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

WATER-SUPPLY PAPER 357

SURFACE WATER SUPPLY OF THE UNITED STATES

1913

PART VII. LOWER MISSISSIPPI RIVER BASIN

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SURFACE WATER SUPPLY OF THE LOWER MISSISSIPPI RIVER BASIN FOR 1913.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of twelve reports presenting results of measurements of flow made on streams in the United States during 1913. Six of these reports contain data for the year ending September 30, and the other six for the calendar year, as indicated in the table on page 6.

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

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

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

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

Annual appropriations for the fiscal years ending June 30, 1895–1914.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1914, inclusive	150,000

In the execution of the work many private and State organizations have cooperated, either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected, and of the second kind on page 15.

Measurements of stream flow have been made at about 3,000 points in the United States, and also at many points in small areas in

Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. In July, 1913, about 1,380 gaging stations were being maintained by the Survey and the cooperating organizations, and many miscellaneous discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular water-supply papers from time to time.

PUBLICATIONS.

A report has been prepared for each year embodying the stream-flow data collected during that year. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119. Circulars are also available giving complete lists of the gaging stations maintained by the Survey to date, and a list of the reports relating to the water supply of the country.

Prior to 1902 gage heights and discharge measurements were published in water-supply papers or bulletins and estimates of monthly discharge in annual reports; since 1902 both classes of data have been published in water-supply papers, and they are now being published in twelve parts, as shown in the following table:

Papers on surface water supply of the United States, 1913.

Part.	No.	Title.	Year used.
I	351	North Atlantic basins	Calendar year.
II	352	South Atlantic and eastern Gulf of Mexico basins	Do.
III	353	Ohio River basin	Year ending Sept. 30.
IV	354	St. Lawrence River basin	Calendar year.
V	355	Upper Mississippi River and Hudson Bay basins	Year ending Sept. 30.
VI	356	Missouri River basin	Calendar year.
VII	357	Lower Mississippi River basin	Do.
VIII	358	Western Gulf of Mexico basins	Year ending Sept. 30.
IX	359	Colorado River basin	Calendar year.
X	360	Great Basin	Year ending Sept. 30.
XI	361	Pacific basins in California	Do.
XII	362	North Pacific basins	Do.

A list of reports containing stream-flow data is presented in the following table:

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

[A=Annual Report; B=Bulletin; WS=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.
WS 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.
WS 15	Descriptions, measurements, and gage heights, for eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, for western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, for eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, for Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332	do	1912.
WS 351 to 362	do	1913.

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

The table on page 8 gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1913. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for any station in the area covered by Part I are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, and 351, which contain records for the New England streams from 1903 to 1913. The year covered by the report is indicated at the head of the column in which the paper is listed.

Numbers of water-supply papers containing results of stream measurements, 1899–1913.

	1899 [a]	1900 [b]	1901	1902	1903	1904	1905	1906	1907–8	1909	1910	1911	1912	1913
North Atlantic coast	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125 [f] 167	[d] 165, [e] 166 [f] 167	[d] 201, [e] 202 [f] 203	241	261	281	301	321	351
South Atlantic coast and eastern Gulf of Mexico	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127	[f] 167, 168	[f] 203, 204	242	262	282	302	322	352
Ohio River basin	36	48, [h] 49	65, 75	83	98	128	169	205	243	263	283	303	323	353
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129	170	206	244	264	284	304	324	354
Hudson Bay and Upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, [k] 100	[j] 128, 130	171	207	245	265	285	305	325	355
Missouri River	[l] 36, 37	49, [m] 50	66, 75	84	99	130, [n] 131	172	208	246	266	286	306	326	356
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131	[j] 169, 173	[j] 205, 209	247	267	287	307	327	357
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248	268	288	308	328	358
Colorado River	[o] 37, 38	50	66, 75	85	100	133	175, [p] 177	211	249	269	289	309	329	359
Great Basin	38, [q] 39	51	66, 75	85	100	133, [r] 134	176, [r] 177	212, [r] 213	250, [r] 251	270, [r] 271	290, [r] 291	310	330	360
California	38, [s] 39	51	66, 75	85	100	134	177	213	251	271	291	311	331	361
North Pacific coast	38	51	66, 75	85	100	135	[t] 177, 178	214	252	272	292	312	[u] 332	[u] 362

[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.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Hudson Bay only.
[l] Gallatin River.
[m] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[n] Platte and Kansas rivers.
[o] Green and Gunnison rivers and Grand River above junction with Gunnison.
[p] Below junction with Gila.
[q] Mohave River only.
[r] Great Basin in California, excepting Truckee and Carson drainage basins.
[s] Kings and Kern rivers only.
[t] Rogue, Umpqua, and Siletz rivers only.
[u] In the three parts: *A*, Pacific basins in Washington and Upper Columbia River; *B*, Snake River; *C*, Lower Columbia River and Rogue, Umpqua, and Siletz rivers.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

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

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

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

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Albany, N. Y., room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., Capitol Building.
Newport, Ky., Federal Building. (Temporarily discontinued.)
St. Paul, Minn., Old Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 328 Customhouse.
Phoenix, Ariz., Fleming Building.
Santa Fe, N. Mex., Capitol Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

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 discharge in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off (depth in inches), acre-feet, and millions of cubic feet. The units used in this series of reports are second-foot, second-feet per square mile, run-off in inches, acre-foot, and millions of cubic feet. They may be defined as follows:

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

unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 10–12).

"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 (depth 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.

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

"Millions of cubic feet" is used to express quantities of water stored in reservoirs, most frequently in studies of flood control.

The following terms used in these reports are not in common use, and may be defined as follows:

"Discharge relation" is an abbreviation for the term "relation of gage height to discharge."

"Control," "controlling section," and "point of control" are terms used to designate the section or sections of the stream below the gage which determines the discharge relation at the gage. It should be noted that the control may not be the same section at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

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

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge in second-feet per square mile.	Run-off in inches.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply the values for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge in second-feet.	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply values for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge in second-feet.	Run-off in millions of cubic feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.024	10.368	10.712
5	.4320	12.095	12.530	12.960	13.390
6	.5184	14.514	15.036	15.552	16.068
7	.6048	16.933	17.542	18.144	18.746
8	.6912	19.352	20.048	20.736	21.424
9	.7776	21.771	22.554	23.328	24.102

NOTE.—For part of a month multiply values for one day by the number of days.

1 second-foot equals 40 California miner's inches (law of March 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 646,317 gallons for one day.

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 equals 86,400 cubic feet.

1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.

1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.

1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.

1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.

1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.

100 California miner's inches equals 18.7 United States gallons per second.

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 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 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 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal 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 regular current-meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage heights, table of daily discharge, table of monthly and yearly discharge and run-off. For stations located at weirs or dams the gage-height table is usually 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 table of daily gage height shows the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day, usually in the morning and in the evening, though at many stations only one reading is made each day. At a comparatively few stations automatic gages are used, some of which give a continuous record of the river stage in the form of a hydrograph and others a record printed at regular intervals, from which the mean daily gage height can be computed. 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 bears no relation to zero flow or the bottom of the river. In general the zero is placed somewhat below the lowest known flow, so that negative readings shall not occur.

In the tables of daily gage height the use of zeros in the hundredths place indicates the limits of accuracy to which the gage was read and to which the mean daily gage height was computed. If a gage is read to tenths or half tenths once a day or to tenths twice a day, no zeros appear in the hundredths place for any stage. If the gage is read to half tenths twice a day or to quarter tenths or hundredths, regardless of the number of readings a day, the gage heights are published to hundredths, and zeros appear in the hundredths place, below a certain limiting stage. This limiting stage is so selected that the average error in the mean daily discharge, resulting from not using the mean daily gage height to hundredths above that stage, shall not be greater than 2 per cent. For automatic gages the allowable average error of the daily discharge has been taken as 1 per cent. The selection of the percentage is arbitrary, but it should be noted that the maximum error will in all cases be twice the average error. In like manner half tenths are used from the hundredths limit to another higher limit, above which only tenths are used. It is the aim to have the gage-height observations at each gaging station recorded to the degree of refinement required by the above method of use, but in practice it is found necessary, in order to avoid confusion in the gage observer's record, to have the observations for all stages recorded to the degree of refinement required for low stages, which usually necessitates readings to hundredths of a foot.

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 tables of daily gage heights and daily discharge by plotting gage heights in feet as ordinates and discharge in second-feet as abscissas.

The table of daily discharge determined from the rating table gives the discharge in second-feet corresponding to the mean of the gage readings observed each day.

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 at "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 base data presented in this report, unless otherwise stated in description of station, have been collected by the methods commonly used at current-meter gaging stations and described in standard textbooks. (See Pls. I and II.)

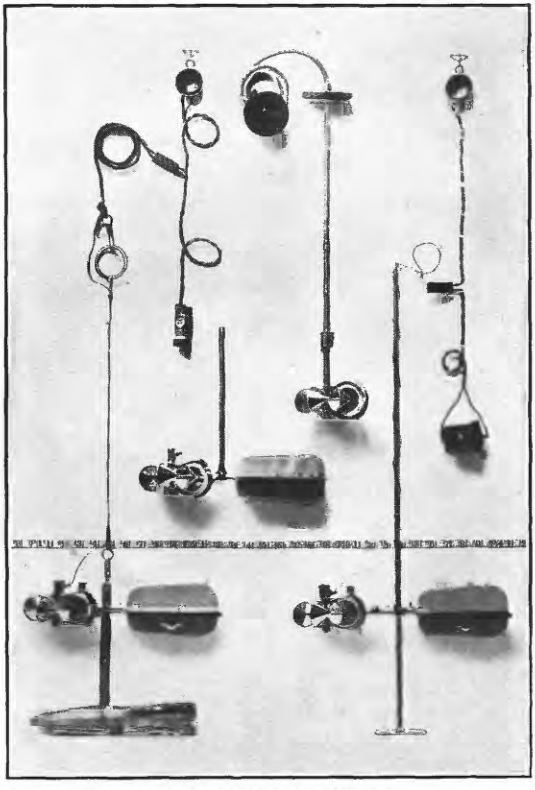
ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

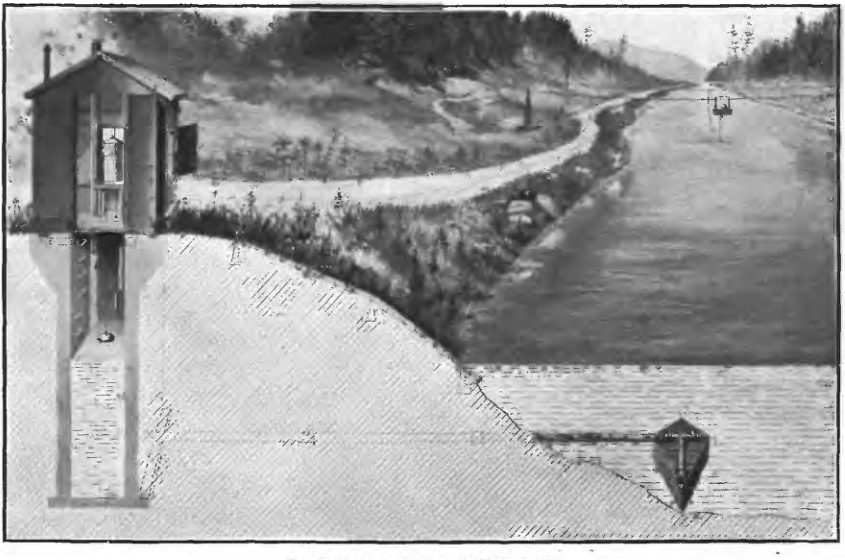
In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables, "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, the number of gage readings per day, the range of the fluctuation in stage, 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.

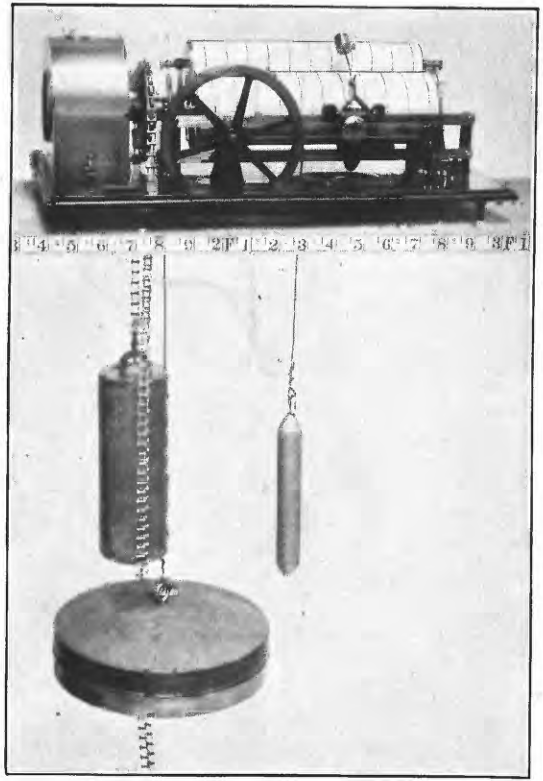
Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors, which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use. On this account the computations of "second-feet per square



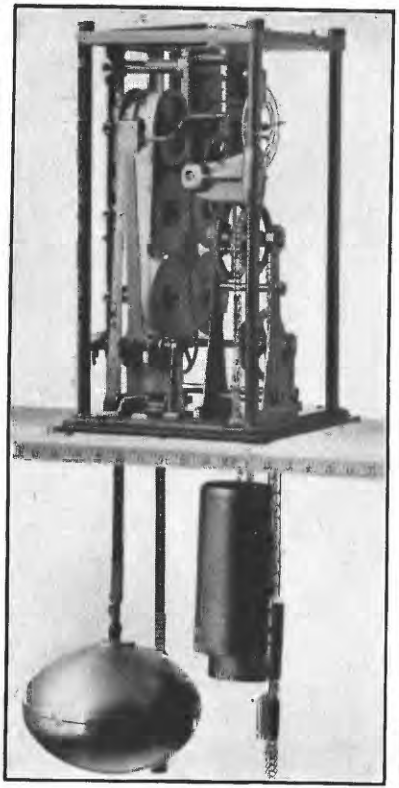
A. PRICE CURRENT METERS.



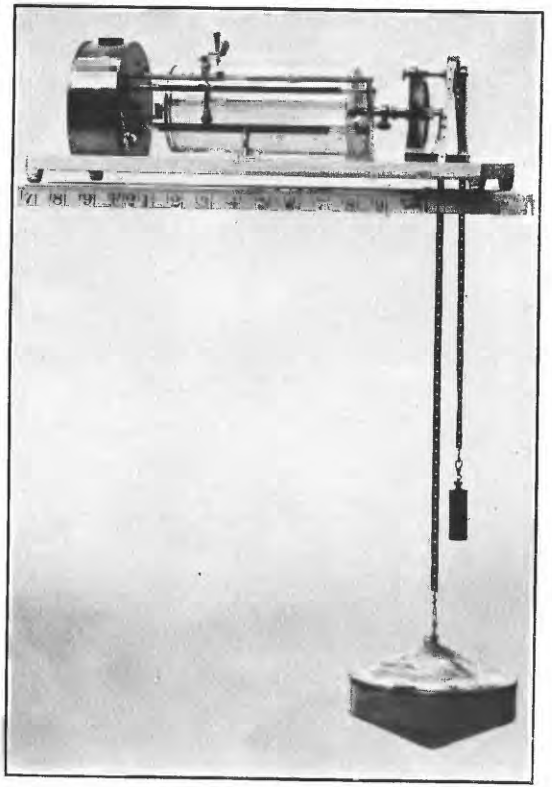
B. TYPICAL GAGING STATIONS.



A. STEVENS.



B. GURLEY.



C. FRIEZ.

AUTOMATIC GAGES.

mile" and "run-off (depth in inches)" have not been made for stations draining areas having an annual rainfall of less than 20 inches, nor for those stations draining areas of over 20 inches of rainfall for which it is believed that the computations would be uncertain and misleading because of the presence of large noncontributing districts in the measured drainage area, of omitting estimates of water diverted for irrigation or other use, or of artificial control or unusual natural control of the flow of the river above the gaging station. All values of "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with extreme caution, and such values in this report should be used with care because of possible inherent sources of error not known to the Survey.

In general, the base data collected each year by the Survey engineers are published, not only to comply with the law, but also to afford any engineer the means of examining and adjusting to his own needs the results of the computations. The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than preliminary estimates. The determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION.

The work in New Mexico was carried on in cooperation with James A. French, State engineer. Work in Oklahoma was carried on in cooperation with the United States Reclamation Service, which paid all expenses. Other cooperative work in the lower Mississippi River basin is duly acknowledged in connection with the description of the stations affected.

DIVISION OF WORK.

The field data for Colorado and Oklahoma were collected under the direction of Robert Follansbee, district engineer, who was assisted in Colorado by R. H. Fletcher, junior engineer, and in Oklahoma by F. B. King, assistant engineer.

In New Mexico field data were collected under the direction of G. A. Gray, district engineer, who was assisted by C. J. Emerson, junior engineer, and J. E. Powers, State hydrographer.

Field data in Mississippi were collected under the direction of W. E. Hall, district engineer.

The ratings and computations were made by Robert Follansbee, G. A. Gray, W. E. Hall, H. J. Dean, W. R. King, and R. H. Fletcher.

The manuscript was prepared by J. G. Mathers, and edited by Mrs. B. D. Wood.

GAGING-STATION RECORDS.

ARKANSAS RIVER BASIN.

EAST FORK OF ARKANSAS RIVER NEAR LEADVILLE, COLO.

Location.—In sec. 16, T. 9 S., R. 80 W., at highway bridge, about 300 yards above mouth of Tennessee Fork, in Leadville National Forest, 3 miles northwest of Leadville.

Records available.—April to August 31, 1890; June 18 to September 29, 1903; June 5, 1911, to November 14, 1913.

Drainage area.—52 square miles (measured from topographic sheet).

Gage.—Vertical staff.

Control.—Somewhat shifting.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Affected by ice.

Diversions.—Court decree for diversion of 40 second-feet from East Fork above station; court decrees for diversions below.

Accuracy.—Owing to the high altitude of the drainage basin, alternate melting and freezing probably cause considerable diurnal fluctuation in river stage at certain seasons, so that mean daily gage heights derived from two readings per day are subject to error; rating curve for the station is, however, good; estimates only fair.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of East Fork of Arkansas River near Leadville, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 20	Raymond Richards	0.53	62	Sept. 8	R. H. Fletcher	0.45	46
June 22	R. H. Fletcher	.70	97	Oct. 14	Robert Follansbee	.21	15

Daily gage height, in feet, of East Fork of Arkansas River near Leadville, Colo., for 1913.

[Merle F. Frey, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	.....	0.55	0.30	0.30	0.25	0.10
2	.....	0.80	.55	.30	.30	.25	.....
3	.....	.80	.55	.30	.30	.25	.....
4	.....	.80	.52	.30	.30	.25	.....
5	.....	.78	.52	.28	.30	.20	.15
6	.....	.75	.52	.28	.35	.20	.20
7	.....	.75	.52	.25	.32	.20	.....
8	.....	.70	.50	.25	.48	.20	.05
9	.....	.70	.60	.25	.45	.20	.....
10	0.25	.65	.65	.25	.45	.20	.....
11	.....	.78	.58	.28	.40	.20	.....
12	.....	.72	.48	.28	.35	.20	.....
13	.....	.70	.50	.28	.35	.20	.15
14	.....	.70	.55	.25	.30	.20	.10
15	.....	.72	.48	.20	.30	.20	.....
16	.40	.72	.55	.20	.30	.20	.....
17	.....	.72	.48	.20	.30	.20	.....
18	.....	.78	.50	.20	.30	.20	.....
19	.....	.72	.48	.20	.30	.15	.....
20	.53	.78	.50	.30	.30	.15	.....
21	.....	.72	.50	.30	.30	.15	.....
22	.....	.70	.50	.30	.25	.15	.....
23	.65	.68	.58	.30	.25	.15	.....
24	.....	.68	.55	.30	.25	.15	.....
25	.92	.62	.45	.30	.25	.15	.....
26	.....	.65	.42	.30	.25	.15	.....
27	.....	.68	.50	.30	.25	.15	.....
28	.....	.65	.48	.30	.25	.15	.....
29	.....	.68	.40	.30	.25	.15	.....
30	.....	.58	.35	.30	.25	.15	.....
31	.....	.....	.35	.30	.....	.10	.....

Daily discharge, in second-feet, of East Fork of Arkansas River near Leadville, Colo., for 1913.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	125	68	25	25	19	6
2	.....	125	68	25	25	19	.....
3	.....	125	68	25	25	19	.....
4	.....	125	61	25	25	19	.....
5	.....	120	61	23	25	13	10
6	.....	112	61	23	32	13	13
7	.....	112	61	19	28	13	.....
8	.....	100	57	19	54	13	4
9	.....	100	78	19	48	13	.....
10	19	89	89	19	48	13	.....
11	.....	120	74	23	40	13	.....
12	.....	105	54	23	32	13	.....
13	.....	100	57	23	32	13	10
14	.....	100	68	19	25	13	6
15	.....	105	54	13	25	13	.....
16	40	105	68	13	25	13	.....
17	.....	105	54	13	25	13	.....
18	.....	120	57	13	25	13	.....
19	.....	105	54	13	25	10	.....
20	63	120	57	25	25	10	.....
21	.....	105	57	25	25	10	.....
22	.....	100	57	25	19	10	.....
23	89	96	74	25	19	10	.....
24	.....	96	68	25	19	10	.....
25	156	82	48	25	19	10	.....
26	.....	89	43	25	19	10	.....
27	.....	96	57	25	19	10	.....
28	.....	89	54	25	19	10	.....
29	.....	96	40	25	19	10	.....
30	.....	74	32	25	19	10	.....
31	.....	.....	32	25	.....	6	.....

Monthly discharge of East Fork of Arkansas River near Leadville, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June	125	74	105	6,250
July	89	32	59.1	3,630
August	25	13	21.8	1,340
September	54	19	27.0	1,610
October	19	6	12.4	762
The period				13,600

ARKANSAS RIVER AT GRANITE, COLO.

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

Records available.—May 1, 1897, to September 10, 1899; April 6, 1910, to December 7, 1913.

Drainage area.—425 square miles.

Gage.—Recording gage established in 1910 by the State engineer; datum of recording gage bears no determined relation to that of the vertical staff gage at the highway bridge near the railroad station, used from 1897 to 1899.

Control.—Practically permanent.

Discharge measurements.—Made from car and cable.

Winter flow.—Discharge relation affected by ice; observations discontinued.

Regulation.—Discharge affected by operation of Twin Lakes reservoir and by a flume used to carry water from Lake Creek to a point below the station.

Diversions.—Court decrees for diversions of 76 second-feet from the Arkansas between this station and the junction of Tennessee and East forks, and for diversions of 22 second-feet from intervening tributaries.

Accuracy.—Conditions favorable for accurate results; estimates reliable.

Cooperation.—During 1913 station was maintained in cooperation with the State engineer, who furnished the gage heights.

Discharge measurements of Arkansas River at Granite, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 27	B. S. Clayton	(a)	73	July 15	R. H. Fletcher	2.80	761
May 20	Raymond Richards	3.07	988	Sept. 9	do	1.96	256

a Gage height affected by ice.

Daily gage height, in second-feet, of Arkansas River at Granite, Colo., for 1913.

[Geo. Morrison, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.6	2.2	3.7	2.6	2.0	1.85	1.8	1.75	1.4
2	.....	1.7	2.4	3.6	2.65	2.0	1.85	1.85	1.8	1.45
3	.....	1.7	2.4	3.2	2.5	1.9	1.85	1.85	1.85	1.45
4	1.5	1.7	2.2	3.1	2.8	1.75	1.85	1.8	1.85	1.55
5	1.5	1.7	2.2	3.0	3.0	1.7	1.9	1.8	1.65	1.55
6	1.6	1.6	2.2	3.05	2.95	1.8	1.85	1.75	1.5	1.65
7	1.6	1.55	2.6	3.1	2.9	2.05	1.85	1.75	1.5	1.6
8	.....	1.4	2.9	2.8	2.9	2.15	1.9	1.75	1.5	.....
9	1.5	1.3	2.95	2.85	2.9	2.05	1.9	1.75	1.55	.....
10	.....	1.3	2.9	2.8	3.0	2.0	1.8	1.8	1.5	.....
11	1.6	1.35	2.9	3.0	3.0	2.15	1.75	1.8	1.5	.....
12	1.6	1.45	3.45	2.75	2.9	2.35	1.8	1.7	1.6	.....
13	1.5	1.7	3.4	3.0	2.8	2.4	1.75	1.65	1.6	.....
14	1.5	1.9	3.1	2.9	2.75	2.4	1.8	1.65	1.6	.....
15	1.5	1.95	2.9	2.8	2.8	2.35	1.8	1.65	1.55	.....
16	.....	1.9	3.05	2.8	2.55	2.3	1.8	1.55	1.5	.....
17	.....	1.95	3.1	2.9	2.3	2.25	1.8	1.55	1.5	.....
18	1.6	1.9	3.1	3.1	2.65	2.25	1.75	1.55	1.55	.....
19	1.6	1.9	3.15	3.3	2.7	2.2	1.75	1.5	1.45	.....
20	1.6	2.05	3.1	3.25	2.5	2.25	1.7	1.5	1.5	.....
21	1.6	2.05	2.5	3.1	2.4	2.25	1.75	1.55	1.55	.....
22	1.6	2.05	2.4	2.8	2.25	2.05	1.7	1.55	1.5	.....
23	1.6	1.85	2.5	2.85	2.25	1.8	1.75	1.5	1.4	.....
24	1.6	1.75	2.9	2.9	2.6	1.8	1.75	1.55	1.45	.....
25	1.6	1.8	3.15	2.75	2.5	1.8	1.75	1.55	1.45	.....
26	1.6	1.8	3.2	2.8	2.45	1.8	1.75	1.55	1.4	.....
27	1.6	1.8	3.35	2.9	2.35	1.8	1.75	1.5	1.4	.....
28	1.6	1.9	3.1	3.0	2.25	1.85	1.75	1.45	1.45	.....
29	1.6	1.95	3.3	2.95	2.2	1.85	1.7	1.4	1.4	.....
30	1.6	2.0	3.5	2.8	2.1	1.85	1.7	1.5	1.4	.....
31	1.6	.....	3.6	.....	2.05	1.8	.....	1.6	.....	.....

NOTE.—Ice present Dec. 4 to 31. Gage heights Apr. 7 to 19 taken from records of Arkansas Valley Ditch Association.

Daily discharge, in second-feet, of Arkansas River at Granite, Colo., for 1913.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	110	139	365	1,600	605	276	220	203	186	82
2	110	170	476	1,490	640	276	220	220	203	96
3	110	170	476	1,090	539	238	220	220	220	96
4	110	170	365	1,000	750	186	220	203	220	.....
5	110	170	365	915	915	170	238	203	154	.....
6	139	139	365	958	872	203	220	186	110	.....
7	139	124	605	1,000	830	297	220	186	110	.....
8	124	82	830	750	830	342	238	186	110	.....
9	110	55	872	750	830	297	238	186	124	.....
10	124	55	830	750	915	276	203	203	110	.....
11	139	68	830	915	915	342	186	203	110	.....
12	139	96	1,340	712	830	447	203	170	139	.....
13	110	170	1,280	915	750	476	186	154	139	.....
14	110	238	1,000	830	712	476	203	154	139	.....
15	110	257	830	750	750	447	203	154	124	.....
16	120	238	958	750	572	418	203	124	110	.....
17	130	257	1,000	830	418	392	203	124	110	.....
18	139	238	1,000	1,000	640	392	186	124	124	.....
19	139	238	1,040	1,180	675	365	186	110	96	.....
20	139	297	1,000	1,140	539	392	170	110	110	.....
21	139	297	539	1,000	476	392	186	124	124	.....
22	139	297	476	750	392	297	170	124	110	.....
23	139	220	539	790	392	203	186	110	82	.....
24	139	186	830	830	605	203	186	124	96	.....
25	139	203	1,040	712	539	203	186	124	96	.....
26	139	203	1,090	750	508	203	186	124	82	.....
27	139	203	1,240	830	447	203	186	110	82	.....
28	139	238	1,000	915	392	220	186	96	96	.....
29	139	257	1,180	872	365	220	170	82	82	.....
30	139	276	1,380	750	318	220	170	110	82	.....
31	139	.....	1,490	.....	297	203	.....	139	.....	.....

NOTE.—Daily discharge computed from a rating curve well defined throughout. Discharge estimated Mar. 1–3, 8, 10, 16, 17.

Monthly discharge of Arkansas River at Granite, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	139	110	129	7,930	A.
April	297	55	192	11,400	A.
May	1,490	365	859	52,800	A.
June	1,600	712	917	54,600	A.
July	915	297	621	38,200	A.
August	476	170	299	18,400	A.
September	238	170	199	11,800	A.
October	220	82	151	9,280	A.
November	220	82	123	7,320	B.
The period				212,000	

ARKANSAS RIVER AT SALIDA, COLO.

Location.—At Salida, Colo., some distance above mouth of South Fork of Arkansas River, the nearest important tributary.

Records available.—April 11, 1895, to October 31, 1903; November 3, 1909, to December 31, 1913.

Drainage area.—1,160 square miles.

Gage.—Recording gage; no determined relation between automatic gage and gage used from 1895 to 1903.

