.4	1.60	1.6
Oct. 7	G. H. Russell	1.6	.36	1.54	.4

Daily gage height, in feet, of Chico Rico River near Raton, N. Mex., for 1910.

[Jay Walrath, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	1.65	1.55	1.6	1.6	16	.....	1.6	1.55	1.5	1.6	1.6
2	.....	2.0	1.65	1.55	1.6	1.6	17	.....	1.6	1.55	1.5	1.6	1.6
3	.....	1.5	1.6	1.55	1.6	1.6	18	.....	1.6	1.6	1.5	1.6	1.6
4	.....	2.4	1.6	1.55	1.6	1.6	19	.....	1.6	1.6	1.5	1.6	1.6
5	.....	2.7	1.6	1.55	1.6	1.6	20	.....	1.6	1.6	1.5	1.6	1.6
6	.....	1.9	1.6	1.55	1.6	1.6	21	.....	1.6	1.6	1.5	1.6	1.6
7	.....	1.85	1.6	1.55	1.6	1.6	22	.....	1.6	1.6	1.55	1.6	1.6
8	.....	1.8	1.6	1.55	1.6	1.6	23	.....	1.7	1.6	1.55	1.6	1.6
9	.....	1.8	1.6	1.55	1.6	1.6	24	.....	1.65	1.6	1.55	1.6	1.6
10	.....	1.8	1.6	1.55	1.6	1.6	25	.....	1.65	1.6	1.55	1.6	1.6
11	.....	1.9	1.6	1.55	1.6	1.6	26	.....	1.65	1.6	1.55	1.6	1.6
12	.....	2.0	1.6	1.55	1.6	1.6	27	.....	1.6	1.6	1.55	1.6	1.6
13	.....	1.85	1.6	1.55	1.6	1.6	28	.....	1.65	1.6	1.55	1.6	1.6
14	.....	2.0	1.6	1.55	1.6	1.6	29	.....	1.65	1.6	1.6	1.6	1.6
15	.....	1.7	1.55	1.55	1.6	1.6	30	1.6	1.6	1.6	1.6	1.6	1.6
							31	1.5	1.6	.....	1.6	.....	1.6

UNA DEL GATO CREEK NEAR RATON, N. MEX.

This station was established May 3, 1910, at a point three-fourths of a mile above the St. Louis, Rocky Mountain & Pacific Railway bridge, 2 miles above A. J. Meloche's ranch and 18 miles east of Raton, N. Mex.

A Friez automatic gage is attached to a tree on the left bank. Measurements are made by wading.

Discharge measurements of Una del Gato Creek near Raton, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	J. B. Stewart	9.4	2.2	0.90	2.0
Aug. 26	W. W. Mills	.....	1.4	.8	.3
Oct. 8	G. H. Russell	.....	.....	.75	a.3

a Estimated.

Daily gage height, in feet, of Una del Gato Creek near Raton, N. Mex., for 1910.

[A. J. Meloche and W. J. Butt, observers.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.85	0.95	0.8	0.8	0.75	0.8
2	.....	.85	1.0	.8	.8	.8	.8
3	0.9	.85	1.0	.95	.8	.8	.8
4	.9	.9	1.0	.95	.8	.8	.8
5	.9	.85	1.0	.9	.8	.8	.8
6	.85	.85	1.0	.8	.8	.8	.8
7	.8	.85	1.0	.8	.8	.8	.8
8	.8	.85	1.0	.8	.8	.8	.8
9	.8	.85	1.0	.8	.8	.8	.8
10	.8	.85	1.0	1.05	.8	.8	.8
11	.75	.85	1.0	.95	.8	.8	.8
12	.75	.8	1.0	1.0	.8	.8	.8
13	.8	.8	1.0	.8	.8	.8	.8
14	.75	.8	1.0	1.1	.8	.8	.8
15	.7	.8	1.0	.95	.8	.8	.8
16	.7	.8	1.0	.9	.8	.8	.8
17	.7	.8	.9	.8	.8	.8	.8
18	.7	.8	.9	.8	1.0	.8	.8
19	.7	.85	.9	.8	.8	.8	.8
20	.7	.85	.9	.8	.75	.8	.85
21	.75	.85	.9	.8	.75	.85	.9
22	1.05	.85	.9	.8	.8	.8	.9
23	1.1	.9	.9	.8	.75	.8	.9
24	1.15	.95	.9	.85	.75	.8	.9
25	1.15	.95	.9	.8	.75	.8	.9
26	1.1	.95	.85	.8	.75	.8	.8
27	1.05	.95	.85	.75	.75	.75	.85
28	1.05	.95	.85	.8	.75	.75	.8
29	.95	.95	1.0	.8	.75	.8	.8
30	.9	.95	.8	.8	.75	.8	.8
31	.85	.....	.8	.8	.....	.8	.....

NOTE.—The stream was frozen during December.

CIMARRON RIVER AT UTE PARK, N. MEX.

This station, which was established July 14, 1907, to determine the amount of water available for storage and irrigation, is located at the highway bridge 300 feet north of the railway station at Ute Park, N. Mex., the terminus of the St. Louis, Rocky Mountain & Pacific Railway. It has been maintained in cooperation with the Territorial engineer of New Mexico.

The station is one-half mile below the mouth of Ute Creek and is below most of the mountain tributaries except the Rayado, which enters several miles below. The drainage area above the station is over 200 square miles.

Very little water is diverted above this point, but most of the normal flow of the stream is used for irrigation in the valley below.

The Eagles Nest reservoir site, which has a capacity of over 100,000 acre-feet, is situated in the canyon a few miles upstream from this station and is capable of storing the entire run-off.

Ice is found on this stream during the winter months, but usually has very little effect on the open-channel flow.

The datum of the rod gage has remained constant since the station was established. In September, 1909, a Friez automatic gage was installed at the same location and datum. High-water measurements are made at the bridge and low-water measurements by wading. The stream bed is fairly permanent, but it is rather rough, making high-water measurements somewhat inaccurate. Results, however, should be very good.

Discharge measurements of Cimarron River at Ute Park, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 27	G. H. Russell	16.5	23.2	0.48	23.2
27	.....do	16.5	23.2	.45	22.4
Mar. 5	.....do	19	34	.60	44.0
May 4	J. B. Stewart	31	41	.98	136
June 14	.....do	22.5	15	.47	17.0
July 27	.....do	15.5	7.6	.20	3.9
Aug. 28	W. W. Mills	19.1	9.0	.35	8.2
28	.....do	20.5	15.1	.35	8.3
Oct. 3	G. H. Russell	12	9.5	.30	4.4

Daily gage height, in feet, of Cimarron River at Ute Park, N. Mex., for 1910.

[Mrs. R. P. Woodward, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.45	0.4	0.4	0.85	.....	0.55	0.35	0.2	0.4	0.25	0.4	0.3
2	.8	.35	.4	.8	.....	.5	.3	.2	.35	.25	.4	.4
3	.6	.35	.55	.7	.....	.5	.3	.3	.35	.25	.4	.55
4	.55	.35	.6	.7	.10	.5	.3	.35	.35	.25	.4	.45
5	.55	.35	.7	.65	.95	.45	.3	.4	.35	.2	.4	.15
6	.55	.4	1.0	.7	.9	.45	.25	.35	.35	.25	.4	.15
7	.55	.4	1.05	.7	.85	.4	.25	.3	.35	.25	.4	.15
8	.55	.35	1.0	.7	.8	.4	.25	.3	.35	.25	.35	.2
9	.55	.35	.85	.8	.75	.35	.25	.35	.35	.3	.35	.25
10	.55	.35	.75	.8	.75	.35	.25	.35	.35	.3	.35	.35
11	.55	.35	.8	.9	.75	.35	.35	.4	.3	.3	.4	.35
12	.55	.35	.7	.85	.75	.3	.35	.45	.3	.3	.35	.35
13	.55	.35	.75	.9	.75	.3	.4	.4	.3	.3	.5	.3
14	.55	.4	.75	.....	.75	.5	.35	.45	.3	.3	.5	.3
15	.4	.35	.7	.....	.8	.55	.35	.4	.35	.3	.45	.3
16	.4	.25	.7	.85	.....	.5	.35	.4	.4	.3	.55	.35
17	.4	.25	.7	.9	.....	.45	.35	.4	.35	.35	.45	.3
18	.35	.25	.75	.95	.....	.45	.35	.4	.35	.4	.45	.3
19	.4	.3	.8	1.0	.....	.4	.35	.4	.35	.45	.4	.3
20	.4	.3	.85	1.05	.....	.4	.35	.4	.35	.45	.4	.3
21	.4	.3	.85	1.05	.....	.4	.35	.4	.35	.4	.35	.3
22	.4	.3	.9	1.05	.....	.35	.3	.4	.35	.4	.4	.3
23	.4	.35	.9	1.05	.....	.35	.25	.45	.35	.45	.35	.3
24	.4	.45	.95	1.0	.....	.35	.3	.45	.3	.4	.4	.35
25	.4	.45	.9	1.15	.....	.4	.3	.4	.3	.4	.4	.35
26	.35	.35	.9	1.15	.....	.4	.3	.4	.3	.4	.4	.35
27	.35	.35	.85	1.15	.....	.4	.2	.35	.25	.4	.35	.35
28	.4	.35	.9	1.15	.....	.4	.15	.35	.25	.4	.35	.35
29	.4	.....	.8	1.30	.5	.4	.15	.35	.3	.4	.25	.35
30	.4	.....	.85	1.20	.55	.35	.25	.35	.3	.4	.25	.35
31	.4	.....	.85	.....	.55	.....	.25	.4	.....	.4	.....	.35

NOTE.—Affected by ice Jan. 1-14 and Dec. 17-31.

Daily discharge, in second-feet, of Cimarron River at Ute Park, N. Mex., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	16	16	16	101	.....	31	8.4	3.3	11	4.6	11	5.8
2	16	13	16	88	.....	25	5.8	3.3	8.4	4.6	11	11
3	16	13	36	64	.....	25	5.8	5.8	8.4	4.6	11	26
4	16	13	44	64	125	25	5.8	8.4	8.4	4.6	11	16
5	16	13	64	54	112	20	5.8	11	8.4	3.3	11	2.8
6	16	16	141	64	100	20	4.6	8.4	8.4	4.6	11	2.8
7	16	16	154	64	87	15	4.6	5.8	8.4	4.6	11	2.8
8	16	13	141	64	75	16	4.6	5.8	8.4	4.6	8.4	3.3
9	16	13	101	88	65	12	4.6	8.4	8.4	5.8	8.4	4.6
10	16	13	76	88	65	12	4.6	8.4	8.4	5.8	8.4	8.4
11	16	13	88	114	65	12	8.4	11	5.8	5.8	11	8.4
12	16	13	64	101	66	9.5	8.4	16	5.8	5.8	8.4	8.4
13	16	13	76	114	66	10	11	11	8.4	5.8	20	5.8
14	16	16	76	110	66	27	8.4	16	5.8	5.8	20	5.8
15	16	13	64	106	78	26	8.4	11	8.4	5.8	16	5.8
16	16	8	64	101	.....	20	8.4	11	11	5.8	26	8.4
17	16	8	64	114	.....	16	8.4	11	8.4	8.4	16	8
18	13	8	76	128	.....	16	8.4	11	8.4	11	16	8
19	16	10	88	141	.....	11	8.4	11	8.4	16	11	8
20	16	10	101	154	.....	11	8.4	11	8.4	16	11	8
21	16	10	101	154	.....	11	8.4	11	8.4	11	8.4	8
22	16	10	114	154	.....	8.4	5.8	11	8.4	11	11	8
23	16	13	114	154	.....	8.4	4.6	16	8.4	16	8.4	8
24	16	22	128	141	.....	8.4	5.8	16	5.8	11	11	8
25	16	22	114	182	.....	11	5.8	11	5.8	11	11	8
26	13	13	114	182	.....	11	5.8	11	5.8	11	11	8
27	13	13	101	182	.....	11	3.3	8.4	4.6	11	8.4	8
28	16	13	114	182	.....	11	2.8	8.4	4.6	11	8.4	8
29	16	.....	88	226	24	11	2.8	8.4	5.8	11	4.6	8
30	16	.....	101	197	31	8.4	4.6	8.4	5.8	11	4.6	8
31	16	.....	101	.....	31	.....	4.6	11	.....	11	.....	8

NOTE.—These discharges were obtained as follows: Jan. 1–14, estimated on account of ice conditions; Jan. 15–May 4, from a rating curve which is fairly well defined; May 5–June 14, indirect method for shifting channels; June 15–Dec. 17, from a rating curve which is fairly well defined; Dec. 17–31, estimated on account of ice conditions.

Monthly discharge of Cimarron River at Ute Park, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	16	13	15.7	965	D.
February	16	8	13.1	728	B.
March	154	16	88.4	5,440	B.
April	226	54	122	7,260	A.
May	125	24	70.4	2,100	B.
June	31	8.4	15.3	910	C.
July	11	2.8	6.30	387	B.
August	16	3.3	9.97	613	B.
September	11	4.6	7.63	454	B.
October	16	3.3	8.36	514	B.
November	26	4.6	11.5	684	B.
December	26	2.8	7.94	488	B.
The period	.....	.....	.....	20,500	

RAYADO RIVER AT ABREU'S RANCH, NEAR CIMARRON, N. MEX.

This station, which was established during the first part of 1908 as a temporary station by the New Mexico Hydrographic Survey to determine the amount of water available for irrigation, is located three-fourths of a mile upstream from Abreu's ranch, which is 20 miles west of Springer and 12 miles southwest of Cimarron, the two nearest railroad points. Daily gage readings were taken during 1909

by the Territorial survey. In October, 1909, when the United States Geological Survey abandoned the station on the Rayado at Miami ranch, near Springer, it took over the station at Abreu's ranch.

