DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 387

SURFACE WATER SUPPLY OF THE UNITED STATES

1914

PART VII. LOWER MISSISSIPPI RIVER BASIN

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Prepared in cooperation with
THE STATES OF COLORADO AND NEW MEXICO

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SURFACE WATER SUPPLY OF THE LOWER MISSISSIPPI RIVER BASIN, 1914.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow of streams in the United States during the year ending September 30, 1914.

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, 1895–1915.

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 1915, 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; cooperation of the second kind is acknowledged on page 12.

Measurements of stream flow have been made at about 3,400 points in the United States and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and the Hawaiian Islands. In July, 1914, 1,480 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscel-

laneous discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

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

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross-section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 7–9).

"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 of 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 connection with studies of flood control.

The following terms used in these reports are not in common use:

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

"Control," "control section," and "point of control," terms used to designate the section or sections of the stream below the gage

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

The "point of zero flow" for a 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 (second-feet per square mile).	Run-off (depth 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 month multiply the run-off for 1 day by the number of days.

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

Discharge (second-feet).	Run-off (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 the run-off for 1 day by the number of days.

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

Discharge (second-feet).	Run-off (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	10.02	10.37	10.71
5	.4320	12.10	12.53	12.96	13.39
6	.5184	14.51	15.04	15.55	16.07
7	.6048	16.93	17.54	18.14	18.75
8	.6912	19.35	20.05	20.74	21.42
9	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

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

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

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 (365 days) covers 1 square mile 1.131 feet, or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foor for one year (365 days) equals 724 acre-feet.

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 miners' 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.
1½ horsepower equals about 1 kilowatt.

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

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1913, and ending September 30, 1914. At the first of January in most parts of the country a large amount of the precipitation for the preceding three months is stored either as ground water, in the form of snow, or in lakes. This stored water passes off in the streams during the spring break-up. At the end of September the only stored water available for run-off in the streams is possibly a small amount held in ground storage. Therefore the run-off for a year beginning with October 1 is practically all derived from precipitation occurring within that year.

For each regular 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.

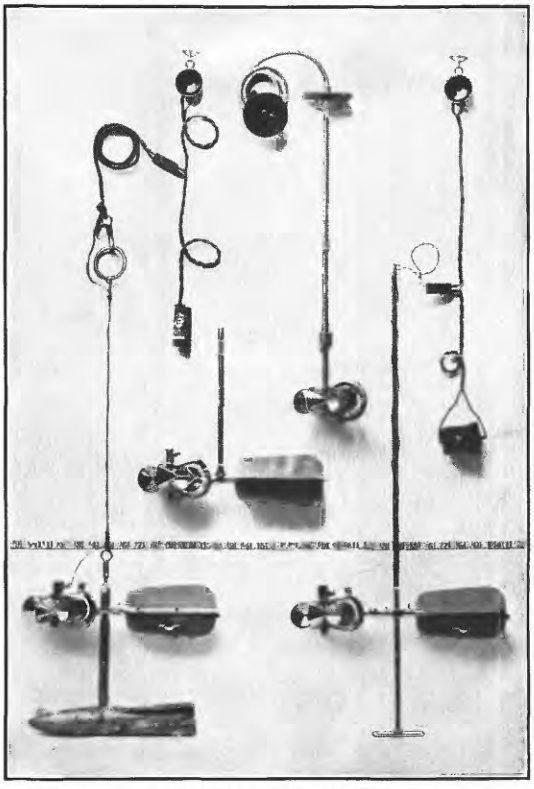
In addition to statements regarding the location and equipment of gaging stations the descriptions give information in regard to any conditions that may affect the constancy of the discharge relation, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the gage. Statements are also made regarding the accuracy of the data and computed results.

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 many stations automatic gages are used, some of which give a continuous record of river stage, in the form of a hydrograph and others a record printed at 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. When the discharge relation is affected by the presence of ice in the streams or by backwater from obstructions, all gage heights 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, in general somewhat below the lowest known stage, to avoid negative readings.

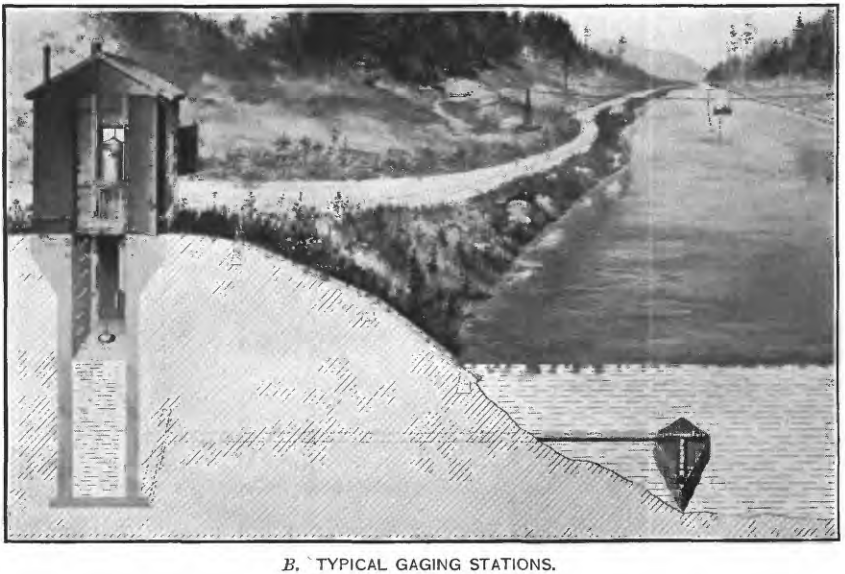
In the tables of daily gage height the use of zeros in the hundredths place indicates the degree of refinement to which the gage was read and to which the mean daily gage height was computed. If a gage is read to tenths or half-tenths once a day or to tenths twice a day, no zeros appear in the hundredths 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 water-stage recorders 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.

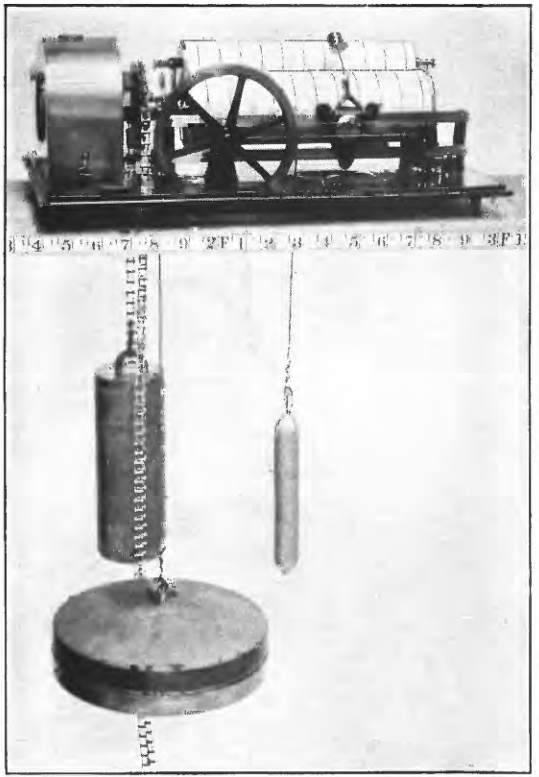
The base data presented in this report, unless otherwise stated in the descriptions of stations, have been collected by the methods commonly used at current-meter gaging stations and described in standard textbooks. (See Pls. I and II.)



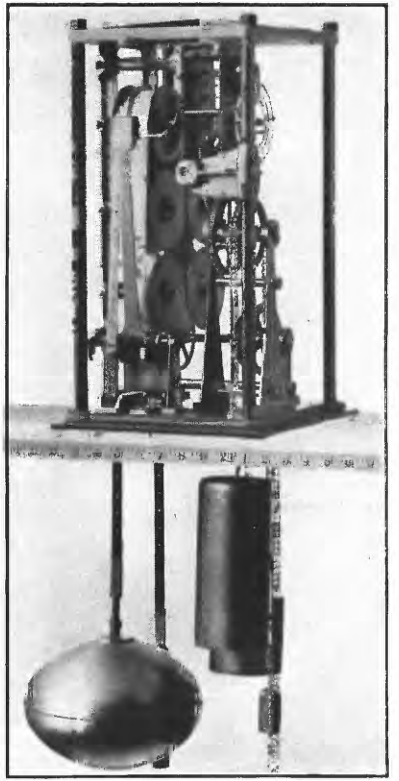
A. PRICE CURRENT METERS.