Control.—Slightly shifting.

Winter flow.—Springs keep the river open during winter months.

Diversions.—Court decrees for diversions of 199 second-feet from the Arkansas between this station and Granite and for diversions of 380 second-feet from intervening tributaries.

Regulation.—The flow at this station is affected to some extent by Twin Lakes and Clear Creek reservoirs, which have storage decrees for 20,645 and 11,489 acre-feet, respectively.

Accuracy.—Conditions favorable for accurate results; estimates reliable.

Cooperation.—Gage-height record for 1913 furnished by the State engineer.

Discharge measurements of Arkansas River at Salida, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 29	B. S. Clayton	0.45	220	May 16	Robert Follansbee	2.75	1,280
Feb. 26	do	.46	222	July 16	R. H. Fletcher	2.35	1,040
Apr. 4	do	.95	365	Aug. 26	do	1.20	459

Daily gage height, in feet, of Arkansas River at Salida, Colo., for 1913.

[Howard Sneddon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.5	0.35	0.35	0.9	1.3	3.4	2.9	1.8	1.05	1.2	0.85	0.65
2	.4	.3	.4	.9	1.5	3.3	2.6	1.2	1.05	1.25	.95	.65
3	.55	.3	.4	.8	1.9	3.0	2.5	1.25	1.1	1.25	1.05	.65
4	.55	.3	.35	.65	1.85	2.9	2.5	1.25	1.05	1 3	.9	.6
5	.45	.35	.35	.6	1.65	2.8	2.7	1.15	1.05	1.25	.75	.65
6	.4	.3	.35	.7	1.7	3.1	2.6	1.05	1.0	1.1	.75	.65
7	.45	.3	.35	.75	1.8	3.1	2.6	1.1	.95	1.1	.7	.6
8	.5	.35	.35	.7	2.4	3.0	2.5	1.15	1.4	1.15	.75	.6
9	.5	.4	.35	.55	2.3	3.1	2.6	1.1	1.5	1.15	.75	.6
10	.5	.3	.35	.45	2.3	3.2	2.6	1.15	1.4	1.05	.75	.55
11	.55	.3	.35	.45	2.2	3.4	2.6	1.15	1.3	1.05	.75	.5
12	.5	.25	.4	.....	2.3	3.0	2.6	1.45	1.35	1.05	.8	.55
13	.45	.25	.4	.....	3.1	3.1	2.4	1.6	1.35	1.1	.85	.55
14	.50	.25	.3	.....	3.0	3.0	2.3	1.6	1.35	1.15	.85	.55
15	.45	.3	.3	.....	2.6	2.9	2.3	1.55	1.35	1.05	.85	.55
16	.45	.3	.2	.....	2.7	2.8	2.3	1.45	1.35	.95	.75	.55
17	.5	.3	.25	.....	2.6	2.8	2.0	1.35	1.3	1.0	.7	.6
18	.5	.3	.35	.....	2.7	3.0	2.2	1.3	1.35	.95	.75	.55
19	.45	.35	.4	.....	3.0	3.1	2.5	1.45	1.35	.8	.75	.6
20	.4	.4	.4	.....	2.6	.....	2.4	1.45	1.25	.8	.75	.55
21	.4	.4	.3	.....	2.4	3.1	2.5	1.6	1.3	.9	.75	.5
22	.45	.4	.3	.....	2.0	3.1	2.5	1.5	1.3	.9	.8	.42
23	.45	.4	.3	.85	2.2	3.0	2.4	1.15	1.25	.9	.75	.48
24	.45	.35	.25	.75	2.4	3.2	2.5	1.25	1.2	.95	.75	.4
25	.45	.35	.2	.7	2.8	3.0	2.3	1.3	1.2	.9	.75	.4
26	.45	.45	.2	.75	3.2	3.0	2.3	1.2	1.25	.8	.75	.45
27	.35	.4	.2	.8	3.3	3.0	2.1	1.1	1.2	.8	.8	.6
28	.4	.4	.25	.9	3.0	3.0	1.95	1.15	1.15	.85	.8	.45
29	.4	.....	.4	.9	3.0	3.2	1.95	1.3	1.15	.85	.65	.41
30	.4	.....	.5	.95	3.2	3.0	1.95	1.25	1.1	.8	.65	.4
31	.4	.....	.65	.....	3.2	.....	1.8	1.15	.....	.85	.....	.43

Daily discharge, in second-feet, of Arkansas River at Salida, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	242	210	210	350	495	1,700	1,360	730	400	455	335	279
2	220	200	220	350	583	1,630	1,170	455	400	475	366	279
3	254	200	220	320	780	1,420	1,110	475	417	475	400	279
4	254	200	210	279	755	1,360	1,110	475	400	495	350	266
5	231	210	210	266	655	1,300	1,230	436	400	475	306	279
6	220	200	210	292	680	1,490	1,170	400	382	417	306	279
7	231	200	210	306	730	1,490	1,170	417	366	417	292	266
8	242	210	210	292	1,050	1,420	1,110	436	538	436	306	266
9	242	220	210	254	995	1,490	1,170	417	583	436	306	266
10	242	200	210	231	995	1,560	1,170	436	538	400	306	254
11	254	200	210	231	940	1,700	1,170	436	495	400	306	242
12	242	191	220	240	995	1,420	1,170	560	516	400	320	254
13	231	191	220	250	1,490	1,490	1,050	630	516	417	335	254
14	242	191	200	360	1,420	1,420	995	630	516	436	335	254
15	231	200	200	380	1,170	1,360	995	606	516	400	335	254
16	231	200	182	360	1,230	1,300	995	560	516	366	306	254
17	242	200	191	380	1,170	1,300	830	516	495	382	292	266
18	242	200	210	360	1,230	1,420	940	495	516	366	306	254
19	231	210	220	360	1,420	1,490	1,110	560	516	320	306	266
20	220	220	220	440	1,170	1,490	1,050	560	475	320	306	254
21	220	220	200	440	1,050	1,490	1,110	630	495	350	306	242
22	231	220	200	440	830	1,490	1,110	583	495	350	320	224
23	231	220	200	335	940	1,420	1,050	436	475	350	306	238
24	231	210	191	306	1,050	1,560	1,110	475	455	366	306	220
25	231	210	182	292	1,300	1,420	995	495	455	350	306	220
26	231	231	182	306	1,560	1,420	995	455	475	320	306	231
27	210	220	182	320	1,630	1,420	885	417	455	320	320	266
28	220	220	191	350	1,420	1,420	805	436	436	335	320	231
29	220	.....	220	350	1,420	1,560	805	495	436	335	279	222
30	220	.....	242	366	1,560	1,420	805	475	417	320	279	220
31	220	.....	279	.....	1,560	.....	730	436	.....	335	.....	227

NOTE.—Daily discharge computed from a rating curve well defined throughout. Discharge Apr. 12–22 estimated by comparison with records of Arkansas River at Granite, Colo.

Monthly discharge of Arkansas River at Salida, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	254	210	233	14,300	B.
February	231	191	207	11,500	B.
March	279	182	208	12,800	B.
April	380	231	327	19,500	B.
May	1,630	495	1,110	68,200	A.
June	1,700	1,300	1,460	86,900	A.
July	1,360	730	1,050	64,600	A.
August	730	400	502	30,900	A.
September	583	366	470	28,000	A.
October	495	320	388	23,900	A.
November	400	279	316	18,800	A.
December	279	220	252	15,500	A.
The year	1,700	182	545	395,000	

ARKANSAS RIVER AT CANON CITY, COLO.

Location.—Just below the suspension bridge at Hot Springs Hotel, at the mouth of the canyon, 1½ miles above Canon City. The nearest important tributary is Grape Creek, which enters above.

Records available.—May 1, 1888, to December 31, 1913.

Drainage area.—3,060 square miles.

Gage.—Automatic recording gage established by the State engineer in September, 1909. The river shifted away from this gage early in 1912 and a chain gage reading to the same datum was placed on the opposite side of the river and used during 1912 and 1913. The original Geological Survey gage was established April 17, 1889. On October 4, 1895, a new staff gage was established on the left bank, 100 feet below the original gage and referred to the same datum. At low stages it read 0.4 foot lower than the original gage, but at high stages the readings were the same. On August 26, 1902, a gage was established on the right bank near the first gage, and referred to the same datum. The datum of the recording gage and chain gage now used is 2.00 feet higher than that of the last gage.

Control.—The channel shifts to such an extent during high water that at times it is necessary to move the gage in order to obtain the gage heights.

Discharge measurements.—Made from cable or by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—Court decrees for diversions of 131 second-feet from the Arkansas between the stations at Canon City and Salida, and for diversions of 2,286 second-feet from intervening tributaries.

Cooperation.—During 1913 station was maintained and records were furnished by the State engineer of Colorado.

Discharge measurements of Arkansas River at Canon City, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 11	B. S. Clayton	4.10	297	June 5	B. S. Clayton	5.70	1,240
Feb. 28	do	4.00	330	22	do	6.60	1,970
Apr. 2	do	4.49	508	Aug. 4	do	4.08	372
May 7	do	4.70	551	Oct. 6	do	4.26	421
8	do	5.32	942	Nov. 25	do	4.00	320

Daily gage height, in feet, of Arkansas River at Canon City, Colo., for 1913.

[S. R. McKissick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.9	4.15	3.9	4.5	4.25	6.45	5.6	4.35	4.1	4.25	4.0	4.0
2	3.9	4.15	3.9	4.6	4.6	6.45	5.4	4.1	4.1	4.5	4.0	4.0
3	3.9	4.15	3.9	4.6	4.95	6.2	5.35	4.0	4.1	4.35	4.1	4.1
4	3.9	4.15	4.1	4.4	4.7	5.75	5.2	4.05	4.1	4.3	4.3	4.15
5	3.9	4.15	4.1	4.1	4.65	5.7	5.5	4.0	4.0	4.3	4.25	4.2
6	3.9	4.15	4.1	4.1	4.7	5.85	5.55	4.0	4.0	4.3	4.25	4.1
7	3.8	4.15	4.1	4.3	4.7	5.95	5.6	4.0	4.0	4.25	4.1	4.0
8	3.8	4.15	4.05	4.3	5.1	5.95	5.5	4.0	4.1	4.2	4.0	4.1
9	3.8	4.15	4.05	4.15	5.35	6.05	5.65	4.0	4.4	4.2	4.0	4.1
10	3.9	4.15	4.05	4.0	5.25	6.2	6.0	4.0	4.35	4.2	4.0	4.0
11	3.9	4.1	4.0	4.0	5.3	6.6	5.55	4.1	4.35	4.15	4.0	3.9
12	3.9	4.1	4.1	4.1	5.4	6.6	5.65	4.1	4.5	4.15	4.0	3.9
13	.....	4.0	4.1	4.3	5.85	6.5	5.35	4.65	4.35	4.2	4.05	3.9
14	4.0	4.0	4.1	4.4	6.0	6.2	5.2	4.6	4.3	4.2	4.0	4.1
15	4.0	4.1	3.9	4.6	5.6	6.1	5.05	4.6	4.3	4.2	4.0	4.2
6	4.0	4.1	3.9	4.55	5.6	6.15	5.15	4.45	4.35	4.1	4.0	4.2
17	4.1	4.1	3.9	4.55	5.6	6.15	5.1	4.4	4.3	4.1	4.0	4.2
18	4.1	4.1	3.9	4.6	5.65	6.25	5.0	4.4	4.3	4.1	4.0	4.2
19	4.1	4.1	3.9	4.55	5.75	6.7	5.45	4.4	4.25	4.0	4.2	4.0
20	4.1	4.1	3.9	4.55	5.75	6.6	5.4	4.55	4.15	4.0	4.1	4.2
21	4.1	4.1	4.05	4.5	5.65	6.45	5.75	4.95	4.1	4.0	4.0	3.9
22	4.1	4.0	4.05	4.5	5.3	6.5	5.75	4.85	4.1	4.0	4.1	3.9
23	4.1	4.0	4.05	4.35	5.15	6.35	5.55	4.45	4.1	4.0	4.0	4.0
24	4.1	4.0	4.0	4.25	5.35	6.3	5.6	4.2	4.3	4.0	4.0	4.0
25	4.15	4.0	4.0	4.15	5.85	6.25	5.5	4.25	4.3	4.0	4.0	4.0
26	4.15	4.0	4.0	4.1	6.0	6.05	5.25	4.2	4.25	4.0	4.1	3.9
27	4.15	4.0	4.0	4.1	6.3	5.95	5.15	4.1	4.15	4.0	4.1	4.3
28	4.1	4.0	4.0	4.15	6.25	5.85	5.0	4.2	4.1	4.0	4.1	4.3
29	4.1	.....	4.0	4.2	6.05	5.95	4.75	4.45	4.2	4.0	4.1	4.1
30	4.1	.....	4.25	4.25	6.4	5.85	4.65	4.25	4.4	4.0	4.0	.....
31	4.15	.....	4.25	.....	6.3	.....	4.55	4.15	.....	4.0	.....	.....

Daily discharge, in second-feet, of Arkansas River at Canon City, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	260	380	310	500	410	1,840	1,150	442	365	410	335	335
2	260	380	310	545	545	1,840	1,005	365	365	500	335	335
3	260	380	310	545	722	1,620	970	335	365	442	365	365
4	260	380	365	460	590	1,260	870	350	365	425	425	380
5	205	380	365	365	568	1,220	1,080	335	335	425	410	395
6	205	380	365	365	590	1,340	1,110	335	335	425	410	365
7	205	380	365	425	590	1,420	1,150	335	335	410	365	335
8	205	380	350	425	810	1,420	1,080	335	365	395	335	365
9	205	380	350	380	970	1,500	1,190	335	460	395	335	365
10	250	380	350	335	902	1,620	1,460	335	442	395	335	335
11	300	365	365	335	935	1,970	1,110	365	442	380	335	310
12	300	365	365	365	1,000	1,970	1,190	365	500	380	335	310
13	275	335	365	425	1,340	1,880	970	568	442	395	350	310
14	300	335	365	460	1,460	1,620	870	545	425	395	335	365
15	400	365	310	545	1,150	1,540	780	545	425	395	335	395
16	400	365	310	522	1,150	1,580	840	480	442	365	335	395
17	350	365	310	522	1,150	1,580	810	460	425	365	335	395
18	280	365	310	545	1,190	1,670	750	460	425	365	335	395
19	300	365	310	522	1,260	2,060	1,040	460	410	335	395	335
20	300	365	310	522	1,260	1,970	1,000	522	380	335	365	395
21	280	365	350	500	1,190	1,840	1,260	722	365	335	335	310
22	280	335	350	500	935	1,880	1,260	668	365	335	365	310
23	300	335	350	442	840	1,750	1,110	480	365	335	335	335
24	300	335	350	410	970	1,710	1,150	395	425	335	335	335
25	300	335	335	380	1,340	1,670	1,080	410	425	335	335	335
26	260	335	335	365	1,460	1,500	902	395	410	335	365	310
27	250	335	335	365	1,710	1,420	840	365	380	335	365	425
28	275	335	335	380	1,670	1,340	750	395	365	335	365	425
29	270	.....	335	395	1,500	1,420	615	480	395	335	365	365
30	280	.....	410	410	1,800	1,340	568	410	460	335	335	335
31	280	.....	410	.....	1,710	.....	522	380	.....	335	.....	335

Monthly discharge of Arkansas River at Canon City, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	400	205	277	17,000
February	380	335	361	20,000
March	410	310	343	21,100
April	545	335	442	26,300
May	1,800	410	1,090	67,000
June	2,060	1,220	1,630	97,000
July	1,460	522	983	60,400
August	722	335	431	26,500
September	500	335	400	23,800
October	500	335	375	23,100
November	425	335	354	21,100
December	425	310	355	21,800
The year	2,060	205	587	425,000

NOTE.—Results changed slightly to conform to computation rules of U. S. Geological Survey.

ARKANSAS RIVER AT PUEBLO, COLO.

Location.—At Main Street Bridge in Pueblo, 2 miles above the mouth of Fountain Creek, the nearest tributary.

Records available.—September 19, 1894, to December 31, 1913. From May 1, 1885, to September 30, 1886, a station was maintained at Pueblo by the State engineer; from June 1, 1887, to September 30, 1887, a station was maintained at a point 9 miles above Pueblo; from May 1, 1889, to August 31, 1889, the Geological Survey maintained the station 9 miles above Pueblo.

Drainage area.—4,600 square miles.

Gage.—An automatic gage located 150 feet below Main Street Bridge has been used since March 22, 1911. It is referred to the same datum as the chain gage on the Main Street Bridge, which was installed July 7, 1905, but the slope of the river between the two points causes differences in readings. In the spring of 1913 the chain gage was moved to the downstream side of the bridge, which caused some difference in readings. A vertical staff placed at the Santa Fe Avenue Bridge on September 19, 1894, was used until July 10, 1898, when a second gage was placed at Main Street Bridge, and used until March 3, 1900. From that date until July 14, 1902, a vertical staff near the Union Avenue Bridge was used. From that date until July 7, 1905, when the chain gage was placed in position, a staff gage referred to a different datum was used.

Control.—The channel shifts to such an extent during high water that it has been necessary to move the gage in order to read the gage heights.

Discharge measurements.—Made from Main Street, Union Avenue, and Victor Avenue bridges, or, at low water, by wading below Main Street Bridge.

Winter flow.—Ice causes some slight backwater during the winter months.

Diversions.—Court decrees for diversions of 637 second-feet from Arkansas River between station at Canon City and Pueblo, and for diversions of 372 second-feet from intervening tributaries.

Cooperation.—Station maintained by United States Geological Survey 1894 to 1908; present station maintained and records furnished by State engineer of Colorado.

Discharge measurements of Arkansas River at Pueblo, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 31	B. S. Clayton	2.12	283	July 31	B. S. Clayton	2.55	554
Feb. 28	do	2.10	312	Aug. 6	C. L. Patterson	2.15	278
Mar. 17	do	1.77	146	12	A. A. Weiland	1.99	228
May 8	C. L. Patterson	2.49	618	13	C. L. Patterson	2.40	383
9	do	3.13	1,100	23	B. S. Clayton	2.46	445
June 2	B. S. Clayton	4.00	1,880	Oct. 7	do	2.40	421
20	do	4.00	1,690	Nov. 12	Clayton and Thompson.	2.10	245
July 7	do	3.21	942				

Daily gage height, in feet, of Arkansas River at Pueblo, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.05	2.10	2.30	2.00	3.95	3.4	2.35	2.2	2.30	2.15	2.20
2	.....	2.00	2.10	2.35	2.05	4.00	3.2	2.30	2.1	2.45	2.00	2.25
3	2.00	2.00	2.05	2.30	2.30	3.60	3.2	2.15	2.15	2.45	2.30	2.40
4	2.00	2.20	2.05	2.20	2.70	3.40	3.0	2.1	2.2	2.45	2.45	2.45
5	1.90	2.20	2.05	2.20	2.50	3.35	2.9	2.15	2.15	2.35	2.45	2.50
6	1.40	2.25	2.00	2.20	2.40	3.25	3.2	2.1	2.1	2.40	2.40	2.50
7	.....	2.20	2.05	2.10	2.40	3.40	3.2	2.0	2.15	2.30	2.40	2.5
8	1.60	2.20	1.90	2.20	2.40	3.50	3.2	1.9	2.1	2.25	2.40	2.5
9	1.90	2.25	1.90	2.20	3.10	3.50	3.2	1.9	2.2	2.40	2.40	2.5
10	2.20	2.30	1.90	2.10	2.95	3.80	3.65	1.9	2.4	2.30	2.25	2.4
11	2.40	2.20	2.00	2.05	3.00	3.90	3.4	1.9	2.5	2.25	2.20	2.3
12	2.40	2.20	2.10	2.00	3.00	4.05	3.25	2.0	2.6	2.40	2.20	2.3
13	2.30	2.15	2.05	2.05	3.15	3.55	3.15	2.3	2.5	2.35	2.05	2.4
14	2.40	2.10	2.10	2.25	3.65	3.6	3.05	2.4	2.4	2.35	2.15	2.3
15	2.60	2.10	1.95	2.35	3.40	3.6	2.95	2.45	2.5	2.40	2.20	2.3
16	2.60	1.95	1.80	2.45	3.10	3.55	2.9	2.45	2.5	2.35	2.20	2.35
17	2.50	2.05	1.70	2.45	3.20	3.55	3.0	2.35	2.45	2.35	2.20	2.45
18	2.35	2.00	1.70	2.40	3.20	3.80	3.25	2.4	2.4	2.30	2.20	2.5
19	2.40	2.10	1.85	2.45	3.30	4.0	3.40	2.4	2.3	2.35	2.10	2.55
20	2.40	2.00	1.90	2.40	3.35	4.05	3.05	2.6	2.3	2.30	2.20	2.55
21	2.35	2.00	1.90	2.40	3.25	4.0	3.0	2.65	2.3	2.30	2.15	2.45
22	2.35	2.00	1.90	2.30	3.10	4.05	3.35	3.0	2.3	2.30	2.20	2.3
23	2.40	2.00	1.90	2.25	2.80	4.00	4.3	2.4	2.3	2.30	2.20	2.3
24	2.40	2.05	2.00	2.20	2.85	3.85	3.95	2.4	2.45	2.30	2.15	2.4
25	2.40	2.20	1.70	2.05	3.10	3.8	3.3	2.35	2.4	2.35	2.15	2.3
26	2.30	2.20	1.85	2.00	3.35	3.6	3.0	2.25	2.35	2.30	2.20	2.3
27	2.25	2.10	1.90	2.00	3.55	3.45	3.15	2.2	2.35	2.30	2.20	2.25
28	2.20	2.10	1.90	2.00	3.80	3.45	3.1	2.2	2.35	2.20	2.20	2.25
29	2.15	.....	1.85	2.00	3.55	3.05	2.8	2.3	2.4	2.1	2.15	2.2
30	2.20	.....	1.90	2.00	3.75	3.60	2.65	2.3	2.35	2.2	2.20	2.2
31	2.10	.....	2.00	.....	4.00	.....	2.5	2.2	.....	2.1	.....	2.2

Daily discharge, in second-feet, of Arkansas River at Pueblo, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	260	290	320	455	260	1,840	1,120	375	300	350	280	300
2	260	260	320	490	290	1,880	950	350	260	428	225	325
3	260	260	290	455	455	1,510	950	280	280	428	350	400
4	260	385	290	385	760	1,320	795	260	300	428	428	428
5	205	385	290	385	600	1,270	720	280	280	375	428	455
6	205	420	260	385	525	1,170	950	260	260	400	400	455
7	205	385	290	320	525	1,290	950	225	280	350	400	455
8	205	385	205	385	525	1,370	950	195	260	325	400	455
9	205	420	205	385	1,080	1,360	950	195	300	400	400	455
10	385	455	205	320	960	1,620	1,350	195	400	350	325	400
11	525	385	260	290	1,000	1,670	1,120	195	455	325	300	350
12	525	385	320	260	1,000	1,820	992	225	515	400	300	350
13	455	352	290	290	1,130	1,360	910	350	455	375	242	400
14	525	320	320	420	1,560	1,400	832	400	400	375	280	350
15	680	320	232	490	1,340	1,390	758	428	455	400	300	350
16	680	232	155	562	1,080	1,340	720	428	455	375	300	375
17	600	290	110	562	1,170	1,320	795	375	428	375	300	428
18	490	260	110	525	1,170	1,530	992	400	400	350	300	455
19	525	320	180	562	1,260	1,700	1,120	400	350	375	260	485
20	525	260	205	525	1,300	1,740	832	515	350	350	300	485
21	490	260	205	525	1,210	1,690	795	548	350	350	280	428
22	490	260	205	455	1,080	1,740	1,080	795	350	350	300	350
23	525	260	205	420	840	1,690	1,990	400	350	350	300	350
24	525	290	260	385	880	1,540	1,640	400	428	350	280	400
25	525	385	110	290	1,080	1,490	1,040	375	400	375	280	350
26	455	385	180	260	1,300	1,300	795	325	375	350	300	350
27	420	320	205	260	1,480	1,160	910	300	375	350	300	325
28	385	320	205	260	1,700	1,160	870	300	375	300	300	325
29	352	.....	180	260	1,480	832	650	350	400	260	280	300
30	385	.....	205	260	1,660	1,300	548	350	375	300	300	300
31	320	.....	260	.....	1,880	.....	455	300	.....	260	.....	300

Monthly discharge of Arkansas River at Pueblo, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	680	205	415	25,500
February	455	232	330	18,300
March	320	110	228	14,000
April	562	260	391	23,300
May	1,880	260	1,050	64,600
June	1,880	832	1,460	86,900
July	1,990	455	952	58,500
August	795	195	348	21,400
September	515	260	365	21,700
October	428	260	359	22,100
November	428	225	315	18,700
December	485	300	385	23,700
The year	1,990	110	550	399,000

NOTE.—Results changed slightly to conform to computation rules of U. S. Geological Survey.

ARKANSAS RIVER NEAR NEPESTA, COLO.

Location.—In sec. 31, T. 21 S., R. 60 W., at the dam of the Oxford Farmers' Canal Co., 1½ miles above Nepesta; about 6 miles below the mouth of Huerfano River, the nearest important tributary.

Records available.—September 8, 1897, to October 31, 1903; July 14, 1909, to November 30, 1912. Discharge measurements during 1913.

Drainage area.—9,130 square miles.

Gage.—Automatic gage established August 23, 1910. From September 8, 1897, to December, 1900, a vertical staff gage fastened to a pier of the wagon bridge at Nepesta was used. On May 1, 1901, a vertical staff was fastened to the wing of the Oxford Farmers' dam, 1½ miles above Nepesta. This gage was used until the station was discontinued, October 31, 1903, and from the date of reestablishment, July 14, 1909, until August 23, 1910, when the automatic gage was established at the same datum.

Control.—The diversion dam results indicate shifting conditions, probably due to the varying amounts diverted by the canal.

Discharge measurements.—Made from the bridge at Nepesta, except during low water, when measurements are made by wading. Between the gage and the measuring section is a wasteway from the canal. The flow at this point is subtracted from the flow at the bridge in order to show the amount of water below the canal.

Winter flow.—Ice causes backwater during a portion of the winter months.

Diversions.—Court decrees for diversions of 1,552 second-feet from the Arkansas between Pueblo and Nepesta, and approximately 1,600 second-feet from intervening tributaries. The discharge records given in this report do not include the flow of the canal.

Cooperation.—Since 1909 station has been maintained and records have been furnished by the State engineer of Colorado.

Discharge measurements of Arkansas River near Nepesta, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 3	B. S. Clayton	0.25	[a] 257	July 9	B. S. Clayton	1.00	487
Apr. 5	do	.39	[a] 267	16	C. L. Patterson	.75	303
June 6	do	1.22	1,040	30	B. S. Clayton	1.20	541
21	do	1.88	1,790	Aug. 6	do	.70	209
30	do	1.47	1,200	18	do	.45	128

[a] Measurements made by wading 200 feet above Santa Fe bridge.

ARKANSAS RIVER AT LA JUNTA, COLO.

Location.—Half a mile below the east bridge at La Junta; no important tributary within several miles.

Records available.—April 11, 1912, to December 31, 1913. From December 5, 1893, to December 31, 1895, a station was maintained near the city pumping plant. During 1899 and 1901 a station was maintained at the head of the Fort Lyon canal by the Great Plains Water Co. From April 7, 1903, to October 31, 1903, a station was maintained 1 mile east of La Junta, and a number of discharge measurements were made during 1904. From August 27, 1908, to November 30, 1908, a station was maintained one-half mile northwest of La Junta, just below the mouth of Crooked Arroyo.

Drainage area.—Not measured.

Gage.—Automatic recording gage.

Discharge measurements.—Made from the bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater for short periods during the winter months.

Diversions.—Court decrees for diversions of 2,735 second-feet from the Arkansas between Nepesta and La Junta, and 511 second-feet from intervening tributaries.

Cooperation.—Station maintained and records furnished by the State engineer in cooperation with Mr. A. A. Weiland, of Pueblo.

Discharge measurements of Arkansas River at La Junta, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 6	B. S. Clayton	2.15	50	June 24	B. S. Clayton	2.12	355
Mar. 4	do	.88	25	July 1	do	2.28	488
Apr. 5	do	1.63	169	10	do	1.70	162
21	C. L. Patterson	2.00	269	30	C. L. Patterson	2.18	362
May 1	do	.80	26	Aug. 7	do	1.10	46
June 4	B. S. Clayton	1.95	301	Nov. 8	B. S. Clayton	1.60	153

Daily gage height, in feet, of Arkansas River at La Junta, Colo., for 1913.