The station is now maintained in cooperation with the Territorial engineer of New Mexico.

The river receives no tributaries for several miles above or below the station, and the station is above all irrigation diversions.

The datum and location of the gage has remained constant during the maintenance of the station. On November 27, 1909, a chain gage was installed at the same location and datum as the rod gage.

Measurements of discharge are made by wading in the vicinity of the gage or from a foot log about 100 yards upstream. Fair results should be obtained. Thin ice is sometimes found at the station during the winter months.

Discharge measurements of Rayado River at Abreu's ranch, near Cimarron, N. Mex., in 1908 and 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 17	R. L. Cooper	23	9.7	1.30	7.8
19	do	23	9.2	1.30	7.3
24	do	23	8.0	1.25	5.1
26	do	23	9.8	1.30	7.4
29	do	31	29.1	2.20	[a] 103
Aug. 10	do	22.5	11.7	1.25	6.1
Oct. 31	do	21	7.3	1.15	3.0
1910.					
Jan. 28	G. H. Russell	13	13	1.32	13
Mar. 4	do	13	8	1.35	7.8
4	do	13	8	1.35	7.7
May 4	J. B. Stewart	14.8	18.8	1.78	49
June 14	do	13	8.4	1.35	8.3
27	do	12.5	5.0	1.25	3.6
Aug. 29	W. W. Mills	16.6	5.0	1.25	3.0

[a] Measured at Abreu's footbridge; 19.8 second-feet were being diverted between the gage and the point of measurement, making a total discharge of 123 second-feet past the gage.

NOTE.—The measurements for 1908 published here were inadvertently omitted from Water-Supply Paper 247.

Daily gage height, in feet, of Rayado River at Abreu's ranch, near Cimarron, N. Mex., for 1910.

(Robert Parker, observer.)

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.
1	1.40	1.32	1.15	.....	.....	.....	1.4
2	1.38	1.32	1.2	.....	.....	1.25	.....
3	1.28	1.35	1.35	.....	.....	1.2	1.3
4	1.29	1.33	1.25	1.8	.....	.....	1.35
5	1.30	1.33	1.0	1.7	.....	.....	.....
6	1.29	1.15	1.4	1.7	.....	1.2	1.3
7	1.29	1.20	1.1	1.45	.....	.....	.....
8	1.29	1.28	1.3	1.45	.....	1.2	1.3
9	1.40	1.16	1.3	1.4	.....	.....	.....
10	1.42	1.30	1.5	1.4	.....	1.2	1.7
11	1.60	1.20	1.35	1.5	.....	.....	1.45
12	1.62	1.21	1.45	1.45	.....	1.25	.....
13	1.32	1.30	1.55	1.25	.....	.....	1.3
14	1.34	1.25	1.55	1.2	1.35	1.25	.....
15	1.34	1.16	1.45	1.2	.....	.....	1.3

Daily gage height, in feet, of Rayado River at Abreu's ranch, near Cimarron, N. Mex., for 1910—Continued.

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.
16	1.35	1.17	1.55	1.1	1.35	1.2	.....
17	1.28	1.12	1.6	1.1	.....	1.2	1.25
18	1.35	1.13	1.6	.85	1.35	.....	.....
19	1.35	1.10	.....	.9	.....	.....	.....
20	1.43	1.15	.....	.9	1.3	1.3	1.25
21	1.30	1.19	.....	.9	.....	.....	1.25
22	1.37	1.09	.....	.7	1.3	1.3	.....
23	1.33	.....	.....	.65	.....	.....	1.25
24	1.36	.....	.....	.....	1.3	1.35	.....
25	1.36	.....	.....	.....	.....	.....	.....
26	1.38	.....	.....	.....	1.25	1.3	.....
27	1.38	.....	.....	.....	.....	.....	.....
28	1.32	.....	.....	.....	1.2	.....	.....
29	1.35	.....	.....	.....	.....	1.3	.....
30	1.30	.....	.....	.....	1.3	1.3	.....
31	1.25	.....	.....	.....	.....	.....	.....

NOTE.—Gage heights for January and February somewhat affected by ice.

Daily discharge, in second-feet, of Rayado River at Abreu's ranch, near Cimarron, N. Mex., for 1910.

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.
1	12	13	1.0	.....	.....	4.2	11
2	11	13	1.7	.....	.....	3.3	8
3	10	15	8	.....	.....	1.7	5
4	10	14	3.3	52	.....	1.7	8
5	10	14	0	39	.....	1.7	6.5
6	10	4	11	39	.....	1.7	5
7	10	6	4	14	.....	1.7	5
8	10	10	5	14	.....	1.7	5
9	10	4	5	11	.....	1.7	22
10	10	12	18	11	.....	1.7	39
11	10	6	8	18	.....	2.5	16
12	10	6	16	14	.....	3.3	10
13	13	12	23	3.3	.....	3.3	5
14	14	9	23	1.7	8	3.3	5
15	14	4	16	1.7	8	2.5	5
16	15	4	23	.4	8	1.7	4.2
17	10	3	28	.4	8	1.7	3.3
18	15	3	28	0	8	1.7	3.3
19	15	2	.....	0	6.5	5	3.3
20	15	3	.....	0	5	5	3.3
21	12	5	.....	0	5	5	3.3
22	14	2	.....	0	5	5	3.3
23	14	.....	.....	0	5	6.5	3.3
24	14	.....	.....	.....	5	8	3
25	14	.....	.....	.....	4.2	6.5	3
26	14	.....	.....	.....	3.3	5	3
27	14	.....	.....	.....	2.5	5	3
28	13	.....	.....	.....	1.7	5	3
29	15	.....	.....	.....	3.4	5	3
30	12	.....	.....	.....	5	5	3
31	9	.....	.....	.....	.....	5	3

NOTE.—These discharges were obtained as follows: Jan. 1–Feb. 22, estimated on the basis of one measurement made during the period. Apr. 1–May 17 and June 14–Aug. 31, from a rating curve which is well defined. May 18–22, estimated. Discharges for days when gage was not read, interpolated.

Monthly discharge of Rayado River at Abreu's ranch, near Cimarron, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	12.2	750	D.
Feb. 1–22	.....	.....	7.5	327	D.
Apr. 1–18	28	0	12.1	432	B.
May 4–23	52	0	11.0	436	C.
June 14–30	8	1.7	5.38	182	C.
July	8	1.7	3.61	222	C.
August	39	3	6.68	411	C.

MORA RIVER AND LA CUEVA CANAL AT LA CUEVA, N. MEX.

This station, which was established August 25, 1903, primarily to determine the amount of water available for storage, is located at the wagon bridge at La Cueva, N. Mex., in the Mora land grant, 26 miles north of Las Vegas, N. Mex. Since July, 1907, the records have been obtained in cooperation with the Territorial engineer of New Mexico.

The station is a few miles above the mouth of the Cebolla and a short distance downstream from the intake of La Cueva Canal, and just below the canal wasteway. This canal carries water for irrigation, and during the nonirrigating season it is used as a feeder for a reservoir below.

The canal rod gage is located at a footbridge below the wasteway, just north of the gaging station on the river. The datum of the canal gage has remained constant, and gage readings have been taken continuously since the station was established whenever there was any water in the canal. Apparent discrepancies in the gagings of the canal are accounted for by the fact that the bed of the canal occasionally contains a considerable deposit of silt, which is cleaned out at intervals.

A little water is diverted above the station for irrigation in addition to that taken out by La Cueva canal, and considerable land is irrigated below the station. By developing the available storage at reservoir sites in that locality it will be possible to utilize the entire flow of the stream for irrigation.

The original gage was washed out in the flood of September 29, 1904, and was replaced by another at practically the same section on April 29, 1905. The datum of this staff gage, which is still in use, is 1.32 feet above that of the original gage.

Fair measurements can be made by wading at low stages; high-water measurements must be corrected for the skew of the bridge. The channel is subjected to some shifting, but fair results should be obtained by making frequent measurements at the higher stages.

Discharge measurements of Mora River at La Cueva, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 6[a]	G. H. Russell	15.5	14.6	1.00	17
Mar. 7	Russell and Strong	19	14.7	1.02	20.3
7	do	19	14.7	1.02	20.5
Apr. 26	J. B. Stewart	33.5	40	1.80	115
June 12	do	10.5	3.5	.62	5.3
Aug. 12	do	18	8.5	1.15	23.5
30	W. W. Mills	14.6	4.6	.70	3.8
Oct. 21	G. H. Russell	16	7.3	.91	8.75
Nov. 30	C. B. Digby	16	5.6	.60	1.85

[a] Ice along edges of stream.

Daily gage height, in feet, of Mora River at La Cueva, N. Mex., for 1910.

[Hugh Loudon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.9	0.8	1.05	1.8	1.2	0.6	1.4	0.55	0.65	0.9	0.9
2	.....	.9	.8	1.0	1.7	1.0	.6	1.1	.55	.7	.9	.9
3	.....	1.1	.85	1.0	1.7	1.0	.6	.9	.6	.85	.95	.6
4	.....	.....	.9	.95	1.6	1.05	.6	1.85	.6	.6	.9	.75
5	.....	.....	1.0	.9	1.6	1.0	.55	1.3	.6	.85	.95	.7
6	.....	1.0	1.0	.9	1.5	1.0	.6	1.0	.55	.65	.95	.55
7	.....	.....	1.0	.85	1.5	1.0	.55	1.0	.6	.75	.95	.55
8	.....	.....	1.0	.9	1.45	.8	.55	1.0	.6	.7	.9	.55
9	.....	.95	1.0	.9	1.4	.7	.5	.9	.6	.6	.6	.6
10	.....	1.0	1.0	1.15	1.5	.65	.55	1.0	.6	.75	.6	.9
11	.....	.95	1.0	1.15	1.4	.6	.5	1.0	.6	.8	.6	.55
12	.....	1.1	1.0	1.25	1.4	.6	.5	1.15	.6	.5	.6	.55
13	.....	1.0	1.1	1.6	1.5	.65	.65	1.1	.55	.8	.6	.9
14	0.95	.85	1.0	1.6	1.5	.7	.5	1.0	.85	.85	.6	.9
15	.95	.75	1.0	1.6	1.5	1.2	.5	1.0	.9	.85	.9	.5
16	1.0	1.0	1.0	1.5	1.4	.95	.5	.95	.9	.5	.7	.6
17	1.0	.....	1.0	1.6	1.4	.85	.5	1.2	.65	.9	.65	.8
18	1.05	.....	1.0	1.6	1.35	.75	.5	1.2	.65	.8	.9	.5
19	1.0	.....	.95	1.6	1.35	.75	.5	1.2	.65	.7	.85	.5
20	1.0	.....	1.15	1.75	1.25	.7	.5	.95	.6	.65	.7	.....
21	1.1	.95	1.05	1.8	1.25	.75	.5	1.0	.6	.6	.9	.....
22	1.0	.95	1.0	1.8	1.3	.7	.5	1.0	.9	.7	.7	.....
23	1.0	.9	1.1	1.8	1.3	.6	.5	1.0	.7	.7	.6	.....
24	1.0	.85	1.15	1.8	1.1	.6	.5	.8	.6	.7	.6	.....
25	1.0	.....	1.2	1.7	1.1	.6	.6	.7	.8	.6	.9	.....
26	1.1	.9	1.2	1.8	1.1	.95	.5	.7	.85	.9	.65	.....
27	1.1	.9	1.15	1.85	1.0	.95	.45	.7	.85	.9	.55	.....
28	1.2	.9	1.0	1.9	1.05	1.0	.45	.7	.9	.95	.6	.....
29	1.0	.....	1.0	1.9	1.1	.8	.5	.75	.65	.95	.85	.....
30	.8	.....	1.1	1.85	1.1	.65	2.5	.7	.65	.95	.6	.....
31	.9	.....	.95	.....	1.0	.....	1.6	.55	.....	.95	.....	.....

NOTE.—Ice conditions Jan. 1–13, Feb. 3–8, 16–20, and Dec. 18–31.

Daily discharge, in second-feet, of Mora River at La Cueva, N. Mex., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10	11	8	28	115	46	2	47	0.8	2.1	9	9
2	10	11	8	24	102	28	2	20	.8	3	9	9
3	10	12	10	24	102	28	2	9	1.2	7	12	1.2
4	10	14	12	21	90	32	2	94	1.2	1.2	9	.8
5	10	16	18	19	90	28	1	34	1.2	7	12	3
6	10	17	18	19	78	28	2	14	.8	2.1	12	.8
7	10	15	18	16	78	28	1	14	1.2	4	12	.8
8	10	15	19	19	72	14	1	14	1.2	3	9	.8
9	10	15	19	19	66	9	.5	9	1.2	1.2	1.2	1.2
10	10	18	19	39	78	6	1	14	1.2	4	1.2	9
11	10	15	20	39	66	5	1	14	1.2	5	1.2	.8
12	10	24	20	48	66	5	1	23	1.2	.5	1.2	.8
13	10	18	27	87	78	7	3	20	.8	5	1.2	9
14	11	10	20	87	78	9	.5	14	7	7	1.2	9
15	11	6	20	87	78	44	.5	14	9	7	9	.5
16	14	6	20	75	66	23	.5	12	9	.5	3	1.2
17	14	6	21	89	66	16	.5	26	2.1	9	2.1	5
18	18	8	21	89	61	10	.5	26	2.1	5	9	.5
19	15	10	18	89	61	10	.5	26	2.1	3	7	.5
20	15	12	33	108	51	8	.5	12	1.2	2.1	3	1
21	21	15	25	114	51	9	.5	14	1.2	1.2	9	1
22	15	15	22	114	56	7	.5	14	9	3	3	1
23	15	12	29	114	56	3	.5	14	3	3	1.2	1
24	15	10	33	114	36	3	.5	5	1.2	3	1.2	1
25	15	10	39	102	36	3	1.5	3	5	1.2	9	1
26	22	12	39	115	36	20	0	3	7	9	2.1	1
27	22	12	35	122	28	20	0	3	7	9	.8	1
28	29	12	23	128	32	22	0	3	9	12	1.2	1
29	16	.....	23	128	36	10	0	4	2.1	12	7	1
30	6	.....	32	122	36	4	186	3	2.1	12	1.2	1
31	10	.....	21	.....	28	.....	68	.8	.....	12	.....	1

NOTE.—These discharges were obtained as follows: Jan. 1–13, Feb. 3–5, 16–20, and Dec. 20–31, estimated on account of ice. Jan. 14–Feb. 2 indirect method for shifting channels. Feb. 6–Mar. 7, based on a rating curve which is not well defined. Mar. 8–Apr. 26, indirect method for shifting channels. Apr. 27–June 12, based on a rating curve which is not well defined. June 13–Aug. 2, indirect method for shifting channels. Aug. 3–Dec. 19, based on a rating curve which is not well defined. Discharges interpolated for all other days for which no gage heights are given.