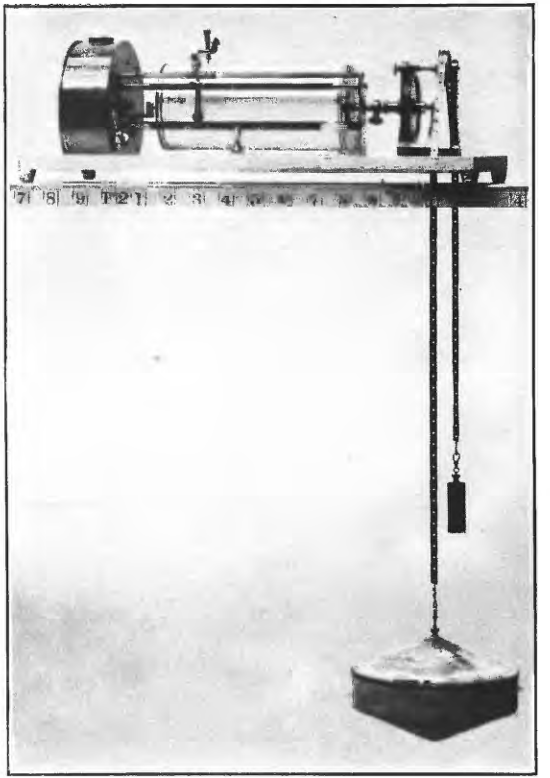
B. TYPICAL GAGING STATIONS.



A. STEVENS.



B. GURLEY PRINTING.



C. FRIEZ.

AUTOMATIC GAGES.

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 gage height and rating tables gives the discharge in second-feet corresponding to the means of the gage readings observed each day. At some stations subject to rapid or diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. When such stations are equipped with automatic gages, the true mean daily discharge may be obtained by weighting discharges for parts of the 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 of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on pages 6 and 7, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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 curves used, and an accuracy column is inserted in the monthly discharge table. For the rating curves, "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" 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 estimate of maximum or minimum discharge nor to that for any one day, but to the monthly mean. It is based on the accuracy of the rating curve, 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 computations of "second-feet per square mile" and "run-off (depth in inches)" have not been made for streams draining areas in which the annual rainfall is less than 20 inches nor for streams draining areas in which the precipitation exceeds 20 inches if such computations might be uncertain or misleading because of the presence of large noncontributing districts in the measured drainage area, because of the omission of estimates of water diverted for irrigation or other use, or because 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 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 analyzing in detail 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 tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data already collected and published.

COOPERATION.

The work in New Mexico was carried on in cooperation with the State through James A. French, State engineer.

The stations on the Arkansas at Granite and Salida, Colo., were maintained in cooperation with the State of Colorado through John E. Field, State engineer. The United States Forest Service assisted in maintaining six stations on tributaries to the Arkansas in Colorado, and the United States Reclamation Service paid all expenses in connection with the work in Oklahoma.

Financial assistance has also been rendered by the Tin Cup Gold Dredging Co., the Red River Valley Co., and George H. Webster, of Cimarron, N. Mex., in connection with stations on streams in which they were interested.

DIVISION OF WORK.

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

For stations in New Mexico the data were collected and prepared for publication under the direction of G. A. Gray, district engineer, who was assisted by W. R. King and C. J. Emerson, junior engineers, and J. E. Powers and R. J. Hank, State hydrographers.

The records were reviewed and assembled by H. J. Dean, assistant engineer.

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; 3 miles northwest of Leadville, in Leadville National Forest.

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

Records available.—April to August 31, 1890; June 18 to September 29, 1903; June 5, 1911, to September 30, 1914.

Gage.—Vertical staff; read morning and evening.

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

Channel.—Somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year: 1.5 feet at 7 a. m. June 1 and 2; discharge, 341 second-feet. Minimum stage recorded: 0.05 foot at 9 a. m. November 8; discharge, 4 second-feet.

Maximum stage recorded 1911–1914: 1.5 feet June 1 and 2, 1914; discharge, 341 second-feet. Minimum stage recorded: 0.05 foot November 8, 1913; discharge, 4 second-feet.

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

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

Accuracy.—Estimates only fair. Owing to the high altitude of the gaging station (9,700 feet), alternate melting and freezing probably cause considerable diurnal fluctuation of river stage at certain seasons, so that mean daily gage heights based on two readings a day are subject to considerable error.

Discharge measurements of East Fork of Arkansas River near Leadville, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Robert Follansbee.....	0.21	15	June 9	Robert Follansbee.....	1.03	203
May 4	R. H. Fletcher.....	.12	12	Aug. 13	M. D. Anderson.....	.41	34

Daily gage height, in feet, of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30, 1914.

[Fred Coquoz, observer.]

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.25	0.10	.....	.....	1.45	0.90	0.70	0.35
2	.25	.....	.....	0.10	1.4	.90	.68	.30
3	.25	.....	.....	.....	1.3	.90	.60	.30
4	.25	.....	.....	.21	1.25	.90	.58	.30
5	.20	.15	.....	.18	1.15	.95	.60	.30
6	.20	.20	.....	.15	1.15	.90	.55	.30
7	.20	.....	.....	.16	1.3	.88	.52	.25
8	.20	.05	.....	.25	1.1	.85	.50	.25
9	.20	.....	.....	.48	1.15	.82	.50	.25
10	.20	.....	.....	.55	1.15	.80	.50	.25
11	.20	.....	.....	.55	1.25	.80	.50	.25
12	.20	.....	.....	.52	1.25	.80	.48	.25
13	.20	.15	.....	.49	1.25	.80	.45	.25
14	.20	.10	.....	.60	1.12	.80	.45	.25
15	.20	.....	.....	.52	1.35	.78	.45	.25
16	.20	.....	.....	.56	1.25	.75	.40	.25
17	.20	.....	.....	.59	1.18	.75	.40	.25
18	.20	.....	.....	.75	1.2	.72	.40	.25
19	.15	.....	.....	.82	1.2	.70	.35	.25
20	.15	.....	0.15	.80	1.2	.70	.35	.25
21	.15	.....	.....	.90	1.2	.70	.35	.25
22	.15	.....	.18	.98	1.2	.70	.35	.25
23	.15	.....	.....	.99	1.1	.70	.40	.25
24	.15	.....	.....	1.05	1.1	.70	.40	.25
25	.15	.....	.18	.90	1.05	.70	.40	.25
26	.15	.....	.....	.98	1.0	.70	.40	.25
27	.15	.....	.12	1.05	1.0	.75	.38	.25
28	.15	.....	.12	1.00	.95	.90	.35	.25
29	.15	.....	.12	.90	.92	.80	.35	.25
30	.15	.....	.....	1.15	.92	.70	.35	.25
31	.10	.....	.....	1.3	.....	.70	.35	.....

Daily discharge, in second-feet, of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	6	.....	11	326	150	87	28
2	19	.....	.....	10	310	150	83	21
3	19	.....	.....	16	280	150	66	21
4	19	.....	.....	22	265	150	48	21
5	13	10	.....	19	236	163	66	21
6	13	13	.....	16	236	145	57	21
7	13	.....	.....	17	280	140	51	16
8	13	4	.....	28	221	132	48	16
9	13	.....	.....	66	236	125	48	16
10	13	.....	.....	80	236	120	48	16
11	13	.....	.....	80	265	120	48	16
12	13	.....	.....	74	265	120	45	17
13	13	10	.....	68	265	120	38	17
14	13	6	.....	91	227	120	38	17
15	13	.....	.....	74	295	115	38	17
16	13	.....	.....	82	295	108	32	17
17	13	.....	.....	89	238	108	32	18
18	13	.....	.....	128	244	101	32	18
19	10	.....	.....	145	244	96	25	18
20	10	.....	16	140	244	96	25	18
21	10	.....	18	166	238	91	25	18
22	10	.....	19	188	238	91	25	18
23	10	.....	19	190	210	91	32	18
24	10	.....	19	207	210	91	34	18
25	10	.....	19	166	196	91	34	18
26	10	.....	16	188	180	91	34	19
27	10	.....	12	207	180	103	31	19
28	10	.....	12	193	163	140	27	19
29	10	.....	12	166	156	115	27	19
30	10	.....	11	236	156	91	27	19
31	6	.....	.....	280	.....	91	27	.....

NOTE.—Discharge determined as follows: Apr. 20 to June 15 from a fairly well defined rating curve; for the rest of the year by indirect method for shifting channels.