[Kearns, Rice and Kinsman, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.94	1.43	1.13	1.27	0.78	2.20	2.20	1.58	1.15	1.82	1.70	1.62
2	.90	1.17	1.04	1.10	.98	2.35	2.15	1.48	1.10	1.81	1.64	1.65
3	.95	1.16	1.18	1.19	1.08	2.20	2.10	1.26	1.11	1.84	1.56	1.66
4	.93	1.15	1.16	1.62	1.02	2.04	2.10	1.03	1.08	1.95	1.53	1.62
5	.88	.....	.95	1.58	1.05	2.28	1.90	.92	.92	1.92	1.81	1.42
6	.80	.....	.89	1.42	1.18	2.58	1.64	.85	1.02	1.78	1.95	1.17
7	.90	.....	.95	1.42	1.02	2.08	1.67	1.10	1.10	1.71	1.92	1.46
8	.91	.....	.95	1.27	1.01	1.26	1.20	1.10	1.10	1.75	1.56	1.32
9	.92	.....	.90	1.51	1.06	1.69	1.10	1.05	1.10	1.69	1.68	1.21
10	.93	1.67	.79	1.46	1.15	2.22	1.51	1.00	1.10	1.75	1.88	1.10
11	.98	1.33	.72	1.72	1.03	2.24	1.72	1.00	1.10	1.65	1.94	1.38
12	1.09	1.30	.62	1.46	.98	1.62	1.78	1.01	1.22	1.58	1.90	1.87
13	1.21	1.15	.61	1.50	1.08	1.38	1.67	1.03	1.44	1.34	1.60	1.70
14	1.09	1.04	.64	1.48	1.49	1.27	1.50	1.01	1.54	1.36	1.52	1.09
15	1.08	.97	1.32	1.50	1.91	1.21	1.13	1.17	1.39	1.66	1.50	1.03
16	1.22	.92	1.67	1.50	2.09	1.10	.97	1.05	1.42	1.75	.....	1.13
17	1.38	.91	1.77	1.76	1.93	2.12	.95	1.21	1.45	1.66	1.72	1.18
18	1.26	.86	1.32	1.97	1.55	2.14	2.13	1.30	1.45	1.75	1.50	1.43
19	1.13	.82	.93	2.04	1.88	2.16	1.74	1.12	1.48	1.66	1.65	1.47
20	.88	.84	.88	2.00	1.88	2.30	1.20	1.12	1.40	1.60	1.67	1.43
21	1.05	.85	.90	2.00	1.95	1.76	1.38	1.01	1.44	1.61	1.62	1.54
22	1.05	.72	.98	1.98	1.91	1.70	1.83	1.33	1.36	1.61	1.51	.....
23	1.25	1.14	.90	1.96	1.78	2.07	2.06	1.78	1.28	1.59	1.54	.....
24	.82	1.14	.75	1.82	1.53	2.02	2.48	1.22	1.30	1.59	1.54	.....
25	1.03	1.14	.79	1.74	1.22	2.54	2.25	1.16	1.42	1.60	1.60	.....
26	1.53	1.27	1.35	1.71	1.34	2.37	1.64	1.25	1.65	1.63	1.60	.....
27	.97	1.29	.93	1.00	2.12	2.12	1.98	1.07	1.69	1.75	1.52	.....
28	1.09	1.18	1.05	1.00	2.45	2.16	2.19	1.10	1.71	1.70	1.23	.....
29	1.14	.....	1.01	.90	2.32	2.26	2.15	1.13	1.78	1.76	1.18	.....
30	1.46	.....	.97	.83	2.24	2.22	2.10	1.12	1.78	1.66	1.54	.....
31	1.72	.....	1.18	.....	2.32	.....	1.78	1.19	.....	1.68	.....	.....

Daily discharge, in second-feet, of Arkansas River at La Junta, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	34	117	57	79	21	430	430	115	40	190	150	126
2	30	61	45	52	38	525	400	92	34	187	132	135
3	35	60	63	65	50	430	372	54	35	198	110	138
4	33	59	60	167	42	341	372	27	32	242	103	126
5	28	50	35	154	46	478	274	19	18	229	187	80
6	22	50	30	111	63	704	174	14	26	176	242	42
7	30	50	35	111	42	362	184	46	34	153	229	88
8	31	50	35	79	41	77	66	46	34	166	210	63
9	32	50	30	133	47	191	52	40	34	147	144	47
10	33	50	22	120	59	442	133	34	34	166	213	34
11	38	50	18	202	44	454	202	34	34	135	238	73
12	51	84	11	120	38	167	224	35	49	115	220	209
13	68	59	10	130	50	102	184	38	84	68	120	150
14	51	45	12	125	128	79	130	35	106	70	101	33
15	50	37	110	130	279	68	56	57	74	138	96	27
16	70	32	184	130	367	52	37	40	80	166	120	38
17	91	31	221	217	288	384	35	64	86	138	157	44
18	77	27	88	306	145	395	389	82	86	166	96	82
19	55	25	33	341	246	407	173	49	92	138	135	90
20	28	25	28	320	246	490	46	49	76	120	141	82
21	46	26	30	320	297	217	63	35	84	123	126	106
22	46	16	38	311	279	194	194	89	70	123	98	100
23	75	58	30	302	224	356	293	224	57	118	106	40
24	24	58	18	240	139	330	564	49	60	118	106	50
25	44	58	21	209	70	672	400	42	80	120	120	50
26	139	79	95	198	93	537	132	53	135	129	120	30
27	37	82	33	40	384	384	255	31	147	166	101	25
28	51	63	46	40	600	407	364	34	153	150	51	20
29	58	.....	41	30	504	466	341	38	176	170	44	15
30	120	.....	37	24	454	442	312	36	176	138	106	15
31	202	.....	63	.....	504	.....	176	45	.....	144	.....	15

NOTE.—Discharge estimated Feb. 5–11, and Dec. 22–31, because of ice.

Monthly discharge of Arkansas River at La Junta, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	202	22	55.8	3,420
February	117	16	51.9	2,870
March	221	10	50.9	3,130
April	320	24	153	9,100
May	600	21	188	11,540
June	704	52	353	20,960
July	564	35	227	13,910
August	224	19	53.1	3,260
September	176	18	74.2	4,410
October	242	68	149	9,120
November	242	44	134	7,960
December	209	15	70.1	4,300
The year	704	10	130	93,980

NOTE.—Results changed slightly to conform to computation rules of U. S. Geological Survey.

ARKANSAS RIVER NEAR LAMAR, COLO.

Location.—About sec. 30, T. 22 S., R. 46 W., at highway bridge 1½ miles north of Lamar.

Records available.—May 11 to December 31, 1913.

Drainage area.—Not measured.

Gage.—Chain.

Control.—Shifting.

Discharge measurements.—Made from bridge or, at low stages, by wading.

Winter flow.—No data.

Diversions.—Court decrees for diversions of approximately 500 second-feet from Arkansas River between La Junta and Lamar, and 1,253 second-feet from intervening tributaries.

Cooperation.—Station maintained by the Arkansas Valley Ditch Association.

Daily gage height, in feet, of Arkansas River near Lamar, Colo., for 1913.

[Geo. Trenhaile, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.84	1.94	0.80	0.90	1.00	0.90	0.90
2	.....	1.21	1.09	.88	.90	.86	.95	1.06
3	.....	1.53	1.35	.85	.90	.97	.90	1.00
4	.....	1.18	1.09	.85	.90	.97	.90	1.40
5	.....	1.04	1.00	.87	.90	.86	.85	1.25
6	.....	1.03	.92	.83	.90	.80	.90	.90
7	.....	2.44	.90	.93	.90	.86	.90	.85
8	.....	2.20	.90	.96	.90	.86	.90	1.16
9	.....	1.09	.90	.96	.83	.86	.95	1.21
10	.....	1.00	.94	.90	.86	.86	.90	1.05
11	0.80	1.05	.90	.95	.80	.86	.95	.98
12	.80	1.44	.90	.87	.93	.86	.85	1.10
13	.80	3.55	.87	.81	.96	.92	.85	1.50
14	.88	2.84	.85	.88	.86	.92	.90	2.00
15	.90	1.80	.80	.97	.86	.86	.90	2.11
16	.90	1.14	.80	1.04	.96	.86	.90	2.11
17	.90	.96	.80	.93	.90	.92	.90	2.01
18	.90	.86	.83	.86	.90	.90	.90	2.01
19	.82	.90	1.49	.88	.84	.86	.90	1.96
20	.80	.98	1.65	.90	.84	.90	.90	1.96
21	.80	1.20	1.29	.88	.90	.95	.90	1.98
22	.80	1.25	1.13	.85	.92	.90	.90	1.96
23	.80	.84	1.01	.93	.92	.90	.85	2.02
24	.80	.82	1.19	.90	.81	.95	.85	2.00
25	.80	.77	1.70	.90	.86	.86	.90	2.07
26	.80	.77	2.02	.90	.86	.80	.80	1.95
27	.80	.90	1.20	.90	.90	.83	.85	2.00
28	.80	.93	.85	.88	.90	.80	.90	2.04
29	.72	.79	1.02	.90	.91	.83	.90	2.00
30	.70	1.02	.78	.97	.88	.80	.90	2.00
31	.70	.....	.80	.92	.....	.90	.....	2.05

Daily discharge, in second-feet, of Arkansas River near Lamar, Colo., for 1913.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1	119	1	2	3	2	2
2	.....	9	5	2	2	2	3	4
3	.....	34	18	2	2	3	2	3
4	.....	9	5	2	2	3	2	21
5	.....	4	3	2	2	2	2	12
6	.....	4	2	1	2	1	2	2
7	.....	394	2	2	2	2	2	2
8	.....	232	2	3	2	2	2	8
9	.....	5	2	3	1	2	3	10
10	.....	3	2	2	2	2	2	4
11	1	4	2	3	1	2	3	3
12	1	25	2	2	2	2	2	5
13	1	1,970	2	1	3	2	2	30
14	2	810	2	2	2	2	2	140
15	2	78	1	3	2	2	2	187
16	2	7	1	4	3	2	2	187
17	2	3	1	2	2	2	2	144
18	2	2	1	2	2	2	2	144
19	1	2	29	2	1	2	2	126
20	1	3	50	2	1	2	2	126
21	1	9	14	2	2	3	2	133
22	1	11	6	2	2	2	2	126
23	1	1	3	2	2	2	2	148
24	1	1	9	2	1	3	2	140
25	1	0	58	2	2	2	2	169
26	1	0	148	2	2	1	1	122
27	1	2	9	2	2	1	2	140
28	1	2	2	2	2	1	2	157
29	0	1	3	2	2	1	2	140
30	0	3	1	3	2	1	2	140
31	0	.....	1	2	.....	2	.....	161

Monthly discharge of Arkansas River near Lamar, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 11-31	2	0	1.1	45
June	1,970	0	121	7,200
July	148	1	19.5	1,000
August	4	1	2.2	131
September	3	1	1.9	113
October	3	1	2.0	121
November	3	1	2.1	123
December	187	2	88.3	5,417
The period	.....	.....	.....	14,150

ARKANSAS RIVER AT HOLLY, COLO.

Location.—On line between secs. 14 and 15, T. 23 S., R. 42 W., at highway bridge half a mile southeast of Holly; 1 mile below the mouth of Wild Horse Creek, an intermittent stream.

Records available.—October 15, 1907, to December 31, 1913.

Drainage area.—Approximately 25,000 square miles.

Gage.—A number of pulleys and scales referred to the same datum are placed on the bridge at frequent intervals and as the river shifts its channel the chain gage is moved to a suitable pulley. The datum has remained unchanged. From October 25 to December 25, 1911, a gage referred to a different datum was used.

Control.—Very shifting.

Discharge measurements.—Made from bridge during high water and by wading at low stages.

Winter flow.—Ice causes backwater during a portion of the winter months.

Diversions.—Court decrees for diversions of approximately 600 second-feet from Arkansas River, between the stations near Lamar and Holly; many diversions from Arkansas River below Holly, in Kansas.

Cooperation.—Station maintained and records furnished by the state engineer of Colorado.

Accuracy.—Because of the shifting character of the stream, and the few discharge measurements, no estimates of daily and monthly discharge have been attempted.

Discharge measurements of Arkansas River at Holly, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 13	B. S. Clayton	2.53	167	June 15	C. L. Patterson	2.77	434
Apr. 26	C. L. Patterson	2.04	29.3	July 20	do	2.88	409
June 14	do	3.20	1,140	21	do	2.73	310

Daily gage height, in feet, of Arkansas River at Holly, Colo., for 1913.

[Arthur Burch, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.8	2.8	2.6	2.25	1.55	1.8	1.9	2.0	1.9	2.0	1.9	2.1
2	2.9	2.8	2.75	2.25	1.6	1.8	2.1	1.95	1.9	2.0	1.9	2.1
3	2.9	2.8	2.6	2.1	1.6	1.8	2.0	2.0	1.9	2.0	1.9	2.1
4	2.9	2.75	2.8	2.7	1.8	1.7	2.05	2.0	1.9	2.0	1.9	2.1
5	2.95	2.7	2.85	2.2	1.75	1.7	2.1	2.0	1.9	1.9	1.9	2.7
6	3.0	2.75	2.85	2.15	1.8	1.7	2.0	2.0	1.9	1.9	1.9	2.4
7	3.0	2.75	2.75	2.1	1.8	1.7	1.9	2.0	1.9	1.9	1.9	.....
8	3.0	2.8	2.65	2.3	1.75	2.8	1.9	2.05	1.9	1.9	1.9	.....
9	3.0	2.9	2.55	1.9	1.8	2.4	1.9	2.05	1.9	1.9	2.0	.....
10	3.0	3.0	2.5	1.95	1.8	2.0	1.9	1.9	1.9	1.9	2.0	.....
11	3.0	3.0	2.5	1.9	1.6	2.0	1.9	1.9	1.9	1.9	2.0	.....
12	3.0	2.95	2.5	2.0	1.6	2.0	1.9	1.9	1.9	1.9	2.0	.....
13	3.0	2.9	2.5	1.7	1.6	2.7	1.9	1.9	1.9	1.9	2.0	.....
14	3.0	2.8	2.6	1.7	1.55	3.4	1.9	1.9	1.9	1.9	2.0	.....
15	3.0	2.85	2.65	1.65	1.55	2.8	1.9	1.9	1.9	1.9	2.0	.....
16	3.0	2.85	2.5	1.6	1.6	2.5	1.9	1.9	1.9	1.9	2.0	.....
17	3.0	2.9	2.95	1.6	1.6	2.2	1.9	1.9	1.9	1.9	2.0	.....
18	3.0	2.9	2.85	1.6	1.7	2.05	1.9	1.85	1.9	1.9	2.0	.....
19	3.0	2.9	2.5	1.6	1.65	2.1	5.15	1.9	1.9	1.9	2.0	.....
20	2.95	2.9	2.75	1.5	1.7	2.1	2.75	1.95	1.9	1.9	2.0	.....
21	2.9	2.9	2.8	1.5	1.7	2.0	2.7	2.0	1.9	1.9	2.0	.....
22	2.9	2.85	2.7	1.9	1.7	1.9	2.5	2.0	1.9	1.9	2.0	.....
23	2.9	2.85	2.7	2.0	1.7	1.9	2.3	1.95	1.95	1.9	2.0	.....
24	2.9	2.8	2.5	2.1	1.7	1.9	2.2	1.9	1.9	1.9	2.0	.....
25	2.8	2.9	2.4	2.2	1.7	1.9	2.2	1.9	1.9	1.9	2.0	.....
26	2.8	2.9	2.5	2.0	1.7	1.9	2.45	1.9	1.9	1.9	2.0	.....
27	2.8	3.25	2.5	1.65	1.8	1.9	2.5	1.9	1.9	1.9	2.0	.....
28	2.85	2.95	2.4	1.65	1.7	1.9	2.35	1.9	2.0	1.9	2.0	.....
29	2.9	.....	2.4	1.6	1.7	1.9	2.2	1.9	2.0	1.9	2.0	.....
30	2.85	.....	2.4	1.5	1.7	1.9	2.2	1.9	2.0	1.9	2.1	.....
31	2.8	.....	2.4	.....	1.7	.....	2.45	1.9	.....	1.9	.....	.....

TENNESSEE FORK NEAR LEADVILLE, COLO

Location.—In sec. 16, T. 9 S., R. 80 W., at highway bridge a few hundred yards above mouth of stream and about 3 miles northwest of Leadville.

Records available.—1890; 1903; February 8, 1911, to November 14, 1913.

Drainage area.—45 square miles (measured on topographic sheet).

Gage.—Vertical staff, installed in 1911.

Control.—Permanent during 1913.

Discharge measurements.—Made from bridge during high water; at ordinary stages by wading.

Winter flow.—Ice causes backwater during winter months.

Diversions.—Court decrees for diversions of 24 second-feet above the station; also a decree for diversion of 18.5 second-feet from the basin of Eagle Creek to that of Tennessee Fork above station.

Accuracy.—Rating curve well-defined; owing to the high altitude of the drainage basin, however, alternate melting and freezing may cause considerable diurnal fluctuation in river stage at certain seasons, and the mean daily gage heights given by one reading per day in 1911 and 1912, and two readings per day in 1913, are therefore subject to considerable error; estimates as a whole can be considered only fair.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Tennessee Fork near Leadville, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 19	Raymond Richards	0.66	121	Sept. 8	R. H. Fletcher	0.14	21
June 22	R. H. Fletcher	.47	70	Oct. 14	Robert Follansbee	.04	14

Daily gage height, in feet, of Tennessee Fork near Leadville, Colo., for 1913.

[F. Coquoz, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	0.6	.....	0.22	0.10	0.00	0.00	.....
2	.....	0.60	.20	.10	.00	.00	.....
3	.....	.62	.20	.10	.00	.00	.....
4	.....	.62	.20	.10	.00	.00	.....
5	.....	.55	.18	.08	.00	.00	0.05
6	.....	.55	.18	.08	.02	.00	.10
7	.....	.55	.18	.05	.05	.00	.....
8	.....	.52	.20	.05	.10	.00	.10
9	.....	.50	.20	.05	.10	.00	.....
10	.6	.58	.20	.05	.10	.00	.....
11	.....	.72	.20	.08	.10	.00	.....
12	.....	.72	.15	.05	.05	.00	.....
13	.....	.42	.12	.08	.05	.00	.00
14	.....	.45	.10	.05	.05	.00	.05
15	.....	.45	.12	.05	.05	.00	.....
16	.5	.45	.25	.05	.05	.00	.....
17	.....	.45	.20	.05	.05	.00	.....
18	.....	.58	.30	.05	.00	.00	.....
19	.66	.48	.38	.05	.00	.00	.....
20	.....	.48	.25	.00	.00	.00	.....
21	.....	.48	.25	.00	.00	.00	.....
22	.....	.42	.25	.00	.00	.00	.....
23	.55	.48	.38	.00	.00	.00	.....
24	.....	.48	.55	.05	.00	.00	.....
25	1.5	.42	.30	.00	.00	.00	.....
26	.....	.42	.22	.00	.00	.00	.....
27	.....	.35	.20	.00	.00	.00	.....
28	.....	.38	.20	.00	.00	.00	.....
29	.....	.38	.20	.00	.00	.00	.....
30	.....	.28	.20	.00	.00	.00	.....
31	.....	.....	.15	.00	.....	.00	.....

NOTE.—Ice present Oct. 23, 1911, to Apr. 20, 1912; Nov. 14 to Dec. 31, 1912; gage read morning and evening from June 1 to Oct. 31, 1913, the record showing the mean; during 1911 and 1912 gage was read only once a day.

Daily discharge, in second-feet, of Tennessee Fork near Leadville, Colo., for 1911–13.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.											
1			18		118						
2				40		66	22				
3											
4				133		66					
5					166			12			
6									27		
7						48					
8	7										
9						40					
10			27				22				
11				103	103	34	22				
12				77							
13					77						
14							15	12	12		
15			12								
16				103		22	15		8		
17							15				
18					77		15				
19				202							
20											
21			12	103	66						
22											
23											
24			56		56						
25					56						12
26			166								
27			56		34		15				
28							15				
29			133					18			
30				133							
31				133							
1912.											
1						133					
2			15								
3				103	280						
4			17								
5											
6								15			
7					380						
8										8	
9							56				
10			27	103							
11			26								
12					240				12		
13											
14				56				15			
15							77				
16									12		
17						66		12			
18					240		34		11		
19				184			27				
20				166				12			
21											
22	11										
23						66		15	12		
24			22	360		66					
25											
26											
27											
28				320							
29			22								
30											
31						90	15				

Daily discharge, in second-feet, of Tennessee Fork near Leadville, Colo., for 1911–13—Con.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1913.											
1				103	100	30	18	12	12		
2					103	27	18	12	12		
3					109	27	18	12	12		
4					109	27	18	12	12		
5					90	25	17	12	12	15	
6					90	25	17	13	12	18	
7					90	25	17	15	12		
8					82	27	15	18	12	18	
9					77	27	15	18	12		
10				103	98	27	15	18	12		
11					140	27	17	18	12		
12					140	22	15	15	12		
13					60	20	17	15	12	12	
14					66	18	15	15	12	15	
15					66	20	15	15	12		
16				77	66	34	15	15	12		
17					66	27	15	15	12		
18					98	40	15	12	12		
19				121	73	53	15	12	12		
20					73	34	12	12	12		
21					73	34	12	12	12		
22					60	34	12	12	12		
23				90	73	53	12	12	12		
24					73	90	15	12	12		
25				440	60	40	12	12	12		
26					60	30	12	12	12		
27					48	27	12	12	12		
28					53	27	12	12	12		
29					53	27	12	12	12		
30					37	27	12	12	12		
31						22	12		12		

NOTE.—Daily discharge determined from a rating curve well defined between 10 and 250 second-feet. Owing to the scattering gage heights during 1911 and 1912, estimates of discharges are given only for the days on which the gage was read.

Monthly discharge of Tennessee Fork near Leadville, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	140	37	79.5	4,730	C.
July	90	18	31.4	1,930	C.
August	18	12	14.6	898	B.
September	18	12	13.5	803	B.
October	12	12	12.0	738	B.
The period				9,100	

HALF MOON CREEK NEAR LEADVILLE, COLO.

Location.—In sec. 6, T. 10 S., R. 80 W., 1 mile above mouth of stream and 6 miles southwest of Leadville; no tributaries below the station.

Records available.—April 10, 1911, to November 30, 1913.

Drainage area.—30 square miles (measured on topographic sheet).

Gage.—Vertical staff.

Control.—Shifting.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months and records are discontinued.

Diversions.—Court decrees for diversions of 12 second-feet above the station.

Accuracy.—Owing to the high altitude of the drainage basin, alternate melting and freezing may cause considerable diurnal fluctuations in stage at certain seasons of the year, and mean daily gage height derived from two readings per day may be considerably in error. For this reason the estimates in general can not be considered better than fair.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Half Moon Creek near Leadville, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 16	Raymond Richards....	0.38	23.7	Sept. 8	R. H. Fletcher.....	0.50	18.5
June 22	R. H. Fletcher.....	.78	66.5	Oct. 14	Robert Follansbee.....	.31	7.3

Daily gage height, in feet, of Half Moon Creek near Leadville, Colo., for 1913.

[Mrs. D. Colohan, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.6	0.85	0.5	0.5	0.3	0.25
2	.....	.8	.85	.5	.5	.3	.25
3	0.25	.8	.85	.5	.5	.3	.25
4	.....	.75	.85	.5	.45	.3	.25
5	.....	.65	.85	.5	.45	.3	.2
6	.....	.65	.85	.5	.45	.3	.2
7	.....	.7	.75	.5	.5	.3	.2
8	.....	.65	.8	.5	.55	.3	.2
9	.....	.75	.8	.5	.45	.3	.2
10	.....	.75	.7	.55	.4	.3	.2
11	.....	.8	.7	.5	.4	.3	.2
12	.....	.8	.7	.45	.4	.3	.2
13	.....	.75	.65	.4	.5	.3	.2
14	.....	.75	.6	.4	.5	.3	.2
15	.....	.7	.65	.4	.5	.3	.2
16	.6	.85	.6	.4	.5	.3	.2
17	.....	.85	.65	.4	.5	.3	.2
18	.....	.95	.7	.4	.5	.3	.2
19	.....	1.05	.7	.5	.5	.3	.2
20	.65	1.05	.7	.6	.5	.3	.2
21	.....	1.05	.6	.6	.4	.3	.2
22	.....	.95	.6	.6	.4	.3	.2
23	.....	.85	.65	.55	.4	.3	.15
24	.....	.8	.7	.55	.4	.3	.15
25	.....	.8	.7	.55	.4	.3	.15
26	.....	.9	.7	.55	.4	.25	.15
27	.7	.85	.7	.6	.4	.25	.15
28	.....	.85	.7	.55	.4	.25	.15
29	.....	.8	.6	.55	.4	.25	.15
30	.8	.8	.6	.5	.4	.25	.15
31	.8	.....	.5	.5	.....	.25	.....

NOTE.—Creek frozen over Nov. 30.

Daily discharge, in second-feet, of Half Moon Creek near Leadville, Colo., for 1913.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	45	82	18	18	7	6
2	.....	90	82	18	18	7	6
3	10	90	82	18	18	7	6
4	.....	78	82	18	14	7	6
5	.....	56	82	18	14	7	4
6	.....	56	82	18	14	7	4
7	.....	67	59	18	18	7	4
8	.....	56	70	18	24	7	4
9	.....	78	70	18	14	7	4
10	.....	78	48	24	10	7	4
11	.....	90	48	18	10	7	4
12	.....	90	48	14	10	7	4
13	.....	78	40	10	18	7	4
14	.....	78	31	10	18	7	4
15	.....	67	40	10	18	7	4
16	65	102	31	10	18	7	4
17	.....	102	40	10	18	7	4
18	.....	130	48	10	18	7	4
19	.....	138	48	18	18	7	4
20	70	138	48	31	18	7	4
21	.....	138	31	31	12	7	4
22	.....	109	31	31	12	7	4
23	.....	82	40	24	10	7	3
24	.....	70	48	24	10	7	3
25	.....	70	48	24	9	7	3
26	.....	95	48	24	9	6	3
27	67	82	48	31	9	6	3
28	.....	82	48	24	8	6	3
29	.....	70	31	24	8	6	3
30	90	70	31	18	8	6	3
31	90	.....	18	18	.....	6	.....

NOTE.—Daily discharge prior to June 19 determined by indirect method for shifting channel; discharge subsequent to that date determined from two well-defined rating curves, one used from June 19 to Sept. 20, and the other from Oct. 1 to Nov. 30. Discharge Sept. 21–30 determined by indirect method.

Monthly discharge of Half Moon Creek near Leadville, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	138	45	85.8	5,110	C.
July	82	18	51.1	3,140	C.
August	31	10	19.4	1,190	C.
September	24	8	14.0	833	C.
October	7	6	6.81	419	B.
November	6	3	4.00	238	B.
The period	.....	.....	.....	10,900	

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

Location.—In sec. 22, T. 14 S., R. 79 W., in the Leadville National Forest, half a mile below the old Hot Springs Hotel, and 6 miles west of Buena Vista; 2 miles below mouth of South Fork, the nearest tributary.

Records available.—April 7, 1911, to December 31, 1913. From September 3, 1910, to September 13, 1911, a station was maintained in sec. 21, 1 mile above present station.

Drainage area.—72 square miles (measured on forest atlas).

Gage.—Vertical staff.

Control.—Rough but permanent.

Discharge measurements.—Made from bridge or by wading.

Winter flow.—River kept open during winter months by hot springs above station.

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

Accuracy.—Owing to the high altitude of the drainage basin, alternate melting and freezing probably cause considerable diurnal fluctuation of river stage at certain seasons; mean daily gage heights given by one reading per day are therefore subject to considerable error; estimates only fair or possibly good. Rating curve for 1913 is good.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 22	Raymond Richards....	1.02	71	Sept. 9	R. H. Fletcher.....	0.95	63
June 21	R. H. Fletcher.....	1.75	187	Oct. 13	Robert Follansbee.....	.87	50

Daily gage height, in feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for 1913.