Monthly discharge of Mora River at La Cueva, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	29	.....	13.4	824	D.
February	24	.....	12.8	711	C.
March	39	8	22.3	1,370	C.
April	128	16	73.3	4,360	C.
May	115	28	63.6	3,910	C.
June	46	3	16.2	964	C.
July	186	0	9.05	556	C.
August	94	.8	16.9	1,040	C.
September	9	.8	3.10	184	C.
October	12	.5	5.04	310	C.
November	12	.8	5.33	317	C.
December	9	.....	2.76	170	C.
The year	186	0	20.3	14,700	

Discharge measurements of La Cueva canal at La Cueva, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 26	J. B. Stewart	8.8	7.6	1.18	7.6
June 12	.....do	8.0	7.3	.86	8.5
Aug. 30	W. W. Mills	7.1	4.3	.60	7.1
Oct. 21	G. H. Russell	6.7	4.0	.43	1.5
Nov. 30	C. B. Digby	8.0	8.8	.60	8.1

Daily gage height, in feet, of La Cueva canal at La Cueva, N. Mex., for 1910.

[Hugh Loudon, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.3	0.65	0.95	1.3	1.3	0.9	.....	0.65	1.05	.....	0.15
2	.....	.7	.75	1.2	1.2	.8	.....	.65	1.05	.....	.3
3	.....	.7	1.1	1.2	1.2	.8	1.0	.8	.5	.....	.55
4	.....	.7	.85	1.2	1.0	.75	.....	1.05	1.0	.....	.6
5	.....	.2	.9	1.25	1.2	.6	.....	1.1	.45	.....	.75
6	.....	.4	1.05	1.2	1.1	.6	1.0	1.0	1.1	.....	.6
7	.....	.75	1.15	1.4	1.0	.5	1.0	1.2	.7	.....	.55
8	.....	.75	1.2	1.35	1.0	.45	.95	1.15	.8	.....	.5
9	.....	.75	1.2	1.4	.9	.4	1.2	1.1	.95	0.6	.5
10	.....	.6	1.15	1.4	.9	.65	1.0	1.05	.7	.6	.05
11	.....	.7	1.15	1.35	.8	.5	1.2	1.05	.3	.6	.5
12	.....	.65	1.2	1.4	.95	.6	1.05	1.15	.8	.6	.5
13	.75	.....	1.15	1.45	.95	1.15	1.0	.9	.5	.6	.....
14	.5	.6	1.0	1.35	.9	.65	1.0	.75	.45	.6	.....
15	1.0	1.05	1.1	1.2	.85	.6	1.0	.75	.45	.2	.5
16	.....	1.0	1.0	1.15	.9	.6	1.0	.55	.8	.65	.5
17	.....	.75	1.15	.9	1.0	.7	.5	1.10	.6	.65	.2
18	.....	.8	1.1	1.1	.95	.5	.9	.95	.6	.3	.5
19	.....	.8	1.1	1.1	.9	.5	.3	1.15	1.2	.3	.5
20	.....	.2	1.3	1.1	.85	.5	1.1	1.10	1.1	.6	.....
21	.....	.85	1.1	1.1	.25	.6	1.1	.95	.75	.05	.....
22	.45	.8	1.05	1.15	.9	.6	.7	.4	1.15	.6	.....
23	.4	.8	1.3	1.2	.8	.6	.7	1.0	1.1	.6	.....
24	.4	1.15	1.25	1.1	.75	.7	1.15	.7	1.15	.6	.....
25	.4	.9	1.25	1.15	.85	.7	1.0	1.0	.8	.1	.....
26	.4	.9	1.25	1.15	1.1	.6	1.0	.7	.....	.6	.....
27	.4	1.15	1.3	1.15	1.3	.5	.75	.7	.....	.6	.....
28	.4	.95	1.35	1.25	.....	.45	1.0	.6	.....	.6	.....
29	.....	1.1	1.25	1.25	1.2	.4	.75	1.0	.....	.25	.....
30	.....	1.15	1.25	1.2	1.1	.....	.6	1.0	.....	.65	.....
31	.....	.95	.....	1.15	.....	.....	.7	.....	.....	.....	.....

NOTE.—No record for January. Ice Dec. 20–31. Canal was dry on all other days for which no gage heights are given.

Daily discharge, in second-feet, of La Cueva canal at La Cueva, N. Mex., for 1910.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.5	2.5	5.0	10.0	15	10	0	8	10	0	2.5
2	0	3	2.8	8.5	13	8	0	8	10	0	4
3	0	3	7.0	9.0	13	8	13	9	2.5	0	7.5
4	0	3	3.5	9.0	10	8	0	14	9	0	8
5	0	0	4.3	10.0	14	6	0	15	2	0	8
6	0	.5	6.0	9	12	6	13	13	10	0	8
7	0	3.5	7.5	13	13	4.5	13	17	5	0	7.5
8	0	3.5	8.2	12	13	4.0	12	16	6	0	7
9	0	3.5	8.2	13	8	3.2	17	15	8	6	7
10	0	1.8	7.5	14	8	6.5	13	13	5	6	2
11	0	2.8	7.5	13	8	4.5	17	13	1	6	7
12	0	2.3	8.0	14	10	6	14	14	6	6	7
13	4.2	0	7.5	15	10	15	13	10	2.5	6	0
14	1.5	1.8	5.5	13	9	6.5	13	9	1.5	6	0
15	7.0	6.8	6.5	11	9	6	13	9	1.5	2	7
16	0	6.0	5.5	10	10	6	13	4	5	7	7
17	0	3.0	7.3	6	11	7.5	5	13	3	7	3
18	0	3.5	6.5	10	10	5	11	9	3	3	7
19	0	3.5	6.5	10	10	5	3	13	11	3	7
20	0	0	9.5	10	9	5	15	12	10	7	5
21	0	4.2	6.5	10	1	6	15	9	4.5	1	5
22	1.1	3.5	6.0	11	10	6	8	2	10	7.5	5
23	1.0	3.5	9.5	12	8	6	8	10	11	7.5	5
24	1.0	8.0	8.5	10	8	7.5	15	5	11	7.5	5
25	1.0	4.5	8.5	11	9	7.5	14	10	6	2	5
26	1.0	4.5	8.5	11	14	6	14	5	0	8	5
27	1.0	7.8	9.5	11	18	5	9	5	0	8	5
28	1.0	5.0	10.5	14	0	4	14	4	0	8	5
29	.....	7.0	9.0	14	16	3.5	9	9	0	3.5	5
30	.....	7.8	9.0	12	14	0	7	9	0	8.5	5
31	.....	5.0	.....	11	.....	0	8	.....	0	.....	5

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of La Cueva canal at La Cueva, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
February	7	0	0.72	40	C.
March	8	0	3.70	228	C.
April	10.5	2.8	7.19	428	C.
May	15	6	11.2	689	C.
June	18	0	10.4	619	C.
July	15	0	5.88	362	C.
August	17	0	10.3	633	C.
September	17	2	10.1	601	C.
October	11	0	4.98	306	C.
November	8.5	0	4.22	251	C.
December	8	0	5.37	330	C.
The period	.....	.....	.....	4,490	

SAPELLO RIVER AT LOS ALAMOS, N. MEX.

This station, which was established August 22, 1903, to determine the amount of water available for diversion into the San Guijuella Reservoir for the Las Vegas project, is located about 100 yards upstream from the post office and general store at Los Alamos, N. Mex., 13 miles north of Las Vegas, the nearest railroad point.

The proposed reservoir lies about 6 miles northwest of Las Vegas, has a storage capacity of about 40,000 acre-feet, is to be filled from

the Gallinas, Sapello, and other streams in that vicinity, and is to be used for the irrigation of 10,000 acres of land. The station is situated about 4 miles below the mouth of the Manuelitos and a few miles above the junction of the Sapello with Mora River. A considerable portion of the normal flow of the stream is diverted for irrigation above the station.

The original gage was destroyed by a flood on September 29, 1904, and was replaced in April, 1905, by the present chain gage 400 feet upstream and at a different datum. Results for short periods during the winter season are sometimes affected by ice on this stream.

The channel is somewhat shifting in character, and on account of the inadequacy of discharge measurements, especially at the higher stages, results have not been entirely satisfactory. Discharge measurements are made from cable during high stages and by wading at miscellaneous sections during low stages. The cable is located about 200 feet above chain gage.

Discharge measurements of Sapello River at Los Alamos, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 6	G. H. Russell	9	3.1	−0.08	1.6
Mar. 7	Russell and Strong	9.5	4.2	− .04	2.3
Apr. 25	J. B. Stewart	12.8	5.5	+ .10	7.4
June 12	do	9	2.8	− .20	1.2
Aug. 12	do	7.5	1.6	− .10	3.1
30	W. W. Mills	12.4	3.0	− .10	1.6
Oct. 21	G. H. Russell	6.0	1.5	− .15	.75
Nov. 30	C. B. Digby	8.0	2.28	− .20	1.27

Daily gage height, in feet, of Sapello River at Los Alamos, N. Mex., for 1910.

[William Frank, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	−0.1	−0.1	−0.15	0.0	0.1	−0.05	−0.2	.....	−0.1	.....	−0.1	−0.2
2	− .1	− .1	− .15	0	.1	− .05	− .2	.....	− .1	−0.2	− .1	− .2
3	− .05	− .1	− .15	0	.1	− .05	− .2	.....	− .2	− .2	− .1	− .2
4	− .05	− .1	− .15	0	.1	− .05	− .2	.....	− .15	− .2	− .1	− .15
5	− .05	− .1	− .15	−.05	.1	− .1	− .2	.....	− .1	− .2	− .1	− .1
6	− .05	− .1	− .15	−.05	.1	− .1	− .2	.....	− .1	− .2	− .1	− .1
7	− .05	− .1	0	−.05	.1	− .1	− .2	.....	− .2	− .2	− .15	− .1
8	− .05	− .1	.1	0	.1	− .1	− .2	.....	− .2	− .2	− .2	− .1
9	0	− .1	− .1	0	.1	− .2	− .2	.....	− .2	− .2	− .15	− .1
10	0	− .1	− .1	0	.1	− .2	− .1	.....	− .2	− .2	− .15	− .1
11	0	− .1	− .1	0	.1	− .2	− .1	.....	− .2	− .2	− .15	− .1
12	0	− .1	− .1	0	.1	− .2	− .2	−0.1	− .2	− .2	− .15	− .1
13	0	− .1	− .1	0	.1	0	− .2	− .1	− .2	− .2	− .15	− .1
14	0	− .1	− .1	.1	.1	0	.....	− .1	− .15	− .2	− .15	− .1
15	0	− .1	− .1	.2	0	.75	.....	− .1	− .1	− .2	− .15	− .1
16	− .05	− .1	− .1	.3	0	− .1	.....	− .2	− .15	− .2	− .15	− .1
17	− .1	− .1	− .1	.2	0	− .2	.....	− .2	− .2	− .2	− .15	− .1
18	− .1	− .1	− .1	.2	.05	− .2	.....	1.35	− .2	− .2	− .2	− .1
19	− .1	− .1	− .1	.2	.05	− .2	.....	.15	− .2	− .15	− .2	− .1
20	− .1	− .2	− .1	.2	.05	− .2	.....	0	− .2	− .15	− .2	− .1

Daily gage height, in feet, of Sapello River at Los Alamos, N. Mex., for 1910—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	−0.1	−0.15	−0.1	0.2	0.05	−0.2	.....	0	−0.15	−0.15	−0.2	−0.05
22	− .1	− .15	− .1	.2	0	− .2	.....	0	− .05	− .15	− .2	− .05
23	− .1	− .15	− .1	.2	0	− .2	.....	0.3	− .1	− .2	− .2	− .05
24	− .1	− .15	− .1	.2	0	− .2	.....	0	− .2	− .15	− .2	− .05
25	− .1	− .15	− .1	.1	0	− .2	.....	− .1	− .2	− .15	− .2	− .05
26	− .1	− .15	.05	.1	0	− .2	.....	− .1	− .2	− .15	− .2	− .05
27	− .1	− .15	0	.1	0	− .2	.....	− .1	− .2	− .15	− .2	− .05
28	− .1	− .15	0	.1	0	− .2	.....	− .1	− .2	− .15	− .2	− .1
29	− .1	.....	0	.1	−.05	− .2	.....	.05	− .2	− .15	− .2	− .1
30	− .1	.....	0	.1	−.05	− .2	.....	− .1	− .2	− .15	− .2	− .1
31	− .1	.....	0	.....	−.05	.....	.....	− .1	.....	− .15	.....	− .1