Monthly discharge of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	19	6	12.4	762	C.
April 20-30	19	11	15.6	340	C.
May	280	10	111	6,820	C.
June	326	156	237	14,100	C.
July	163	91	117	7,190	C.
August	87	25	41.2	2,530	C.
September	28	16	18.5	1,100	C.

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.

Drainage area.—425 square miles.

Records available.—May 1, 1897, to September 10, 1899; April 6, 1910, to September 30, 1914.

Gage.—Bristol water-stage recorder installed in 1910 by State engineer; datum of recording gage bears no determined relation to that of vertical staff gage which was used from 1897 to 1899 and which was at the highway bridge near the railroad station.

Discharge measurements.—Made from car and cable.

Channel.—Practically permanent.

Extremes of discharge.—Maximum stage during year, from automatic-gage record: 4.1 feet at 6 p. m. June 15; discharge, 2,040 second-feet. Minimum stage, from automatic-gage record: 1.25 feet from 6 to 9 p. m. March 22; discharge, 58 second-feet. (Records are discontinued during winter months when minimum flow occurs.)

Maximum stage recorded 1910–1914: 4.1 feet, June 6, 7, 9, 1912, and June 15, 1914; discharge, 2,040 second-feet. The minimum stage occurs during the winter months, when the records are discontinued.

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

Regulation.—Discharge affected by operation of the Twin Lakes reservoir, which has a storage decree for 20,645 acre-feet, and by a flume used to carry water from Lake Creek to a point below station.

Diversions.—There are court decrees for diversion, of 77 second-feet from the Arkansas between this station and the junction of Tennessee and East forks.

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

Discharge measurements of Arkansas River at Granite, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 3	R. H. Fletcher	1.51	124	Aug. 14	M. D. Anderson	2.10	287
June 3	C. L. Patterson	3.60	1,530				

Daily gage height, in feet, of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.8	1.75	1.4	.....	1.5	3.8	3.2	3.2	2.1
2	1.85	1.8	1.45	.....	1.55	3.8	3.05	3.1	2.0
3	1.85	1.85	1.45	.....	1.55	3.7	3.1	2.9	1.95
4	1.8	1.85	1.55	.....	1.6	3.6	3.25	2.75	1.95
5	1.8	1.65	1.55	.....	1.65	3.6	3.45	2.55	1.95
6	1.75	1.5	1.65	.....	1.65	3.45	3.3	2.5	1.9
7	1.75	1.5	1.6	.....	1.6	3.3	3.15	2.5	1.85
8	1.75	1.5	.....	.....	1.8	3.2	3.0	2.5	1.75
9	1.75	1.55	.....	.....	2.2	3.1	3.05	2.45	1.65
10	1.8	1.5	.....	.....	2.4	3.25	3.2	2.35	1.6
11	1.8	1.5	.....	.....	2.4	3.3	3.25	2.15	1.65
12	1.7	1.6	.....	.....	2.35	3.45	3.1	2.05	1.7
13	1.65	1.6	.....	1.45	2.3	3.65	3.0	2.0	1.75
14	1.65	1.6	.....	1.55	2.5	3.6	3.05	2.1	1.8
15	1.65	1.55	.....	1.65	2.7	3.7	3.05	2.15	1.8
16	1.55	1.5	.....	1.7	2.8	3.45	3.05	2.05	1.75
17	1.55	1.5	.....	1.6	2.8	3.25	3.0	2.0	1.7
18	1.55	1.55	.....	1.55	2.85	3.3	3.1	2.15	1.7
19	1.5	1.45	.....	1.5	2.9	3.35	3.05	2.45	1.7
20	1.5	1.5	.....	1.7	3.0	3.35	3.1	2.5	1.65
21	1.55	1.55	.....	1.8	3.35	3.25	3.0	2.6	1.85
22	1.55	1.5	.....	1.8	3.4	3.2	3.15	2.5	1.85
23	1.5	1.4	.....	1.8	3.45	3.4	3.0	2.6	1.75
24	1.55	1.45	.....	1.75	3.3	3.5	2.9	2.75	1.75
25	1.55	1.45	.....	1.8	3.4	3.6	2.7	2.7	1.8
26	1.55	1.4	.....	1.85	3.4	3.6	2.75	2.6	1.85
27	1.5	1.4	.....	1.75	3.5	3.4	2.95	2.55	1.8
28	1.45	1.45	.....	1.55	3.45	3.35	3.3	2.5	1.7
29	1.4	1.4	.....	1.55	3.3	3.3	3.0	2.45	1.7
30	1.5	1.4	.....	1.55	3.35	3.25	2.95	2.15	1.7
31	1.6	.....	.....	.....	3.3	.....	3.1	2.15	.....

NOTE.—Discharge relation affected by ice Dec. 4–7.

Daily discharge, in second-feet, of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	203	186	82	.....	120	1,700	1,090	1,090	307
2	220	203	96	.....	133	1,700	958	1,000	270
3	220	220	96	.....	133	1,600	1,000	830	253
4	203	220	.....	.....	146	1,490	1,140	705	253
5	203	154	.....	.....	160	1,490	1,340	554	253
6	186	110	.....	.....	160	1,340	1,180	518	236
7	186	110	.....	.....	146	1,180	1,040	518	220
8	186	110	.....	.....	204	1,090	915	518	189
9	186	124	.....	.....	349	1,000	958	486	160
10	203	110	.....	.....	453	1,140	1,090	425	146
11	203	110	.....	.....	453	1,180	1,140	328	160
12	170	139	.....	.....	425	1,340	1,000	288	174
13	154	139	.....	108	397	1,540	915	270	189
14	154	139	.....	133	518	1,490	958	307	204
15	154	124	.....	160	665	1,600	958	328	204
16	124	110	.....	174	745	1,340	958	288	189
17	124	110	.....	146	745	1,140	915	270	174
18	124	124	.....	133	788	1,180	1,000	328	174
19	110	96	.....	120	830	1,240	958	486	174
20	110	110	.....	174	915	1,240	1,000	518	160
21	124	124	.....	204	1,240	1,140	915	590	220
22	124	110	.....	204	1,280	1,090	1,040	518	220
23	110	82	.....	204	1,340	1,280	915	590	189
24	124	96	.....	189	1,180	1,380	830	705	189
25	124	96	.....	204	1,280	1,490	665	665	204
26	124	82	.....	220	1,280	1,490	705	590	220
27	110	82	.....	189	1,380	1,280	872	554	204
28	96	96	.....	133	1,340	1,240	1,180	518	174
29	82	82	.....	133	1,180	1,180	915	486	174
30	110	82	.....	133	1,240	1,140	872	328	174
31	139	.....	.....	.....	1,180	.....	1,000	328	.....

NOTE.—Discharge determined from two rating curves well defined between 100 and 1,800 second-feet.

Monthly discharge of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	220	82	151	9,280	A.
November	220	82	123	7,320	B.
April 13–30	220	108	164	5,860	B.
May	1,380	120	723	44,500	B.
June	1,800	1,000	1,320	78,600	A.
July	1,340	665	981	60,300	A.
August	1,090	270	514	31,600	B.
September	307	146	202	12,000	B.

ARKANSAS RIVER AT SALIDA, COLO.

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

Drainage area.—1,160 square miles.

Records available.—April 11, 1895, to October 31, 1903; November 3, 1909, to September 30, 1914.

Gage.—Bristol water-stage recorder installed by State engineer. No determined relation between datum of automatic gage and that of gage used from 1895 to 1903.

Discharge measurements.—Made from two-span concrete bridge 300 feet above gage.

Channel.—Slightly shifting at intervals.

Extremes of discharge.—Maximum stage during year, from automatic-gage record: 5.2 feet at 11 p. m. July 11; discharge, 3,570 second-feet. Minimum stage recorded: 0.40 foot February 15 and 25; discharge, 220 second-feet.

Maximum stage recorded 1909–1914: 5.3 feet, June 7, 1912; discharge, 3,550 second-feet. Minimum stage recorded: 0.20 foot, January 12, 1912, and February 13, 1913; discharge, 182 second-feet.

Winter flow.—River kept open by springs.

Diversions.—There are court decrees for diversions of 199 second-feet from the Arkansas between this station and Granite.

Regulation.—Flow at Salida regulated 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.