[E. D. Masters, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.62	0.62	.....	0.59	0.76	1.80	.....	.....	0.90	0.95	.....	0.60
2	.62	.62	0.64	.59	.86	1.80	.....	.....	.90	1.00	0.70	.65
3	.62	.62	.59	.54	.76	1.70	.....	.....	.85	1.00	.70	.70
4	.62	.62	.59	.54	.76	1.70	.....	.....	.85	1.00	.75	.70
5	.62	.62	.59	.54	.76	1.70	.....	.95	.85	1.00	.75	.70
6	.62	.62	.59	.54	.81	1.70	.....	.90	.85	.95	.75	.75
7	.62	.62	.59	.54	.96	1.50	.....	.90	.85	.95	.70	.75
8	.62	.62	.59	.54	1.01	1.50	.....	.90	.85	.95	.70	.70
9	.62	.62	.59	.54	.91	1.60	.....	.....	.92	.95	.70	.75
10	.62	.62	.59	.54	.96	1.80	.....	.....	.90	1.00	.70	.70
11	.62	.62	.59	.54	1.06	1.70	.....	.....	.90	1.00	.75	.70
12	.62	.62	.59	.54	1.16	1.60	.....	.....	1.00	.95	.70	.70
13	.62	.62	.59	.54	1.16	1.50	.....	.....	1.00	.98	.75	.70
14	.62	.62	.59	.54	1.06	1.50	.....	.....	1.00	.95	.75	.70
15	.62	.62	.59	.59	.86	1.70	.....	.....	1.00	.95	.75	.70
16	.62	.62	.59	.61	.86	1.80	.....	.....	.95	.90	.65	.70
17	.62	.62	.59	.61	.96	1.80	1.00	.....	.95	.85	.65	.70
18	.62	.62	.59	.66	1.06	1.80	1.00	.90	.90	.80	.70	.70
19	.62	.57	.59	.66	1.16	1.80	1.00	.90	.90	.80	.70	.65
20	.62	.57	.59	.66	1.06	1.90	1.00	.85	.90	.80	.70	.60
21	62	.57	.59	.66	.96	1.80	1.00	.85	.90	.75	.70	.60
22	.62	.57	.59	.66	.99	1.80	1.30	.90	.90	.75	.70	.65
23	.62	.57	.59	.66	1.10	1.70	1.30	1.00	.90	.80	.60	.65
24	.62	.57	.59	.56	1.30	1.70	1.20	1.00	.90	.80	.65	.70
25	.62	.57	.59	.56	1.30	1.70	1.10	1.00	.90	.80	.70	.70
26	.62	.62	.59	.56	1.60	1.70	1.10	.95	.90	.85	.70	.65
27	.62	.62	.54	.61	1.80	1.70	.....	.95	.90	.85	.70	.65
28	.62	.62	.54	.61	1.50	1.65	.....	.90	.90	.70	.65	.65
29	.62	.....	.54	.66	1.70	1.65	.....	.90	.90	.75	.65	.65
30	.62	.....	.59	.71	1.80	1.65	.....	.90	.90	.75	.60	.60
31	.62	.....	.59	.....	1.90	.....	.....	.....	.....	.70	.....	.60

Daily discharge, in second-feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	21	21	22	18	37	200	.....	70	55	62	30	19
2	21	21	23	18	50	200	.....	68	55	68	30	24
3	21	21	18	14	37	181	.....	66	48	68	30	30
4	21	21	18	14	37	181	.....	64	48	68	36	36
5	21	21	18	14	37	181	.....	62	48	68	36	30
6	21	21	18	14	43	181	.....	55	48	62	36	36
7	21	21	18	14	63	144	.....	55	48	62	30	36
8	21	21	18	14	69	144	.....	55	48	62	30	30
9	21	21	18	14	56	162	.....	.....	58	62	30	36
10	21	21	18	14	63	200	.....	.....	55	68	30	30
11	21	21	18	14	76	181	.....	.....	55	68	36	30
12	21	21	18	14	90	162	.....	.....	68	62	30	30
13	21	21	18	14	90	144	.....	.....	68	65	36	30
14	21	21	18	14	76	144	.....	.....	68	62	36	30
15	21	21	18	18	50	181	.....	.....	68	62	36	30
16	21	21	18	20	50	200	.....	.....	62	55	24	30
17	21	21	18	20	63	200	68	.....	62	48	24	30
18	21	21	18	26	76	200	68	55	55	42	30	30
19	21	17	18	26	90	200	68	55	55	42	30	24
20	21	17	18	26	76	220	68	48	55	42	30	19
21	21	17	18	26	63	200	68	48	55	36	30	19
22	21	17	18	26	67	200	111	55	55	36	30	24
23	21	17	18	26	82	181	111	68	55	42	19	24
24	21	17	18	16	111	181	96	68	55	42	24	30
25	21	17	18	16	111	181	82	68	55	42	30	30
26	21	21	18	16	162	181	82	62	55	48	30	24
27	21	21	14	20	200	181	80	62	55	48	30	24
28	21	21	14	20	144	172	78	55	55	30	24	24
29	21	.....	14	26	181	172	76	55	55	36	24	24
30	21	.....	18	31	200	172	74	55	55	36	19	19
31	21	.....	18	.....	220	.....	72	.....	.....	30	.....	19

NOTE.—Daily discharge determined from a rating curve well defined throughout. Discharge estimated July 27 to Aug. 4 by comparison with records of nearby stations. Estimates not made for discharge July 1 to 16, nor Aug. 9 to 17.

Monthly discharge of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	21	21	21.0	1,290	B.
February	21	17	20.0	1,110	B.
March	23	14	17.9	1,100	B.
April	31	14	18.8	1,120	B.
May	220	37	89.4	5,500	C.
June	220	144	181	10,800	C.
July 16–31	111	68	80.1	2,380	C.
September	68	48	55.9	3,330	B.
October	68	30	52.4	3,220	C.
November	36	19	29.7	1,770	B.
December	36	19	27.3	1,680	B.

NORTH COTTONWOOD CREEK NEAR BUENA VISTA, COLO.

Location.—In sec. 10, T. 14 S., R 79 W., at highway bridge 6 miles northwest of Buena Vista, just below a small stream entering from the west, 1½ miles below mouth of Silver Creek.

Records available.—October 5, 1911, to December 31, 1913.

Drainage area.—50 square miles (measured on forest atlas).

Gage.—Vertical staff.

Control.—Practically permanent.

Discharge measurements.—Made from the bridge during high water; at ordinary stages by wading.

Winter flow.—Ice causes some backwater during winter months.

Diversions.—Court decrees for diversions of 35 second-feet from North Cottonwood Creek.

Accuracy.—Rating curve good, but owing to the high altitude of the drainage basin, alternate melting and freezing probably cause considerable diurnal fluctuations of the river stage at certain seasons; mean daily gage height given by one reading per day may therefore be considerably in error; estimates only fair.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of North Cottonwood Creek near Buena Vista, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 22	Raymond Richards	4.24	20	Sept. 9	R. H. Fletcher	4.25	22
June 21	R. H. Fletcher	4.90	49	Oct. 13	Robert Follansbee	4.04	11

Daily gage height, in feet, of North Cottonwood Creek near Buena Vista, Colo., for 1913.

[C. A. Mack, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1								4.15	
2					4.3				
3		4.1					4.2	4.15	4.15
4									
5						4.1			
6		4.1							4.05
7		4.25	4.8				4.25		
8				4.4	4.1	4.4		4.13	4.03
9			5.25			4.25	4.2		
10									
11								4.08	
12									
13							4.05		4.02
14		4.1					4.15		
15				4.3				4.1	4.0
16		4.1			4.1	4.45	4.18		
17			5.3						
18				4.3		4.4	4.05	4.1	
19		4.1							
20									4.0
21			4.9						
22		4.25						4.07	
23	3.95			4.8	4.15		4.2		
24						4.3		4.1	4.01
25				4.7			4.18		
26	4.05							4.09	
27						4.15			
28							4.2		
29							4.22		4.02
30	4.05					4.25			
31				4.4					

NOTE.—Gage heights Dec. 26-31 slightly affected by ice.

Daily discharge, in second-feet, of North Cottonwood Creek near Buena Vista., Colo., for 1913.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		11			24	14	19	16	15
2		11			22	14	19	16	15
3		10			22	14	18	16	16
4		11			20	14	18	17	14
5		12			18	14	18	17	13
6		14			18	15	19	17	12
7		20	45		16	16	20	16	12
8		19		26	14	26	19	15	12
9		18	75	25		20	18	14	12
10		17		25		20	16	14	12
11		16		24		20	14	13	12
12		15		24		24	13	13	12
13		14		23		26	12	14	12
14		14		23		28	16	14	11
15		14		22		28	16	14	11
16		14		22	14	28	17	14	11
17		14	79	22	14	28	17	14	11
18		14		22	14	26	12	14	10
19		14		22	15	26	13	14	10
20		16		22	15	25	14	13	10
21		18	51	23	15	25	15	13	10
22		20		40	16	24	16	13	10
23	10			45	16	23	18	14	10
24	10			42	16	22	18	14	10
25	11			40	16	20	17	14	10
26	12			38	15	18	17	14	9
27	12			35	15	16	18	14	9
28	12			32	15	17	18	14	9
29	12			30	15	18	19	14	9
30	12			28	15	20	18	14	9
31				26	15		17		9

NOTE.—Daily discharge determined from a rating curve well defined below 300 second-feet. Discharge estimated by comparison with Cottonwood Creek for days on which gage was not read, except during high-water period from May 23 to July 7 and for period from Aug. 9 to 15, when rain fell. Discharge Dec. 20–31 gradually decreased, as shown by measurement made in January, 1914.

Monthly discharge of North Cottonwood Creek near Buena Vista, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 1–22	20	10	14.8	646	D.
July 8–31	45	22	28.4	1,350	D.
September	28	14	21.0	1,250	C.
October	20	12	16.7	1,030	C.
November	17	13	14.4	857	B.
December	16	9	11.2	689	C.

CHALK CREEK (UPPER STATION) NEAR ST. ELMO, COLO.

Location.—In sec. 27, T. 15 S., R. 80 W., in the Leadville National Forest, a quarter of a mile below the power plant of the Tin Cup Gold Dredging Co., and 1¼ miles below St. Elmo. Nearest tributary, Coal Creek, enters a quarter of a mile below.

Records available.—November 15 to December 21, 1913.

Drainage area.—48 square miles (measured on forest atlas).

Gage.—Recording gage owned by the Tin Cup Gold Dredging Co.

Control.—Data too meager to determine.

Discharge measurements.—Made from footbridge or by wading.

Winter flow.—Ice causes backwater; discharge measurements made to determine approximate winter flow.

Diversions.—No court decrees for diversions of water not returned to the stream above the station.

Regulation.—Low-water flow controlled to a certain extent by a small reservoir at St. Elmo formed by the diversion dam for the Tin Cup Gold Dredging Co.'s power house.

Cooperation.—Station maintained in cooperation with the Tin Cup Gold Dredging Co., which furnished the gage heights.

Data insufficient for estimates of daily discharge.

The following discharge measurement was made by R. H. Fletcher:

November 15, 1913: Gage height, 1.20 feet; discharge, 11.6 second-feet.

Daily gage height, in feet, of Chalk Creek (upper station) near St. Elmo, Colo., for 1913.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	1.17	11	.....	1.16	21	1.16	1.35
2	.....	1.19	12	.....	1.17	22	1.17	.....
3	.....	1.09	13	.....	1.17	23	1.17	.....
4	.....	1.12	14	.....	1.22	24	1.14	.....
5	.....	1.15	15	1.20	1.15	25	1.16	.....
6	.....	1.15	16	1.23	1.18	26	1.15	.....
7	.....	1.14	17	1.20	1.09	27	1.19	.....
8	.....	1.16	18	1.24	1.12	28	1.17	.....
9	.....	1.15	19	1.18	1.10	29	1.17	.....
10	.....	1.15	20	1.13	1.37	30	1.17	.....

NOTE.—Backwater from ice Dec. 20–31.

CHALK CREEK NEAR ST. ELMO, COLO.

Location.—In sec. 28, T. 15 S., R. 79 W., in the Leadville National Forest, at highway bridge, just below the cascades of Chalk Creek, and 6 miles east of St. Elmo. Nearest tributary a small intermittent stream entering from the north just below station.

Records available.—March 10, 1911, to December 31, 1913. From September 6–December 28, 1910, a station was maintained in sec. 24, T. 15 S., R. 79 W.

Drainage area.—75 square miles (measured on forest atlas).

Gage.—Vertical staff.

Control.—Somewhat shifting.

Discharge measurements.—Made from the bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes slight backwater; discharge measurements made to determine approximate flow.

Diversions.—No court decrees for diversions from Chalk Creek between the upper station and this one; decrees for 117 second-feet below.

Accuracy.—Owing to the high altitude of the drainage basin, alternate melting and freezing probably cause considerable diurnal fluctuation in stage at certain seasons, so that the mean daily gage height given by one reading per day and the maximum stage from high-water mark may be considerably in error. Estimates only fair.

Cooperation.—Station maintained in cooperation with United States Forest Service.

Discharge measurements of Chalk Creek near St. Elmo, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 21	Raymond Richards	1.46	86	Oct. 13	Robert Follansbee	1.16	40
July 16	R. H. Fletcher	1.43	89	Nov. 11	R. H. Fletcher	1.02	21

Daily gage height, in feet, of Chalk Creek near St. Elmo, Colo., for 1913.

[John Mohr and Lee Dillon, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.75	0.73	.....	0.83	1.13	1.90	1.85	1.34	.....	1.26	0.96	1.2
2	.....	.74	.....	.82	1.16	1.90	1.80	1.34	.....	1.26	.....	1.25
3	.75	.....	0.67	.79	1.16	1.85	1.80	1.34	.....	1.26	1.06	.....
4	.75	.75	.75	.78	1.15	1.85	1.75	1.32	.....	1.26	1.46	.....
5	.74	.78	.74	.77	1.26	1.80	1.75	1.33	.....	.....	1.06	.....
6	.75	.73	.73	.81	1.41	1.80	1.70	1.32	.....	1.26	.96	.....
7	.....	.75	.74	.79	1.46	1.75	1.60	1.33	.....	1.16	.96	.....
8	.75	.75	.73	.78	1.49	1.70	1.60	1.28	1.41	1.26	.96	.....
9	.75	.75	.76	.80	1.39	1.80	1.60	1.24	1.36	1.11	.....	.....
10	.73	.72	.74	.81	1.44	1.90	1.70	.....	.....	1.11	1.01	.....
11	.73	.75	.77	.81	1.55	1.90	1.65	.....	.....	1.08	.99	.....
12	.73	.73	.76	.81	1.60	1.95	1.60	.....	1.36	.....	1.1	.....
13	.73	.73	.77	.78	1.65	1.85	1.55	.....	1.36	1.16	1.0	.....
14	.73	.73	.....	.96	1.55	1.90	1.48	.....	.....	1.16	1.0	.....
15	.73	.71	.....	.91	1.44	1.95	1.46	.....	1.31	1.14	.95	1.05
16	.71	.75	.....	.89	1.33	2.00	1.50	.....	.....	1.06	.....	.90
17	.72	.76	.77	1.11	1.48	2.00	1.60	.....	.....	1.06	1.0	.90
18	.72	.74	.75	1.01	1.60	2.05	1.50	1.28	.....	.96	1.0	1.00
19	.72	.74	.76	1.01	1.65	2.05	1.46	.....	.....	.....	1.05	1.15
20	.68	.....	.74	.93	1.55	2.00	1.48	.....	1.31	1.11	.95	.....
21	.71	.....	.72	1.01	1.50	2.00	1.60	.....	.....	1.06	1.0	.....
22	.72	.....	.74	1.08	1.60	1.95	1.70	.....	.....	1.08	1.0	.....
23	.72	.....	.75	1.01	1.80	1.90	1.75	.....	.....	1.06	.....	.90
24	.73	.....	.73	1.01	1.85	1.95	1.75	.....	.....	1.04	1.2	.90
25	.74	.75	.....	1.04	1.80	1.95	1.65	1.38	.....	.96	.95	.90
26	.75	.74	.....	.91	1.95	1.90	1.65	.....	1.16	.....	.90	.95
27	.76	.74	.....	1.01	1.90	1.95	1.46	.....	.....	1.06	.90	.95
28	.75	.....	.....	1.13	1.75	1.95	1.44	1.43	.....	1.06	.90	.....
29	.75	.....	.78	1.21	1.85	1.90	1.42	.....	.....	.98	1.25	.90
30	.75	.....	.77	1.23	1.90	1.90	1.41	.....	.....	1.65	.....	.90
31	.74	.....	.78	.....	1.85	.....	1.38	.....	.....	1.06	.....	.90

NOTE.—Practically no backwater from ice, except a few days during the last part of November and first part of December.

Daily discharge, in second-feet, of Chalk Creek near St. Elmo, Colo., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10	9	10	10	28	300	270	66	94	54	17	16
2	10	10	9	10	32	300	240	66	93	54	20	16
3	10	10	8	9	32	270	240	66	92	54	24	16
4	10	10	10	9	30	270	215	62	91	54	96	16
5	10	11	10	8	44	240	215	64	90	54	24	16
6	10	9	9	9	72	240	190	62	89	54	17	17
7	10	10	10	9	89	215	146	64	88	39	17	17
8	10	10	9	9	99	190	146	54	88	54	17	17
9	10	10	10	9	67	240	146	47	75	32	18	17
10	9	9	10	9	82	300	190	.....	75	32	19	17
11	9	10	11	9	120	300	168	.....	75	29	19	17
12	9	9	10	9	138	332	146	.....	75	34	28	17
13	9	9	11	9	159	270	128	.....	75	39	19	17
14	9	9	11	16	120	300	104	.....	69	39	19	17
15	9	9	11	14	82	332	98	.....	63	36	17	17
16	9	10	11	12	56	365	110	.....	63	27	18	17
17	9	10	11	26	95	365	146	.....	63	27	19	17
18	9	10	10	19	138	380	110	54	63	19	19	24
19	9	10	10	19	159	380	98	56	63	26	23	24
20	8	10	10	14	120	365	104	56	63	32	17	22
21	9	10	9	19	102	365	146	56	59	27	19	20
22	9	10	10	24	138	332	190	62	54	28	19	18
23	9	10	10	19	230	300	215	67	50	25	18	17
24	9	10	9	19	258	332	215	72	46	24	18	17
25	10	10	9	21	230	332	168	78	42	18	18	17
26	10	10	9	14	317	300	168	80	38	22	16	21
27	10	10	10	19	285	332	98	88	40	25	16	21
28	10	10	10	28	205	332	92	96	45	25	16	19
29	10	.....	10	37	258	300	86	96	45	18	16	17
30	10	.....	10	40	285	300	83	95	50	150	16	17
31	10	.....	10	.....	258	.....	75	95	.....	25	.....	17

NOTE.—Daily discharge determined from two rating curves, one used from Apr. 1 to May 31, and the other from June 1 to Aug. 9. Discharge for rest of year determined by indirect method. Discharge for days for which gage heights are missing estimated by comparison with records of Cottonwood Creek except for period Aug. 10–17, when rain occurred.

Monthly discharge of Chalk Creek near St. Elmo, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	10	8	9.48	583	D.
February	11	9	9.79	544	D.
March	11	8	9.90	609	D.
April	40	8	15.9	946	C.
May	317	28	140	8,610	C.
June	380	190	306	18,200	C.
July	270	75	153	9,410	C.
September	94	38	67.2	4,000	C.
October	150	18	37.9	2,330	C.
November	96	16	21.3	1,270	C.
December	24	16	17.9	1,100	D.

SOUTH FORK OF ARKANSAS RIVER AT PONCHA, COLO.

Location.—In sec. 10, T. 49 N., R. 8 E., at highway bridge about half a mile from Poncha; nearest tributary, Poncha Creek, enters one-fourth mile below.

Records available.—January 14, 1911, to October 25, 1913.

Drainage area.—140 square miles (measured on forest atlas).

Gage.—Vertical staff.

Control.—Practically permanent during 1913.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Not affected by ice; stream kept open by springs.

Diversions.—Court decrees for diversions of 114 second-feet from the South Fork above station, and 77 second-feet below; also for 85 second-feet from the North Fork, which enters above.

Accuracy.—Owing to the high altitude of the drainage basin, alternate melting and freezing cause diurnal fluctuations of stage during certain seasons; mean daily gage height is based on record of the maximum stage, which occurs during the night, and readings at 6 a. m. and 6 p. m.; mean stage determined in this manner may be somewhat in error; estimates therefore only good.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of South Fork of Arkansas River at Poncha, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 16	Robert Follansbee	−0.03	16.5	Aug. 26	R. H. Fletcher	0.10	20.4
June 20	R. H. Fletcher	1.00	134	Oct. 25	Robert Follansbee	−.20	7.0

Daily gage height, in feet, and discharge, in second-feet, of South Fork of Arkansas River at Poncha, Colo., for 1913.

[J. M. Cuenin, observer.]

Day.	May.		June.		July.		Aug.		Sept.		Oct.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	−0.02	15	1.10	152	0.37	40	−0.40	4	−0.02	15	−0.07	13
2	− .02	15	1.20	173	.10	21	− .28	7	.00	16	− .03	15
3	− .25	8	1.05	142	.00	16	− .30	6	.00	16	.03	18
4	− .30	6	.93	119	− .12	11	− .12	11	− .23	8	.00	16
5	− .35	5	.70	79	− .03	15	− .05	14	− .40	4	.02	17
6	− .08	13	.67	75	.07	20	.00	16	− .40	4	− .15	10
7	.00	16	.53	57	.10	21	.02	17	− .55	2	− .22	8
8	.12	22	.60	65	.07	20	− .15	10	− .35	5	− .20	9
9	.15	24	1.40	218	.13	23	− .25	8	− .40	4	− .15	10
10	.15	24	1.55	255	.03	18	− .25	8	− .40	4	− .15	10
11	.55	59	.....	.....	.03	18	− .08	13	− .40	4	− .15	10
12	1.00	132	.....	.....	.07	20	.33	37	− .40	4	− .08	13
13	1.00	132	.....	.....	.05	18	.06	19	− .40	4	− .10	12
14	.83	100	1.10	152	− .20	9	− .02	15	− .30	6	− .10	12
15	.25	30	1.30	195	− .10	12	.....	17	− .22	8	− .10	12
16	.07	20	1.30	195	.....	13	.....	18	− .28	7	− .12	11
17	.10	21	1.20	173	.....	14	.....	20	− .30	6	− .20	9
18	.28	33	1.15	162	.....	15	.10	21	− .23	8	− .23	8
19	.43	46	1.25	184	.00	16	.27	32	− .35	5	− .20	9
20	.22	28	1.10	152	.20	27	.43	46	− .25	8	− .20	9
21	.03	18	1.25	184	.47	50	.22	28	− .22	8	− .20	9
22	.05	18	1.45	230	.22	28	.17	25	− .25	8	− .25	8
23	.50	53	1.30	195	.90	113	.17	25	− .13	11	− .25	8
24	.90	113	1.30	195	.40	43	.10	21	− .17	10	− .20	9
25	1.15	162	1.15	162	.18	26	.17	25	− .15	10	− .15	10
26	1.30	195	.83	100	.22	28	.12	22	− .18	10	.....	.....
27	1.35	206	.60	65	.10	21	.10	21	− .22	8	.....	.....
28	1.20	173	.50	53	.08	20	.12	22	− .22	8	.....	.....
29	1.25	184	.45	48	− .22	8	.10	21	− .25	8	.....	.....
30	1.20	173	.27	32	− .50	3	.00	16	− .22	8	.....	.....
31	1.25	184	.....	.....	− .42	4	.00	16	.....	.....	.....	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge interpolated July 16–18, and Aug. 15–17.

Monthly discharge of South Fork of Arkansas River at Poncha, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	206	5	71.9	4,420	C.
July	113	3	22.9	1,410	C.
August	46	4	18.7	1,150	B.
September	16	2	7.57	450	B.
October 1–25	18	8	11.0	546	B.

PONCHA CREEK AT PONCHA, COLO.

Location.—In sec. 10, T. 49 N., R. 8 E., at highway bridge near Poncha, about one-fourth mile above the mouth of creek.

Records available.—January 14, 1911, to October 25, 1913.

Drainage area.—89 square miles (measured on forest atlas).

Gage.—Vertical staff.

Control.—Fairly permanent during 1913.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Springs prevent the creek from freezing to any considerable extent.

Diversions.—Court decrees for diversions of 7 second-feet above station but none below.

Accuracy.—Owing to the high altitude of this drainage basin, alternate melting and freezing are likely to cause considerable diurnal fluctuations of the stream at certain seasons of the year, and the mean daily gage height derived from morning and evening readings and record of the maximum stage for the 24 hours may be somewhat in error; estimates of daily discharge therefore only fair.

Cooperation.—Station maintained in cooperation with United States Forest Service.

Discharge measurements of Poncha Creek at Poncha, Colo., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 16	Robert Follansbee	0.99	43	Aug. 26	R. H. Fletcher	0.35	6.9
June 20	R. H. Fletcher	1.10	59	Oct. 25	Robert Follansbee	.25	5.0

Daily gage height, in feet, and discharge, in second-feet, of Poncha Creek at Poncha, Colo., for 1913.

[J. M. Cuenin, observer.]

Day.	May.		June.		July.		Aug.		Sept.		Oct.	
	Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	0.82	31	1.15	58	0.73	26	0.42	11	0.47	13	0.60	19
2	.80	30	1.25	68	.72	25	.45	12	.45	12	.53	16
3	.70	24	1.10	54	.70	24	.42	11	.47	13	.53	16
4	.65	22	1.15	58	.68	23	.42	11	.47	13	.55	16
5	.70	24	.93	39	.58	18	.38	9	.40	10	.53	16
6	.80	30	1.05	50	.60	19	.35	8	.40	10	.35	8
7	.88	36	.97	43	.57	18	.40	10	.40	10	.62	20
8	.92	39	1.05	50	.57	18	.32	7	.45	12	.30	6
9	.85	34	1.30	73	.63	20	.30	6	.40	10	.32	7
10	1.15	58	1.25	68	.63	20	.30	6	.40	10	.25	4
11	1.15	58	.....	.....	.57	18	.42	11	.40	10	.35	8
12	1.10	54	.....	.....	.52	15	.45	12	.40	10	.50	14
13	1.25	68	.....	.....	.47	13	.53	16	.40	10	.53	16
14	1.35	78	1.35	78	.47	13	.48	13	.40	10	.42	11
15	1.00	45	1.20	63	.50	14	.....	13	.43	11	.38	9
16	1.00	45	1.20	63	.....	14	.....	13	.45	12	.38	9
17	1.20	73	1.10	54	.....	14	.....	13	.45	12	.33	7
18	1.20	73	1.10	54	.....	20	.48	13	.42	11	.32	7
19	1.30	73	1.15	58	.75	27	.48	13	.37	9	.30	6
20	1.10	54	1.20	63	.95	41	.50	14	.23	4	.28	5
21	1.05	50	1.10	54	.87	35	.48	13	.30	6	.30	6
22	1.10	54	1.05	50	.95	41	.45	12	.23	4	.20	3
23	1.25	68	.93	39	.93	39	.42	11	.33	7	.25	4
24	1.30	73	1.00	45	.87	35	.38	9	.37	9	.20	3
25	1.35	78	.88	36	.70	24	.43	11	.37	9	.25	4
26	1.35	78	.83	32	.63	20	.40	10	.35	8	.....	.....
27	1.55	100	.90	37	.62	20	.42	11	.38	9	.....	.....
28	1.30	73	.77	28	.53	16	.38	9	.35	8	.....	.....
29	1.35	78	.77	28	.53	16	.45	12	.35	8	.....	.....
30	1.25	68	.72	25	.55	16	.47	13	.35	8	.....	.....
31	1.35	78	.....	.....	.48	13	.52	15	.....	.....	.....	.....

NOTE.—Daily discharge determined from a rating curve not very well defined above 40 second-feet. Discharge interpolated July 16–18, and Aug. 15–17.

Monthly discharge of Poncha Creek at Poncha, Colo., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	100	22	56.4	3,470	C.
July	41	13	21.8	1,340	C.
August	16	6	11.2	689	C.
September	13	4	9.60	571	C.
October 1–25	20	3	9.60	476	C.

WEST BEAVER CREEK NEAR VICTOR, COLO.

Location.—In sec. 30, T. 16 S., R. 68 W., at the Skagway power station of the Arkansas Valley Railway, Light & Power Co., about 7 miles southeast of Victor.

Records available.—January 1, 1905, to December 31, 1913.

Drainage area.—70 square miles.

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

Diversions.—Above the power reservoir are three reservoirs from which the town of Victor obtains its municipal supply. In the upper basin are four reservoirs from which water is diverted into Lake Moraine, and thence by natural channels to Colorado Springs, where it is used as municipal supply. Filings for these diversions from the basin—52 second-feet by ditch and 5 second-feet by pipe line—have not yet been adjudicated. The town of Altman, for municipal supply, has also filed on five reservoir sites in the upper basin, having a combined capacity of 2,300 acre-feet. Below the power plant there are adjudicated decrees for diversions of 57 second-feet from Beaver Creek, which is formed by East and West Beaver creeks. In addition there is an irrigation reservoir in operation which has a filing for 4,760 acre-feet.

Cooperation.—Records are furnished through courtesy of Arkansas Valley Railway, Light & Power Co., and are said to be probably correct within 5 per cent.

Monthly discharge of West Beaver Creek near Victor, Colo., for 1913.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
January	2.01	124	August	13.2	812
February	3.30	183	September	14.1	839
March	6.47	398	October	9.97	613
April	16.6	988	November	8.08	481
May	10.2	627	December	7.23	445
June	40.0	2,380			
July	14.2	873	The year	12.1	8,760

CANADIAN RIVER NEAR SANCHEZ, N. MEX.

Location.—In sec. 8, T. 17 N., R. 24 E., 1 mile below the old Sanchez ruins, 2 miles north of Sanchez post office, 30 miles northwest of Bell Ranch post office; about 5 miles south of the mouth of Mora River, and 1½ miles below the mouth of Canyon Largo.

Records available.—May 15, 1912, to December 31, 1913.
Drainage area.—Not measured.
Gage.—Automatic recording.
Control.—Shifting.
Discharge measurements.—Made by wading at low stages and from a cable during medium stages. Flood stages are measured by applying Kutter's formula to the slope and cross section.
Winter flow.—Slightly affected by ice.
Diversions.—A large part of the flow is diverted for irrigation above the station.
Accuracy.—The extreme high-water estimates made June 11 to 17, 1913, are based on the slope and cross section of the stream at the various stages; results fair.
Cooperation.—Maintained in cooperation with the Red River Valley Co., Bell Ranch, N. Mex.

Discharge measurements of Canadian River near Sanchez, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft*
Feb. 5	C. J. Emerson	1.66	52.7	July 18	C. J. Emerson	2.20	72.9
Mar. 28	do	1.10	6.4	Aug. 6	do	1.75	23.7
May 2	do	1.26	11.5	Sept. 2	do	1.98	60.0
June 4	do	1.78	66.0	Nov. 18	J. E. Powers	1.90	40.4
24	do	4.02	687				

Daily gage height, in feet, of Canadian River near Sanchez, N. Mex., for 1913.