Daily discharge, in second-feet, of Sapello River at Los Alamos, N. Mex., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	1.5	1.0	3.2	7.4	3.8	1.2	.....	1.5	0.6	1.5	1.2
2	1.5	1.5	1.0	3.2	7.4	3.8	1.2	.....	1.5	.6	1.5	1.2
3	2.4	1.5	1.0	3.2	7.4	3.8	1.2	.....	.6	.6	1.5	1.2
4	2.4	1.5	1.0	3.2	7.4	3.8	1.2	.....	1.0	.6	1.5	2.0
5	2.4	1.5	1.0	2.4	7.4	2.8	1.2	.....	1.5	.6	1.5	2.8
6	2.4	1.5	1.0	2.4	7.4	2.8	1.2	.....	1.5	.6	1.5	2.8
7	2.4	1.5	3.2	2.4	7.4	2.8	1.2	.....	.6	.6	1.0	2.8
8	2.4	1.5	6.3	3.2	7.4	2.8	1.2	.....	.6	.6	.6	2.8
9	3.2	1.5	1.5	3.2	7.4	1.2	1.2	.....	.6	.6	1.0	2.8
10	3.2	1.5	1.5	3.2	7.4	1.2	2.8	.....	.6	.6	1.0	2.8
11	3.2	1.5	1.5	3.2	7.4	1.2	2.8	.....	.6	.6	1.0	2.8
12	3.2	1.5	1.5	3.2	7.4	1.2	1.2	2.8	.6	.6	1.0	2.8
13	3.2	1.5	1.5	3.2	7.4	4.9	1.2	2.8	.6	.6	1.5	2.8
14	3.2	1.5	1.5	6.3	7.4	4.9	.....	2.8	1.0	.6	2.0	2.8
15	3.2	1.5	1.5	10.2	4.9	46	.....	2.8	1.5	.6	2.0	2.8
16	2.4	1.5	1.5	14.8	4.9	2.8	.....	1.2	1.0	.6	2.0	2.8
17	1.5	1.5	1.5	10.7	4.9	1.2	.....	1.2	.6	.6	2.0	2.8
18	1.5	1.5	1.5	10.7	6.2	1.2	.....	112	.6	.6	1.2	2.8
19	1.5	1.5	1.5	10.7	6.2	1.2	.....	8.2	.6	1.0	1.2	2.8
20	1.5	.6	1.5	10.7	6.2	1.2	.....	3.2	.6	1.0	1.2	2.8
21	1.5	1.0	1.5	10.7	6.2	1.2	.....	3.2	1.0	1.0	1.2	3.8
22	1.5	1.0	1.5	10.7	4.9	1.2	.....	3.2	2.4	1.0	1.2	3.8
23	1.5	1.0	1.5	10.7	4.9	1.2	.....	14.8	1.5	.6	1.2	3.8
24	1.5	1.0	1.5	10.7	4.9	1.2	.....	3.2	.6	1.0	1.2	3.8
25	1.5	1.0	1.5	7.4	4.9	1.2	.....	1.5	.6	1.0	1.2	3.8
26	1.5	1.0	4.8	7.4	4.9	1.2	.....	1.5	.6	1.0	1.2	3.8
27	1.5	1.0	3.2	7.4	4.9	1.2	.....	1.5	.6	1.0	1.2	3.8
28	1.5	1.0	3.2	7.4	4.9	1.2	.....	1.5	.6	1.0	1.2	2.8
29	1.5	.....	3.2	7.4	3.8	1.2	.....	4.8	.6	1.0	1.2	2.8
30	1.5	.....	3.2	7.4	3.8	1.2	.....	1.5	.6	1.0	1.2	2.8
31	1.5	.....	3.2	.....	3.8	.....	.....	1.5	.....	1.0	.....	2.8

NOTE.—These discharges are based on curves applicable as follows: Jan. 1–Apr. 16 and Aug. 18–Dec. 31, fairly well defined; Apr. 17–Aug. 17, fairly well defined.

Monthly discharge of Sapello River at Los Alamos, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	3.2	1.5	2.09	129	B.
February	1.5	.6	1.32	73	C.
March	6.3	1	2	123	B.
April	14.8	2.4	6.68	397	B.
May	7.4	3.8	6.09	374	B.
June	46	1.2	3.55	211	B.
July (1-13)	2.8	1.2	1.45	37	B.
August (12–31)	112	1.2	8.76	348	B.
September	2.4	.6	.89	53	C.
October	1	.6	.75	46	C.
November	2	.6	1.32	79	C.
December	3.8	1.2	2.85	175	C.
The period				2050	

UTE CREEK NEAR LOGAN, N. MEX.

This station, which was reestablished April 13, 1909, to obtain records of the flow available for storage and irrigation, is located 7 miles northwest of Logan, N. Mex., 4 miles above the mouth of Ute Creek and 100 yards northwest of the old Martínez house. The station is maintained in cooperation with the Territorial engineer of New Mexico.

No important tributaries enter Ute Creek below the station or for several miles above. The stream is intermittent in character and most of the run-off water is derived from heavy rains on the basin. A little water is diverted for irrigation above the station, but storage is necessary in order to utilize any considerable proportion of the flow for that purpose. Several reservoir sites are located in that vicinity, the best known of which is probably the Ute Creek reservoir site, a few miles above the gaging station.

Measurements are made by wading near the gage. Estimates of flood discharge have been made by Kutter's formula. To obtain good results it will be necessary to install a cable in the vicinity of the gage. The stream bed is very shifting in character and the creek is subject to sudden rises, so that results obtained will at best be only moderately accurate.

The location and datum of the inclined rod gage has remained constant and is the same as that used by the United States Reclamation Service from August 12, 1904, to June 30, 1906.

Discharge measurements of Ute Creek near Logan, N. Mex., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 31	G. H. Russell	8	1.1	0.42	0.23
Mar. 15	do				*a*.1
May 7	J. B. Stewart				0
June 17	do			.52	0
Aug. 1	do	58	51	1.45	177
3	do	42	18.6	1.22	31.8
24	W. W. Mills	24	9.2	1.40	10.2
Oct. 14	G. H. Russell			.81	*a*.1
Dec. 20	W. B. Freeman				*a*.1

a Estimated.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Ute Creek near Logan, N. Mex., for 1910.

[Eligio Martinez, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.4	0.2	0.2	0.2	0.2	1.0	2.5	0.4	0.2
2	0.55	.4	.2	.2	.2	.2	.9	3.25	.85	.....
3	.55	.4	.2	.2	.2	.2	1.6	2.6	1.05	.....
4	.5	.4	.2	.2	.2	.2	1.25	4.05	.65	.....
5	3.6	.4	.2	.2	.2	.2	1.4	1.6	.7	.....
6	3.15	.3	.2	.2	.2	.2	2.1	1.2	.75	.....
7	2.2	.3	.2	.2	.2	.2	1.6	1.2	.8	.....
8	.95	.3	.2	.2	.2	.2	1.6	1.1	.8	.....
9	.6	.3	.2	.2	.2	.2	2.6	.95	.8	.....
10	.6	.3	.2	.2	.2	.2	6.2	4.4	.8	.....
11	.6	.3	.2	.2	.2	.2	5.5	1.8	.2	.....
12	.6	.3	.2	.2	.2	.5	5.0	3.0	.2	.....
13	.6	.4	.2	.2	.2	.5	4.5	1.3	.2	.....
14	.6	.4	.2	.2	.2	.5	4.0	1.5	.2	.....
15	.6	.4	.2	.2	.2	.5	4.05	1.5	.2	.....
16	.4	.4	.2	.2	.2	.5	3.45	1.0	.2	.....
17	.4	.4	.2	.2	.2	.5	1.4	2.0	.2	.....
18	.4	.4	.2	.2	.2	.5	1.3	4.9	.2	.....
19	.4	.4	.2	.2	.2	.5	1.25	2.7	.2	.....
20	.4	.2	.2	.2	.2	.5	1.2	1.8	.2	.....
21	.4	.2	.2	.2	.2	.5	1.2	1.2	.2	.....
22	.4	.2	.2	.2	.2	.5	.9	1.3	.2	.....
23	.4	.2	.2	.2	.2	.5	.8	1.1	.2	.....
24	.4	.2	.2	.2	.2	.5	.5	1.35	.2	.....
25	.4	.2	.2	.2	.2	.5	.4	1.15	.2	.....
26	.4	.2	.2	.2	.2	1.4	.3	1.05	.2	.....
27	.4	.2	.2	.2	.2	1.1	.3	.7	.2	.....
28	.4	.2	.2	.2	.2	1.05	.35	.4	.2	.....
29	.4	.....	.2	.2	.2	1.0	.35	.4	.2	.....
30	.4	.....	.2	.2	.2	1.0	1.0	.4	.2	.....
31	.4	.....	.2	.....	.2	.....	3.65	.4	.....	.....

NOTE.—Observer reported the creek dry after Oct. 2.

Daily discharge, in second-feet, of Ute Creek near Logan, N. Mex., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2	0.2	0.1	0	0	0	21	560	0	0	0	0
2	3	.2	.1	0	0	0	13	1,210	0	0	0	0
3	3	.2	.1	0	0	0	136	640	6	0	0	0
4	2	.2	.1	0	0	0	58	2,120	0	0	0	0
5	1,590	.2	.1	0	0	0	88	100	0	0	0	0
6	1,120	.1	.1	0	0	0	310	24	0	0	0	0
7	360	.1	.1	0	0	0	136	24	0	0	0	0
8	8	.1	.1	0	0	0	136	13	0	0	0	0
9	4	.1	.1	0	0	0	640	6	0	0	0	0
10	4	.1	.1	0	0	0	6,280	2,710	0	0	0	0
11	4	.1	.1	0	0	0	4,700	120	0	0	0	0
12	4	.1	.1	0	0	0	3,700	980	0	0	0	0
13	4	.2	.1	0	0	0	2,800	22	0	0	0	0
14	4	.2	.1	0	0	0	2,050	42	0	0	0	0
15	4	.2	.1	0	0	0	2,120	42	0	0	0	0
16	.2	.2	.1	0	0	0	1,420	4	0	0	0	0
17	.2	.2	.1	0	0	0	88	200	0	0	0	0
18	.2	.2	.1	0	0	0	67	3,530	0	0	0	0
19	.2	.2	.1	0	0	0	58	720	0	0	0	0
20	.2	.1	.1	0	0	0	49	84	0	0	0	0
21	.2	.1	.1	0	0	0	49	6	0	0	0	0
22	.2	.1	.1	0	0	0	13	9	0	0	0	0
23	.2	.1	.1	0	0	0	8	2	0	0	0	0
24	.2	.1	.1	0	0	0	.2	8	0	0	0	0
25	.2	.1	.1	0	0	0	0	4	0	0	0	0
26	.2	.1	.1	0	0	88	0	2	0	0	0	0
27	.2	.1	.1	0	0	33	0	0	0	0	0	0
28	.2	.1	.1	0	0	27	0	0	0	0	0	0
29	.2	.....	.1	0	0	21	0	0	0	0	0	0
30	.2	.....	.1	0	0	21	21	0	0	0	0	0
31	.2	.....	.1	.....	0	.....	1,640	0	.....	0	.....	0

NOTE.—These discharges were obtained as follows: Jan. 1–31, based on a rating curve which is well defined; Feb. 1–June 25, estimated from hydrographer's notes; June 26–July 30, based on a rating curve which is fairly well defined; July 31–Sept. 3, indirect method for shifting channels. There may have been some flow at times during the periods for which zero flow is given, but if so, it was practically negligible.

Monthly discharge of Ute Creek near Logan, N. Mex., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	1,590	0.2	101	6,210	B.
February	.2	.1	.14	8	C.
March	.1	.1	.10	6	C.
April	0	0	0	0	
May	0	0	0	0	
June	88	0	6.33	377	C.
July	6,280	0	858	52,800	B.
August	3,530	0	425	26,100	B.
September	6	0	.20	12	C.
October	0	0	0	0	
November	0	0	0	0	
December	0	0	0	0	
The year	6,280	0	118	85,500	

YAZOO RIVER DRAINAGE BASIN.

DESCRIPTION.

Yazoo River is formed by the union of Tallahatchie and Yalobusha rivers just above Greenwood, Miss., whence it flows southward and southwestward to its junction with the Mississippi at Vicksburg.

Tallahatchie River and its large tributary Coldwater River rise in the northern part of Mississippi. Yokona River, also an important tributary of the Tallahatchie, comes in from the east just above the mouth of the Coldwater. Yalobusha River rises in the northern part of the State, farther east than the other tributaries. Sunflower River, which empties into the Yazoo about 20 miles above Vicksburg, drains a narrow basin along the upper western border of the State which is cut off from Mississippi River by the levees.

The drainage area may be divided into two distinct parts, the delta and the hill lands. The delta comprises a strip of land east of the Mississippi extending from the State line on the north to Vicksburg on the south, about 60 miles wide at the center and decreasing in width to about 5 miles at either end. The hill lands comprise the portion of the drainage area located to the east of the delta. The entire delta is traversed by many small streams and bayous and contains numerous so-called lakes, which are really old river channels. During high-water periods the natural channels carry water from one stream to another, and large areas are covered by overflow water.

Except for the land that has been cleared for cultivation—at present a relatively small amount—the drainage area is forested. The mean annual precipitation is about 50 inches. Yazoo River is navigable for its entire length, and most of the larger tributaries are navigable for small boats. The tributaries are used to some extent for logging.