Discharge measurements of Arkansas River at Salida, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 16	R. H. Fletcher	0.62	271	Aug. 16	M. D. Anderson	1.65	731
May 6	do	.80	345				

Daily gage height, in feet, of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.2	0.85	0.65	0.5	0.6	0.55	0.5	0.75	4.4	3.7	3.4	1.8
2	1.25	.95	.65	.55	.55	.6	.5	.7	5.0	3.6	3.2	1.65
3	1.25	1.05	.65	.55	.5	.6	.6	.65	4.7	3.6	3.2	1.55
4	1.3	.9	.6	.5	.55	.55	.7	.7	4.6	4.0	3.2	1.5
5	1.25	.75	.65	.48	.55	.55	.65	.7	4.2	4.0	2.9	1.5
6	1.1	.75	.65	.48	.55	.5	.75	.8	3.3	3.8	2.8	1.2
7	1.1	.7	.6	.48	.45	.45	.7	.75	3.1	3.7	2.7	1.2
8	1.15	.75	.6	.47	.5	.5	.65	.75	3.0	3.4	2.6	1.05
9	1.15	.75	.6	.5	.55	.5	.6	1.15	2.8	3.2	2.4	.95
10	1.05	.75	.55	.55	.55	.5	.6	1.6	3.0	3.2	2.2	.9
11	1.05	.75	.5	.5	.55	.5	.6	1.75	3.6	3.2	2.1	1.0
12	1.05	.8	.55	.5	.55	.45	.65	1.7	4.0	3.2	1.95	1.1
13	1.1	.85	.55	.5	.5	.5	.55	1.65	4.4	3.2	1.85	1.1
14	1.15	.85	.55	.6	.5	.55	.6	1.85	4.6	3.4	1.65	1.1
15	1.05	.85	.55	.6	.4	.55	.7	2.0	5.2	3.3	1.55	1.05
16	.95	.75	.55	.65	.45	.65	.8	2.1	5.0	3.2	1.5	.85
17	1.0	.7	.6	.7	.45	.7	.8	2.0	4.4	3.4	1.45	.85
18	.95	.75	.55	.65	.5	.7	.75	2.2	4.5	3.6	1.65	.85
19	.8	.75	.6	.55	.5	.6	.6	2.1	4.6	3.7	1.8	.95
20	.8	.75	.55	.5	.5	.55	.65	2.4	4.6	3.8	1.95	.95
21	.9	.75	.5	.5	.55	.55	.75	3.2	4.5	3.6	2.1	.95
22	.9	.8	.42	.55	.55	.5	.8	3.6	4.2	4.2	1.95	1.0
23	.9	.75	.48	.6	.45	.5	.85	3.5	4.0	3.7	1.85	.9
24	.95	.75	.4	.6	.45	.55	.85	3.6	4.5	3.4	2.2	.9
25	.9	.75	.4	.55	.4	.45	.9	3.4	4.4	3.2	2.2	.95
26	.8	.75	.45	.55	.45	.5	.9	3.2	4.2	3.3	2.2	.95
27	.8	.8	.6	.6	.45	.55	.85	3.4	3.8	3.4	2.2	.9
28	.85	.8	.45	.6	.55	.55	.8	3.6	3.7	4.4	2.2	.9
29	.85	.65	.41	.45	.....	.6	.75	3.3	3.7	3.8	2.2	.95
30	.8	.65	.4	.5	.....	.55	.8	3.4	3.5	3.6	2.0	1.0
31	.85	.....	.43	.55	.....	.....	.....	3.8	.....	3.5	1.85	.....

Daily discharge, in second-feet, of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	455	335	279	242	266	254	242	328	2,720	2,080	1,840	807
2	475	366	279	254	254	266	242	315	3,350	2,000	1,690	730
3	475	400	279	254	242	266	266	300	3,020	2,000	1,690	680
4	495	350	266	242	254	254	292	315	2,920	2,340	1,690	655
5	475	306	279	238	254	254	279	315	2,520	2,340	1,480	655
6	417	306	279	238	254	242	306	345	2,160	2,160	1,400	518
7	417	292	266	238	231	231	292	345	1,620	2,080	1,340	518
8	436	306	266	235	242	242	279	345	1,540	1,840	1,280	456
9	436	306	266	242	254	242	266	475	1,400	1,690	1,150	415
10	400	306	254	254	254	242	266	680	1,540	1,690	1,030	395
11	400	306	242	242	254	242	266	755	2,000	1,690	970	435
12	400	320	254	242	254	231	279	730	2,340	1,690	888	476
13	417	335	254	242	242	242	254	705	2,720	1,690	834	476
14	436	335	254	266	242	254	266	805	2,920	1,840	730	476
15	400	335	254	266	220	254	292	885	3,570	1,760	680	456
16	366	306	254	279	231	279	320	940	3,350	1,690	655	376
17	382	292	266	292	231	292	320	885	2,720	1,840	632	376
18	366	306	254	279	242	292	320	995	2,820	2,000	730	376
19	320	306	266	254	242	266	278	940	2,920	2,080	807	415
20	320	306	254	242	242	254	290	1,110	2,920	2,160	888	415
21	350	306	242	242	254	254	325	1,630	2,820	2,000	970	415
22	350	320	224	254	254	242	340	1,930	2,520	2,520	888	435
23	350	306	238	266	231	242	355	1,850	2,340	2,080	834	395
24	366	306	220	266	231	254	355	1,930	2,820	1,840	1,030	395
25	350	306	220	254	220	231	370	1,770	2,720	1,690	1,030	415
26	320	306	231	254	231	242	370	1,630	2,520	1,760	1,030	415
27	320	320	266	266	231	254	355	1,770	2,160	1,840	1,030	395
28	335	320	231	266	254	254	340	1,930	2,080	2,720	1,030	395
29	335	279	222	231	.....	266	325	1,700	2,080	2,160	1,030	415
30	320	279	220	242	.....	254	345	1,770	1,920	2,000	915	435
31	335	.....	227	254	.....	248	.....	2,090	.....	1,920	834	.....

NOTE.—Discharge determined from two well-defined rating curves, one applicable Oct. 1, 1913, to Apr. 17, 1914: the other, June 1 to Sept. 30, 1914. Apr. 18 to May 31, discharge determined by indirect method for shifting channels.

Monthly discharge of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	495	320	388	23,900	A.
November	400	279	316	18,800	A.
December	279	220	252	15,500	A.
January	292	231	253	15,600	A.
February	266	220	243	13,500	A.
March	292	231	253	15,600	A.
April	370	242	303	18,000	B.
May	2,090	300	1,050	64,600	B.
June	3,570	1,400	2,500	149,000	B.
July	2,720	1,690	1,970	121,000	B.
August	1,840	1,632	1,070	65,800	A.
September	807	376	474	28,200	A.
The year	3,570	220	758	550,000	

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.

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

Records available.—June 18 to October 16, 1903; February 8, 1911, to September 30, 1914.

Gage.—Vertical staff; read morning and evening except during winter months. No known relation between gage used in 1903 and that installed in 1911.

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

Channel.—Shifts slightly at intervals.

Extremes of discharge.—Maximum stage recorded during year: 1.6 feet at 8 a. m. May 24; discharge, 448 second-feet. Minimum stage recorded, —0.20 foot, March 11, 14, and 20; estimated discharge, 6 second-feet.

Maximum stage recorded 1911–1914: 1.6 feet, May 24, 1914; discharge, 448 second-feet. Minimum stage recorded: —0.20 foot, March 11, 14, and 20, 1914; estimated discharge, 6 second-feet.

Winter flow.—Discharge relation affected by ice.

Diversions.—There are court decrees for diversions of 24 second-feet above station. There is also a decree for diversion of 18.5 second-feet from the headwaters of Eagle River to Tennessee Fork above station. No water was diverted from Eagle Creek during 1914.

Accuracy.—Owing to the high altitude of the station (9,700 feet), alternate melting and freezing probably cause considerable diurnal fluctuation of stage at certain seasons, so that mean daily gage heights based on two readings a day are subject to considerable error. Rating curve well defined; estimates for the most part only fair.

Discharge measurements of Tennessee Fork near Leadville, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Robert Follansbee	0.04	14	June 9	Robert Follansbee	.62	121
May 4	R. H. Feltcher	.34	50	Aug. 13	M. D. Anderson	.11	21

Daily gage height, in feet, of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1914.

[Fred Coquoz, observer.]