[Luther Hamilton, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	.....	1.75	1.05	1.2	1.05	3.6	2.25	2.1	2.6	2.0	2.05
2	1.45	.....	1.75	1.1	1.25	1.05	3.25	2.1	2.05	[b]4.0	2.0	2.0
3	1.55	.....	1.75	1.1	1.25	1.35	3.05	2.0	2.0	.....	2.0	2.0
4	1.5	1.5	1.7	1.05	1.2	1.75	3.05	1.85	2.0	.....	2.0	2.2
5	1.55	1.55	1.7	1.0	1.15	1.55	3.0	1.8	2.0	.....	2.05	2.2
6	1.7	1.75	1.7	1.0	1.1	1.3	3.05	1.75	1.9	.....	2.05	2.1
7	1.65	1.7	1.7	1.0	1.05	1.5	3.25	1.75	.....	2.5	2.0	2.0
8	1.65	1.7	1.7	1.0	1.15	2.0	3.3	1.75	.....	2.5	1.9	2.0
9	1.65	1.75	1.7	1.2	1.15	3.45	3.1	1.75	1.9	2.5	1.85	2.15
10	1.65	1.75	1.65	1.15	1.15	4.4	3.0	1.75	1.95	2.4	1.8	2.2
11	1.65	1.85	1.65	1.15	1.1	.....	3.45	1.75	1.95	2.4	1.8	2.2
12	1.6	1.9	1.6	1.1	1.05	(a)	3.25	1.9	2.1	2.4	1.9	2.2
13	1.6	1.8	1.55	1.15	1.0	.....	3.05	2.1	2.4	2.35	1.9	2.2
14	1.55	1.7	1.55	1.1	1.0	.....	2.8	2.05	2.2	2.0	1.9	2.2
15	1.6	1.7	1.5	1.1	1.0	.....	2.55	2.05	1.9	2.05	1.9	2.1
16	1.6	1.75	1.5	1.1	1.0	.....	2.5	2.05	1.9	2.05	1.9	2.0
17	1.75	1.8	1.5	1.1	1.05	.....	2.5	2.1	1.95	2.1	1.9	1.9
18	1.7	1.75	1.45	1.1	1.1	5.3	2.4	2.3	1.95	2.1	1.9	1.95
19	1.6	1.75	1.4	1.1	1.05	5.8	2.4	1.95	1.9	2.1	1.95	2.0
20	1.55	1.9	1.4	1.1	1.0	5.4	2.7	1.9	1.9	2.1	2.0	2.0
21	1.45	1.95	1.4	2.0	1.0	5.0	3.15	1.9	1.85	2.0	2.0	2.05
22	1.55	1.8	1.4	1.8	1.0	4.4	2.75	2.1	1.85	2.0	2.0	2.0
23	1.55	1.75	1.4	1.9	1.0	4.2	2.6	2.8	1.8	2.0	1.9	2.0
24	1.5	1.6	1.4	1.9	1.0	4.0	2.8	3.65	.....	2.0	1.9	2.0
25	1.55	1.5	1.4	2.1	1.0	3.8	2.95	3.1	.....	2.0	1.9	2.0
26	1.55	1.55	1.3	2.0	1.0	3.8	.....	2.8	.....	2.0	2.0	2.0
27	1.55	1.6	1.2	1.85	1.0	3.7	.....	2.6	.....	2.0	2.0	2.0
28	1.45	1.7	1.1	1.7	1.0	3.6	.....	2.45	.....	2.0	2.0	2.0
29	1.45	.....	1.1	1.55	1.0	3.6	2.5	2.4	.....	2.0	2.05	2.0
30	.....	.....	1.05	1.4	1.05	3.65	2.75	2.25	2.2	2.0	2.05	2.0
31	.....	.....	1.05	.....	1.05	.....	2.4	2.15	.....	2.0	.....	2.0

[a] Maximum gage height 25.0 feet.

[b] Maximum gage height 7.6 feet.

NOTE.—Gage heights slightly affected by ice Jan. 5–20.

Daily discharge, in second-feet, of Canadian River near Sanchez, N. Mex., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	33	31	64	4	12	4	485	84	76	176	50	56
2	28	32	64	6	15	4	352	62	69	[b] 740	50	50
3	39	33	64	6	15	21	282	50	62	620	50	50
4	33	33	57	4	12	64	282	33	62	500	50	76
5	39	39	57	2	9	39	265	28	62	380	56	76
6	39	64	57	2	6	18	282	24	50	260	56	62
7	39	57	57	2	4	33	352	24	50	152	50	50
8	39	57	57	2	9	108	370	24	50	152	38	50
9	39	64	57	12	9	595	300	24	50	152	33	69
10	39	64	51	9	9	1,250	265	24	56	131	28	76
11	39	81	51	9	6	3,000	425	24	56	120	28	76
12	39	90	45	6	4	[a] 32,000	352	38	76	120	38	76
13	39	72	39	9	2	50,000	282	62	131	110	38	76
14	39	57	39	6	2	6,000	203	56	92	56	38	76
15	39	57	33	6	2	3,000	142	56	50	62	38	62
16	39	64	33	6	2	2,100	131	56	50	62	38	50
17	39	72	33	6	4	1,800	131	62	56	69	38	38
18	39	64	28	6	6	1,810	110	92	56	69	38	44
19	39	64	24	6	4	2,460	110	44	50	69	44	50
20	39	90	24	6	2	1,930	176	38	50	69	50	50
21	28	99	24	108	2	1,480	318	38	44	50	50	50
22	39	72	24	72	2	940	190	62	44	50	50	50
23	39	64	24	90	2	800	152	218	38	50	38	50
24	33	45	24	90	2	680	203	555	38	50	38	50
25	39	33	24	129	2	580	249	335	38	50	38	50
26	39	39	18	108	2	580	220	233	38	50	50	50
27	39	45	12	81	2	530	191	176	38	50	50	50
28	28	57	6	57	2	485	161	142	38	50	50	50
29	28	.....	6	39	2	485	131	131	38	50	56	50
30	29	.....	4	24	4	508	190	101	92	50	56	50
31	30	.....	4	.....	4	.....	110	84	.....	50	.....	50

[a] Maximum discharge, 82,700 second-feet. [b] Maximum discharge, 5,810 second-feet.

NOTE.—Daily discharge determined as follows: Jan. 1–4, Jan. 21 to June 10, June 24 to Aug. 22, Aug. 25 to Oct. 10, and Oct. 21 to Dec. 31, from well-defined curves; Jan. 5–20, estimated because of ice; June 11–17, estimated by comparison with records of stations in this drainage basin and data collected for use with Kutter's formula; June 18–23, Aug. 23 and 24, Oct. 11–20, by indirect method for shifting channels; interpolated for days for which gage heights are missing.

Monthly discharge of Canadian River near Sanchez, N. Mex., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	39	28	36.4	2,240	C.
February	99	31	58.5	3,250	C.
March	64	4	35.6	2,190	B.
April	129	2	30.4	1,810	B.
May	15	2	5.16	317	B.
June	50,000	4	3,780	225,000	D.
July	485	110	239	14,700	C.
August	555	24	96.1	5,910	B.
September	131	38	56.7	3,370	C.
October	740	50	149	9,160	C.
November	56	28	44.2	2,630	C.
December	76	38	57.1	3,510	C.
The year	50,000	2	378	274,000	

CANADIAN RIVER AT LOGAN, N. MEX.

Location.—In sec. 15, T. 13 N., R. 33 E., three-fourths of a mile above the railroad bridge, 1 mile south of Logan; 5 miles below the mouth of Ute Creek and about 5 miles above the mouth of Arroyo Largo or Tucumcari Creek.

Records available.—June 29, 1904, to February 26, 1905; December 22, 1908, to December 31, 1913.

Drainage area.—Approximately 12,000 square miles.

Gage.—Automatic recording gage installed August 5, 1910, at a point three-fourths mile above bridge and referred to a datum different from that of gage previously used; original gage was a staff. On the reestablishment of the station in 1908 a gage was painted on one of the bridge piers and referred to a new datum. This gage was used until August 5, 1910, when the present gage was installed. From June 12 to July 12, 1913, when the automatic gage was removed because of high water, a staff gage was read which was referred to the automatic gage datum. The automatic gage was reinstalled July 12, 1913.

Control.—Shifting.

Discharge measurements.—Flood measurements made by floats, owing to the great amount of drift carried in the stream. Measurements at ordinary stages made from a cable; low stage measurements made by wading.

Winter flow.—Ice causes slight backwater during parts of the winter months.

Diversions.—Some water is diverted from the headwater streams, as irrigation is carried on quite actively, but there are no diversions from the Canadian in the vicinity of this station.

Accuracy.—Estimates of daily discharge during 1913 good except for the high-water period from June 11 to 16, which were made from the slope and cross section and are considered fair.

Discharge measurements of Canadian River at Logan, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 3	C. J. Emerson	4.92	14.3	July 19	C. J. Emerson	4.50	80.5
Mar. 7	do	5.12	30.5	Aug. 4	do	4.45	72.2
26	do	4.73	2.8	30	do	4.66	130
Apr. 30	do	4.95	28.8	Sept. 29	do	4.52	70.9
June 3	do	4.12	*a* 1	Nov. 20	do	4.40	43.8
16	do	5.70	2,110				

a Estimated.

Daily gage height, in feet, of Canadian River at Logan, N. Mex., for 1913.

[Samuel Rufi, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.90	5.55	4.50	4.80	.....	5.90	4.78	4.95	4.62	4.20	4.30
2	.....	4.90	5.45	4.52	4.65	.....	5.60	4.67	4.72	4.88	4.20	4.30
3	.....	4.90	5.35	4.55	4.55	.....	5.30	4.56	4.76	5.79	4.20	4.61
4	.....	4.90	5.30	4.55	4.45	5.22	5.00	4.50	4.66	5.41	4.20	4.71
5	4.95	5.00	5.05	4.50	4.35	6.11	4.90	4.40	4.88	5.42	4.20	4.70
6	4.95	5.00	5.10	4.48	4.30	6.19	4.91	4.32	4.90	4.90	4.20	4.70
7	4.90	5.05	5.10	4.45	4.35	5.95	5.00	4.16	4.72	4.80	4.25	4.73
8	4.95	5.05	5.05	4.42	4.32	5.81	5.10	3.95	4.56	4.80	4.25	4.60
9	4.95	5.15	5.10	4.45	4.35	6.34	5.00	3.93	4.50	4.75	4.20	4.40
10	5.00	5.10	5.10	4.45	4.32	6.82	5.00	3.90	4.65	4.70	4.20	4.21
11	4.95	5.15	5.10	4.43	4.80	6.43	5.00	3.87	4.64	4.70	4.20	4.19
12	4.95	5.15	5.05	4.42	5.15	[a]13.80	4.80	3.85	4.81	4.72	4.20	4.18
13	4.90	5.10	5.00	4.40	4.82	16.43	4.80	3.80	4.71	4.70	4.21	4.12
14	4.95	5.10	5.10	4.35	4.70	8.00	5.00	3.90	4.43	4.62	4.29	4.07
15	5.00	5.10	5.20	.....	4.50	6.34	4.90	3.83	4.35	4.58	4.29	4.02
16	5.00	5.10	5.25	.....	4.40	5.71	4.82	3.75	4.23	4.55	4.34	4.21
17	5.00	5.10	5.25	4.30	4.30	5.50	4.76	3.71	4.28	4.51	4.39	4.25
18	4.95	5.15	5.30	4.30	4.25	6.10	4.70	3.75	4.40	4.45	4.39	4.30
19	5.00	5.20	5.25	4.28	4.20	7.00	4.63	4.22	4.44	4.40	4.40	4.30
20	5.05	5.20	5.10	4.40	.....	7.00	5.70	4.38	4.30	4.30	4.42	4.25
21	5.20	5.20	5.05	5.40	.....	6.10	5.42	4.48	4.30	4.25	4.38	4.25
22	5.20	5.20	4.90	5.80	.....	6.00	5.00	4.60	4.22	4.25	4.36	4.20
23	5.10	5.25	4.74	6.65	.....	5.90	5.00	4.78	4.12	4.30	4.34	4.20
24	5.05	5.25	4.72	6.75	.....	5.70	5.20	5.04	4.15	4.30	4.32	4.22
25	5.00	5.45	4.74	6.75	.....	5.50	5.12	5.02	4.15	4.24	4.30	4.21
26	5.00	5.55	4.73	6.70	4.11	5.10	5.00	5.55	4.10	4.22	4.25	4.19
27	4.90	5.60	4.62	6.60	4.84	5.00	5.00	5.25	4.15	4.21	4.22	4.21
28	5.00	5.60	4.55	6.20	4.60	6.50	5.00	4.85	4.32	4.20	4.23	4.32
29	5.00	.....	.....	5.30	4.40	7.18	5.00	4.72	4.50	4.20	4.24	4.31
30	5.00	.....	.....	4.90	4.20	5.60	4.95	4.66	4.50	4.20	4.30	4.21
31	4.95	.....	.....	.....	.....	.....	4.87	4.55	.....	4.20	.....	4.20

[a] Maximum gage height, 20.0 feet.

NOTE.—Gage heights affected by ice Jan 1–20 and Dec. 16–29; not read Jan 1–4; readings June 12 to July 12 taken from a staff gage referred to datum of automatic gage.

Daily discharge, in second-feet, of Canadian River at Logan, N. Mex., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6	15	93	0.5	18	0	990	165	248	87	25	39
2	7	15	75	.7	10	0	690	124	141	165	25	39
3	8	15	59	1.0	6.5	0	465	95	157	771	25	85
4	9	15	51	1.0	3.5	70	273	83	121	472	25	106
5	10	21	25	.5	1.5	472	223	67	213	479	25	103
6	10	21	29	.8	1.0	528	228	54	223	173	25	103
7	10	25	29	.5	1.5	362	273	35	141	133	29	112
8	10	25	25	.4	1.2	279	330	18	95	133	29	83
9	10	34	29	.5	1.5	642	273	17	83	118	25	51
10	10	29	29	.5	1.2	1,130	273	15	118	103	25	30
11	10	54	25	.8	18	3,240	273	14	115	103	25	28
12	10	34	21	.7	51	[a] 34,500	173	12	178	109	25	27
13	10	29	18	.5	19	56,500	173	10	137	103	26	23
14	10	29	25	.2	12	6,700	273	15	72	87	33	19
15	15	29	34	.0	5.0	3,070	223	12	59	80	33	16
16	15	29	34	.0	3.5	2,120	183	8.2	32	75	38	35
17	15	29	34	.2	1.5	1,820	157	6.8	37	69	44	39
18	15	34	39	.2	1.0	2,800	133	8.2	51	59	44	45
19	20	39	34	.2	.5	6,700	112	41	57	51	45	45
20	25	39	21	1.0	.0	6,700	780	64	39	39	48	39
21	39	39	15	83	.0	1,230	550	80	39	29	43	39
22	39	39	8.2	223	.0	1,110	273	103	31	29	40	34
23	29	45	3.3	830	.0	990	273	165	23	34	38	34
24	25	45	2.9	935	.0	780	395	296	25	34	36	36
25	21	75	3.3	935	.0	610	343	284	25	28	34	35
26	21	93	2.9	935	.1	330	273	650	21	27	29	33
27	15	103	1.2	830	24	273	273	430	25	26	27	35
28	21	103	.5	500	10	5,300	273	198	41	25	27	47
29	21	.....	.0	75	3.5	7,100	273	141	67	25	28	46
30	21	.....	.0	25	.5	700	248	121	67	25	34	35
31	18	.....	.0	.....	.0	.....	208	93	.....	25	.....	34

[a] Maximum discharge, 97,000 second-feet.

NOTE.—Daily discharge determined as follows: Jan. 1–20 and Dec. 16–29, estimated by means of climatologic reports, discharge measurements, and information furnished by gage reader; Jan. 21 to Mar. 10t from fairly well-defined rating curve; Mar. 11 to June 10, June 18 to Dec. 15, and Dec. 30–31, by indirec, method for shifting channels; June 11–17, from high-water curve developed by means of Kutter's formula and discharge measurements.

Monthly discharge of Canadian River at Logan, N. Mex., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	39	6.0	16.3	1,000	B.
February	103	15	38.6	2,140	B.
March	93	.0	24.7	1,520	B.
April	935	.0	179	10,700	B.
May	51	.0	6.31	388	B.
June	56,500	.0	4,870	290,000	D.
July	990	112	319	19,600	C.
August	650	6.8	110	6,760	B.
September	248	21	89.4	5,320	B.
October	771	25	120	7,380	B.
November	48	25	31.8	1,890	B.
December	112	16	47.6	2,930	C.
The year	56,500	.0	483	350,000	

CHICORICA[1] CREEK NEAR RATON, N. MEX.

Location.—In sec. 28, T. 30 N., R. 24 E., at St. Louis, Rocky Mountain & Pacific Railway bridge, 10 miles southeast of Raton; above Raton and Una del Gato creeks.

[1] Called Chico Rica Creek in previous reports.

Records available.—July 29, 1910, to December 31, 1913.
Drainage area.—Not measured.
Gage.—Automatic recording.
Control.—Shifting.
Discharge measurements.—Made from a bridge during high water and by wading at ordinary stages.
Winter flow.—Ice causes backwater during winter months.
Diversions.—Greater part of the normal flow is diverted above the station for irrigation.
Floods.—From June 9 to 14, 1913, a series of floods passed the station which at times filled the stream from bank to bank. For details see pages 76–78.
Accuracy.—Results for 1913 fair.

Discharge measurements of Chicorica Creek near Raton, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 13	J. E. Powers		[a] 0.2	June 14	J. E. Powers	2.38	106
Apr. 11	do	1.50	[a] .5	July 14	do	1.00	[a] .8
May 16	do	1.40	[a] .4	Oct. 13	do	1.00	[a] .7
June 12	do	11.20	[b] 6,120	Nov. 13	do	1.02	[a] .6

[a] Estimated. [b] Computed from Kutter's formula.

Daily gage height, in feet, of Chicorica Creek near Raton, N. Mex., for 1913.

[J. S. Tuyman and John Sherry, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.5	2.6	1.40	1.64	1.59	1.32			1.82	0.97	1.05
2					1.55	1.60	1.27			1.50	.97	1.08
3					1.51	[a] 2.19	1.20			1.41	.98	1.10
4					1.49	1.69	1.18			1.32	.98	1.18
5		2.5	2.4		1.45	1.60	1.18			1.12	.98	1.20
6					1.46	1.60	1.20				.97	1.20
7					1.47	1.72	1.17				.93	
8	1.8	2.5	2.4		1.44	1.77	1.12				.94	
9					1.43	4.30	1.16		1.35		.96	1.55
10					1.45	7.68	1.19		1.13		.98	1.55
11	1.9			1.50	1.45	8.44	1.19				1.00	2.38
12		2.5	2.2	1.46	1.45	[b] 9.09	1.20				1.02	
13				1.46	1.45	7.40	1.20			1.00	1.03	1.85
14				1.45	1.45	3.44	1.03			1.00	1.03	
15	1.9	2.5	1.9	1.45	1.45	2.26	.99			1.00	1.02	1.80
16				1.43	1.40	2.10	.98			1.01	1.02	1.80
17				1.42	1.60	1.96	.97	1.15		1.02	1.02	1.82
18	2.0			1.43	1.70	1.75	.95	1.85		1.03	1.03	1.67
19		2.4	1.7	1.45	1.70	1.75	1.05	1.50		1.00	1.03	1.67
20				1.47	1.70	1.79	1.08	1.37		1.00	1.04	1.72
21				1.47	1.69	1.75	1.05	1.32	1.15	1.00	1.03	
22	2.5	2.6	1.7	1.48	1.68	1.70	1.02	1.62	1.20	1.00	1.02	2.02
23				1.46	1.68	1.68	1.14	1.46	1.20	1.00	1.04	2.05
24				1.42	1.60	1.66	1.34	1.32	1.33	1.00	1.07	2.00
25	2.6			1.41	1.59	1.63	1.15	1.30	1.35	.90	1.04	
26		2.6		1.40	1.57	1.60			1.39	.90	1.01	1.97
27				1.66	1.59	1.60			1.30	.95	1.00	1.91
28				1.92	1.58	1.62			1.30	.93	1.00	1.91
29	2.5		1.9	1.88	1.56	1.52			1.25	1.03	1.01	2.00
30			1.25	1.73	1.59	1.40			1.20	.98	1.01	2.01
31			1.35		1.60							2.03

[a] Maximum gage height, 6.2 feet. [b] Maximum gage height, 11.2 feet.

NOTE.—Gage heights affected by ice Jan. 8 to Mar. 29 and Dec. 1–31.

Daily discharge, in second-feet, of Chicorica Creek near Raton, N. Mex., for 1913.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	0.3	3.6	1.8	8.6	0.0	0.0	38	0.6
2	.0	1.2	2.0	6.5	.0	.0	17	.6
3	.0	.6	[a] 32	3.6	.0	.0	12	.7
4	.0	.5	5.6	3.2	.0	.0	8.6	.7
5	.0	.4	2.0	3.2	.0	.0	2.0	.7
6	.0	.4	2.0	3.6	.0	.0	.0	.6
7	.0	.4	6.8	3.0	.0	.0	.0	.4
8	.0	.4	8.8	2.0	.0	.0	.0	.4
9	.0	.4	645	2.8	.0	9.9	.0	.5
10	.0	.4	2,800	3.4	.0	2.2	.0	.5
11	.5	.4	3,450	3.4	.0	.0	.0	.6
12	.4	.4	[b] 4,020	3.6	.0	.0	.0	.6
13	.4	.4	2,620	3.6	.0	.0	.7	.7
14	.4	.4	332	1.0	.0	.0	.7	.7
15	.4	.4	89	.8	.0	.0	.7	.6
16	.4	.3	67	.7	.0	.0	.7	.6
17	.3	2.0	52	.6	2.6	.0	.8	.6
18	.4	6.0	32	.6	40	.0	.8	.7
19	.4	6.0	32	1.2	17	.0	.7	.7
20	.4	6.0	35	1.4	11	.0	.7	.7
21	.4	5.6	32	1.2	8.6	2.6	.7	.7
22	.5	5.2	29	1.0	23	3.6	.7	.6
23	.4	5.2	28	2.4	15	3.6	.7	.7
24	.3	2.0	26	9.5	8.6	9.1	.4	.8
25	.3	1.8	24	2.6	7.8	9.9	.5	.7
26	.3	1.6	22	.0	.0	12	.4	.6
27	4.4	1.8	22	.0	.0	7.8	.6	.5
28	16	1.7	23	.0	.0	7.8	.6	.5
29	14	1.4	18	.0	.0	5.7	.6	.6
30	7.2	1.8	12	.0	.0	3.6	.6	.6
31	.....	2.0	.....	.0	.0	.....	.6	.....

[a] Maximum discharge, 1,740 second-feet. [b] Maximum discharge, 6,100 second-feet.

NOTE.—Discharge determined as follows: Apr. 1 to Oct. 5, from two fairly well defined curves; Oct. 13 to Nov. 30, by indirect method for shifting channels.

Monthly discharge of Chicorica Creek near Raton, N. Mex., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 0.20	12	D.
February	.....	.....	[a] .20	11	D.
March	.....	.....	[a] .20	12	D.
April	16	0.0	1.60	95	C.
May	6.0	.3	1.96	121	C.
June	4,020	1.8	482	28,700	C.
July	9.5	.0	2.37	146	C.
August	40	.0	4.31	265	C.
September	12	.0	2.59	154	C.
October	38	.0	2.90	178	C.
November	.8	.4	.62	37	C.
December	.....	.....	[a] .60	37	D.
The year	4,020	.0	41.1	29,800	

[a] Estimated by means of climatic records, information from observer, and discharge measurement.

UNA DEL GATO CREEK NEAR RATON, N. MEX.

Location.—In sec. 13, T. 30 N., R. 25 E., about 2 miles northeast of Meloche's ranch, 18 miles southeast or Raton, N. Mex. No important tributary enters within several miles.

Records available.—May 3, 1910, to August 2, 1913, when station was discontinued.

Drainage area.—Not measured.

Gage.—Automatic recording.

Control.—Probably permanent.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during parts of the winter months.

Regulation.—A short distance above the station is a reservoir designed to hold the flood water for use in irrigation farther down valley.

Accuracy.—Estimates of daily discharge for 1913 omitted because of lack of discharge measurements.

Cooperation.—Gage heights furnished by Mr. A. J. Meloche, Raton, N. Mex.

Discharge measurements of Una del Gato Creek near Raton, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 13	J. E. Powers	.....	[a] 0.1
Apr. 11	do	.....	[b] .2

[a] Estimated on account of ice. [b] Estimated.

Daily gage height, in feet, of Una del Gato Creek near Raton, N. Mex., for 1913.

[A. J. Meloche, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	.....	0.60	0.60	0.60	0.60	16	0.59	0.60	0.40	0.60	.....
2	.....	.60	.60	.60	.60	17	.58	.60	.40	.60	.....
3	.....	.60	.61	.60	.....	18	.....	.60	.80	.60	.....
4	.....	.60	.60	.60	.....	19	.60	.51	1.06	.60	.....
5	.....	.60	.60	.60	.....	20	.55	.55	.90	.60	.....
6	.....	.60	.61	.60	.....	21	.60	.59	.90	.60	.....
7	.....	.60	.65	.60	.....	22	.56	.60	.90	.60	.....
8	.....	.60	.75	.60	.....	23	.42	.60	.85	.60	.....
9	.....	.60	.54	.60	.....	24	.43	.60	.80	.60	.....
10	.....	.60	.53	.60	.....	25	.60	.60	.75	.60	.....
11	.....	.60	.80	.60	.....	26	.60	.55	.70	.60	.....
12	0.60	.60	.64	.60	.....	27	.60	.....	.65	.60	.....
13	.60	.60	.40	.60	.....	28	.60	.....	.60	.60	.....
14	.60	.58	.40	.60	.....	29	.60	.....	.60	.60	.....
15	.60	.58	.40	.60	.....	30	.60	.....	.60	.60	.....
						31	.....	.....	.....	.60	.....

NOTE.—Gage not in operation Jan. 1 to Apr. 11, Apr. 18, and May 27-31.

CIMARRON RIVER AT UTE PARK, N. MEX.

Location.—In sec. 19, T. 27 N., R. 18 E., at highway bridge in Ute Park, half a mile below mouth of Ute Creek.

Records available.—July 14, 1907, to December 31, 1913.

Drainage area.—235 square miles (measured on land office map).

Gage.—Automatic recording; installed in September, 1909; datum same as that of staff gage previously used.

Control.—Rough, somewhat shifting.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Backwater from ice during winter months.

Diversions.—Little water is diverted above station, but most of the normal flow is diverted below.

Accuracy.—Conditions favorable for accurate results; estimates for 1913 good.

Discharge measurements of Cimarron River at Ute Park, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 4[a]	J. E. Powers	0.20	8.8	June 16	J. E. Powers	.70	48.0
Feb. 3[a]	do	.45	7.9	July 15	do	.20	7.4
Mar. 15[a]	do	.40	14.4	Sept. 2	do	.32	11.0
Apr. 13	do	.70	50.3	Oct. 15	do	.40	16.5
May 17	do	.58	33.1	Nov. 14	do	.40	15.0

[a] Ice present.

Daily gage height, in feet, of Cimarron River at Ute Park, N. Mex., for 1913.

[F. B. Strong, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.35	.....	.....	0.93	0.92	0.44	0.39	.....	0.31	0.45	0.45	0.42
2	.....	0.40	.....	1.08	.89	.44	.38	0.11	.30	.53	.44	.50
3	.....	.45	.....	.96	.85	.44	.36	.11	.31	.46	.46	.73
4	.20	.....	.....	.85	.77	.42	.35	.10	.31	.45	.47	.71
5	.35	.40	0.40	.83	.73	.42	.30	.09	.31	.45	.45	.45
6	.....	.....	.....	1.02	.72	.42	.29	.09	.30	.45	.43	.36
7	.....	.....	.....	1.08	.73	.49	.29	.08	.35	.43	.41	.....
8	.30	.....	.....	.88	.72	.51	.32	.08	.36	.43	.40	.30
9	.....	.40	.35	.85	.72	.54	.52	.09	.37	.43	.39	.....
10	.....	.....	.....	.....	.68	.55	.47	.10	.38	.41	.39	.33
11	.....	.....	.....	.....	.68	.84	.35	.12	.40	.40	.38	.....
12	.40	.30	.40	.65	.71	.86	.34	.21	.39	.40	.40	.....
13	.....	.....	.....	.75	.70	.75	.31	.22	.38	.40	.40	.38
14	.....	.....	.....	.88	.68	.70	.26	.24	.40	.40	.40	.....
15	.40	.....	.38	.97	.67	.70	.22	.26	.38	.40	.40	.29
16	.....	.30	.37	1.02	.64	.66	.20	.21	.42	.40	.41	.....
17	.....	.....	.33	1.07	.58	.62	.22	.21	.39	.41	.42	.30
18	.....	.....	.33	.97	.57	.59	.23	.26	.36	.40	.42	.....
19	.30	.40	.34	1.05	.56	.58	.28	.28	.33	.40	.41	.....
20	.....	.....	.33	1.03	.55	.55	.26	.35	.30	.39	.42	.37
21	.....	.....	.33	1.01	.53	.55	.20	.27	.31	.40	.39	.....
22	.40	.....	.38	1.02	.52	.46	.18	.36	.32	.40	.34	.33
23	.....	.30	.42	.99	.53	.45	.27	.39	.49	.40	.32	.....
24	.....	.....	.42	.85	.45	.45	.36	.34	.50	.40	.32	.34
25	.....	.....	.44	.82	.44	.44	.24	.33	.40	.40	.35	.....
26	.40	.40	.44	.78	.44	.43	.17	.32	.40	.40	.37	.....
27	.....	.....	.47	.82	.45	.42	.....	.30	.40	.41	.36	.35
28	.....	.....	.48	.87	.48	.42	.....	.29	.37	.42	.33	.....
29	.30	.....	.52	.88	.46	.44	.....	.36	.36	.42	.45	.36
30	.....	.....	.58	.92	.44	.42	.....	.34	.36	.44	.43	.....
31	.....	.....	.77	.....	.44	.....	.....	.34	.....	.45	.....	.35

NOTE.—Gage heights affected by ice Jan. 1 to Mar. 16 and Dec. 2–31; average thickness of ice during January and February, 0.5 foot. Gage not read on days for which record is missing.