The data collected in the drainage basin are of value for drainage and navigation problems. The Tallahatchie drainage commission is engaged in a drainage project in the upper portion of the basin.

TALLAHATCHIE RIVER AT BATESVILLE, MISS.

This station, which is located at the county highway bridge 1 mile west of Batesville and about 2 miles below the crossing of the Illinois Central Railroad, was established on June 15, 1906. The record has been continuous since that time except for a break from August 1 to September 19, 1906. The station is now maintained in connection with the Tallahatchie drainage commission.

The ground on the right bank is low for a mile or more, but the road has been raised above high water except at a number of bridged openings.

Discharge measurements can be conveniently made at all stages, and the relation between gage heights and discharge should be fairly constant. A chain gage attached to the bridge is used, the datum of which has remained the same.

Discharge measurements of Tallahatchie River at Batesville, Miss., in 1910.

[By engineers of the Tallahatchie drainage commission.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 1...	210	2,140	14.04	5,600	Apr. 20..	185	1,700	10.54	4,300
Apr. 18..	173	1,460	9.44	3,500	21..	188	1,780	11.17	4,830
19..	181	1,610	9.98	4,030					

Daily gage height, in feet, of Tallahatchie River at Batesville, Miss., for 1910.

[J. S. Goff, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.4	4.9	14.1	3.9	4.6	8.5	4.5	4.1	3.3	2.4	2.4	2.8
2	4.2	4.8	13.3	3.9	4.4	6.9	5.7	3.9	3.7	2.4	2.4	2.8
3	3.9	5.0	12.3	3.9	4.1	4.8	7.7	3.9	3.6	2.4	2.4	2.8
4	3.7	5.2	11.4	3.8	4.0	4.2	7.9	3.7	3.4	2.4	2.5	2.8
5	6.0	4.7	10.6	3.9	3.8	4.5	7.9	3.6	3.2	2.6	2.5	2.8
6	12.1	4.6	9.7	3.8	3.7	4.0	7.7	3.5	3.0	2.4	2.5	3.5
7	10.9	4.6	8.9	3.9	3.7	3.7	7.9	4.0	3.0	2.5	2.5	3.2
8	9.1	4.6	8.0	4.0	3.6	3.6	12.6	4.8	3.0	2.7	2.5	3.9
9	8.8	4.4	7.4	4.1	3.5	4.0	14.4	4.1	3.0	3.0	2.5	3.2
10	8.4	4.3	6.6	3.8	3.4	11.6	14.6	4.5	3.0	2.8	2.5	3.2
11	8.6	4.2	5.7	3.7	3.4	9.5	16.3	4.3	3.0	2.7	2.5	3.2
12	9.3	4.1	5.3	3.6	3.4	8.9	17.1	3.9	2.9	2.8	2.5	3.2
13	9.2	4.1	5.0	3.5	3.3	8.7	16.6	4.0	2.8	2.7	2.5	3.1
14	9.1	4.0	4.8	3.4	3.2	8.6	15.9	4.2	2.8	2.7	2.5	3.0
15	9.7	4.1	4.7	9.2	3.2	8.6	15.1	3.8	2.7	2.7	2.5	2.8
16	9.3	4.7	4.6	8.7	3.1	8.9	14.2	3.6	2.7	3.0	2.5	2.8
17	9.1	5.2	4.4	9.3	4.0	8.5	13.2	3.5	2.7	2.8	2.4	2.8
18	8.4	6.1	4.3	9.4	3.4	8.1	13.8	3.4	2.7	2.7	2.4	2.7
19	8.2	7.2	4.2	9.8	3.3	8.6	14.6	3.3	2.6	2.8	2.4	2.7
20	8.0	7.4	4.1	10.3	4.9	8.6	12.7	4.0	2.6	2.7	2.4	2.7
21	9.5	10.7	4.1	11.0	6.1	6.5	10.9	6.2	2.6	2.7	2.4	2.7
22	8.4	11.1	4.0	11.6	7.1	4.6	9.5	3.3	2.5	2.7	2.4	2.6
23	8.3	11.3	4.0	12.0	7.6	4.5	7.7	3.2	2.5	2.6	2.4	3.1
24	8.3	11.5	3.9	11.9	8.0	4.0	7.0	4.6	2.5	2.6	2.4	3.3
25	8.4	11.9	3.9	11.4	9.5	3.9	12.6	4.5	2.5	2.5	2.4	3.3
26	8.5	12.8	3.9	10.7	8.6	4.3	10.4	4.0	2.4	2.5	2.4	3.3
27	8.4	13.9	3.8	8.9	8.7	4.4	8.1	3.5	2.5	2.5	2.5	3.3
28	8.2	14.5	3.9	7.0	9.0	4.5	5.7	3.7	2.6	2.4	2.5	3.4
29	8.0	.....	3.9	6.4	9.1	4.9	4.8	3.9	2.4	2.4	2.5	4.8
30	7.6	.....	3.9	4.9	9.2	4.4	4.4	3.8	2.4	2.4	2.5	5.7
31	7.3	.....	3.9	.....	9.1	.....	4.2	3.5	.....	2.4	.....	5.4

Daily discharge, in second-feet, of Tallahatchie River at Batesville, Miss., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,100	1,290	7,390	919	1,170	2,970	1,140	991	713	425	425	549
2	1,030	1,250	6,550	919	1,100	2,140	1,600	919	849	425	425	549
3	919	1,320	5,640	919	991	1,250	2,540	919	815	425	425	549
4	849	1,400	4,900	883	955	1,030	2,650	849	747	425	455	549
5	1,730	1,210	4,320	919	883	1,140	2,650	815	679	485	455	549
6	5,480	1,170	3,700	883	849	955	2,540	781	613	425	455	781
7	4,530	1,170	3,200	919	849	849	2,650	955	613	455	455	679
8	3,320	1,170	2,700	955	815	815	5,910	1,250	613	517	455	919
9	3,140	1,100	2,390	991	781	955	7,720	991	613	613	455	679
10	2,920	1,060	2,000	883	747	5,060	7,950	1,140	613	549	455	679
11	3,020	1,030	1,600	849	747	3,570	10,200	1,060	613	517	455	679
12	3,440	991	1,440	815	747	3,200	11,400	919	581	549	455	679
13	3,380	991	1,320	781	713	3,080	10,700	955	549	517	455	645
14	3,320	955	1,250	747	679	3,020	9,620	1,030	549	517	455	613
15	3,700	991	1,210	3,380	679	3,020	8,550	883	517	517	455	549
16	3,440	1,210	1,170	3,080	645	3,200	7,500	815	517	613	455	549
17	3,320	1,400	1,100	3,440	955	2,970	6,460	781	517	549	425	549
18	2,920	1,770	1,060	3,500	747	2,750	7,060	747	517	517	425	517
19	2,800	2,290	1,030	3,760	713	3,020	7,950	713	485	549	425	517
20	2,700	2,390	991	4,110	1,290	3,020	6,000	955	485	517	425	517
21	3,570	4,390	991	4,600	1,770	1,950	4,530	1,820	485	517	425	517
22	2,920	4,680	955	5,060	2,240	1,170	3,570	713	455	517	425	485
23	2,860	4,820	955	5,390	2,490	1,140	2,540	679	455	485	425	645
24	2,860	4,980	919	5,300	2,700	955	2,190	1,170	455	485	425	713
25	2,920	5,300	919	4,900	3,570	919	5,910	1,140	455	455	425	713
26	2,970	6,090	919	4,390	3,020	1,060	4,180	955	425	455	425	713
27	2,920	7,170	883	3,200	3,080	1,100	2,750	781	455	455	455	713
28	2,800	7,830	919	2,190	3,260	1,140	1,600	849	485	425	455	747
29	2,700	.....	919	1,910	3,320	1,290	1,250	919	425	425	455	1,250
30	2,490	.....	919	1,290	3,380	1,100	1,100	883	425	425	455	1,600
31	2,340	.....	919	.....	3,320	.....	1,030	781	.....	425	.....	1,480

NOTE.—These discharges were obtained from a rating curve which is well defined.

Monthly discharge of Tallahatchie River at Batesville, Miss., for 1910.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January	5,480	849	2,850	A.
February	7,830	955	2,550	A.
March	7,390	883	2,100	A.
April	5,390	747	2,400	A.
May	3,570	645	1,590	A.
June	5,060	815	1,990	A.
July	11,400	1,030	4,950	A.
August	1,820	679	941	A.
September	849	425	557	A.
October	613	425	490	B.
November	455	425	442	B.
December	1,600	485	706	A.
The year	11,400	425	1,800	

TALLAHATCHIE RIVER AT PHILIPP, MISS.

This station is located at the Yazoo & Mississippi Valley Railroad bridge at Philipp. It was established September 6, 1908, for the purpose of obtaining run-off data in connection with the work of the Tallahatchie drainage commission.

The stream above the station will at times overflow the surrounding country for a distance of several miles on either side. The overflow,

however, with small exceptions, is intercepted by the railroad embankment and is made to flow in the main channel at the gaging station, and a few trestled openings in the railroad embankment. Variations in the relative stage of the river below the station will probably so affect the slope as to disturb the relation between gage heights and discharge. Judging by the plotting of the discharge measurements so far made, this disturbance does not appear to be great.

The datum of the gage, which is a vertical staff, is mean sea level; the gage readings therefore represent elevations above sea level. Measurements are made from the downstream side of the railway bridge.

Discharge measurements of Tallahatchie River at Philipp, Miss., in 1910.

[By engineers of the Tallahatchie drainage commission.]

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 4	240	4,370	120.4	9,650
10	275	5,030	130.7	10,900

Daily gage height, in feet, of Tallahatchie River at Philipp, Miss., for 1910.

[J. P. Mahoney, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	123.6	129.2	119.1	116.5	130.0	128.0	124.0	133.7	115.5	112.5	112.4	112.1
2	123.5	129.0	120.2	116.2	130.2	128.0	123.5	133.5	115.3	112.5	112.3	112.2
3	123.2	128.9	120.3	116.0	130.3	127.9	123.5	133.0	114.9	112.4	112.3	112.2
4	122.7	128.4	120.4	115.8	130.3	127.7	124.0	132.6	114.6	112.4	112.2	112.3
5	122.0	127.9	120.5	115.8	130.3	127.9	124.6	132.0	114.6	112.4	112.2	112.6
6	122.0	127.3	120.9	115.9	130.2	126.0	125.5	131.5	114.7	112.5	112.2	112.9
7	122.9	126.3	130.0	116.6	129.8	124.6	126.5	130.8	114.7	113.0	112.2	113.2
8	124.0	125.0	130.4	117.2	129.2	123.3	127.3	129.8	114.8	114.4	112.2	113.6
9	125.0	123.5	130.6	117.7	128.4	121.4	128.3	128.8	115.0	114.8	112.2	113.5
10	125.8	122.0	130.7	118.1	127.0	121.7	129.0	127.5	115.1	115.0	112.2	113.5
11	126.4	120.9	130.8	118.3	125.4	122.3	129.7	126.0	115.0	115.2	112.2	113.4
12	126.7	119.7	130.8	118.3	123.6	122.3	130.5	124.4	114.7	115.1	112.2	113.3
13	127.0	118.7	130.8	117.6	121.5	123.0	131.3	122.9	114.4	115.0	112.2	113.3
14	127.5	118.0	130.8	117.3	119.9	123.5	132.0	121.4	114.1	114.7	112.2	113.2
15	127.6	117.6	130.6	117.6	118.5	124.0	132.6	120.0	113.7	115.0	112.2	113.2
16	127.7	117.1	130.5	120.4	117.4	124.5	133.0	118.8	113.5	114.6	112.2	113.1
17	127.8	117.6	130.3	123.0	116.8	124.7	133.4	117.9	113.3	114.9	112.2	113.0
18	128.0	118.8	130.0	124.7	116.6	125.0	133.6	117.4	113.1	114.5	112.2	112.8
19	128.0	118.8	129.5	125.7	117.2	125.4	133.8	116.8	113.0	114.1	112.2	112.7
20	128.2	118.9	129.0	126.5	117.7	125.6	133.9	116.3	113.0	114.6	112.1	112.6
21	128.6	118.9	128.0	127.0	118.9	125.8	134.0	116.0	112.9	115.0	112.1	112.6
22	128.7	119.1	127.0	127.5	121.2	126.3	134.1	117.5	112.9	114.8	112.1	112.5
23	128.9	119.2	125.7	127.9	122.5	126.5	134.2	118.5	112.8	114.5	112.1	112.5
24	129.0	119.3	124.0	128.3	123.7	126.7	134.3	118.4	112.8	114.2	112.1	113.1
25	129.1	119.5	122.5	128.5	124.8	127.0	134.3	118.8	112.8	113.6	112.1	113.7
26	129.2	119.6	121.0	128.9	125.8	126.4	134.3	118.9	112.7	113.2	112.1	114.1
27	129.3	119.8	119.5	129.0	126.9	125.8	134.3	118.2	112.7	113.0	112.1	114.2
28	129.4	119.9	118.6	129.4	127.1	125.5	134.2	117.4	112.6	112.8	112.1	114.3
29	129.5	.....	117.8	129.6	127.5	125.4	134.0	116.5	112.5	112.6	112.1	114.5
30	129.4	.....	117.3	129.9	127.7	124.6	133.9	115.7	112.5	112.5	112.1	114.8
31	129.3	.....	116.7	.....	127.9	.....	133.8	115.5	.....	112.4	.....	115.9