Day.	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.00					0.20		1.50	0.48	0.40	0.15
2	.00						0.20	1.45	.46	.40	.10
3	.00				−.05	.30		1.25	.48	.35	.10
4	.00			−.05		.35	.50	1.2	.48	.30	.10
5	.00	0.05					.42	1.0	.48	.30	.10
6	.00	.10			−.10	.30	.42	1.0	.46	.30	.10
7	.00		0.10	−.05			.49	.80	.42	.25	.00
8	.00	.10				.25	.75	.80	.40	.25	.00
9	.00					.12	.92	.65	.38	.30	.00
10	.00		.05			.20	.98	.75	.38	.30	.00
11	.00			−.05	−.20	.10	.98	.90	.35	.30	.00
12	.00						.80	.85	.30	.30	.00
13	.00	.00	.05			.40	.78	.82	.35	.30	.00
14	.00	.05		−.10	−.20		.85	.88	.35	.30	.00
15	.00		.08			.65	.84	1.4	.35	.25	.00
16	.00						.88	1.0	.35	.20	.00
17	.00					.50	.80	.85	.35	.20	.00
18	.00			−.10		.45	.88	.90	.35	.20	.00
19	.00				−.20		1.1	.90	.38	.20	.00
20	.00					.41	1.15	.82	.45	.20	.00
21	.00		.05	−.10	−.10		1.25	.85	.40	.15	.00
22	.00					.48	1.35	.80	.40	.15	.00
23	.00						1.4	.78	.40	.15	.00
24	.00		.00				1.55	.70	.40	.15	.00
25	.00			−.10	−.10	.58	1.1	.68	.38	.15	.00
26	.00			−.10			1.30	.58	.42	.15	.00
27	.00					.52	1.15	.50	.52	.15	.00
28	.00				−.10	.45	1.3	.50	.85	.15	.00
29	.00		.00			.29	1.05	.50	.55	.15	.00
30	.00				−.05		1.2	.50	.50	.15	.00
31	.00		−.05				1.35		.40	.15	

NOTE.—Discharge relation somewhat affected by ice January to March.

Daily discharge, in second-feet, of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Sept.
1	12			29	34	414	84	24
2	12			36	29	397	79	18
3	12			43	58	329	84	18
4	12			43	86	312	84	18
5	12	15		43	67	244	84	18
6	12	18		43	67	244	79	18
7	12			40	84	176	69	12
8	12	18		36	160	176	64	12
9	12			20	217	129	60	12
10	12			29	237	160	60	12
11	12		6	18	237	210	54	12
12	12			40	176	193	45	12
13	12	12		62	170	183	54	12
14	12	15	6	96	193	203	54	12
15	12			129	190	380	54	12
16	12			108	203	247	54	12
17	12			86	176	196	54	12
18	12			74	203	213	54	12
19	12		6	69	278	213	62	12
20	12			64	295	186	79	12
21	12		8	72	329	196	67	12
22	12			81	363	179	67	12
23	12			90	380	173	67	12
24	12			99	431	147	67	12
25	12		8	108	278	141	62	12
26	12			100	346	111	72	12
27	12			92	295	89	97	12
28	12		8	74	346	89	200	12
29	12			42	261	89	106	12
30	12		10	38	312	89	92	12
31	12				363		67	

NOTE.—Discharge determined as follows: June 16 to Aug. 31, by indirect method for shifting channels; for rest of year from a rating curve well defined between 10 and 200 second-feet. Discharge for August not estimated as gage heights reported by observer are believed to be in error.

Monthly discharge of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	12	12	12.0	738	B.
February	.....	.....	8.0	440	D.
March	.....	.....	8.0	492	D.
April	129	18	63.5	3,780	C.
May	431	29	221	13,600	C.
June	414	89	204	12,100	C.
July	200	45	73.4	4,510	C.
September	24	12	13.4	791	C.

NOTE.—Estimates for February and March based chiefly on gage readings, as discharge relation was apparently not seriously affected by ice.

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 station.

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

Records available.—April 10, 1911, to September 30, 1914.

Gage.—Vertical staff, read morning and evening.

Discharge measurements.—Made by wading.

Channel.—Shifting.

Extremes of discharge.—Maximum stage recorded during year: 1.2 feet at 6 p. m. June 14; discharge, 219 second-feet. Minimum stage recorded: 0.10 foot, morning readings, November 23 to 30, inclusive; discharge, 2 second-feet.

Maximum stage recorded 1911–1914: 1.3 feet, evening readings, June 5 to 8, 1912, inclusive; discharge, 235 second-feet. Minimum stage recorded, 0.0 foot, November 15, 1912; estimated discharge, 1 second-foot.

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

Diversions.—There are court decrees for diversions of 12 second-feet above station.

Accuracy.—Owing to the high altitude of the station (9,700 feet), alternate melting and freezing cause considerable diurnal fluctuation at certain seasons of the year, so that the mean daily gage height based on two readings a day may be considerably in error; for this reason and because of the shifting of the channel, estimates are only fair.

Discharge measurements of Half Moon Creek near Leadville, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Robert Follansbee.....	0.31	7.3	June 9	Robert Follansbee.....	0..50	35
May 4[a]	R. H. Fletcher.....	.14	7.0	Aug. 13	M. D. Anderson.....	.55	31

[a] Stream partly frozen over.

Daily gage height, in feet, of Half Moon Creek near Leadville, Colo., for the year ending Sept. 30, 1914.

[Mrs. D. Calahan, observer.]

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	0.3	0.25	.....	0.95	0.95	0.82	0.38
2	.3	.25	.....	.95	.95	.75	.38
3	.3	.25	.....	.90	.98	.75	.38
4	.3	.25	0.14	.90	.98	.75	.38
5	.3	.2	.25	.75	.98	.75	.38
6	.3	.2	.25	.75	.98	.65	.38
7	.3	.2	.25	.55	.98	.65	.38
8	.3	.2	.25	.50	.98	.65	.38
9	.3	.2	.25	.60	.85	.65	.38
10	.3	.2	.45	.85	.85	.65	.38
11	.3	.2	.45	.90	.88	.65	.38
12	.3	.2	.45	.95	.85	.65	.38
13	.3	.2	.55	1.05	.85	.55	.35
14	.3	.2	.55	1.15	.88	.40	.35
15	.3	.2	.55	1.05	.82	.40	.35
16	.3	.2	.60	.98	.82	.40	.35
17	.3	.2	.60	.95	.85	.38	.35
18	.3	.2	.65	1.05	.88	.38	.35
19	.3	.2	.70	1.05	.88	.40	.35
20	.3	.2	.70	1.08	.85	.40	.30
21	.3	.2	.70	1.05	.85	.45	.30
22	.3	.2	.80	1.05	.80	.40	.30
23	.3	.15	.80	1.00	.75	.40	.30
24	.3	.15	.85	1.05	.90	.40	.30
25	.3	.15	.85	.98	.90	.38	.30
26	.25	.15	.85	.95	.92	.35	.30
27	.25	.15	.85	.92	.85	.35	.30
28	.25	.15	.75	.95	.85	.45	.30
29	.25	.15	.75	.95	.82	.45	.30
30	.25	.15	.80	.98	.82	.45	.30
31	.25	.....	.95	.....	.82	.45	.....

Daily discharge, in second-feet, of Half Moon Creek near Leadville, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	7	6	.....	138	132	87	15
2	7	6	.....	138	132	71	15
3	7	6	.....	123	140	69	15
4	7	6	7	123	140	69	15
5	7	4	12	85	140	69	15
6	7	4	12	85	138	49	15
7	7	4	12	44	138	49	15
8	7	4	12	35	138	49	15
9	7	4	12	52	102	49	15
10	7	4	29	110	102	47	15
11	7	4	29	123	110	47	15
12	7	4	29	138	102	47	15
13	7	4	44	168	100	31	13
14	7	4	44	202	107	17	13
15	7	4	44	168	92	17	13
16	7	4	52	146	92	17	13
17	7	4	52	138	100	15	13
18	7	4	62	168	107	15	13
19	7	4	73	168	107	17	13
20	7	4	73	178	97	17	10
21	7	4	73	168	97	21	10
22	7	4	97	165	85	17	10
23	7	3	97	149	73	17	10
24	7	3	110	165	110	17	10
25	7	3	110	143	110	15	10
26	6	3	110	135	115	13	10
27	6	3	110	126	95	13	10
28	6	3	85	135	95	21	10
29	6	3	85	132	87	21	10
30	6	3	97	140	87	21	10
31	6	.....	138	.....	87	21	.....

NOTE.—Discharge determined from two fairly well-defined rating curves, and by indirect method for shifting channels.

Monthly discharge of Half Moon Creek near Leadville, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	7	6	6.8	419	B.
November	6	3	4.0	238	B.
May 4–31	138	7	61.1	339	C.
June	202	35	133	7,910	D.
July	140	73	108	6,640	C.
August	87	13	33.7	2,070	C.
September	15	10	12.7	756	C.