Daily discharge, in second-feet, of Cimarron River at Ute Park, N. Mex., for 1913.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	8	93	91	19	14	2.6	10	21	20
2	8	130	84	19	14	2.4	9.4	30	20
3	8	100	76	19	12	2.4	10	22	21
4	9	76	61	17	12	2.1	10	21	22
5	9	72	54	17	8.0	1.8	10	21	20
6	10	114	52	17	7.5	1.5	9.4	21	19
7	10	130	54	23	7.5	1.2	13	20	17
8	10	82	52	25	9.4	1.2	14	20	16
9	12	76	52	28	36	1.5	14	20	15
10	12	64	46	30	31	1.8	15	18	15
11	12	53	46	74	19	2.4	17	17	14
12	12	42	51	78	18	6.5	16	17	15
13	14	58	49	58	15	7.0	15	17	15
14	14	82	46	49	12	8.0	17	17	15
15	14	102	45	49	8.7	9.4	15	17	15
16	14	114	41	43	7.0	6.0	19	17	16
17	10	127	33	38	8.0	6.0	16	18	17
18	10	102	32	34	8.7	8.7	14	17	17
19	11	122	31	33	12	10	12	17	16
20	10	117	30	30	11	15	9.4	16	17
21	10	111	27	30	7.0	8.7	10	17	14
22	14	114	26	20	6.0	15	11	17	11
23	17	107	27	20	12	18	25	17	9.4
24	17	76	20	20	19	14	26	17	9.4
25	19	70	19	19	9.4	13	17	17	12
26	19	63	19	18	5.0	12	17	17	13
27	21	70	20	17	4.6	10	17	18	12
28	22	80	22	17	4.2	9.4	14	19	10
29	26	82	20	19	3.8	14	14	19	20
30	33	91	19	17	3.4	13	14	20	18
31	61	.....	19	.....	3.0	13	.....	21	.....

NOTE.—Daily discharge determined as follows: Mar. 1–16, estimated, because of ice, by means of climatologic reports and discharge measurements; Mar. 17 to July 8 and July 10–15, from well-defined curves; July 9 and July 16 to Nov. 30, by indirect method for shifting channels; discharge interpolated for days for which gage heights are missing.

Monthly discharge of Cimarron River at Ute Park, N. Mex. for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a]9.0	553	D.
February	.....	.....	[a]8.0	444	D.
March	61	8.0	15.4	947	C.
April	130	42	90.7	5,400	A.
May	91	19	40.8	2,510	A.
June	78	17	29.9	1,780	A.
July	36	3.0	11.2	689	B.
August	18	1.2	7.66	471	B.
September	26	9.4	14.3	851	B.
October	30	16	18.8	1,160	B.
November	22	9.4	15.7	934	B.
December	.....	.....	[a]12.0	738	D.
The year	130	1.2	22.7	16,500	

[a] Estimated by means of information furnished by the observer, climatologic data, and discharge measurements.

RAYADO RIVER NEAR CIMARRON, N. MEX.

Location.—In sec. 23, T. 25 N., R. 17 E., just above the box canyon, 20 miles southwest of Cimarron; nearest tributary, Agua Fria Creek, enters one-fourth mile above.

Records available.—May 8 to October 7, 1911; May 25 to ~~October 10~~ Sept 17, 1913.

Drainage area.—Not measured.

Gage.—Vertical staff.

Control.—Permanent.

Discharge measurements.—Made by wading.

Winter flow.—Winters severe, owing to high altitude; station maintained only during summer months.

Diversions.—No diversions above station.

Accuracy.—Discharge computed for 1911 and is here published with data for 1913. Results fair.

Cooperation.—Station maintained in cooperation with Mr. George H. Webster, jr., Cimarron, N. Mex.

Discharge measurements of Rayado River near Cimarron N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 18	J. E. Powers	0.90	38.2
July 18	do	.40	7.2

Daily gage height, in feet, of Rayado River near Cimarron, N. Mex., for 1913.

[Valentine Shipley, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	0.58	0.60	0.45	0.40	16	.....	1.10	0.45	0.32	0.40
2	.....	.58	.58	.42	.40	17	.....	1.10	.42	.38	.40
3	.....	.59	.55	.40	.35	18	.....	.90	.42	.35	.....
4	.....	.60	.55	.40	.40	19	.....	.....	.58	.38	.....
5	.....	.57	.55	.40	.40	20	.....	.....	.....	.48	.....
6	.....	.58	.55	.42	.40	21	.....	.....	.....	.38	.....
7	.....	.59	.50	.42	.....	22	.....	.....	.....	.70	.....
8	.....	.65	.50	.42	.....	23	.....	.....	.....	.50	.....
9	.....	.65	.52	.38	.....	24	.....	.....	.55	.42	.....
10	.....	.70	.55	.40	.....	25	.....	0.60	.50	.48	.....
11	.....	3.00	.50	.50	.....	26	.....	.61	.45	.48	.....
12	.....	1.65	.45	.45	.35	27	.....	.62	.45	.45	.....
13	.....	1.25	.45	.45	.35	28	.....	.64	.42	.45	.....
14	.....	1.15	.42	.42	.35	29	.....	.60	.40	.48	.....
15	.....	1.05	.40	.40	.38	30	.....	.59	.40	.48	.....
						31	.....	.59	.....	.40	.45	.....

Daily discharge, in second-feet, of Rayado River near Cimarron, N. Mex., for 1911 and 1913.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1911.							1911.						
1	.....	20	5.9	8.9	4.8	4.0	16	15	7.0	8.1	4.8	4.8	.....
2	.....	14	5.9	8.9	4.3	5.0	17	15	7.0	8.1	4.8	4.0	.....
3	.....	14	5.4	8.1	4.0	5.0	18	15	8.9	7.0	10	4.0	.....
4	.....	14	5.4	7.0	7.0	8.1	19	15	7.0	7.0	5.9	3.2	.....
5	.....	11	5.4	5.9	5.1	106	20	15	8.1	8.9	4.8	3.2	.....
6	.....	11	12	5.4	4.3	86	21	15	8.9	14	4.8	3.2	.....
7	.....	11	14	5.4	4.0	86	22	15	8.9	8.9	6.2	2.9	.....
8	26	11	9.6	5.4	4.0	.....	23	15	7.0	7.0	9.2	2.7	.....
9	26	11	7.0	5.4	4.0	.....	24	12	5.9	14	7.3	2.7	.....
10	24	9.6	7.0	5.4	4.0	.....	25	12	5.4	11	5.9	2.7	.....
11	22	8.9	7.0	5.4	3.2	.....	26	12	5.4	9.6	5.4	2.7	.....
12	20	8.9	7.0	5.4	3.2	.....	27	10	5.4	8.9	4.8	2.7	.....
13	18	8.9	7.0	4.8	3.2	.....	28	10	5.4	8.9	5.4	3.0	.....
14	18	8.9	7.0	4.8	4.3	.....	29	11	5.4	26	5.4	3.0	.....
15	15	7.0	7.0	4.8	6.7	.....	30	12	5.4	11	5.4	3.5	.....
							31	20	.....	9.6	4.8	.....	.....

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1913.						1913.					
1	.....	14	15	8.1	6.2	16	.....	60	8.1	4.0	6.2
2	.....	14	14	7.0	6.2	17	.....	60	7.0	5.7	6.2
3	.....	14	12	6.2	4.8	18	.....	38	7.0	4.8	.....
4	.....	15	12	6.2	6.2	19	.....	36	14	5.7	.....
5	.....	14	12	6.2	6.2	20	.....	34	14	9.2	.....
6	.....	14	12	7.0	6.2	21	.....	32	13	5.7	.....
7	.....	14	10	7.0	6.0	22	.....	30	13	22	.....
8	.....	18	10	7.0	5.8	23	.....	28	12	10	.....
9	.....	18	11	5.7	5.6	24	.....	26	12	7.0	.....
10	.....	22	12	6.2	5.2	25	15	24	10	9.2	.....
11	.....	339	10	10	5.0	26	16	22	8.1	9.2	.....
12	.....	136	8.1	8.1	4.8	27	16	20	8.1	8.1	.....
13	.....	80	8.1	8.1	4.8	28	18	18	7.0	8.1	.....
14	.....	66	7.0	7.0	4.8	29	15	16	6.2	9.2	.....
15	.....	54	6.2	6.2	5.7	30	14	16	6.2	9.2	.....
						31	14	.....	6.2	8.1	.....

NOTE.—Daily discharge determined as follows: May 31 to Oct. 7, 1911, by indirect method for shifting channels; May 8–30, 1911 and 1913, from a curve well defined between 15 and 70 second-feet; interpolated for days for which gage heights are missing.

Monthly discharge of Rayado River near Cimarron, N. Mex., for 1911 and 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1911.					
May 8-31	26	10	16.2	757	C.
June	20	5.4	9.01	536	C.
July	26	5.4	9.05	556	C.
August	10	4.8	6.00	369	C.
September	7.0	2.7	3.81	227	C.
October 1-7	106	4.0	42.9	596	C.
The period				3,040	
1913.					
May 25-31	18	14	15.4	214	B.
June	339	14	43.1	2,560	C.
July	15	6.2	10.0	615	C.
August	22	4.0	7.79	478	B
September 1-17	6.2	4.8	5.64	190	C.
The period				4,060	

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

Location.—Near sec. 29, T. 25 N., R. 18 E., 6 miles above Abreu's ranch house, at the mouth of the box canyon, 15 miles southwest of Cimarron.

Records available.—May 4, 1911, to December 31, 1913. June 17, 1908, to May 5, 1911, a station was maintained three-fourths miles above Abreu's ranch house. No streams enter between the two points, but it is possible that some of the flow is lost by sinking into the sand.

Drainage area.—Not measured.

Gage.—Automatic recording gage installed May 4, 1911; washed out by a severe flood June 10, 1913; reinstalled July 17, 1913, downstream from the old site and referred to a new datum; staff gage read June 17 to July 12, 1913.

Control.—Shifts slightly.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes some backwater during the winter months.

Diversions.—None above station.

Accuracy.—Estimates for 1913 fair.

Discharge measurements of Rayado River near Abreu's ranch, near Cimarron N. Mex., in 1913.

Date.	Hydrograpeer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6[a]	J. E. Powers	0.50	[b]1.5	June 17	J. E. Powers	[c]2.06	53.5
Feb. 1[a]	do	.70	[b]1.0	July 17	do	.70	9.7
Mar. 16[a]	do	.80	4.4	Sept. 1	do	.73	10.6
Apr. 14	do	1.25	19.7	Oct. 16	do	.65	9.5
May 19	do	1.10	13.7	Nov. 15	do	.58	5.9

[a] Ice present. [b] Estimated. [c] Gage height determined with level.

NOTE.—Gage heights after June 17 are referred to a new datum.

Daily gage height, in feet, of Rayado River near Abreu's ranch, near Cimarron, N. Mex., for 1913.

[A. J. Senseman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.70	0.80	1.13	1.36	1.05	.....	0.69	0.75	0.67	0.56	0.64
2	.....	.....	.....	1.20	1.32	1.05	.....	.76	.81	.86	.56	.64
3	.....	.....	.....	1.15	1.32	1.05	0.90	.76	.82	.87	.57	.64
4	1.08	.....	.....	1.12	1.33	1.05	.....	.65	.66	.79	.55	.64
5	.....	.....	.....	1.10	1.32	1.05	.83	.61	.65	.78	.44	.....
6	.50	.....	.....	1.35	1.32	1.05	.....	.59	.60	.74	.58	.....
7	.....	.....	.....	1.25	1.31	1.03	.....	.62	.59	.71	.57	.....
8	.....	.70	.80	1.12	1.31	.....	.....	.69	.57	.70	.57	.....
9	.....	.....	.....	1.05	1.30	.....	.....	.69	.59	.70	.56	.....
10	.....	.....	.....	1.00	1.25	.....	.....	.55	.55	.70	.57	.....
11	.60	.....	.....	.95	1.23	.....	.....	.52	.69	.70	.56	.....
12	.....	.....	.79	.90	1.21	.....	.71	.62	.65	.69	.54	.....
13	.....	.....	.77	.....	1.20	.....	.....	.80	.57	.70	.56	.....
14	.....	.....	.76	1.30	1.18	.....	.....	.73	.51	.70	.57	.....
15	.....	.80	.75	1.45	1.16	.....	.....	.69	.50	.69	.58	.....
16	.....	.....	.75	1.58	1.16	.....	.....	.67	.59	.67	.49	.....
17	.....	.....	.75	1.55	1.10	2.06	.70	.57	.68	.66	.42	.....
18	.....	.....	.75	1.46	1.10	.....	.71	.57	.58	.65	.40	.....
19	.....	.....	.77	1.44	1.00	.....	.73	.66	.49	.63	.39	.....
20	.....	.....	.78	1.40	.....	.....	.70	.71	.42	.62	.40	.....
21	.....	.....	.79	1.38	.....	1.50	.69	.71	.41	.60	.40	.....
22	.70	.....	.80	1.40	.....	.....	.99	.73	.40	.59	.31	.....
23	.....	.80	.....	1.36	.....	.....	.89	.81	.57	.58	.26	.....
24	.....	.....	.....	1.20	1.10	.....	.90	.79	.99	.59	.28	.....
25	.70	.....	.....	1.08	1.10	1.18	.94	.81	.88	.56	.29	.....
26	.....	.....	.....	1.10	1.10	.....	.90	.79	.78	.51	.41	.....
27	.....	.....	.....	1.32	1.10	.....	.81	.78	.79	.45	.57	.....
28	.....	.....	.....	1.37	1.10	1.08	.79	.79	.77	.51	.59	.....
29	.....	.....	.82	1.38	1.11	.....	.78	.79	.72	.55	.61	.....
30	.....	.....	.95	1.35	1.05	.....	.71	.80	.69	.57	.63	.....
31	.....	.....	1.10	.....	1.05	.....	.69	.75	.....	.56	.....	.....

NOTE.—Gage heights Jan. 1 to June 7, refer to datum of automatic gage washed out June 10; June 17 to Dec. 31, to datum of automatic gage installed July 17. Gage heights affected by ice Jan. 1 to Mar. 22 and Nov. 26 to Dec. 31; staff gage read June 17 to July 12; average thickness of ice in January, 1.3 feet; February, 1.4 feet; March, 1.0 foot.

Daily discharge, in second-feet, of Rayado River near Abreu's ranch, near Cimarron, N. Mex., for 1913.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	15	25	12	20	9.2	11	8.5	5.4
2	.....	18	23	12	18	12	13	15	5.4
3	.....	16	23	12	17	12	14	16	5.6
4	.....	14	24	12	15	7.9	8.2	13	5.2
5	.....	14	23	12	14	6.6	7.9	12	3.1
6	.....	24	23	12	13	6.1	6.3	11	5.9
7	.....	20	22	11	12	6.9	6.1	10	5.6
8	.....	14	22	11	11	9.2	5.6	9.8	5.6
9	.....	12	22	10	11	9.2	6.1	10	5.4
10	.....	9.5	20	.....	10	5.2	5.2	10	5.6
11	.....	8.0	19	.....	10	4.5	9.2	11	5.4
12	.....	6.5	18	.....	9.8	6.9	7.9	10	5.0
13	.....	14	18	80	9.7	13	5.6	11	5.4
14	.....	22	17	80	9.6	11	4.3	11	5.6
15	.....	30	16	80	9.5	9.2	4.1	11	5.9
16	4.4	37	16	65	9.5	8.5	6.1	10	3.9
17	.....	35	14	54	9.5	5.6	8.9	9.8	2.8
18	.....	30	14	53	9.8	5.6	5.9	9.5	2.5
19	.....	29	9.5	52	11	8.2	3.9	8.5	2.4
20	.....	27	10	51	9.5	9.8	2.8	8.2	2.5
21	.....	26	11	50	9.2	9.8	2.7	7.3	2.5
22	.....	27	12	45	22	11	2.5	6.9	1.4
23	.....	25	13	40	17	13	5.6	6.3	1.0
24	.....	18	14	35	17	13	22	6.6	1.1
25	.....	13	14	31	19	13	16	5.6	1.2
26	.....	14	14	29	17	13	12	4.5	1.5
27	.....	23	14	28	13	12	13	3.3	2.0
28	.....	26	14	26	13	13	12	4.3	2.0
29	4.6	26	14	24	12	13	10	5.2	2.0
30	8.0	24	12	22	9.8	13	9.2	5.6	2.0
31	14	.....	12	.....	9.2	11	.....	5.4	.....

NOTE.—Daily discharge determined as follows: Mar. 29 to June 7, June 17 to Oct. 6, and Oct. 27 to Nov. 25, from two well-defined curves; Oct. 7–26, by indirect method for shifting channels; Nov. 26–30, estimated from climatologic reports and discharge measurements. Discharge for days for which gage heights are missing interpolated or estimated from information furnished by gage reader and hydrographer. Data for estimates June 10–12 lacking.

Monthly discharge of Rayado River near Abreu's ranch, near Cimarron, N. Mex., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a]2	123	D.
February	.....	.....	[a]4	222	D.
March	.....	.....	[a]4	246	C.
April	37	6.5	20.6	1,230	B.
May	25	9.5	16.9	1,040	B.
July	22	9.2	12.8	787	C.
August	13	4.5	9.72	598	B.
September	22	2.5	8.24	490	B.
October	16	3.3	8.91	548	C.
November	5.9	1.0	3.70	220	C.
December	.....	.....	[a]3	184	D.

[a] Estimated by means of discharge measurements, climatologic records, and information furnished by the hydrographer.

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

Location.—In sec. 28, T. 25 N., R. 19 E., 12 miles south of Cimarron, half a mile east of Abreu's ranch house, a quarter of a mile above the headgate of the ditch of the Farmers' Development Co.

Records available.—September 10, 1912, to September 4, 1913, when station was discontinued.

Drainage area.—Not measured.
Gage.—Automatic recording.
Control.—Shifting.
Discharge measurements.—Made by wading.
Winter flow.—Affected by ice.
Diversions.—Water is diverted above station for irrigation.
Accuracy.—Estimates for 1913 fair.
Cooperation.—Maintained in cooperation with the Rayado Colonization Co., Cimarron, N. Mex.

Discharge measurements of Rayado River below Abreu's ranch, near Cimarron, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6[a]	J. E. Powers	1.30	4.1	May 19	J. E. Powers	1.30	4.4
Feb. 1	do	1.40	5.9	June 17	do	1.86	54.6
Mar. 16	do	1.41	6.6	July 17	do	.82	[b]7
Apr. 14	do	1.50	13.6	Sept. 4	do	1.06	4.7

[a] Ice present. [b] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Rayado River below Abreu's ranch, near Cimarron, N. Mex., for 1913.

[Stanley Browning, observer.]

Day.	January.		February.		March.		April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	2.0	1.38	5.5	1.40	6.0	.....	7.0	1.70	32	1.34	6.0
2	.....	2.5	1.35	4.8	.....	5.5	.....	8.0	.....	30	1.38	7.4
3	.....	2.5	1.27	3.0	.....	5.0	.....	9.0	.....	29	1.42	9.3
4	1.70	3.0	1.43	7.2	.....	4.5	.....	10	.....	28	1.48	13
5	1.60	3.5	1.35	4.8	.....	4.0	1.50	12	.....	26	1.50	14
6	1.45	4.1	1.32	4.0	.....	3.5	.....	33	.....	24	1.50	14
7	1.45	4.1	1.35	4.8	.....	3.0	.....	30	.....	23	1.54	17
8	1.60	3.5	.....	.....	1.25	2.7	.....	27	.....	22	1.58	20
9	1.60	3.5	.....	.....	1.20	1.9	.....	24	.....	20	1.62	24
10	1.65	3.5	.....	.....	1.25	2.7	.....	20	.....	18	.....	.....
11	1.70	3.5	.....	.....	1.25	2.7	.....	16	.....	17	.....	.....
12	1.60	3.5	.....	.....	1.25	2.7	1.50	13	.....	15	.....	.....
13	1.50	3.5	.....	.....	1.30	3.5	.....	13	.....	14	.....	.....
14	1.45	3.0	.....	.....	1.35	4.8	1.50	13	.....	12	.....	.....
15	1.45	3.0	.....	.....	1.40	6.0	.....	20	.....	10	.....	.....
16	1.40	3.0	.....	.....	1.40	6.0	.....	27	.....	8.8	1.90	62
17	1.40	2.7	.....	.....	1.40	6.0	.....	33	.....	7.4	1.86	56
18	1.30	2.7	.....	.....	1.40	6.0	1.75	39	.....	6.0	1.79	45
19	1.25	2.7	.....	.....	1.40	6.0	1.60	22	1.30	4.6	1.74	38
20	1.24	2.5	.....	.....	1.40	6.0	.....	22	1.25	3.6	1.66	28
21	1.24	2.5	.....	.....	1.35	4.8	1.60	22	1.24	3.5	1.64	26
22	1.25	2.7	1.40	6.0	1.30	3.5	1.65	27	1.26	3.8	1.68	30
23	1.22	2.2	1.45	8.0	1.30	3.5	.....	24	1.32	5.3	1.58	20
24	1.27	3.0	1.45	8.0	1.30	3.5	.....	21	1.35	6.4	1.46	12
25	1.35	4.8	1.45	8.0	1.30	3.5	1.55	18	1.30	4.6	1.46	12
26	1.28	3.2	1.50	10	1.25	2.7	1.65	27	1.25	3.6	1.42	9.3
27	1.27	3.0	1.50	10	1.30	3.5	1.60	22	1.20	2.7	1.40	8.1
28	1.26	2.9	1.50	10	1.35	4.8	1.65	27	1.20	2.7	1.39	7.8
29	1.26	2.9	.....	.....	1.35	4.8	1.65	27	1.22	3.1	1.38	7.4
30	1.24	2.5	.....	.....	1.40	6.0	1.70	32	1.26	3.8	1.36	6.7
31	1.28	3.2	.....	.....	.....	6.0	.....	.....	1.30	4.6	.....	.....

NOTE.—Gage heights affected by ice Jan. 4–18; gage not in operation on days for which records are missing.
Daily discharge determined as follows: Jan. 4–18, estimated, on account of ice, by means of discharge measurements and information furnished by the gage reader; Jan. 19 to Mar. 31 and Apr. 14 to June 30, from poorly defined rating curves; Apr. 1–13, by indirect method for shifting channels. No data for estimates June 11–15. Discharges for days for which gage heights are missing interpolated or estimated from information furnished by gage reader.

Monthly discharge of Rayado River below Abreu's ranch, near Cimarron, N. Mex., for 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	4.8	2.0	3.07	189	C.
February	10	.....	a 5	278	C.
March	6.0	1.9	4.36	268	C.
April	39	7.0	21.5	1,280	C.
May	32	2.7	12.7	781	C.
The period	.....	.....	.....	2,800	

a Estimated.

URRACA CREEK NEAR CIMARRON, N. MEX.

Location.—Near sec. 35, T. 26 N., R. 18 E., 8 miles southwest of Cimarron, 5 miles upstream from Urraca ranch, at proposed reservoir site.

Records available.—November 25, 1912, to December 31, 1913.

Drainage area.—6.3 square miles (private survey)

Gage.—Automatic recording.

Control.—Fairly permanent.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—No diversions above station.

Accuracy.—Estimates fair.

Cooperation.—Maintained in cooperation with Mr. George H. Webster, jr., Cimarron, N. Mex.

Discharge measurements of Urraca Creek near Cimarron, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 7	J. E. Powers	1.00	a 0.5	June 18	J. E. Powers	1.12	9.3
Feb. 2	do	1.00	a .3	July 19	do	.60	b .8
Mar. 17	do	1.00	.8	Sept. 3	do	.70	1.3
Apr. 13	do	1.54	3.6	Oct. 16	do	.62	.7
May 20	do	1.19	1.6				

a Estimated on account of ice.

b Estimated.

Daily gage height, in feet, of Urraca Creek near Cimarron, N. Mex., for 1913.

[F. H. Brinkhaus, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.00	1.18	1.49	1.51	1.15	0.77	0.60	.....	0.80	0.61	.....
2	1.00	1.00	1.19	1.57	1.55	1.15	.72	.60	.....	.75	.61	.....
3	1.00	1.00	1.08	1.65	1.54	1.16	.72	.60	0.70	.71	.60	0.70
4	1.00	1.00	1.10	1.66	1.53	1.16	.74	.55	.73	.70	.60	.70
5	1.00	1.00	1.19	1.67	1.52	1.16	.77	.50	.75	.70	.60	.71
6	1.00	1.00	1.24	1.73	1.51	1.19	.75	.50	.....	.....	.60	.71
7	1.00	1.00	1.26	1.75	1.39	1.20	.72	.50	.....	.....	.60	.....
8	1.00	1.00	1.38	1.75	1.38	1.20	.76	.50	.....	.65	.60	.....
9	1.00	1.00	1.31	1.55	1.37	1.67	.62	.50	.....	.69	.60	.....
10	1.00	1.00	1.11	1.40	1.36	[a] 1.84	.61	.50	.....	.69	.60	.64
11	1.00	1.00	1.07	1.37	1.35	1.99	.61	.....	.....	.69	.60	.64
12	1.00	1.00	1.08	1.59	1.34	1.53	.61	.....	.....	.68	.60	.64
13	1.00	1.00	1.12	1.54	1.33	1.37	.57	.60	.....	.65	.60	.64
14	1.00	1.00	1.10	1.54	1.33	1.24	.54	.60	.....	.62	.61	.64
15	1.00	1.00	1.10	1.54	1.31	1.11	.52	.59	.....	.52	.62	.64
16	1.00	1.00	1.10	1.54	1.30	.97	.52	.....	.....	.62	.61	.64
17	1.00	1.00	1.13	1.52	1.29	1.02	.57	.....	.....	.65	.60	.64
18	1.00	1.00	1.06	1.59	1.28	1.11	.61	.....	.55	.67	.60	.64
19	1.00	1.04	1.05	1.52	1.22	1.02	.81	.....	.55	.69	.60	.65
20	1.00	1.17	1.05	1.38	1.20	.97	.83	.91	.60	.69	.62	.65
21	1.00	1.16	1.20	1.49	1.21	.95	.74	1.13	.60	.68	.65	.66
22	1.00	1.16	1.10	1.48	1.24	.94	.80	1.33	.55	.68	.67	.66
23	1.00	1.16	1.05	1.54	1.23	.94	.84	1.35	.70	.68	.67	.66
24	1.00	1.15	1.05	1.57	1.21	.93	.90	.....	.72	.68	.66	.70
25	1.00	1.16	1.05	1.59	1.18	.92	.80	.....	.70	.68	.64	.74
26	1.00	1.16	1.10	1.60	1.16	.90	.78	.....	.70	.68	.62	.75
27	1.00	1.17	1.15	1.58	1.13	.87	.73	1.00	.75	.....	.63	.75
28	1.00	1.18	1.20	1.55	1.12	.87	.71	.....	.70	.60	.65	.71
29	1.00	.....	1.17	1.52	1.13	.84	.71	.....	.67	.60	.67	.69
30	1.00	.....	1.20	1.49	1.14	.79	.60	.....	.71	.61	.66	.67
31	1.00	.....	1.26	.....	1.15	.....	.60	.....	.....	.61	.....	.65

[a] Maximum gage height, 5.1 feet.

NOTE.—Gage heights affected by ice Jan. 1 to Feb. 18 and Dec. 3 to 31. Gage out of order on days for which gage heights are missing.