Daily discharge, in second-feet, of Tallahatchie River at Philipp, Miss., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6,160	9,520	3,510	2,260	10,000	8,800	6,400	13,500	1,880	1,030	1,010	956
2	6,100	9,400	4,120	2,140	10,100	8,800	6,100	13,200	1,800	1,030	990	972
3	5,920	9,340	4,180	2,060	10,200	8,740	6,100	12,500	1,660	1,010	990	972
4	5,620	9,040	4,240	1,980	10,200	8,620	6,400	12,000	1,560	1,010	972	990
5	5,200	8,740	4,300	1,980	10,200	8,740	6,760	11,400	1,560	1,010	972	1,050
6	5,200	8,380	4,540	2,020	10,100	7,600	7,300	11,000	1,600	1,030	972	1,110
7	5,740	7,780	10,000	2,300	9,880	6,760	7,900	10,500	1,600	1,130	972	1,170
8	6,400	7,000	10,200	2,570	9,520	5,980	8,380	9,880	1,630	1,500	972	1,270
9	7,000	6,100	10,400	2,800	9,040	4,840	8,980	9,280	1,700	1,630	972	1,250
10	7,480	5,200	10,400	2,990	8,200	5,020	9,400	8,500	1,740	1,700	972	1,250
11	7,840	4,540	10,500	3,100	7,240	5,380	9,820	7,600	1,700	1,770	972	1,220
12	8,020	3,840	10,500	3,100	6,160	5,380	10,300	6,640	1,600	1,740	972	1,200
13	8,200	3,300	10,500	2,750	4,900	5,800	10,800	5,740	1,500	1,700	972	1,200
14	8,500	2,940	10,500	2,620	3,950	6,100	11,400	4,840	1,410	1,600	972	1,170
15	8,560	2,750	10,400	2,750	3,200	6,400	12,000	4,000	1,300	1,700	972	1,170
16	8,620	2,520	10,300	4,240	2,660	6,700	12,500	3,360	1,250	1,560	972	1,150
17	8,680	2,750	10,200	5,800	2,390	6,820	13,000	2,890	1,200	1,660	972	1,130
18	8,800	3,360	10,000	6,820	2,300	7,000	13,400	2,660	1,150	1,530	972	1,090
19	8,800	3,360	9,700	7,420	2,570	7,240	13,700	2,390	1,130	1,410	972	1,070
20	8,920	3,410	9,400	7,900	2,800	7,360	13,900	2,180	1,130	1,560	956	1,050
21	9,160	3,410	8,800	8,200	3,410	7,480	14,100	2,060	1,110	1,700	956	1,050
22	9,220	3,510	8,200	8,500	4,720	7,780	14,300	2,700	1,110	1,630	956	1,030
23	9,340	3,570	7,420	8,740	5,500	7,900	14,500	3,200	1,090	1,530	956	1,030
24	9,400	3,620	6,400	8,980	6,220	8,020	14,800	3,150	1,090	1,440	956	1,150
25	9,460	3,730	5,500	9,100	6,880	8,200	14,800	3,360	1,090	1,270	956	1,300
26	9,520	3,780	4,600	9,340	7,480	7,840	14,800	3,410	1,070	1,170	956	1,410
27	9,580	3,890	3,730	9,400	8,140	7,480	14,800	3,040	1,070	1,130	956	1,440
28	9,640	3,950	3,250	9,640	8,260	7,300	14,500	2,660	1,050	1,090	956	1,470
29	9,700	.....	2,840	9,760	8,500	7,240	14,100	2,260	1,030	1,050	956	1,530
30	9,640	.....	2,620	9,940	8,620	6,760	13,900	1,940	1,030	1,030	956	1,630
31	9,580	.....	2,340	.....	8,740	.....	13,700	1,880	.....	1,010	.....	2,020

NOTE.—These discharges were obtained from a rating curve which is fairly well defined between 1,100 and 9,400 second-feet. Above 9,400 second-feet the rating is only approximate, as the stage of the river below causes much variation in slope and the higher measurements include large amounts of overflow which was very roughly measured.

Monthly discharge of Tallahatchie River at Philipp, Miss., for 1910.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January	9,700	5,200	8,060	A.
February	9,520	2,520	5,100	A.
March	10,500	2,340	7,210	A.
April	9,940	1,980	5,370	A.
May	10,200	2,300	6,840	A.
June	8,800	4,840	7,140	A.
July	14,800	6,100	11,400	B.
August	13,500	1,880	5,930	A.
September	1,880	1,030	1,360	A.
October	1,770	1,010	1,370	B.
November	1,010	956	969	B.
December	2,020	956	1,210	B.
The year	14,800	956	5,180	

YAZOO RIVER AT GREENWOOD, MISS.

This station, which is located at the highway bridge at Greenwood, a point about 1 mile below the junction of Yalobusha River, was established July 15, 1908, for the purpose of obtaining general run-off data applicable to navigation and drainage problems, and is maintained in cooperation with the Tallahatchie drainage commission.

There are no artificial diversions of water above the station, and all natural diversions return to river above unless at extreme floods some overflow water may be lost to Sunflower River. The conditions at the station are favorable for accurate discharge measurements at all stages, but it is expected that the relation between gage heights and discharges will be greatly disturbed by changes in slope of Yazoo River, caused by varying stages of Mississippi River.

The chain gage is fastened to the downstream handrail of the bridge. Its datum is mean sea level and has not been changed. Discharge measurements are made from this bridge. The United States Weather Bureau has maintained a gage here since November 1, 1904, the datum of which was 92.5 feet above sea level.

Daily gage height, in feet, of Yazoo River at Greenwood, Miss., for 1910.

[W. T. Davis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	103.73	111.03	113.90	98.69	108.69	108.99	106.42	117.85	97.04	93.93	93.93	93.56
2	103.53	110.58	114.12	98.13	108.73	108.73	106.28	117.64	96.80	93.85	93.84	93.56
3	103.29	110.14	114.29	97.75	108.77	108.35	106.13	117.09	96.48	93.81	93.77	93.56
4	102.93	109.70	114.42	97.46	108.85	107.95	106.55	116.49	96.13	93.76	93.73	93.61
5	102.54	109.20	114.55	97.29	108.91	107.74	107.14	115.89	95.88	93.75	93.72	93.70
6	103.09	108.67	114.63	97.19	108.89	107.46	108.21	115.28	95.90	94.08	93.70	93.91
7	105.45	107.99	114.67	97.27	108.80	106.86	109.31	114.62	96.06	96.13	93.70	94.22
8	106.73	107.14	114.59	97.54	108.58	105.99	110.22	114.02	96.00	97.88	93.70	94.88
9	107.10	106.11	114.40	97.94	108.16	104.91	110.99	113.25	95.93	97.89	93.70	95.10
10	107.46	104.96	114.05	98.28	107.56	103.93	111.71	112.42	95.89	97.23	93.70	94.96
11	107.89	103.80	113.62	98.56	106.68	103.84	112.59	111.40	95.88	96.84	93.68	94.91
12	108.25	102.66	113.16	98.71	105.51	104.73	113.66	110.31	95.82	96.56	93.66	94.80
13	108.44	101.55	112.74	98.63	104.14	105.23	114.83	109.09	95.64	96.56	93.66	94.67
14	108.46	100.61	112.31	98.39	102.70	105.48	115.92	107.58	95.39	97.34	93.65	94.57
15	108.36	99.78	112.94	98.26	101.24	105.64	116.87	106.07	95.12	98.53	93.62	94.53
16	108.29	99.07	111.61	100.06	99.96	105.77	117.55	104.64	94.85	98.63	93.61	94.46
17	108.19	100.95	111.29	102.96	98.96	105.75	118.04	103.32	94.66	98.00	93.60	94.36
18	108.06	106.05	110.97	105.16	98.11	105.65	118.49	102.05	94.52	97.29	93.58	94.27
19	107.98	107.79	110.61	106.60	97.75	105.61	118.94	100.76	94.40	96.59	93.56	94.14
20	108.38	108.08	110.18	107.60	97.94	106.70	119.21	99.62	94.30	96.07	93.54	94.06
21	110.69	108.83	109.69	108.32	98.74	107.50	119.28	100.16	94.20	95.94	93.54	93.96
22	111.93	110.39	109.03	108.74	101.34	107.64	119.29	101.41	94.14	95.94	93.52	93.90
23	111.98	111.29	108.17	108.92	104.24	107.78	119.28	101.43	94.09	95.84	93.50	94.30
24	111.88	111.87	107.14	108.91	105.53	107.75	119.18	101.08	94.03	95.60	93.50	95.55
25	111.95	112.40	105.92	108.84	106.34	107.49	119.02	100.86	93.99	95.25	93.50	96.88
26	112.08	112.79	104.69	108.74	107.23	107.25	119.08	100.73	94.00	94.91	93.50	97.24
27	112.18	113.14	103.43	108.65	107.97	107.13	119.04	100.28	94.01	94.65	93.55	97.06
28	112.23	113.53	102.20	108.61	108.60	106.97	118.76	99.60	94.04	94.46	93.54	97.02
29	112.17	.....	101.13	108.62	109.08	106.73	118.42	98.90	94.01	94.24	93.54	96.85
30	111.93	.....	100.20	108.65	109.22	106.41	118.09	98.05	93.97	94.09	93.54	96.81
31	111.51	.....	99.39	.....	109.20	.....	117.83	97.41	.....	94.01	.....	96.98

COLDWATER RIVER AT SAVAGE, MISS.

This station is located at the Yazoo & Mississippi Valley Railroad bridge at Savage, about 5 miles below the place where the river leaves the hills and enters the delta. It was established July 1, 1908, for the purpose of determining the amount of water entering the delta from the foothills and is maintained in cooperation with the Tallahatchie drainage commission.

Although there are large overflow areas along the banks of the river, the flow is practically confined by the railroad embankments to the channel under the bridge and can be conveniently measured at all stages.

The gage, which consists of two vertical sections just below the bridge, is set on sea-level datum so as to read actual elevations. Measurements are made from the downstream side of the bridge.

The following discharge measurement was made by engineers of the Tallahatchie drainage commission:

February 25: Width, 280 feet; area of section, 3,600 square feet; gage height, 184.34 feet; discharge, 6,400 second-feet.

Daily gage height, in feet, of Coldwater River at Savage, Miss., for 1910.

[David J. Hill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	174.7	171.1	184.7	167.0	170.0	178.0	171.9	180.8	166.6	166.0	166.1	169.2
2	170.3	169.9	184.8	167.2	169.5	174.3	174.5	169.3	168.7	166.0	166.1	169.1
3	169.2	169.0	184.8	168.6	168.7	171.4	176.4	174.2	168.7	166.0	166.1	168.3
4	169.0	168.5	184.7	169.9	169.5	169.3	177.3	171.4	170.0	166.0	166.1	168.0
5	168.8	168.2	184.3	171.5	167.7	168.3	178.4	171.0	171.4	166.0	166.1	167.0
6	176.4	168.2	183.8	173.7	167.4	169.3	180.3	171.0	172.3	166.4	166.1	166.5
7	179.8	168.0	183.0	173.8	167.3	171.3	181.0	168.9	170.8	169.7	166.1	166.7
8	181.3	167.9	182.2	173.3	167.3	171.5	182.0	168.4	168.8	170.3	166.1	166.7
9	182.9	167.8	180.6	172.0	167.0	170.0	182.6	168.0	167.3	170.0	166.1	167.0
10	184.2	167.5	178.6	169.7	167.0	171.3	183.9	168.0	166.7	169.8	166.1	167.0
11	184.4	167.5	176.5	169.5	166.9	176.7	182.8	168.0	167.3	168.2	166.1	166.8
12	184.4	167.5	174.1	168.8	166.8	177.5	182.4	169.4	167.0	168.5	166.1	166.7
13	183.7	167.9	172.0	168.5	166.8	179.9	182.0	168.9	164.6	166.9	166.1	166.6
14	183.3	167.7	171.3	168.6	166.8	181.0	181.8	169.8	162.3	169.0	166.1	166.6
15	183.0	167.9	170.0	174.9	166.6	181.7	181.6	169.6	161.1	170.0	166.1	166.6
16	182.3	168.0	169.0	182.0	166.6	182.0	181.4	168.3	161.1	171.8	166.1	166.6
17	181.5	169.1	168.5	186.1	166.8	181.7	181.1	167.2	161.0	173.3	166.1	166.6
18	181.2	172.4	168.1	187.0	167.4	180.9	181.0	166.9	166.0	172.3	166.1	166.6
19	181.2	173.6	167.0	186.7	167.5	179.2	180.7	166.7	166.0	170.0	166.1	166.6
20	180.8	174.2	167.8	186.0	168.0	181.0	179.9	166.5	166.0	169.7	166.1	166.5
21	181.2	178.6	167.8	185.8	170.3	180.6	178.9	167.1	166.0	167.0	166.1	166.5
22	181.4	180.8	167.5	184.7	173.3	179.8	177.6	167.3	166.0	166.8	166.1	166.5
23	181.8	182.0	167.5	184.0	175.0	178.8	174.8	168.5	166.0	166.7	166.1	166.5
24	182.3	183.6	167.6	182.5	176.4	174.1	174.0	167.9	166.0	166.5	166.1	166.6
25	182.4	184.3	167.5	182.0	177.8	173.4	170.2	167.0	166.0	166.3	166.1	166.6
26	182.2	184.3	167.4	180.5	179.4	172.5	172.5	169.0	166.0	166.3	166.1	166.6
27	181.5	184.2	167.3	178.4	180.0	172.2	178.3	170.9	166.0	166.4	166.1	166.5
28	180.0	184.5	167.2	176.3	180.4	171.0	183.2	169.4	166.0	166.2	166.4	167.8
29	177.9	.....	167.0	173.8	180.7	169.8	183.6	168.6	166.0	166.2	166.5	167.8
30	174.9	.....	167.0	•175.0	180.6	169.7	183.2	167.5	166.0	166.1	166.5	170.5
31	172.7	.....	166.9	.....	180.0	.....	182.0	166.8	.....	166.1	.....	172.0