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

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

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

Records available.—April 7, 1911, to September 30, 1914. From September 25, 1910, to September 13, 1911, a station was maintained in sec. 21, 1 mile above present station.

Gage.—Vertical staff, read morning and evening.

Discharge measurements.—Made from bridge or by wading.

Channel.—Rough but permanent.

Extremes of discharge.—Maximum stage recorded during year: 2.7 feet at 6 p. m. June 1; discharge, 380 second-feet. Minimum stage recorded: 0.50 foot, 7 a. m. readings, March 20–23, 25, April 9, 19; discharge, 10 second-feet.

Maximum stage recorded 1911–1914: 2.7 feet, June 1, 1914; discharge, 380 second-feet. Minimum stage recorded: 0.50 foot, March 20–23, 25, April 9, 19, 1914; discharge, 10 second-feet.

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

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

Accuracy.—Owing to high altitude of station (8,200 feet), alternate melting and freezing probably cause considerable diurnal fluctuation of stage at certain seasons, so that mean daily gage heights based on two readings a day are subject to considerable error. Rating curve well-defined but estimates fair or possibly good.

Discharge measurements of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	Robert Follansbee	0.87	50	Aug. 15	M. D. Anderson	1.20	96
Jan. 7	R. H. Fletcher	.63	20				

Daily gage height, in feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1914.

[E. D. Masters, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.95	.....	0.60	.....	0.66	0.64	0.62	0.72	2.6	2.0	1.70	1.12
2	1.00	0.70	.65	.....	.64	.62	.60	.72	2.4	1.95	1.65	1.05
3	1.00	.70	.70	.....	.64	.62	.64	.72	2.2	1.90	1.65	1.05
4	1.00	.75	.70	0.65	.62	.62	.64	.75	2.1	2.0	1.60	1.05
5	1.00	.75	.70	.65	.64	.64	.68	.75	2.0	1.95	1.65	1.00
6	.95	.75	.75	.65	.62	.62	.68	.77	1.85	1.95	1.55	.98
7	.95	.70	.75	.63	.62	.62	.66	.78	1.75	1.80	1.55	.95
8	.95	.70	.70	.63	.62	.62	.65	.82	1.75	1.75	1.55	.95
9	.95	.70	.75	.62	.64	.62	.55	.94	1.60	1.75	1.55	.92
10	1.00	.70	.70	.60	.61	.64	.65	1.12	1.90	1.70	1.50	.92
11	1.00	.75	.70	.60	.62	.62	.65	1.12	2.1	1.70	1.45	.92
12	.95	.70	.70	.60	.64	.62	.60	1.05	2.2	1.70	1.35	.92
13	.98	.75	.70	.60	.64	.62	.62	1.08	2.3	1.70	1.35	.88
14	.95	.75	.70	.60	.64	.64	.65	1.15	2.4	1.90	1.28	.88
15	.95	.75	.70	.65	.66	.64	.69	1.15	2.5	1.80	1.25	.92
16	.90	.65	.70	.65	.66	.62	.70	1.08	2.4	1.80	1.25	.98
17	.85	.65	.70	.65	.64	.64	.68	1.15	2.3	1.80	1.25	.92
18	.80	.70	.70	.65	.65	.64	.68	1.25	2.3	2.0	1.22	.88
19	.80	.70	.65	.65	.65	.64	.58	1.35	2.2	1.95	1.18	.88
20	.80	.70	.60	.63	.66	.58	.65	1.52	2.2	2.0	1.12	.90
21	.75	.70	.60	.64	.66	.58	.65	1.80	2.2	1.95	1.12	1.10
22	.75	.70	.65	.60	.66	.58	.68	1.90	2.1	1.95	1.18	1.10
23	.80	.60	.65	.63	.62	.60	.72	1.90	2.1	1.90	1.18	1.02
24	.80	.65	.70	.65	.62	.60	.68	1.95	2.0	1.80	1.12	1.02
25	.80	.70	.70	.63	.64	.58	.72	1.85	2.0	1.80	1.18	.98
26	.85	.70	.65	.63	.64	.60	.70	1.80	2.0	1.80	1.15	.98
27	.85	.70	.65	.65	.62	.64	.72	2.0	1.95	1.80	1.15	.92
28	.70	.65	.65	.65	.64	.65	.72	1.95	1.95	2.0	1.20	.90
29	.75	.65	.65	.62	.....	.64	.72	1.80	1.95	1.95	1.20	.90
30	.75	.60	.60	.60	.....	.60	.74	2.1	1.95	1.75	1.15	.88
31	.70	.....	.60	.62	.....	.61	.....	2.3	.....	1.75	1.18	.....

Daily discharge, in second-feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	62	30	19	20	24	22	19	32	360	240	181	85
2	68	30	24	21	22	19	17	32	320	230	172	75
3	68	30	30	22	22	19	22	32	280	220	172	75
4	68	36	30	23	19	19	22	36	260	240	162	75
5	68	36	30	23	22	22	27	36	240	230	172	68
6	62	36	36	23	19	19	27	38	210	230	153	65
7	62	30	36	21	19	19	24	39	190	200	153	62
8	62	30	30	21	19	19	23	45	190	190	153	62
9	62	30	36	19	22	19	14	60	162	190	153	58
10	68	30	30	17	18	22	23	85	220	181	144	58
11	68	36	30	17	19	19	23	85	260	181	136	58
12	62	30	30	17	22	19	17	75	280	181	119	58
13	65	36	30	17	22	19	19	79	300	181	119	52
14	62	36	30	17	22	22	23	89	320	220	108	52
15	62	36	30	23	24	22	28	89	340	200	104	58
16	55	24	30	23	24	19	29	79	320	200	104	65
17	48	24	30	23	22	22	27	89	300	200	104	58
18	42	30	30	23	23	22	27	104	300	240	99	52
19	42	30	24	23	23	22	16	119	280	230	93	52
20	42	30	19	21	24	16	23	148	280	240	85	55
21	36	30	19	22	24	16	23	200	280	230	85	82
22	36	30	24	17	24	16	27	220	260	230	93	82
23	42	19	24	21	19	17	32	220	260	220	93	71
24	42	24	30	23	19	17	27	230	240	200	85	71
25	42	30	30	21	22	16	32	210	240	200	93	65
26	48	30	24	21	22	17	29	200	240	200	89	65
27	48	30	24	23	19	22	32	240	230	200	89	58
28	30	24	24	23	22	23	32	230	230	240	96	55
29	36	24	24	19	.....	22	32	200	230	230	96	55
30	36	19	19	17	.....	17	34	260	230	190	89	52
31	30	.....	19	19	.....	18	.....	300	.....	190	93	.....

NOTE.—Discharge determined from a rating curve well defined below 300 second-feet. Jan. 1–3, discharge interpolated.

Monthly discharge of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	68	30	52.4	3,220	C.
November	36	19	29.7	1,770	B.
December	36	19	27.3	1,680	B.
January	23	17	20.6	1,270	B.
February	24	18	21.5	1,190	B.
March	23	16	19.4	1,190	B.
April	34	14	25.0	1,490	B.
May	300	32	126	7,750	B.
June	360	162	262	15,600	C.
July	240	181	211	13,000	C.
August	181	85	119	7,320	B.
September	85	52	63.3	3,770	B.
The year	360	14	818	59,200	

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, and 1½ miles below mouth of Silver Creek.

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

Records available.—October 3, 1911, to July 25, 1914.

Gage.—Vertical staff.

Discharge measurements.—Made from bridge or by wading.

Channel.—Practically permanent.

Extremes of discharge.—Maximum stage recorded during year: 6.5 feet at 10 a. m. June 16; discharge, 223 second-feet. Minimum stage recorded: 3.8 feet at 11 a. m. April 23; discharge, 5 second-feet.

Maximum stage recorded 1911–1914: 6.5 feet at 10 a. m. June 16, 1914; discharge, 223 second-feet. Minimum stage recorded: 3.8 feet at 11 a. m. March 12, 1912; discharge, 4.5 second-feet.

Winter flow.—Discharge relation affected by ice.

Diversions.—There are court decrees for diversions of 35 second-feet from North Cottonwood Creek.

Accuracy.—Owing to the high altitude of the station (8,300 feet), alternate melting and freezing probably cause considerable diurnal fluctuations in river stage at certain seasons, so that the mean daily gage height estimated from one reading a day may be considerably in error. Estimates only fair.