Daily discharge, in second-feet, of Urraca Creek near Cimarron, N. Mex., for 1912–13.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1912.			1912.			1912.		
1	.....	1.4	11	.....	0.8	21	.....	0.5
2	.....	.9	12	.....	.7	22	.....	.5
3	.....	1.0	13	.....	.7	23	.....	.5
4	.....	.9	14	.....	.7	24	.....	.5
5	.....	.9	15	.....	.7	25	0.9	.6
6	.....	.9	16	.....	.7	26	1.3	.6
7	.....	.9	17	.....	.7	27	1.1	.6
8	.....	.9	18	.....	.7	28	.9	.6
9	.....	.9	19	.....	.7	29	1.1	.6
10	.....	.8	20	.....	.7	30	1.3	.6
						31	.....	.5

Daily discharge, in second-feet, of Urraca Creek near Cimarron, N. Mex., for 1912–13—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1913.										
1	0.3	1.6	3.3	3.5	1.4	3.9	0.8	1.8	1.4	0.7
2	.3	1.6	3.9	3.8	1.4	3.5	.8	1.6	1.2	.7
3	.3	1.1	4.4	3.7	1.5	3.5	.8	1.3	1.0	.6
4	.3	1.2	4.5	3.6	1.5	3.7	.5	1.4	1.0	.6
5	.3	1.6	4.6	3.5	1.5	3.9	.5	1.4	1.0	.6
6	.5	1.9	4.8	3.5	1.6	3.1	.5	1.4	1.0	.6
7	.5	2.0	5.2	2.7	1.7	2.9	.5	1.3	.8	.6
8	.5	2.7	5.2	2.7	1.7	3.2	.5	1.3	.8	.6
9	.5	2.3	3.8	2.6	7.7	2.3	.5	1.2	1.0	.6
10	.5	1.2	2.8	2.6	15	2.3	.5	1.2	1.0	.6
11	.7	1.1	2.6	2.5	26	1.8	.6	1.1	1.0	.6
12	.7	1.1	4.0	2.4	15	1.8	.7	1.1	.9	.6
13	.7	1.3	3.7	2.4	12	1.6	.8	1.0	.8	.6
14	.7	1.2	3.7	2.4	10	1.4	.8	1.0	.7	.7
15	.7	1.2	3.7	2.3	9.2	1.3	.8	.8	.7	.7
16	.8	1.2	3.7	2.2	7.8	.9	.8	.8	.7	.7
17	.8	1.4	3.5	2.2	8.3	1.1	.8	.6	.8	.6
18	.8	1.0	4.0	2.1	9.2	.8	.8	.6	.9	.6
19	1.0	1.0	3.5	1.8	8.3	1.8	1.0	.6	1.0	.6
20	1.6	1.0	2.7	1.7	7.8	1.8	2.3	.8	1.0	.7
21	1.5	1.7	3.3	1.8	6.7	1.4	3.6	.8	.9	.8
22	1.5	1.2	3.3	1.9	6.6	1.7	5.0	.6	.9	.9
23	1.5	1.0	3.7	1.8	6.6	1.9	5.2	1.2	.9	.9
24	1.4	1.0	3.9	1.8	6.5	2.2	4.6	1.3	.9	.8
25	1.5	1.0	4.0	1.6	6.5	1.7	4.0	1.2	.9	.8
26	1.5	1.2	4.1	1.5	5.5	1.6	3.4	1.2	.9	.7
27	1.6	1.4	4.0	1.4	5.3	1.4	2.8	1.4	.8	.7
28	1.6	1.7	3.8	1.3	5.3	1.2	2.6	1.2	.6	.8
29	.....	1.6	3.5	1.4	5.1	1.2	2.4	1.1	.6	.9
30	.....	1.7	3.3	1.4	4.7	.8	2.2	1.2	.7	.8
31	.....	2.0	.....	1.4	.....	.8	2.0	.....	.7	.....

NOTE.—Daily discharge determined as follows: Nov. 25 to Dec. 3 and Dec. 6–9, 1912, by indirect method for shifting channels; Dec. 4, 5, 10–31, 1912, and Feb. 1–18, 1913, estimated, on account of ice, by means of discharge measurements and information furnished by the gage reader; Feb. 19 to June 8 and June 12–18, 1913, from poorly defined curves; June 9–11 and June 19 to Nov. 30, 1913, by indirect method for shifting channels. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Urraca Creek near Cimarron, N. Mex., for 1912–13.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1912.					
November 25–30	1.3	0.9	1.10	13	B.
December	1.4	.5	.73	45	C.
The period	.....	.....	.....	58	
1913.					
January	.....	.....	[a] 0.40	25	D.
February	1.6	.....	.88	49	D.
March	2.7	1.0	1.43	88	C.
April	5.2	2.7	3.82	227	C.
May	3.8	1.3	2.31	142	C.
June	26	1.4	6.91	411	C.
July	3.9	.8	2.02	124	C.
August	5.2	.5	1.71	105	C.
September	1.8	.6	1.12	67	C.
October	1.4	.6	.89	55	C.
November	.9	.6	.69	41	C.
December	.....	.....	[a] .60	37	D.
The year	26	.....	1.89	1,370	

[a] Estimated by means of discharge measurements, climatologic records, and information furnished by the observer.

PAJARITO CREEK BELOW VIGIL CREEK, NEAR HANLEY, N. MEX.

Location.—In sec. 21, T. 11 N., R. 29 E., 2 miles below mouth of Vigil Creek, about 1 mile above mouth of Alamo Draw, 9 miles west of Tucumcari, and 3 miles northeast of Hanley, the nearest post office.

Records available.—May 21, 1912, to December 5, 1913, when station was discontinued. From August 30, 1911, to May 20, 1912, a station was maintained above the mouth of Vigil Creek.

Drainage area.—About 350 square miles

Gage.—Automatic recording.

Control.—Shifting.

Discharge measurements.—Made by wading or from cable.

Winter flow.—No data.

Diversions.—Very little water diverted above station.

Cooperation.—Gage heights furnished by Mr. V. W. Moore, Tucumcari, N. Mex. Flow of stream erratic; data insufficient for estimates of daily discharge.

Discharge measurements of Pajarito Creek below Vigil Creek, near Hanley, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 6	C. J. Emerson		0.0	June 18	C. J. Emerson	1.80	0.0
June 6	do	3.35	25.9	Aug. 2	do	1.45	.0

Daily gage height, in feet, of Pajarito Creek below Vigil Creek, near Hanley, N. Mex., for 1913.

[Theo. Martinez, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			2.55	2.72					[a]4.52
2			2.55	2.53					4.46
3			2.56	2.45					3.82
4			2.92	2.38		3.82			3.52
5			[b]3.75	2.31		4.40			3.59
6			2.99			4.20			
7			2.99		2.74	2.97			
8			[c]4.83		2.25	2.70			
9			3.22		2.10	3.61			
10			2.71		2.10	3.46			
11			5.02		2.74	3.76			
12			5.70		2.57	3.30			
13			5.50		2.36	2.70			
14			5.50		2.21	2.30			
15			5.48		2.15	2.24			
16			3.17		2.17	2.22			
17					2.45	2.19			
18					2.58			3.09	
19			2.65		2.51			3.39	
20	2.03		3.63		2.90			3.32	
21	[d]6.71		2.96		2.60			3.29	
22	6.78		2.72		2.50			3.22	
23	6.00		2.57		2.42			3.15	
24	4.59		2.42	1.65	2.40			3.15	
25	3.50		2.30	1.95	[e]4.28			3.15	
26	2.28		2.20	1.85	3.99			3.14	
27		2.15		1.75	2.73			3.12	
28		2.05		1.75	2.50			3.12	
29		2.13	[f]3.67	1.75	2.38			3.15	
30		2.50	4.17	1.50				3.31	
31		3.05							

[a] Maximum gage height, 6.2 feet.
[b] Maximum gage height, 5.35 feet.
[c] Maximum gage height, 8.85 feet.
[d] Maximum gage height, 7.1 feet.
[e] Maximum gage height, 7.05 feet.
[f] Maximum gage height, 9.2 feet.

NOTE.—No flow in creek on days for which gage heights are missing between Jan. 1 and Dec. 5.

UTE CREEK NEAR LOGAN, N. MEX.

Location.—In the northeastern corner of T. 13 N., R. 32 E., 4 miles above the mouth of Ute Creek. No important tributaries enter within several miles.

Records available.—August 12, 1904, to June 30, 1906; April 13, 1909, to December 31, 1913.

Drainage area.—Not measured.

Gage.—Automatic recording. Installed August 1, 1911, to replace original staff gage used since 1904. Datum of recording gage different from that of staff gage.

Channel.—Shifting.

Discharge measurements.—Made by wading at low stages and from cable at ordinary stages. Estimates of flood discharge made by slope measurements and Kutter's formula.

Winter flow.—Little backwater from ice during winter months.

Diversions.—A small amount of water is diverted above the station for irrigation. Estimates withheld for additional data.

Discharge measurements of Ute Creek near Logan, N. Mex., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 7	C. J. Emerson	0.60	[a] 0.2
June 17	do	1.38	37.6
Aug. 4	do	.80	.0

[a] Estimated.

Daily gage height, in feet, of Ute Creek near Logan, N. Mex., for 1913.

[Samuel Rufi, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.75			0.81		1.02				0.94
2		.75					1.00		1.46		.94
3		.72					.90		1.25		.96
4		.60			1.91						1.55
5					2.46						2.02
6					[c] 1.56						1.71
7		.60			1.20						1.54
8		.61			.88						1.41
9		.65			.82						1.35
10		.64						1.56			1.31
11		.65			1.05			1.34		0.91	1.29
12		.66			[d] 2.19			1.21		.91	1.23
13		.67			2.68					.91	1.21
14		.60			1.51					.93	1.21
15		.64			1.30					.94	1.21
16		.63			1.44					.89	1.21
17		.64			1.33					.89	1.20
18		.65			1.39		.99			.95	1.20
19	0.60	.65			[e] 3.02		1.66			.95	1.20
20	.67	.67			1.90	0.97	1.33			.95	1.20
21	.68	.68	[a] 1.77		1.44	1.54	1.12			.95	1.20
22	.68		1.40		1.41	1.37				.95	1.20
23	.67		1.62		1.35	1.26				.95	1.20
24	.66		1.42		1.20	[f] 2.66				.95	1.20
25	.60		1.32		1.10	2.28				.95	1.20
26	.70		1.15		.97	1.73				.95	1.20
27	.75		1.00	[b] 1.46	.89	1.70				.95	1.20
28	.77			.82	.87	1.70				.95	1.20
29					.85	1.55				.95	1.20
30					.85	1.11				.95	1.20
31				.88		1.05					1.20

[a] Maximum gage height, 3.0 feet.
[b] Maximum gage height, 3.15 feet.
[c] Maximum gage height, 3.6 feet.
[d] Maximum gage height, 4.6 feet.
[e] Maximum gage height, 5.7 feet.
[f] Maximum gage height, 4.9 feet.

NOTE.—Gage heights affected by ice Dec. 17–31; no flow in stream on days of missing gage heights.

YAZOO RIVER BASIN.

TALLAHATCHIE RIVER AT PHILIPP, MISS.

Location.—At the Yazoo & Mississippi Valley Railroad bridge at Philipp, Miss.
Records available.—September 6, 1908, to June 30, 1913.
Drainage area.—Not measured.
Gage.—Vertical timber attached to upstream end of a bridge pier; datum is sea level.
Channel and control.—The channel is considered fairly permanent, but backwater from the Mississippi causes the control to vary considerably.
Discharge measurements.—Made from the railroad bridge.
Floods.—Flood of April 28, 1911, reached gage height of 138.6 feet by the gage datum.
Winter flow.—Not affected by ice.
Regulation.—None.
Accuracy.—Discharge relation probably affected by backwater from cofferdams used by the railroad company in constructing a new bridge. For this reason discharge has not been estimated.

Daily gage height, in feet, of Tallahatchie River at Philipp, Miss., for 1913.

[A. Y. Young, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	124.5	138.2	136.8	136.4	136.2	122.0	16	132.2	137.7	136.5	137.6	123.8	117.0
2	124.7	138.2	136.8	136.5	136.0	121.8	17	132.8	137.6	136.5	137.6	122.9	116.4
3	124.9	138.2	136.8	136.6	135.7	121.3	18	133.7	137.5	136.5	137.6	121.9	116.0
4	125.2	138.2	136.8	137.0	135.4	120.3	19	134.3	137.4	136.5	137.5	121.2	115.5
5	125.4	138.2	136.8	137.1	135.0	119.4	20	134.6	137.3	136.5	137.4	120.5	115.3
6	125.5	138.2	136.8	137.3	134.7	118.3	21	135.5	137.2	136.5	137.4	119.9	115.1
7	125.7	138.2	136.8	137.4	134.2	117.7	22	135.9	137.1	136.4	137.2	119.5	115.1
8	126.4	138.1	136.8	137.5	133.7	117.3	23	136.2	137.0	136.4	137.2	119.6	115.1
9	126.9	138.1	136.8	137.6	133.1	117.4	24	136.7	136.8	136.4	137.1	120.2	115.2
10	127.2	138.0	136.7	137.7	132.3	118.2	25	137.0	136.6	136.3	137.1	120.6	115.3
11	128.1	138.0	136.6	137.8	131.3	118.2	26	137.2	136.7	136.3	137.0	121.0	115.4
12	129.0	138.0	136.5	137.8	130.3	117.7	27	137.6	136.8	136.3	136.8	121.5	115.5
13	130.0	137.9	136.5	137.8	128.8	117.3	28	137.7	136.8	136.3	136.7	121.8	114.4
14	131.0	137.8	136.5	137.8	127.0	117.2	29	137.8	.....	136.3	136.6	122.0	114.3
15	131.7	137.7	136.5	137.7	125.4	117.1	30	138.0	.....	136.4	136.4	122.2	114.8
							31	131.8	.....	136.4	.....	122.2	.....

YAZOO RIVER AT GREENWOOD, MISS.

Location.—At highway bridge in city of Greenwood, about 1 mile below mouth of Yalobusha River.
Records available.—January 1, 1908, to December 31, 1912; April 6 to June 30, 1913. Gage heights prior to July 15, 1908, when station was established, from United States Weather Bureau, whose records began November 1, 1904.
Drainage area.—Not measured.
Gage.—Standard chain gage attached to highway bridge; datum, sea level; datum of United States Weather Bureau gage, 92.5 feet above sea level.
Channel and control.—The channel is considered practically permanent but backwater from the Mississippi causes the control to vary considerably.
Discharge measurements.—Made from downstream side of highway bridge.
Floods.—Flood of May 2, 1911, reached a height of 128.9 feet referred to gage datum; that of April 7, 1912, 130.7 feet.
Winter flow.—Not affected by ice.
Regulation.—None.

Accuracy.—Gage heights affected by backwater from Mississippi River; comparison of monthly means, computed in ordinary way from a mean rating curve, and also by correcting for slope, indicate that the percentage of difference is very slight. Results for individual days show considerable variation but monthly means are apparently compensating; estimates as published are computed from a mean rating curve.

Daily gage height, in feet, and discharge, in second-feet, of Yazoo River at Greenwood, Miss., for 1913.

[F. A. Maas, observer.]

Day.	April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	122.7	27,200	104.3	7,580
2	.....	.....	122.4	26,800	103.9	7,280
3	.....	.....	122.0	26,200	103.4	6,930
4	.....	.....	121.6	25,700	102.6	6,370
5	.....	.....	121.2	25,200	101.8	5,820
6	124.0	29,000	120.8	24,600	101.0	5,300
7	124.0	29,000	120.3	24,000	100.2	4,820
8	124.0	29,000	119.8	23,300	99.7	4,520
9	124.2	29,300	119.2	22,600	100.1	4,760
10	124.8	30,200	118.5	21,600	100.4	4,940
11	125.2	30,800	117.7	20,600	100.3	4,880
12	125 3	31,000	116.8	19,600	99.9	4,640
13	125.5	31,200	115.8	18,400	99.35	4,310
14	125.6	31,400	114.6	17,100	98.95	4,070
15	125.7	31,600	113.4	15,700	98.75	3,950
16	125.8	31,700	112.4	14,700	98.55	3,830
17	125.8	31,700	111.4	13,700	98.3	3,680
18	125.8	31,700	110.4	12,700	97.9	3,440
19	125.7	31,600	109.4	11,800	97.55	3,250
20	125.6	31,400	108.0	11,200	97.25	3,090
21	125.4	31,100	107.7	10,300	97.05	2,980
22	125.2	30,800	106.7	9,460	97.0	2,950
23	125.0	30,500	106.4	9,220	97.0	2,950
24	124.7	30,000	106.0	8,900	97.05	2,980
25	124.6	29,900	105.6	8,580	96.9	2,900
26	124.3	29,400	105.4	8,420	96.65	2,760
27	124.0	29,000	105.2	8,260	96.4	2,620
28	123.7	28,600	105.0	8,100	96.2	2,510
29	123.4	28,200	104.9	8,020	96.1	2,460
30	123.0	27,600	104.8	7,950	96.2	2,510
31	.....	.....	104.5	7,720	.....	.....

Monthly discharge of Yazoo River at Greenwood, Miss., for 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
April 6–30	31,700	27,600	30,200	A.
May	27,200	7,720	16,100	A.
June	7,580	2,460	4,170	A.

RED RIVER BASIN.

MEDICINE BLUFF CREEK NEAR LAWTON, OKLA.

Location.—In sec. 18, T. 3 N., R. 12 W., at Medicine Park, 12 miles northwest of Lawton; nearest tributary, Little Medicine Bluff Creek, enters a few hundred yards above.

Records available.—November 26, 1912, to December 31, 1913.
Drainage area.—Approximately 110 square miles.
Gage.—Vertical staff.
Control.—Rock ledge. River bed is composed largely of ledge rock covered with some silt and gravel. Channel forms a pool one-third mile in length.
Discharge measurements.—Made from cable during high water and by wading at low stages.
Winter flow.—Little, if any, affected by backwater from ice.
Regulation.—Flow controlled to a great extent by reservoir of Lawton waterworks, which is situated a mile upstream and which covers an area of 1,100 acres; entire low-water flow used by waterworks.
Accuracy.—Conditions favorable for accurate results; estimates reliable.
Cooperation.—Station maintained in cooperation with United States Reclamation Service.

Discharge measurements of Medicine Bluff Creek near Lawton, Okla., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 30	Robert Follansbee	0.80	0.67	July 1	F. B. King	2.80	149
May 11	F. B. King	1.40	17.4	Nov. 5	do	4.55	773

Daily gage height, in feet, of Medicine Bluff Creek near Lawton, Okla., for 1913.

[W. F. Stuart and W. S. Kesler, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.72	0.75	0.80	0.82	0.80	0.70	2.90	1.10	0.78	0.98	0.82	3.05
2	.72	.75	.80	.82	.80	.70	2.60	1.20	.78	.92	.82	4.65
3	.75	.75	.75	a.85	.80	.70	2.10	1.20	.78	.90	.82	4.85
4	.75	.72	.75	a.82	1.60	.70	1.60	1.20	.78	2.10	4.25	4.85
5	.75	.72	.80	.80	a1.32	.70	1.50	1.20	.78	1.30	4.95	5.55
6	.85	.72	.78	.80	a1.75	.70	1.32	1.20	.78	1.18	3.65	3.85
7	.75	.70	.75	.80	1.00	a.85	1.12	1.20	.78	1.08	a3.35	3.05
8	.75	.70	.75	.95	1.00	.90	1.00	1.20	.80	1.00	a2.60	2.75
9	.75	.75	.75	a1.15	1.00	.92	2.00	1.20	.85	1.35	2.25	2.65
10	.75	.75	.80	a1.20	1.15	.90	2.00	1.20	b1.00	1.12	2.15	2.50
11	.75	.75	.80	a1.30	1.25	.80	2.00	1.20	.90	1.05	2.05	2.40
12	.75	.75	.88	.90	1.25	.80	2.00	1.20	.80	1.02	1.90	2.30
13	.75	.75	1.30	.88	1.15	.78	2.00	1.20	.75	.98	1.85	2.80
14	.76	.75	1.00	.88	1.00	.78	1.80	1.10	.75	.95	1.82	2.60
15	.75	.75	.95	.85	a1.75	.78	1.40	1.10	.75	.92	1.75	2.45
16	.75	.75	.92	.82	1.05	.78	1.25	1.10	.75	a2.25	1.55	2.45
17	.75	.75	.92	.82	1.00	.75	1.25	1.10	.85	a1.55	1.55	2.60
18	.75	.75	.90	.82	1.25	b1.15	1.22	.90	.80	a1.32	1.52	2.65
19	.75	.75	.88	.80	.80	.75	1.22	.80	.80	a2.30	1.52	2.55
20	.80	.85	.90	.80	.90	b1.10	1.22	.80	.80	1.08	1.50	a2.75
21	.75	.95	a.98	.80	a1.45	.75	1.22	.80	.80	1.12	1.45	1.95
22	.75	.85	.85	.80	a1.25	.75	1.22	.80	b1.00	a2.40	a2.15	2.05
23	.75	.80	.85	.92	.85	.80	1.00	.80	b1.00	1.02	a1.75	2.25
24	.75	.80	.85	.92	.80	.80	1.00	.80	b.90	1.00	1.10	a2.75
25	.75	.80	.85	.85	.80	.80	1.00	.80	1.35	1.00	.98	a2.35
26	a.80	.80	a1.10	.82	.82	.78	.98	.80	1.05	a2.10	1.15	1.85
27	.75	.80	.85	.82	.80	.75	.98	.78	1.00	1.10	1.25	2.25
28	.75	.80	.85	.82	.75	.75	1.08	.78	1.22	a3.20	1.40	1.95
29	.75	.....	.82	.80	.72	.75	1.10	.78	1.08	.88	1.85	1.95
30	.8	.....	.82	.80	.72	.75	1.10	.78	1.00	.82	2.95	2.00
31	.75	.....	.82	.....	.70	.....	1.10	.78	.....	.82	.....	2.25

a Water flowing over reservoir dam. b Water let out of small dam.

NOTE.—No ice at this station. Water let out of reservoir July 9 to Aug. 18.

Daily discharge, in second-feet, of Medicine Bluff Creek near Lawton, Okla., for 1912–13.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1912.			1912.			1912.		
1		1.1	11		0.6	21		0.4
2		.6	12		.4	22		.4
3		.6	13		.3	23		.4
4		.6	14		.3	24		.4
5		1.3	15		.3	25		.4
6		1.1	16		.3	26	0.4	.4
7		.4	17		.4	27	.7	.4
8		.4	18		.4	28	.4	.4
9		.3	19		.4	29	.4	.4
10		.3	20		.4	30	.4	.4
						31		.3

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1913.												
1	0.3	0.4	0.7	0.9	0.7	0.2	166	5	0.6	2.7	0.9	194
2	.3	.4	.7	.9	.7	.2	121	8	.6	1.8	.9	830
3	.4	.4	.4	1.1	.7	.2	65	8	.6	1.5	.9	950
4	.4	.3	.4	.9	28	.2	28	8	.6	65	615	950
5	.4	.3	.7	.7	14	.2	22	8	.6	12	1,010	1,390
6	1.1	.3	.6	.7	37	.2	13	8	.6	7	358	435
7	.4	.2	.4	.7	3	1.1	6	8	.6	5	266	194
8	.4	.2	.4	2.2	3	1.5	3	8	.7	3	121	142
9	.4	.4	.4	6.5	3	1.8	56	8	.7	14	80	128
10	.4	.4	.7	8	6.5	1.5	56	8	3.0	6	70	108
11	.4	.4	.7	12	10	.7	56	8	1.5	4	60	96
12	.4	.4	1.3	1.5	10	.7	56	8	.7	3	48	85
13	.4	.4	12	1.3	6.5	.6	56	8	.4	2.7	44	150
14	.4	.4	3	1.3	3	.6	41	5	.4	2.2	42	121
15	.4	.4	1.5	1.1	37	.6	17	5	.4	1.8	38	102
16	.4	.4	1.8	.9	4	.6	10	5	.4	80	25	102
17	.4	.4	1.8	.9	3	.4	10	5	1.1	25	25	121
18	.4	.4	1.5	.9	10	6.5	9	1.5	.7	13	23	128
19	.4	.4	1.3	.7	.7	.4	9	.7	.7	85	23	114
20	.7	1.1	1.5	.7	1.5	5	9	.7	.7	5	22	142
21	.4	2.2	2.7	.7	19	.4	9	.7	.7	6	20	52
22	.4	1.1	1.1	.7	10	.4	9	.7	3.0	96	70	60
23	.4	1.1	1.1	1.8	1.1	.7	3	.7	3.0	3	38	80
24	.4	.7	1.1	1.8	.7	.7	3	.7	1.5	3	5	142
25	.4	.7	1.1	1.1	.7	.7	3	.7	14	3	2.7	90
26	.7	.7	5	.9	.9	.6	2.7	.7	4	65	6.5	44
27	.4	.7	1.1	.9	.9	.4	2.7	.6	3	5	10	80
28	.4	.7	1.1	.9	.4	.4	5	.6	9	228	17	52
29	.4	.....	.9	.7	.3	.4	5	.6	4.6	1.3	44	52
30	.7	.....	.9	.7	.3	.4	5	.6	3.0	.9	175	56
31	.4	.....	.9	.....	.2	.....	5	.6	.....	.9	.....	80

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Medicine Bluff Creek near Lawton, Okla., for 1912–13.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1912.					
November 26–30	0.7	0.4	0.46	4	B.
December	1.3	.3	.48	30	B.
The period	.....	.....	.....	34	
1913.					
January	1.1	.3	.45	28	B.
February	2.2	.2	.57	32	B.
March	12	.4	1.58	97	B.
April	12	.7	1.80	107	B.
May	37	.2	6.99	430	B.
June	6.5	.2	.94	59	B.
July	166	2.7	27.8	1,710	A.
August	8	.6	4.23	260	A.
September	14	.6	2.05	122	B.
October	228	.9	24.2	1,490	B.
November	1,010	.9	109	6,490	B.
December	1,390	52	235	14,400	B.
The year	1,390	.2	34.6	25,200	

LITTLE MEDICINE BLUFF CREEK NEAR LAWTON, OKLA.

Location.—150 feet below west line of sec. 18, T. 3 N., R. 12 W., 12½ miles northwest of Lawton, and one-half mile above the mouth of the creek.

Records available.—November 26, 1912, to December 31, 1913.

Drainage area.—Approximately 10 square miles.

Gage.—Vertical staff.

Control.—Rock ledge. There is a fall of about 8 feet between the station and the crest of the small dam on Medicine Bluff Creek just below the mouth.

Discharge measurements.—Made by wading.

Winter flow.—Little, if any, backwater from ice during the winter months.

Accuracy.—Conditions favorable for accurate results; estimates reliable.

Cooperation.—Station maintained in cooperation with the United States Reclamation Service.