Daily discharge, in second-feet, of Coldwater River at Savage, Miss., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,240	607	8,630	230	482	2,180	711	3,390	206	170	176	400
2	515	471	8,870	244	430	1,150	1,190	410	356	170	176	390
3	400	380	8,870	348	356	644	1,680	1,130	356	170	176	324
4	380	340	8,630	471	430	410	1,940	644	482	170	176	300
5	364	316	7,920	657	279	324	2,320	595	644	170	176	230
6	1,680	316	6,970	1,020	258	410	3,140	595	771	194	176	200
7	2,910	300	5,450	1,040	251	631	3,500	372	571	450	176	212
8	3,680	293	4,350	945	251	657	4,180	332	364	515	176	212
9	5,270	286	3,290	725	230	482	4,800	300	251	482	176	230
10	7,730	265	2,400	450	230	631	7,160	300	212	460	176	230
11	8,110	265	1,700	430	224	1,760	5,100	300	251	316	176	218
12	8,110	265	1,110	364	218	2,010	4,550	420	230	340	176	212
13	6,780	293	725	340	218	2,960	4,180	372	104	224	176	206
14	6,020	279	631	348	218	3,500	4,020	460	36	380	176	206
15	5,450	293	482	1,290	206	3,940	3,880	440	21	482	176	206
16	4,440	300	380	4,180	206	4,180	3,740	324	21	697	176	206
17	3,800	390	340	11,300	218	3,940	3,560	244	20	945	176	206
18	3,620	787	308	13,000	258	3,440	3,500	224	170	771	176	206
19	3,620	1,000	293	12,500	265	2,640	3,340	212	170	482	176	206
20	3,390	1,130	286	11,200	300	3,500	2,960	200	170	450	176	200
21	3,620	2,400	286	10,800	515	3,290	2,520	237	170	230	176	200
22	3,740	3,390	265	8,680	945	2,910	2,040	251	170	218	176	200
23	4,020	4,180	265	7,350	1,310	2,480	1,260	340	170	212	176	200
24	4,440	6,590	272	4,660	1,680	1,110	1,080	293	170	200	176	206
25	4,550	7,920	265	4,180	2,110	964	504	230	170	188	176	206
26	4,350	7,920	258	3,240	2,730	803	803	380	170	188	176	206
27	3,800	7,730	251	2,320	3,000	755	2,280	583	170	194	176	200
28	3,000	8,300	244	1,650	3,190	595	5,830	420	170	182	194	286
29	2,140	.....	230	1,040	3,340	460	6,590	348	170	182	200	286
30	1,290	.....	230	1,310	3,290	450	5,830	265	170	176	200	548
31	837	.....	224	.....	3,000	.....	4,180	218	.....	176	.....	725

NOTE.—These discharges were obtained from a rating curve which is fairly well defined between 380 and 5,450 second-feet. Below 380 second-feet the curve is an approximate extension.

Monthly discharge of Coldwater River at Savage, Miss., for 1910.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January	8,110	364	3,650	B.
February	8,300	265	2,040	B.
March	8,870	224	2,400	B.
April	13,000	230	3,540	B.
May	3,340	206	988	B.
June	4,180	324	1,770	B.
July	7,160	504	3,300	B.
August	3,390	200	478	B.
September	771	20	237	B.
October	945	170	328	B.
November	200	176	178	B.
December	725	200	260	B.
The year	13,000	20	1,600	

YALOBUSHA RIVER AT GRENADA, MISS.

This station, which was established June 14, 1906, for the purpose of obtaining general run-off data, is located in the western part of Grenada at the county highway bridge, about one-half mile from the depot and the same distance below the crossing of the Illinois Central Railroad. It is below the mouth of Bataupan Bogue, which comes

in a short distance above the railroad bridge. The gage chain was stolen a second time on November 2, 1906, and the station was temporarily abandoned. On July 7, 1908, the station was again established in connection with the Tallahatchie drainage commission, using the same gage datum as formerly. The gage is located on the bridge.

The left bank is not liable to overflow. The ground on the right bank is low for a long distance, but is crossed by the public highway embankment, which is above high water except at a few bridged openings.

Conditions are favorable for accurate discharge measurements, which are made from the bridge. It is probable that the station rating will be somewhat affected by backwater from Yazoo River and also by shifting of the stream bed.

The following measurement was made by engineers of the Tallahatchie drainage commission:

February 28: Width, 160 feet; area of section, 2,420 square feet; gage height, 19.52 feet; discharge, 7,320 second-feet.

Daily gage height, in feet, of Yalobusha River at Grenada, Miss., for 1910.

[W. L. Hamby, observer.]

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	.....	1.9	1.75	5.0	7.9	3.0	1.75	1.45	1.5	1.5
2	4.1	.....	1.9	1.7	3.8	7.8	2.9	1.7	1.4	1.5	1.5
3	6.4	.....	1.9	1.7	2.5	13.0	2.8	1.65	1.35	1.5	1.5
4	9.4	.....	1.9	1.9	2.2	13.3	2.7	1.65	1.3	1.6	1.5
5	11.0	.....	2.05	1.75	3.1	13.4	2.45	1.8	1.3	1.65	1.5
6	13.4	.....	2.3	1.7	2.4	21.0	2.25	2.1	7.5	1.6	1.8
7	13.6	.....	2.3	1.65	2.0	23.4	6.0	2.05	8.5	1.55	2.0
8	12.1	.....	2.2	1.65	2.0	24.5	6.0	2.0	4.8	1.5	2.4
9	.....	.....	2.05	1.6	2.0	25.7	5.2	1.95	3.7	1.5	2.5
10	.....	.....	2.0	1.6	7.3	25.1	4.2	1.9	3.0	1.5	2.5
11	.....	.....	2.0	1.55	12.1	24.3	4.0	1.85	2.5	1.5	2.35
12	.....	.....	1.95	1.5	11.1	23.6	3.8	1.8	2.1	1.5	2.25
13	.....	3.4	2.0	1.45	9.8	22.7	3.4	1.75	6.0	1.5	2.1
14	.....	3.4	1.95	1.4	8.3	22.0	3.1	1.7	5.8	1.5	2.05
15	.....	3.3	4.0	1.4	7.0	21.0	2.9	1.6	4.2	1.5	2.0
16	.....	3.0	9.1	1.4	5.8	19.5	2.65	1.5	3.1	1.45	1.95
17	.....	2.8	11.1	1.5	4.5	17.7	2.4	1.4	2.9	1.45	1.85
18	.....	2.65	10.1	1.9	3.8	17.0	2.3	1.35	2.6	1.45	1.75
19	.....	2.55	9.0	1.9	3.5	16.3	2.2	1.3	2.3	1.45	1.7
20	.....	2.45	7.4	2.95	10.0	13.3	2.2	1.25	2.3	1.45	1.65
21	.....	2.4	6.4	6.9	12.3	7.8	7.0	1.2	2.8	1.45	5.1
22	.....	2.35	5.0	11.9	8.3	5.4	5.0	1.15	2.2	1.45	7.8
23	.....	2.3	4.1	12.8	5.8	4.2	5.0	1.15	1.8	1.45	7.7
24	.....	2.2	3.4	12.8	5.3	5.0	5.0	1.15	1.7	1.45	7.5
25	.....	2.15	3.0	15.1	6.0	9.8	4.4	1.15	1.6	1.45	7.0
26	.....	2.1	2.6	14.4	7.5	8.9	3.2	1.15	1.5	1.5	6.5
27	.....	2.1	2.35	11.6	5.4	7.1	2.9	1.15	1.5	1.5	5.9
28	.....	2.05	2.05	9.7	6.3	5.4	2.3	1.3	1.5	1.5	5.1
29	.....	2.05	1.95	8.3	7.4	4.6	2.05	1.5	1.5	1.5	4.4
30	.....	1.95	1.85	7.1	7.8	3.9	1.9	1.5	1.5	1.5	4.4
31	.....	1.9	.....	6.0	.....	3.4	1.8	.....	1.5	.....	7.1

Daily discharge, in second-feet, of Yalobusha River at Grenada, Miss., for 1910.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	465	.....	190	160	1,100	2,300	465	160	102	110	110
2	780	.....	190	150	690	2,250	440	150	95	110	110
3	1,630	.....	190	150	340	5,100	415	140	88	110	110
4	3,120	.....	190	190	265	5,260	390	140	80	130	110
5	4,000	.....	228	160	490	5,320	328	170	80	140	110
6	5,320	.....	290	150	315	10,900	278	240	2,100	130	170
7	5,430	.....	290	140	215	14,100	1,470	228	2,620	120	215
8	4,600	.....	265	140	215	15,800	1,470	215	1,020	110	315
9	.....	.....	228	130	215	17,600	1,160	202	660	110	340
10	.....	.....	215	130	2,020	16,700	815	190	465	110	340
11	.....	.....	215	120	4,600	15,400	750	180	340	110	302
12	.....	.....	202	110	4,060	14,400	690	170	240	110	278
13	.....	570	215	102	3,340	13,100	570	160	1,470	110	240
14	.....	570	202	95	2,520	12,100	490	150	1,390	110	228
15	.....	540	750	95	1,880	10,900	440	130	815	110	215
16	.....	465	2,960	95	1,390	9,260	378	110	490	102	202
17	.....	415	4,060	110	920	7,790	315	95	440	102	180
18	.....	378	3,500	190	690	7,340	290	88	365	102	160
19	.....	352	2,900	190	600	6,920	265	80	290	102	150
20	.....	328	2,060	452	3,450	5,260	265	72	290	102	140
21	.....	315	1,630	1,840	4,720	2,250	1,880	65	415	102	1,130
22	.....	302	1,100	4,500	2,520	1,240	1,100	60	265	102	2,250
23	.....	290	780	4,990	1,390	815	1,100	60	170	102	2,200
24	.....	265	570	4,990	1,200	1,100	1,100	60	150	102	2,100
25	.....	252	465	6,260	1,470	3,340	885	60	130	102	1,880
26	.....	240	365	5,870	2,100	2,840	515	60	110	110	1,670
27	.....	240	302	4,330	1,240	1,920	440	60	110	110	1,430
28	.....	228	228	3,280	1,590	1,240	290	80	110	110	1,130
29	.....	228	202	2,520	2,060	955	228	110	110	110	885
30	.....	202	180	1,920	2,250	720	190	110	110	110	885
31	.....	190	.....	1,470	.....	570	170	.....	110	.....	1,920

NOTE.—These discharges were obtained from a rating curve which is fairly well defined.

Monthly discharge of Yalobusha River at Grenada, Miss., for 1910.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
Jan. 1–8	5,430	465	3,170	A.
Mar. 13–31	570	190	335	B.
April	4,060	180	839	B.
May	6,260	95	1,450	A.
June	4,720	215	1,660	A.
July	17,600	570	6,930	A.
August	1,880	170	632	B.
September	240	60	126	C.
October	2,620	80	491	B.
November	140	102	110	C.
December	2,250	110	694	B.

SUNFLOWER RIVER NEAR RULEVILLE, MISS.

This station, which was established June 15, 1908, and is maintained in cooperation with the Tallahatchie drainage commission, is located at the new iron wagon bridge 3 miles southwest of Ruleville, Miss. The gage was not installed until early in October, 1908, and readings were then intermittent until the end of 1908.

The drainage area above the station is very flat and is cut by a number of small tributaries and bayous. The river at the station

and below has a very small amount of slope, making the current too sluggish for measurements at times. The amount of slope and consequently of velocity varies greatly with the stage of Mississippi River, making it impossible to rate the station in the usual way by basing daily discharges upon the daily gage heights.

As the gage, which consists of two vertical sections below the bridge, is set to sea-level datum, the gage readings are actual elevations above the sea. Measurements are made from the downstream side of the bridge.

Daily gage height, in feet, of Sunflower River near Ruleville, Miss., for 1910.