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

January 7, 1914: Gage height, 4.0 feet; discharge, 6.0 second-feet.

Daily gage height, in feet, of North Cottonwood Creek near Buena Vista, Colo., for the year ending Sept. 30, 1914.

[C. A. Mack, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1		4.15						4.10		
2						3.95				
3	4.2	4.15	4.15	4.02						
4					4.00		3.92		6.30	
5				4.01				4.05		
6			4.05			3.95	3.88			
7	4.25			4.00				4.05		
8		4.13	4.03					4.12		
9	4.2			4.01	3.98	3.95				
10										
11		4.08					3.85		6.00	
12										
13	4.05		4.02	4.00	4.05		3.85			5.60
14	4.15									
15		4.1	4.0							
16	4.18			4.03		4.01			6.50	5.70
17					4.00					
18	4.05	4.1					3.84	4.65		5.70
19				4.01					6.30	
20			4.0		4.01					
21						4.10	3.85			5.10
22		4.07								
23	4.2						3.80	5.45	6.30	
24		4.1	4.01	4.00	4.03					
25	4.18									5.00
26		4.09		4.02						
27					3.98	3.97				
28	4.2						3.83			
29	4.22		4.02						6.00	
30				4.02		3.98				
31										

NOTE.—Discharge relation affected by ice during January, February, and March.

Daily discharge, in second-feet, of North Cottonwood Creek near Buena Vista, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.
1		16					14		
2					10				
3	18	16	16						
4						9		193	
5							12		
6			12		10	7			
7	20			6			12		
8		15	12				15		
9	18				10				
10									
11		13				6		152	
12									
13	12		12			6			106
14	16								
15		14	11						
16	17				11			223	116
17									
18	12	14				6	38		116
19								193	
20			10						
21					14	6			64
22		13							
23	18					5	92	193	
24		14	10						
25	17								57
26		14							
27					10				
28	18					6			
29	19		9					152	
30					10				
31									

NOTE.—Discharge determined from a rating curve fairly well defined below 200 second-feet. Discharge not estimated for days on which the gage was not read.

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

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

Drainage area.—48 quare miles (Forest atlas measurement).

Records available.—November 15, 1913, to September 30, 1914.

Gage.—Friez water-stage recorder.

Discharge measurements.—Made from footbridge and by wading.

Channel.—Apparently permanent.

Extremes of dscharge.—Maximum stage during year, from automatic-gage record: 3.15 feet at midnight June 1; discharge, 448 second-feet. Minimum stage recorded: 1 foot on February 17 and 18; discharge, 7 second-feet.

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

Diversions.—No court decrees for diversion of water that is not returned to creek above station.

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

Accuracy.—Conditions favorable for accurate results. Estimates considered good.

Discharge measurements of Chalk Creek (upper station) near St. Elmo, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15	R. H. Fletcher	1.20	12	May 5	R. H. Fletcher	1.33	21
Jan. 6	do	1.07	7.7	June 8	Robert Follansbee	1.98	117
Feb. 18	do	1.00	7.6	Aug. 15	M. D. Anderson	1.60	50

Daily gage height, in feet, of Chalk Creek (upper station) near St. Elmo, Colo., for the year ending Sept. 30, 1914.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		1.17	1.10			1.10	1.30	2.90	2.00	1.82	1.48
2		1.19	1.10			1.11	1.30	2.85	2.00	1.84	1.46
3		1.09	1.10			1.13	1.30	2.75	2.00	1.82	1.46
4		1.12	1.10			1.13	1.36	2.60	2.00	1.79	1.43
5		1.15				1.09	1.36	2.40	2.00	1.75	1.40
6		1.15	1.07			1.09	1.36	2.25	1.94	1.71	1.38
7		1.14		1.10		1.10	1.46	2.10	1.91	1.68	1.34
8		1.16				1.10	1.62	2.05	1.82	1.70	1.35
9		1.15				1.07	1.72	2.15	1.81	1.79	1.38
10		1.15	1.10			1.05	1.80	2.40	1.82	1.78	1.36
11		1.16	1.10			1.15	1.78	2.60	1.80	1.70	1.36
12		1.17	1.10			1.18	1.77	2.65	1.79	1.66	1.36
13		1.17	1.10			1.16	1.83	2.65	1.87	1.63	1.38
14		1.22	1.10	1.02	1.05	1.18	1.85	2.55	1.93	1.60	1.39
15	1.20	1.15	1.10	1.02	1.05	1.28	1.78	2.70	1.92	1.60	1.41
16	1.23	1.18	1.10	1.01	1.03	1.28	1.74	2.50	1.98	1.61	1.38
17	1.20	1.09	1.10	1.00	1.04	1.23	1.83	2.50	1.94	1.62	1.33
18	1.24	1.12	1.12	1.00	1.05	1.16	1.89	2.50	2.05	1.63	1.32
19	1.18	1.10	1.12	1.01	1.07	1.17	1.95	2.50	2.10	1.57	1.30
20	1.13	1.37	1.16	1.02	1.09	1.25	2.15	2.35	2.05	1.57	1.27
21	1.16	1.35	1.19		1.08	1.26	2.40		2.10	1.63	1.45
22	1.17		1.25		1.15	1.29	2.50		2.15	1.61	1.41
23	1.17		1.25		1.08	1.27	2.30		2.00	1.56	1.33
24	1.14		1.25		1.03	1.29	2.25		1.96	1.54	1.32
25	1.16		1.32		1.10	1.36	2.20		1.98	1.53	1.25
26	1.15		1.20		1.04	1.36	2.35	2.10	1.95	1.52	1.28
27	1.19		1.30		1.00	1.33	2.45	2.20	1.95	1.44	1.27
28	1.17		1.25		1.12	1.34	2.25	2.15	2.05	1.40	1.25
29	1.17		.93		1.12	1.33	2.35	2.05	1.93	1.43	1.27
30	1.17		1.25		1.12	1.32	2.65	2.00	1.89	1.55	1.27
31			1.15		1.10		2.80		1.89	1.53	

NOTE.—Discharge relation probably affected by ice during last part of December and January.

Daily discharge, in second-feet, of Chalk Creek (upper station) near St. Elmo, Colo., for the year ending Sept. 30, 1914.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	11	9	.....	8	9	18	357	121	86	35
2	.....	12	9	.....	8	9	18	334	121	90	33
3	.....	9	9	.....	8	10	18	304	121	86	33
4	.....	10	9	.....	8	10	23	263	121	80	29
5	.....	11	8	.....	8	9	23	204	121	74	26
6	.....	11	8	.....	8	9	23	182	109	67	24
7	.....	10	8	9	8	9	33	136	103	62	21
8	.....	11	8	.....	8	9	53	118	86	65	22
9	.....	11	9	.....	8	8	68	140	84	80	24
10	.....	11	9	.....	8	8	82	220	86	79	23
11	.....	11	9	.....	8	11	79	259	82	65	23
12	.....	11	9	.....	8	11	77	277	80	59	23
13	.....	11	9	.....	8	11	88	284	95	54	24
14	.....	13	9	7	8	11	92	253	107	50	25
15	12	11	9	7	8	17	79	296	105	50	27
16	14	11	9	7	8	17	72	235	117	52	24
17	12	9	9	7	8	14	85	246	109	53	20
18	14	10	.....	7	8	11	100	240	132	54	20
19	11	9	.....	7	8	11	113	235	143	46	18
20	10	9	.....	7	9	15	160	224	132	46	16
21	11	9	.....	.....	9	16	215	220	143	54	32
22	11	9	.....	.....	11	17	236	215	154	52	27
23	11	9	.....	.....	9	16	190	210	121	45	20
24	10	9	.....	.....	8	17	179	200	113	42	20
25	11	9	.....	.....	9	23	167	190	117	41	15
26	11	9	.....	.....	8	23	203	143	111	40	17
27	12	9	.....	.....	7	20	224	166	111	30	16
28	11	9	.....	.....	10	21	178	154	132	26	15
29	11	9	.....	.....	10	20	194	132	107	29	16
30	11	9	.....	.....	10	20	264	121	99	44	16
31	.....	9	.....	.....	9	.....	320	.....	99	41	.....

NOTE.—Discharge determined from a rating curve well defined between 7 and 150 second-feet, but somewhat uncertain above 150 second-feet. Discharge May 17 to June 20 obtained from the mean of the hourly discharge; discharge, Dec. 20–31, Mar. 1–13, and June 21–25, estimated by study of records of lower station on Chalk Creek.