Discharge measurements of Little Medicine Bluff Creek near Lawton, Okla., in 1913.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 30	Robert Follansbee	0.20	0.63	May 11	F. B. King	0.30	1.29
May 4	F. B. King	.78	18.9	July 1	do	.91	35.1
4	do	.75	20.4	Dec. 2	do	1.75	180
5	do	.55	7.12				

Daily gage height, in feet, of Little Medicine Bluff Creek near Lawton, Okla., for 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.15	0.10	0.20	0.20	0.20	0.10	0.90	0.00	0.00	0.28	0.20	0.85
2	.15	.10	.20	.20	.18	.10	.52	.00	.00	.25	.20	1.80
3	.15	.10	.15	.20	.18	.10	.48	.00	.00	.22	.20	1.00
4	.15	.10	.15	.20	.85	.10	.35	.00	.00	1.00	1.90	1.20
5	.15	.10	.15	.20	.55	.10	.30	.00	.00	.52	1.00	1.00
6	.15	.10	.12	.20	.50	.10	.25	.00	.00	.48	.75	.80
7	.15	.10	.12	.18	.42	.12	.20	.00	.00	.42	.65	.70
8	.15	.10	.12	.30	.38	.15	.18	.00	.00	.38	.68	.65
9	.15	.10	.12	.40	.32	.18	.18	.00	.00	.52	.50	.58
10	.15	.10	.18	.35	.30	.18	.15	.00	.00	.45	.45	.55
11	.15	.10	.15	.35	.30	.18	.15	.00	.08	.40	.42	.50
12	.15	.10	.28	.35	.28	.15	.12	.00	.05	.35	.40	.48
13	.15	.10	.60	.30	.25	.15	.10	.00	.02	.32	.38	.90
14	.15	.10	.50	.30	.22	.15	.10	.00	.02	.30	.35	.70
15	.15	.10	.50	.28	.25	.15	.10	.00	.02	.28	.35	.60
16	.15	.10	.40	.28	.25	.12	.10	.00	.02	.55	.32	.55
17	.15	.10	.32	.25	.22	.12	.08	.00	.10	.45	.32	.72
18	.15	.10	.30	.25	.20	.12	.08	.00	.08	.42	.32	.65
19	.15	.10	.30	.20	.20	.12	.08	.00	.05	.38	.30	.60
20	.15	.15	.30	.20	.22	.12	.08	.00	.02	.35	.30	.55
21	.18	.25	.30	.20	.20	.12	.08	.00	.00	.32	.30	.52
22	.12	.15	.25	.20	.20	.12	.08	.00	.00	.30	.28	.52
23	.12	.15	.25	.30	.18	.18	.08	.00	.00	.28	.28	.55
24	.10	.20	.25	.30	.15	.12	.08	.00	.00	.28	.28	.55
25	.10	.20	.25	.25	.12	.12	.08	.00	.55	.25	.30	.52
26	.10	.20	.25	.22	.12	.10	.05	.00	.45	.25	.32	.52
27	.10	.20	.25	.22	.12	.10	.05	.00	.38	.25	.32	.50
28	.10	.20	.25	.22	.12	.10	.02	.00	.52	.22	.32	.48
29	.10	.....	.22	.20	.12	.10	.02	.00	.40	.22	.60	.48
30	.10	.....	.22	.20	.12	.10	.00	.00	.32	.20	.80	.45
31	.10	.....	.20	.....	.10	.....	.00	.00	.....	.20	.....	.45

Daily discharge, in second-feet, of Little Medicine Bluff Creek near Lawton, Okla., for 1912–13.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1912.			1912.			1912.		
1		0.4	11		0.2	21		0.2
2		.2	12		.2	22		.2
3		.2	13		.2	23		.2
4		.2	14		.2	24		.2
5		.2	15		.2	25		.2
6		.2	16		.2	26	0.2	.2
7		.2	17		.2	27	.2	.2
8		.2	18		.2	28	.2	.2
9		.2	19		.2	29	.2	.2
10		.2	20		.2	30	.2	.2
						31		.2

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1913.												
1	0.2	0.1	0.4	0.4	0.4	0.1	33	0.0	0.0	1.1	0.4	28
2	.2	.1	.4	.4	.3	.1	6.2	.0	.0	.8	.4	189
3	.2	.1	.2	.4	.3	.1	5.0	.0	.0	.6	.4	45
4	.2	.1	.2	.4	27	.1	2.1	.0	.0	45	211	75
5	.2	.1	.2	.4	7.2	.1	1.3	.0	.0	6.2	45	45
6	.2	.1	.2	.4	5.5	.1	.8	.0	.0	5	19	23
7	.2	.1	.2	.3	3.5	.2	.4	.0	.0	3.5	12	15
8	.2	.1	.2	1.3	2.7	.2	.3	.0	.0	2.7	8.3	12
9	.2	.1	.2	3.0	1.6	.3	.3	.0	.0	6.2	5.5	8.3
10	.2	.1	.3	2.1	1.3	.3	.2	.0	.0	4.2	4.2	7.2
11	.2	.1	.2	2.1	1.3	.3	.2	.0	.1	3.0	3.5	5.5
12	.2	.1	1.1	2.1	1.1	.2	.2	.0	.1	2.2	3.0	5.0
13	.2	.1	9.0	1.3	.8	.2	.1	.0	.0	1.6	2.7	33
14	.2	.1	5.5	1.3	.6	.2	.1	.0	.0	1.3	2.2	15
15	.2	.1	5.5	1.1	.8	.2	.1	.0	.0	1.1	2.2	9
16	.2	.1	3.0	1.1	.8	.2	.1	.0	.0	7.3	1.6	7.2
17	.2	.1	1.6	.8	.6	.2	.1	.0	.1	4.2	1.6	17
18	.2	.1	1.3	.8	.4	.2	.1	.0	.1	3.5	1.6	12
19	.2	.1	1.3	.4	.4	.2	.1	.0	.1	2.7	1.3	9
20	.2	.2	1.3	.4	.6	.2	.1	.0	.0	2.2	1.3	7.2
21	.3	.8	1.3	.4	.6	.2	.1	.0	.0	1.6	1.3	6.2
22	.2	.2	.8	.4	.6	.2	.1	.0	.0	1.3	1.1	6.2
23	.2	.2	.8	1.3	.3	.3	.1	.0	.0	1.1	1.1	7.2
24	.1	.4	.8	1.3	.2	.2	.1	.0	.0	1.1	1.1	7.2
25	.1	.4	.8	.8	.2	.	.1	.0	7.3	.8	1.3	6.2
26	.1	.4	.8	.6	.2	.1	.1	.0	4.2	.8	1.6	6.2
27	.1	.4	.8	.6	.2	.1	.1	.0	2.7	.8	1.6	5.5
28	.1	.4	.8	.6	.2	.1	.0	.0	6.2	.6	1.6	5.0
29	.1	.....	.6	.4	.2	.1	.0	.0	3.0	.6	9	5.0
30	.1	.....	.6	.4	.2	.1	.0	.0	1.6	.4	23	4.2
31	.1	.....	.4	.....	.1	.....	.0	.0	.....	.4	.....	4.2

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Little Medicine Bluff Creek near Lawton, Okla., for 1912–13.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1912.					
November 26–30	0.2	0.2	0.20	2	B.
December	.4	.2	.21	13	B.
1913.					
January	.2	.1	.18	11	B.
February	.8	.1	.19	11	B.
March	9	.2	1.32	81	B.
April	3	.3	.91	54	B.
May	27	.1	1.94	119	B.
June	.3	.1	.17	10	B.
July	33	.0	1.69	104	B.
August	.0	.0	.00	0	B.
September	7.3	.0	.85	51	B.
October	45	.4	3.67	226	B.
November	211	.4	12.3	732	C.
December	189	4.2	20.3	1,250	C.
The year	211	.0	3.63	2,650	

EVAPORATION STATION NEAR LAWTON, OKLA.

Location.—In a somewhat sheltered bay on the west side of Lawton reservoir, 12 miles northwest of Lawton.

Records available.—February 20 to December 31, 1913.

Equipment for measurement.—A galvanized iron pan 3 feet square and 18 inches deep floating in the center of a skeleton raft about 75 feet from the shore; in the center of the pan is a vertical needle point which is the reference point for measuring evaporation.

Cooperation.—Station maintained in cooperation with United States Reclamation Service.

Evaporation, in inches, from Lawton reservoir near Lawton, Okla., for 1913.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.28	0.38	0.02	0.41	0.35	0.12	0.06	0.00
2	.26	.29	.17	.42	.33	.08	.07	.01
3	.....	.23	.21	.36	.27	.04	.05	.00
4	.....	.30	.29	.24	.26	.05	.00	.00
5	.20	.20	.18	.40	.28	.10	.02	.02
6	.22	.24	23	.41	.28	.07	.02	.02
7	.20	.63	.25	.40	.38	.06	.06	a.10
8	.19	.23	.32	.44	.16	.05	.11	.06
9	.14	.19	.31	.42	.06	a.15	.13	.08
10	.17	.17	.28	.43	.14	.11	.09	.06
11	.00	.15	.40	.41	.09	a.15	.08	.05
12	.19	.22	.38	.40	.32	.15	.07	.08
13	.23	.20	.42	.38	.35	.17	.09	.03
14	.28	.17	.38	.36	.30	.24	.05	.05
15	.07	.23	.41	.30	.14	.13	.01	.07
16	.16	.15	.41	.25	.22	.25	.03	.02
17	.12	.14	.33	.30	.16	.23	.02	.03
18	.22	.18	.31	.32	.12	.17	.04	.06
19	.11	.12	.30	.36	.20	.23	.04	.03
20	.31	.23	a.32	.25	a.24	.18	.02	.06
21	.18	.17	.35	.30	.24	.17	.01	.04
22	.23	.14	.36	.29	.30	.12	.10	.05
23	.25	.06	.35	.28	.36	.06	.06	.02
24	.33	.19	.29	.33	.27	.10	.00	.04
25	.24	.21	.25	.36	.09	.15	.00	.03
26	.29	.32	.28	.35	.33	.26	.01	.02
27	.32	.23	.29	.39	.16	.17	.00	.04
28	.28	.17	.34	.36	.14	a.20	.00	.06
29	.35	.14	.31	.26	.12	.09	.00	.03
30	.32	.15	.35	.32	.07	.08	.00	.04
31	.19	.....	.34	.42	.....	.11	.....	.05
Total	6.45	6.43	9.43	10.92	6.73	4.24	1.24	1.25

a Estimated. Record spoiled by wind.

NOTE.—The following additional observations were made:

		Total evaporation in inches.
Feb.	20–24	0.17
	25–28	.13
Mar.	1– 8	.59
	9–11	.34
	12–20	.29
Apr.	1– 5	1.32
	6– 7	.19
Apr.	8–10	0.55
	11	.30
	12–13	.36
	14–15	.24
	16–17	.29
	18–19	.34
Apr.	20–21	0.35
	22–23	.53
	24–25	.33
	26–27	.34
	28–30	.60
May	3– 4	.12

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made on streams in the Arkansas River basin in 1913:

Miscellaneous measurements in Arkansas River drainage basin in 1913.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 15	Chalk Creek	Arkansas River	Just above Grizzley Cr., St. Elmo, Colo.		6.52
15	Grizzley Creek	Chalk Creek	St. Elmo, Colo		.78
15	Tailrace, Tincup Gold Dredging Co.'s power plant.	(a)	do		2.31
Feb. 17	Fountain Creek	Arkansas River	Wigwam, Colo		29
18	Chico Creek	do	May's ranch, near Pueblo, Colo.		6.49
4	Vermejo Creek	Canadian River	Above reservoir near Wagon Mound, N. Mex.		.21
4	do	do	Below reservoir near Wagon Mound, N. Mex.		.15
Apr. 13	Cimarron River	do	Cimarron, N. Mex.	b 2.10	55.5
May 17	do	do	do	b 1.80	29.2
July 15	do	do	do		2.2
Sept. 2	do	do	do		9.5
Oct. 15	do	do	do		17.0
Nov. 14	do	do	do		16.2

a Diverts from Chalk Creek. b Private gage.

FLOODS IN CANADIAN RIVER BASIN IN NEW MEXICO IN 1913.

CHICORICA CREEK BASIN, JUNE 9–14, 1913.

During the week ending June 14, 1913, a general rain over the northeastern section of New Mexico caused disastrous floods on Chicorica Creek and other tributaries of the upper Canadian. A large part of the precipitation occurred between 10 p. m. of the 8th and 10 p. m. of the 12th. The United States Weather Bureau reported 1.46 inches of rainfall at Raton on the 8th, 3.12 inches on the 10th, 1.30 inches on the 11th, and 0.65 inch on the 12th, a total of 6.53 inches. At Lake Alice 4.05 inches of rain fell, at Johnson Park 3.52 inches, and at Dawson 5.83 inches during this period. At Elizabethtown and Cimarron the precipitation was not excessive, although 2.60 inches of rain fell at Cimarron on the 10th. In the country east of Raton rainfall was not so heavy as in and around Raton, the rainfall at Folsom during this period amounting to only 1.64 inches.

An automatic gage is maintained on Chicorica Creek, at the St. Louis, Rocky Mountain & Pacific Railway bridge, in sec. 28, T. 30 N., R. 24 E., 10 miles southeast of Raton, above the confluence with Raton and Una del Gato creeks. At 6.30 p. m., June 9, this gage started to register a rise, which continued until 11 p. m., when it recorded a stage of 10.20 feet. The maximum discharge of this flood at this point, computed from the slope and cross-section of the stream, was approximately 5,100 second-feet; a flood stage

was also maintained on the 10th, the average discharge for 24 hours being 2,800 second-feet. At 11 a. m. on the 11th a second flood passed the gage, which recorded a stage of 10.8 feet, the corresponding discharge being 5,700 second-feet. On the 11th the mean discharge was 3,450 second-feet. On the 12th two floods occurred, the first at 7 a. m., when 10.3 feet was recorded by the gage, representing a discharge of 5,200 second-feet, and the second at 7 p. m., when the gage registered 11.2 feet (6,100 second-feet), and the water filled the creek bed from bank to bank. From the maximum height of 11.2 feet the creek gradually fell to a low-water stage of 1.75 feet on June 18.

The mean discharge of Chicorica Creek from June 9 to 14 was 2,310 second-feet. It is estimated that 27,000 acre-feet of water passed the gage during this period of floods, an amount that properly stored in reservoirs would suffice to cover 900 acres of land to a depth of 1 foot 30 times, or maintain a flow of 450 second-feet during a 30-day month.

The drainage area of Chicorica Creek above the gaging station, as measured on United States Geological Survey maps, comprises 84 square miles. A large part of this area lies east of Raton and borders that part of the State where the rainfall was lighter than at Raton, but about three-fourths of the basin is classed as mountainous, over which a heavier rainfall than at Raton may be assumed, as it is well known that rainfall increases with altitude, varying according to the locality and type of drainage. Assuming an increase of 1 inch for 300 feet rise in altitude as applicable to the Chicorica basin—an assumption justified by observation—and using the rainfall at Raton as a basis, it is estimated that an average of 8 inches of rain fell in the drainage area, or about 18.6 millions of cubic feet of water per square mile, or approximately 36,000 acre-feet of water. As the flow at the gaging station was estimated at 27,000 acre-feet, it appears that about 75 per cent of the precipitation was carried away by Chicorica Creek. For a rolling or prairie country this ratio of rainfall to run-off would be excessive, but for a mountainous section such as that drained by the Chicorica the ratio is thought to be nearly correct.

The run-off over the drainage area during the maximum stage of this series of floods, which occurred at 7 p. m. on the 12th, was 72.6 second-feet per square mile. Few data are available concerning the flood flow of streams in this section of the United States. A rate of flow of 50 second-feet per square mile over a drainage area of 200 or 300 square miles is large, but not altogether unusual. In September, 1904, the estimated maximum rate of discharge of the Purgatory at Trinidad, Colo., was 61 second-feet per square mile over a drainage area of 712 square miles, and of Mora River, in the

northern part of New Mexico, 66 second-feet per square mile over a drainage area of 422 square miles.

CIMARRON RIVER BASIN, JUNE 9–12, 1913.

Area affected.—Cimarron River drains approximately one-third of Colfax County, rising in the northwestern corner of the county and flowing southeastward to its junction with Canadian River a few miles southeast of Springer, N. Mex., in sec. 9, T. 24 N., R. 23 E. The principal tributaries of the Cimarron are Cimarroncito Creek and Rayado River, which flow from the west, and Ponil Creek, which joins from the north. The Rayado Basin includes the basin of Urraca Creek.

Precipitation.—Floods are not uncommon in the area drained by the Cimarron, and as a rule they result from melting snow, but occasionally they are caused by heavy rains such as fell fron June 6 to 12, 1913. The precipitation in and above the Ute Park section of the area was light in comparison with that in the other districts. At Elizabethtown 1.44 inches fell from June 7 to 12, the maximum fall being 0.55 inch on the 11th. From the 6th to the 12th 4.22 inches of rain fell at Cimarron, the maximum being 2.60 inches on the 10th; 2.48 inches at Vermejo Park, the maximum being 0.82 inch on the 11th; 6.23 inches at Dawson, with a maximum of 4.43 inches on the 11th; 4.70 inches at Miami ranch, with a maximum of 1.87 inches on the 11th, and 6.85 inches at Aurora, with a maximum of 3.80 inches on the 11th. The rainfall from the 6th to the 9th was not of sufficient intensity to cause heavy run-off, though some tributaries showed the effects of accumulated moisture. The heavy fall of rain in general came on the 10th and 11th, gradually decreasing on the 12th until the skies cleared.

Urraca Creek flood.—Urraca Creek drains an area comprising approximately 22 square miles of rolling country and 15 square miles of mountainous country, and is measured at a gaging station just above the confluence of the main stream with its south fork. The drainage area above this gaging station is 6.3 square miles. From a general study of the rainfall it is estimated that 4.5 inches of rain fell from June 9 to 12 on the part of the basin classed as rolling and 7 inches on the mountainous part, equivalent to 10,900 acre-feet of of water. The first rainfall merely saturated the ground and prepared it for the heavy run-off which followed the heavy rains.

The gage on Urraca Creek shows that the creek began to rise at 9.30 a. m. June 9; prior to this time it had been at low-water stage. During its peak this flood carried about 25 second-feet at the gage. The maximum gage height, 2.45 feet, was recorded at 10 a. m. and again at 1 p. m., there being a drop of 0.4 foot in the creek between the two peaks; after 1 p. m. the creek gradually fell to a stage of

1.40 feet, which it reached at noon on the 10th. At 5 p. m. on the 10th another rise began, continuing until 11.30 p. m., when a maximum stage of 5.1 feet, about 4 feet above low-water stage, was recorded. This stage was not maintained long as the gage recorded a stage of 2.2 feet at 2 a. m. on the 11th, and the stream continued to fall from the 11th to the 15th, when it again reached low-water stage.

From the estimated velocity of the peak of this flood at the mouth of the creek, it is believed that the water flowed from the gaging station to the mouth in two hours. At the mouth the action of the stream was similar to that at the gage but two hours later—that is, the maximum discharge of the creek at its mouth occurred at 1.30 a. m. on the 11th. From the cross-section and slope this maximum discharge is estimated at 2,660 second-feet, or 72 second-feet per square mile of drainage area. The maximum flow did not last more than one-half hour, but the creek maintained an excessive flood stage from 10 p. m. on the 10th until 2.30 a. m. on the 11th, as shown by the following gage heights:

Gage height, in feet, at the gaging station on upper Urraca Creek, June 8 to 14, 1913.

Date.	Mean gage height.	Maximum gage height.	Time of maximum gage height.
June 8	1.20	.....	
9	1.67	2.45	10 a. m. and 1 p. m.
10	1.84	5.10	11.30 p. m.
11	1.99	3.25	1 p. m.
12	1.53	1.65	1 p. m.
13	1.37	.....	
14	1.24	.....	

Rayado River flood.—Rayado River drains an area comprising approximately 197 square miles, of which 73 square miles can be classed as mountainous and 124 square miles as rolling. Above the confluence with Urraca Creek, Rayado River drains about 151 square miles, 56 square miles being in a mountainous area.

Rain began in this area June 6 but did not affect the run-off to any great extent until the night of June 10–11, when it fell in cloudbursts just above the point at which the river leaves the mountains. The precipitation at Agua Fria Park was not heavy at any time from the 6th to the 12th, nor did the record at Miami ranch show an exceedingly heavy rainfall during this period. The behavior of the Rayado was similar to that of Urraca Creek, the flood occurring at the same time, but, owing to the size of the drainage area, lasting longer.

A gaging station is maintained at the mouth of the box canyon on Rayado River, but the automatic gage which was installed at this point was washed out the night of the 10th.

Estimating the rainfall on this basin as on that of Urraca Creek—that is, at 4.5 inches on the part classed as rolling and 7 inches on the mountainous part—the rainfall over the area during this period of rains amounts to approximately 43,700 acre-feet. About one-half of this quantity fell on the 10th and 11th.

The discharge of Rayado River just above its mouth has been estimated for the maximum flood of the night of the 10th by means of the cross section and slope. The exact duration of this flood is not known, but at its peak the river was carrying 5,710 second-feet of water, of which 2,660 second-feet came from Urraca Creek; 3,050 second-feet, therefore, represents the run-off of the Rayado basin above the confluence with Urraca Creek.

On the 12th it was estimated that 150 second-feet of water was flowing at the intake headgate of the Farmers Development Co.'s canal. The flow at this point for the 13th to the 15th inclusive has been estimated at 100 second-feet. On the 16th the flow at the intake canal headgate was estimated at 80 second-feet, and on the 17th a discharge measurement made a short distance below Abreu's ranch showed 55 second-feet of water. The stream continued to fall after the 17th until it reached low-water stage about the 25th.

The maximum run-off from the drainage area above the confluence with Urraca Creek amounted to 20 second-feet per square mile, which is much lower than the maximum for the Urraca basin. This difference is due to the relative size of the drainage areas, nearly one-half of the Urraca basin being mountainous, whereas only about one-third of the Rayado basin can be considered mountainous. A part of the upper Rayado basin did not contribute as much water in proportion as was furnished by that section just above the gaging station. The maximum rate of run-off in that section of the Rayado basin which furnished most of the run-off was undoubtedly as large as if not larger than the maximum rate of the Urraca basin.

Cimarron River above confluence with Rayado River.—The rainfall in the upper Cimarron basin was light in comparison with the precipitation in the lower parts of the area, but along the eastern and southern edges of the basin it was considerably in excess of the total fall at Cimarron—4.22 inches from the 6th to the 12th.

The drainage area of the Cimarron above its confluence with Rayado River can not be accurately determined from the maps available, but probably 95 per cent of it is mountainous, so that the ratio of rainfall to run-off is high.

The maximum discharge of the stream on June 11, just above its confluence with Rayado River, is estimated from the slope and cross-section at 8,830 second-feet, but as this maximum occurred during the night, its duration is unknown. Cimarroncito Creek, which joins Cimarron River from the west about 2 miles below Cimarron, and

which drains an area similar to that drained by Urraca Creek, probably contributed considerable water to this flood. Ponil Creek, which joins the Cimarron from the northwest at a point about 7 miles below Cimarron, furnished a large part of the discharge of the river, for the precipitation was heaviest in the eastern part of the basin of this creek. The fact that the automatic gage on Cimarron River at Ute Park recorded a maximum rise of one-half foot on June 11 indicates that the run-off did not come from the upper Cimarron basin. The maximum discharge at Ute Park was 124 second-feet and was maintained from 2 p. m. to 11 p. m. on the 11th. From 11 p. m. on the 11th to the 14th the stream gradually fell until it reached low-water stage.

These computations show that Rayado River furnished 5,710 second-feet of water to Cimarron River during its maximum discharge, and that Cimarron River above its confluence with Rayado River was carrying 8,830 second-feet of water during its peak flood, giving a total of approximately 15,000 second-feet of water as the discharge of Cimarron River below its confluence with Rayado River. As the drainage area below the mouth of Rayado River is small in comparison with that above, it seems probable that Cimarron River discharged into Canadian River during its peak of the flood about 15,000 second-feet.

MORA RIVER BASIN, JUNE 9–22, 1913.

SAPELLO CREEK.

The drainage area of Sapello Creek, as measured from the United States Geological Survey topographic sheets, comprises above the mouth 284 square miles, of which 160 square miles may be classed as rolling and 124 square miles as mountainous. Above Los Alamos it includes 150 square miles, of which 124 square miles is mountainous and 26 square miles rolling.

Rain began in the upper part of the basin June 7 and in the lower section June 5. The United States Weather Bureau reports a rainfall of 5.95 inches from June 7 to 11 at Rociada, N. Mex.; 6.19 inches at Harvey's ranch, a few miles west of Beulah, N. Mex., from June 7 to 12; and 7.93 inches at Fort Union from June 7 to 11. In contrast to the conditions prevalent during most storms, the rainfall was very heavy in the part of the basin classed as rolling, and decreased with the altitude. It is estimated that 6 inches of water fell from June 7 to 11 in the mountainous part of this area and 8 in the rolling part. The rain was not heavy enough to increase the run-off noticeably until 4 p. m. June 9, when the first flood went down the creek. The mean flow for the 9th at Los Alamos is estimated at 1,050 second-feet, or a total of 2,080 acre-feet for the day. The Don Santiago

canal diverts water to the Don Santiago reservoir about 2 miles above Los Alamos. The mean discharge of this canal for the 9th has been estimated at 115 second-feet, or a total of 228 acre feet, making the total discharge of the creeks above Los Alamos 2,310 acre-feet. The peak of this flood carried 1,900 second-feet at Los Alamos, and the Don Santiago canal carried 626 second-feet for a short time during this period, making a total flood of 2,530 second-feet.

On June 10 the rainfall was general over the area, but not of sufficient intensity to cause sudden floods. The estimated mean discharge of the creek at Los Alamos for June 10 was 1,000 second-feet, or a total of 1,980 acre-feet. The estimated mean discharge of the Don Santiago canal was 390 second-feet, or a total of 773 acre-feet, making a total run-off of 2,750 acre-feet for the area above Los Alamos for the 24-hour period of June 10.

On June 11 precipitation was heavy over the basin, especially in the lower parts, a fall of 2.93 inches being recorded at Fort Union during the 24-hour period. The largest flood of this series went past Los Alamos at 5 a. m. on the 11th and maintained a stage corresponding to 10,800 second-feet at Los Alamos from 5 a. m. to 11 a. m., when it began to recede. The Don Santiago canal carried 626 second-feet during a part of this flood, making a total of 11,400 second-feet above Los Alamos for the peak. The mean discharge for the day at Los Alamos is estimated at 5,580 second-feet, or a total of 11,000 acre-feet. The mean discharge of the Don Santiago canal is estimated at 590 second-feet, or a total of 1,170 acre-feet, making a total of 12,200 acre-feet at Los Alamos.

Practically no rain fell after June 11, and the creek gradually fell until the 22d, when it reached low-water stage. For the period from the 12th to the 22d, inclusive, the mean discharge at Los Alamos is estimated at 500 second-feet, or a total of 10,900 acre feet. The mean flow in the Don Santiago canal during this period was 626 second-feet, or a total of 13,700 acre-feet, making a total of 24,600 acre-feet above Los Alamos.

The run-off above Los Alamos is estimated at 41,900 acre-feet from June 9 to 22 inclusive; 15,900 acre-feet of water was diverted to the Don Santiago reservoir by the Don Santiago canal and 26,000 acre-feet passed Los Alamos.

September 29, 1904, Sapello Creek reached a stage of 8,100 second-feet, which was considered very high at that time. This flood eroded the banks to a distance of 40 feet back from the creek. The failure of the flood of 1913 to assume the apparent proportions of the flood of 1904 was due to the change in cross section. Estimates of the volume of discharge during the flood of 1904 indicate a run-off of 54 second-feet per square mile of area drained; those for the flood of 1913 give 75 second-feet per square mile as the maximum rate of

discharge, a quantity that is not excessive for small streams draining mountainous areas.

It is estimated that 20,000 acre-feet of water was furnished to Sapello Creek between Los Alamos and its confluence with Mora River during this period of floods in 1913. This estimate is based on the rainfall and is liable to considerable error, but assuming that it is correct, 61,900 acre-feet of water passed down Sapello Creek from June 9 to 22, 1913. The water that passed Los Alamos during this period would cover 860 acres of land to a depth of 1 foot 30 times or maintain a flow of 437 second-feet for a 30-day month, or 36 second-feet for one year.

MORA RIVER.

The precipitation in the Mora River basin occurred during the same period as in the Sapello Creek basin. In general, conditions in the two areas are similar except that the Mora basin above Loma Parda is about four times the size of the Sapello basin above Los Alamos, the points of comparison.

The Weather Bureau gage at Chacon showed a precipitation of 4.23 inches from June 7 to 11, at Black Lake 3.76 inches, and at Fort Union 7.93 inches.

As in the Sapello basin, rain was heaviest in the lower part of the area. The rainfall in the upper basin of the Mora was approximately 2 inches less than in the upper Rayado basin, which lies north of the upper end of the Mora basin.

The drainage area of Mora River above Loma Parda is estimated at 585 square miles, of which 390 square miles may be classed as mountainous and 195 square miles as rolling. It is thought that an average of 5 inches of rain fell on the mountainous part and 8 inches on the rolling part of the basin. In most parts of this area the rain began June 7, but it was not excessive until the 10th. The heavy precipitation on the 10th and 11th caused the maximum flood stage in Mora River on the 11th.

The first flood passed Loma Parda June 9 with a crest of 5,800 second-feet, and this crest stage was maintained by additional precipitation on the 10th. It is estimated that 11,500 acre-feet of water passed Loma Parda on the 10th.

A second flood went down the river on the 11th and reached a crest stage of 34,500 second-feet. After reaching the peak of this flood the stage fell in 30 hours to a discharge of 11,800 second-feet. The mean discharge for the 11th is estimated at 24,600 second-feet, or a total of 48,800 acre-feet. The stream continued to fall gradually on the 12th with an estimated mean discharge for the day of 11,000 second-feet, or a total of 21,800 acre-feet. Definite information concerning the action of the stream after the 12th is not available, but it is believed that the river fell gradually until it reached low-water

stage about the end of the month. Such conditions being assumed, the mean discharge through this period is estimated at 1,000 second-feet, or a total of 35,700 acre-feet.

For the flood from September 29 to October 10, 1904, the run-off at Weber has been estimated at 173,000 acre-feet, an amount corresponding to a depth of 7.7 inches over the drainage area above Weber, and a maximum rate of run-off of 65.7 second-feet per square mile. The maximum occurred September 30, 1904.

The total run-off at Loma Parda from June 10 to 30, 1913, has been estimated at 118,000 acre-feet and corresponds to a depth of 3.8 inches over the drainage area above Loma Parda, and a maximum rate of run-off of 59 second-feet per square mile. The rainfall from June 10 to 30 is estimated at 6 inches over the entire drainage area above Loma Parda. The run-off corresponding to 3.8 inches shows that 63 per cent of the rainfall passed Loma Parda as run-off. This ratio, however, is not applicable throughout the drainage area.

COMPARATIVE RESULTS.

The following table summarizes the yearly discharge of Sapello Creek and Mora River from 1905 to 1911:

Yearly discharge of Sapello Creek at Los Alamos, N. Mex., and of Mora River at La Cueva, N. Mex.

Year.	Sapello Creek (discharge in second-feet.)		Sapello Creek (run-off in acre-feet).	Mora River (run-off in acre-feet).
	Maximum.	Minimum.		
1905	1,100	5	46,200	30,840
1906	1,170	1.8	23,200	31,600
1907	172	1.0	15,100	31,700
1908	85	.5	3,990	16,100
1909	159	.3	2,460	25,500
1910	112	.6	2,050	19,200
1911	54	1.5	1,800	19,500

NOTE.—Data for Sapello Creek for 1905 and 1910 are for fractional parts of the year; those for 1911 cover the period from Jan. 1 to May 31. For Mora River the yearly summaries represent the sum of the discharges of the river and of La Cueva canal at La Cueva. The years 1909 and 1910 are full years; the remaining years are fractional, but run-off is correct within a small percentage: 1911 is f om January 1 to July 31.

The estimated run-off of Mora River at Loma Parda from June 10 to 30, 1913, is about four times any yearly run-off of that river at La Cueva since the flood of 1904. This difference is of course due in part to the difference in drainage areas, but allowing one-half for the effect of drainage area, the flood of 1913 is still of remarkable size.

The largest yearly run-off of Sapello Creek at Los Alamos since 1904 was during 1905, which was approximately 8,000 acre-feet larger than the estimated discharge during the flood of June, 1913. These estimates have been made for the same point and will bear direct comparison.

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