[W. E. McMathe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	100.50	99.70	104.45	98.60	99.52	99.62	100.00	99.38	98.00	97.00	97.00	97.00
2	100.15	99.60	104.68	98.60	99.42	99.48	100.50	99.28	98.00	97.00	97.00	97.00
3	99.65	99.62	104.75	98.60	99.32	99.25	102.50	99.18	98.00	97.00	97.00	97.00
4	99.35	99.52	104.55	98.60	99.22	99.48	104.35	98.95	98.00	97.00	97.00	97.00
5	100.00	99.42	104.35	99.15	99.12	98.88	105 55	98 78	98.00	97.00	97.00	97.00
6	104.00	99.32	104.10	100.35	98.95	98.78	106.50	98.58	98.00	97.00	97.00	97.00
7	108.10	99.22	103.60	100.75	98.78	98.68	107.85	98.48	98.00	97.00	97.00	97.00
8	109.75	99.12	103.25	100.80	98.62	98.58	109.60	98.38	98.00	97.00	97.00	97.00
9	109.38	98.00	102.45	100.65	98.52	98.48	109.90	98.28	98.00	97.00	97.00	97.00
10	108.10	98.00	101.60	100.55	98.42	98.38	109.50	98.18	98.00	97.00	97.00	97.00
11	106.70	98.00	100.60	100.50	98.32	98.28	109.10	98.05	98.00	97.00	97.00	97.00
12	105.85	98.05	100.25	100.50	98.22	98.32	108.15	98.00	98.00	97.00	97.00	97.00
13	104.70	98.25	100.05	100.50	98.12	98.42	107.20	98.00	97.95	97.00	97.00	97.00
14	103.30	98.38	99.48	100.50	98.00	98.52	106.30	98.00	97.75	97.00	97.00	97.00
15	102.80	98.42	99.82	102.65	98.00	98.65	106.00	98.00	97.55	97.00	97.00	97.00
16	102.05	98.52	99.72	106.00	98.00	98.78	106.00	98.00	97.50	97.00	97.00	97.00
17	101.35	98.60	99.62	107.90	98.00	98.95	105.60	98.00	97.50	97.00	97.00	97.00
18	100.60	98.60	99.52	107.95	98.00	99.00	104.75	98.00	97.38	97.00	97.00	97.00
19	100.60	98.80	99.45	107.25	98.22	99.10	103.75	98.00	97.28	97.00	97.00	97.00
20	101.50	99.60	99.38	106.20	98.35	99.35	102.85	98.00	97.18	97.00	97.00	97.00
21	103.35	100.65	99.28	104.80	98.48	99.40	102.10	98.00	97.05	97.00	97.00	97.00
22	104.15	102.00	99.18	103.85	98.90	99.32	101.45	98.00	97.00	97.00	97.00	97.00
23	104.30	103.90	99.05	103.05	99.50	99.22	100.90	98.00	97.00	97.00	97.00	97.00
24	104.30	104.85	98.92	102.25	99.90	99.12	100.72	98.00	97.00	97.00	97.00	97.00
25	104.30	104.85	98.82	101.10	100.35	99.10	100.58	98.00	97.00	97.00	97.00	97.00
26	103 90	104.65	98.72	100.25	100.80	99.35	100.42	98.00	97.00	97.00	97.00	97.00
27	102.75	104.40	98.62	100.05	100.85	99 55	100 32	98.00	97.00	97.00	97.00	97.00
28	101.90	104.40	98.60	99.85	100.60	99.75	100.22	98.00	97.00	97.00	97.00	97.00
29	101.30	.....	98.60	99.72	100.35	99.42	99.95	98.00	97.00	97.00	97.00	97.00
30	100.45	.....	98.60	99.62	100.10	99.75	99.58	98.00	97.00	97.00	97.00	97.00
31	99.70	.....	98.60	.....	99.75	.....	99.48	98.00	.....	97.00	.....	97.00

SUNFLOWER RIVER AT BAIRD, MISS.

This station, which is located at the Southern Railway bridge, one-half mile west of Baird, Miss., was established June 16, 1908, but the gage was not put in until October 4, 1908. It is maintained in cooperation with the Tallahatchie drainage commission.

Owing to the great variation in height of the outlet of Sunflower River into the Mississippi through the lower portion of Yazoo River and consequently in the slope of Sunflower River, there is no relation whatever between gage heights and discharge at this station.

As the gage, which consists of two vertical sections above the bridge, is set on a sea-level datum, the readings are elevations above sea level. Measurements are from the downstream side of the bridge.

The United States Army engineers have maintained a gage at this station for a portion of the time, and the gage heights prior to October 4, 1908, are from their records corrected to the sea-level datum of the new gage.

Daily gage height, in feet, of Sunflower River at Baird, Miss., for 1910.

[H. V. Finch, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	86.5	90.0	94.1	86.8	86.9	86.0	84.8	86.0	83.3	82.6	82.6	82.6
2	86.1	89.3	93.9	86.3	86.5	85.7	85.5	85.8	83.2	82.6	82.6	82.6
3	85.5	88.6	93.7	85.7	85.9	85.3	86.5	85.7	83.2	82.6	82.6	82.6
4	85.4	88.2	93.4	85.2	85.6	85.0	87.4	85.6	83.1	82.6	82.6	82.7
5	85.3	88.0	93.0	84.8	85.0	84.9	89.8	85.4	83.1	82.6	82.6	82.7
6	87.8	87.6	92.4	84.5	84.8	84.9	91.4	85.4	83.1	82.6	82.6	82.7
7	89.6	87.3	91.8	84.3	84.6	84.6	92.6	85.3	83.2	82.8	82.6	82.7
8	92.0	87.1	91.1	84.3	84.5	84.4	93.7	85.2	83.1	82.8	82.6	82.7
9	93.3	87 0	90 5	84.4	84.4	84.2	94.5	85.0	83.0	82.7	82.6	82.7
10	93.8	86.7	89.9	84.5	84.1	84.2	94.9	85.0	83.0	82.7	82.6	82.7
11	94.0	86.5	89.4	84.5	84.1	84.1	94.9	84.8	82.9	82.7	82.6	82.7
12	93.7	86.3	89.0	84.5	84.0	85.0	94.8	84.6	82.9	82.7	82.6	82.7
13	93.4	85.6	88.6	84.4	84.0	85.1	94.7	84.5	82.9	82.7	82.6	82.7
14	93.0	85.3	88.3	84.3	83.7	85.3	94.3	84.3	82.8	82.7	82.6	82.7
15	92.3	85.2	88.0	84.4	83.6	85.5	93.9	84.1	82.8	82.8	82.6	82.6
16	91.5	85.0	88.0	86.8	83.5	85.3	93.4	84.0	82.8	82.8	82.6	82.6
17	90.8	86.9	87.9	90.4	83.4	85.1	92.8	83.9	82.8	82.8	82.6	82.6
18	90.1	89.6	87.9	92.5	83.4	84.8	92.1	83.8	82.8	82.8	82.6	82.6
19	89.5	90.8	87.8	93.4	83.4	84.5	91.4	83.6	82.8	82.8	82.6	82.6
20	89.0	91.1	87.8	93.5	83.5	84.4	90.7	83.6	82.8	82.8	82.6	82.6
21	91.5	92.0	87.8	93.5	84.0	84.3	89.9	83.5	82.8	82.8	82.6	82.6
22	92.8	93.0	87.9	93.1	84.7	84.2	89.3	83.4	82.7	82.7	82.6	82.6
23	93.7	94.0	88.0	92.7	84.8	84.1	88.6	83.3	82.7	82.7	82.6	82.8
24	94.0	94.5	88.1	92.1	85.1	84.0	88.0	83.4	82.7	82.7	82.6	82.8
25	94.0	94.9	88.1	91.5	85.5	84.3	87.5	83.5	82.7	82.6	82.6	82.8
26	93.7	94.8	88.1	90.7	86.1	84.4	86.9	83.6	82.7	82.6	82.6	82.8
27	93.3	94.6	88.1	89.9	86.7	84.2	86.5	83.6	82.7	82.6	82.6	82.8
28	92.7	94.6	88.1	89.0	86.9	84.4	86.2	83.5	82.7	82.7	82.6	82.8
29	92.0	.....	87.9	88.0	86.8	84.4	85.9	83.5	82.7	82.7	82.6	82.8
30	91.3	.....	87.7	87.5	86.8	84.4	85.6	83.4	82.7	82.6	82.6	83.0
31	90.6	.....	87.3	.....	86.4	.....	85.3	83.3	.....	82.6	.....	83.0

RED RIVER DRAINAGE BASIN.

DESCRIPTION.

Red River is formed by several forks, all of which have their sources in northern Texas, and takes a general easterly direction along the northern boundary of Texas, and then turns toward the southeast, flows through a low swampy region in Louisiana, and enters the Mississippi not far from the southern boundary of the State of Mississippi.

North Fork and Salt Fork rise in the Panhandle of Texas and flow in a general southeasterly direction across the southwest corner of Oklahoma, uniting with Prairie Dog Fork a short distance above

Vernon, Tex. Elm Fork, rising in the same locality, joins North Fork 50 or 75 miles above its mouth. The flow ceases entirely in the late summer and fall in ordinary dry years, and most of the run-off from the basin is flood water from heavy rains. The drainage area consists of dry, semiarid plains varied by sand hills in some portions. The underlying rocks are sandstone, limestone, and gypsum in the upper portion, and granite where the streams pass through the Wichita Mountains.

Wichita River rises in Dickens County, flows northeastward, and joins the Red in Clay County.

Washita River rises in northern Texas, crosses southern Oklahoma and flows into Red River in the southern part of that State, about 10 miles from Denison, Tex.

Sulphur Fork of Red River rises in Hunt and Fanning counties, Tex., flows eastward, forming the boundary between Delta, Red River, and Bowie counties on the north, and Hopkins, Franklin, Titus, Morris, and Cass counties on the south, and joins Red River about 7 miles north of the Louisiana boundary line. The flow of this fork is exceedingly variable; during dry summers it ceases entirely, but enough water always remains standing in pools to water stock; during or immediately after protracted or unusually heavy rains the river becomes very wide and deep, floods its bottoms, and often occasions considerable loss of stock and damage to planters and to the railroads.

WICHITA RIVER AT WICHITA FALLS, TEX.

This station, which is located at the Fort Worth & Denver City Railway bridge at Wichita Falls, Tex., was established in September, 1910, and gage-height observations were begun on October 1, 1910. A standard chain gage was installed on this bridge by R. A. Thompson, chief engineer of the Wichita Falls & Northwestern Railway. Wichita River at this point has a sandy bottom, which shifts from time to time.

Discharge measurements of Wichita River at Wichita Falls, Tex., in 1910.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	J. D. Metcalfe	5.00	1,770
22	....do	4.00	809
24	....do	2.40	195
Nov. 24	....do	1.40	15

Daily gage height, in feet, of Wichita River at Wichita Falls, Tex., for 1910.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	1.1	1.4	1.2	11	1.1	1.2	1.1	21	5.0	1.5	1.6
2	1.1	1.4	1.2	12	1.1	1.2	1.1	22	4.1	1.5	1.6
3	1.0	1.3	1.2	13	1.1	1.2	1.2	23	3.4	1.5	1.5
4	1.0	1.3	1.2	14	1.1	1.2	1.3	24	2.5	1.4	1.5
5	1.0	1.3	1.2	15	1.1	1.2	1.3	25	2.2	1.3	1.5
6	1.0	1.3	1.1	16	1.1	1.4	1.3	26	2.0	1.3	1.4
7	1.0	1.3	1.1	17	1.3	1.4	1.3	27	1.8	1.3	1.4
8	1.0	1.3	1.1	18	1.2	2.2	1.4	28	1.6	1.2	1.4
9	1.0	1.3	1.1	19	1.2	2.0	1.5	29	1.5	1.2	1.3
10	1.1	1.2	1.1	20	1.6	1.8	1.6	30	1.4	1.2	1.3
								31	1.4	.....	1 2

MISCELLANEOUS MEASUREMENTS IN LOWER MISSISSIPPI RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the lower Mississippi River drainage basin during 1910:

Miscellaneous measurements in lower Mississippi River basin in 1910.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Oct. 26	East Fork of Arkansas River.	.....	Leadville, Colo.	.....	10.6
Aug. 30	Arkansas River	.....	Boone, Colo.	.....	286
Jan. 23	.....do.....	.....	La Junta, Colo.	.....	635
June 23	.....do.....	.....	.....do.....	.....	550
Oct. 26	Tennessee Fork of Arkansas River.	Arkansas River	Leadville, Colo.	.....	6.6
26	Lake Fork of Arkansas River.	.....do.....	.....do.....	.....	9.0
May 5	Lake Creek	.....do.....	Twin Lakes, Colo.	.....	116
July 19	.....do.....	.....do.....	.....do.....	.....	69
June 12	Clear Creek	.....do.....	Geibfried's ranch, Colo.	.....	236
Sept. 23	Middle Cottonwood Creek.	Cottonwood Creek	1 mile above junction with South Fork near Buena Vista, Colo.	.....	22.6
Feb. 26	Grape Creek	Arkansas River	Canon City, Colo.	1.45	38
Apr. 5	.....do.....	.....do.....	.....do.....	1.30	46
30	.....do.....	.....do.....	.....do.....	1.80	124
July 23	.....do.....	.....do.....	.....do.....	1.10	22
Aug. 11	.....do.....	.....do.....	.....do.....	1.38	23
17	.....do.....	.....do.....	.....do.....	1.32	20
Sept. 17	.....do.....	.....do.....	.....do.....	.....	28
Oct. 4	.....do.....	.....do.....	.....do.....	.....	25
28	.....do.....	.....do.....	.....do.....	.....	25
Nov. 24	.....do.....	.....do.....	.....do.....	.....	15
May 31	Oil or Fourmile Creek	.....do.....	Headgate Long Gulch Ditch, Colo.	.....	15
31	.....do.....	.....do.....	End of Garden Park, Colo.	.....	16.5
Apr. 12	.....do.....	.....do.....	At mouth, Colo.	.....	21
Sept. 10	.....do.....	.....do.....	.....do.....	.....	28
Oct. 31	.....do.....	.....do.....	.....do.....	.....	51
Apr. 2	East Fourmile Creek	Fourmile Creek	At junction with West Fourmile Creek, Colo.	.....	10.9
Mar. 3	North Cheyenne Creek	Fountain Creek	Colorado Springs, Colo.	.....	*a* 7
Apr. 22	St. Charles River	Arkansas River	Lime, Colo.	.....	148
Dec. 17	Canadian River	.....do.....	Maxwell City, N. Mex.	.....	*b* 2.5
Oct. 5	Rayado River	Cimarron River	6 miles above station at Abreu's ranch near Cimarron, N. Mex.	*c* 1.72	2.4
Oct. 22	Savoya River	Mora River	La Cueva, N. Mex.	.....	*a* 1.0
Dec. 20	Carrizo Creek	Ute Creek	Albert, N. Mex.	.....	*b*. 25

a Estimated.
b Estimated. Ice conditions.
c Distance of water surface from reference mark, which is lower end of outside, downward projecting point of rock near the upstream end of a vertical rock bank, about 200 yards below the forks of the river.

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