Monthly discharge of Chalk Creek (upper station) near St. Elmo, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
November 15–30	14	10	11.4	329	A.
December	13	9	10.0	615	B.
January	.....	.....	[a] 8.0	492	B.
February	.....	.....	[a] 8.0	444	C.
March	11	7	8.4	516	B.
April	23	8	13.7	815	A.
May	320	18	119	7,320	A.
June	357	118	219	13,000	B.
July	154	80	112	6,890	A.
August	90	26	56.2	3,460	A.
September	35	15	22.8	1,360	A.
The period	.....	.....	.....	35,200	

[a] Estimated by study of records of lower station on Chalk Creek.

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 is a small intermittent stream entering from the north just below the station.

Drainage area.—75 square miles (Forest atlas measurement).

Records available.—March 10, 1911, to September 30, 1914. From September 6 to December 28, 1910, a station was maintained in sec. 24, T. 15 S., R. 79 W.

Gage.—Vertical staff, read morning and afternoon.

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

Channel.—Somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year: 2.2 feet at 10 a. m. June 2 and 4 p. m. June 15; discharge, 515 second-feet. Minimum stage recorded: 0.84 foot, morning readings, March 6, 7, 10, 12, 13, 14, 25; discharge, 16 second-feet.

Maximum stage recorded 1911–1914: 2.3 feet at 6 p. m. June 6 and 7 a. m. June 7, 1912; discharge, 635 second-feet. Minimum stage recorded: 0.68 foot at 9 a. m. January 20; discharge, 8 second-feet.

Winter flow.—Discharge relation somewhat affected by ice; flow determined by discharge measurements.

Diversions.—No court decrees for diversions from Chalk Creek between upper station and this one, but below there are decrees for 117 second-feet.

Accuracy.—Owing to high altitude of station (8,600 feet), alternate melting and freezing probably cause considerable diurnal fluctuation of stage, so that mean daily gage heights based on two readings a day and the maximum stage from high-water mark may be considerably in error. Estimates only fair.

Discharge measurements of Chalk Creek near St. Elmo, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	Robert Follansbee.....	1.16	40	May 5	R. H. Fletcher.....	1.10	28
Nov. 11	R. H. Fletcher.....	1.02	21	June 8	Robert Follansbee.....	1.68	185
Jan. 6	.....do.....	.90	18	Aug. 15	M. D. Anderson.....	1.42	83

Daily gage height, in feet, of Chalk Creek near St. Elmo, Colo., for the year ending Sept. 30, 1914.

[Lee Dillon and Miss P. J. Zabuske, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.26	0.96	1.2	0.90	.....	.....	0.90	1.10	2.1	1.8	1.7	1.35
2	1.26	.....	1.25	.90	0.89	0.85	.86	1.08	2.15	1.7	1.7	1.32
3	1.26	1.06	.....	.90	.89	.85	.91	.....	2.05	1.8	1.7	1.30
4	1.26	1.46	.....	.....	.89	.85	.96	1.09	2.0	1.8	1.65	1.3
5	.....	1.06	.....	.90	.89	.85	.....	1.09	1.95	.....	1.65	1.3
6	1.26	.96	.....	.90	.89	.84	1.00	1.11	1.8	1.7	1.6	1.25
7	1.16	.96	.....	.90	.88	.84	1.05	1.11	.....	1.7	1.6	1.25
8	1.26	.96	.....	.90	.....	.....	1.0	1.21	1.7	1.7	1.6	1.25
9	1.11	.....	.....	.90	.89	.88	.99	1.35	1 8	1.7	1.6	1.22
10	1.11	1.01	.....	.90	.89	.84	.98	.....	2.0	1.7	1.6	1.2
11	1.08	.99	.....	.....	.89	.85	.97	1.48	2.0	1.65	1.6	1.2
12	.....	1.1	.....	1.0	.87	.84	.....	1.42	2.0	1.7	1.55	1.2
13	1.16	1.0	.....	.90	1.0	.84	.98	1.42	2.0	1.7	1.5	1.2
14	1.16	1.0	.....	.90	.90	.84	.95	1.5	.....	1.8	1.48	1.2
15	1.14	.95	1.05	.90	.....	.....	1.00	1.5	2.15	1.7	1.45	1.2
16	1.06	.....	.90	.90	.88	.85	1.08	1.46	2.0	1.75	1.45	1.25
17	1.06	1.0	.90	.90	.87	.85	1.08	.....	2.0	1.7	1.45	1.2
18	.96	1.0	1.0	.....	.86	.86	.99	1.5	2.0	1.8	1.45	1.2
19	.....	1.05	1.15	.89	.86	.88	.....	1.55	2.0	1.85	1.4	1.2
20	1.11	.95	.....	.89	.86	.88	1.02	1.7	2.0	1.8	1.4	1.2
21	1.06	1.0	.....	.89	.85	.90	1.02	1.9	.....	1.8	1.4	1.3
22	1.08	1.0	.....	.89	.....	.....	1.04	2.0	2.0	1.85	1.45	1.25
23	1.06	.....	.90	.89	.86	.86	1.07	1.95	2.0	1.8	1.45	1.25
24	1.04	1.2	.90	.89	.86	.90	1.10	.....	1.85	1.75	1.45	1.2
25	.96	.95	.90	.....	.85	.84	1.09	1.8	1.85	1.7	1.38	1.2
26	.....	.90	.95	.89	.85	.83	.....	1.9	1.6	1.7	1.35	1.2
27	1.06	.90	.95	.89	.85	.85	1.09	1.85	1.6	1.7	1.35	1.18
28	1.06	.90	.....	.89	.85	.88	1.10	1.80	.....	1.8	1.35	1.15
29	.98	1.25	.90	.89	.....	.....	1.08	1.9	.....	1.8	1.4	1.15
30	1.65	.....	.90	.89	.....	.90	1.12	2.0	.....	1.7	1.4	1.15
31	1.06	.....	.90	.89	.....	.90	.....	.....	.....	1.7	1.38	.....

NOTE.—Discharge relation not affected by ice except Nov. 24 and 29, and Dec. 1, 2, 15, and 19.

Daily discharge, in second-feet, of Chalk Creek near St. Elmo, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	54	17	16	17	17	16	17	28	445	250	195	69
2	54	20	16	17	17	16	16	26	480	195	195	63
3	54	24	16	17	17	16	17	27	410	250	195	58
4	54	96	16	17	17	16	19	27	375	250	170	58
5	54	24	16	17	17	16	20	27	342	220	170	58
6	54	17	17	17	17	16	20	29	250	195	145	50
7	39	17	17	17	17	16	24	29	230	195	145	52
8	54	17	17	17	17	16	20	42	195	195	145	52
9	32	18	17	17	17	17	20	67	250	195	145	46
10	32	19	17	17	17	16	19	84	375	195	145	43
11	29	19	17	17	17	16	19	101	375	170	145	43
12	34	28	17	20	16	16	19	84	375	195	126	43
13	39	19	17	17	20	16	19	84	375	195	107	45
14	39	19	17	17	17	16	18	107	425	250	101	45
15	36	17	17	17	17	16	20	107	480	195	92	45
16	27	18	17	17	17	16	26	95	375	222	92	53
17	27	19	17	17	16	16	26	101	375	195	92	45
18	19	19	24	17	16	16	20	107	375	250	92	45
19	26	23	24	17	16	17	22	126	375	280	78	46
20	32	17	22	17	16	17	22	195	375	250	78	46
21	27	19	20	17	16	17	22	310	375	250	78	65
22	28	19	18	17	16	17	23	375	375	280	92	54
23	25	18	17	17	16	16	26	342	375	250	92	54
24	24	18	17	17	16	17	28	300	280	222	92	46
25	18	18	17	17	16	16	27	250	280	195	74	48
26	22	16	21	17	16	16	27	310	145	195	67	48
27	25	16	21	17	16	16	27	280	145	195	67	44
28	25	16	19	17	16	17	28	250	175	250	67	40
29	18	16	17	17	.....	17	26	310	200	250	78	40
30	150	16	17	17	.....	17	30	375	225	195	78	40
31	25	.....	17	17	.....	17	.....	410	.....	195	74	.....

NOTE.—Discharge determined from a rating curve fairly well defined below 300 second-feet; after Aug. 31 by indirect method for shifting control. Discharge interpolated for days on which gage was not read, and estimated Nov. 24, 29, Dec. 1, 2, 15, and 19.

Monthly discharge of Chalk Creek near St. Elmo, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	150	18	37.9	2,330	C.
November	96	16	21.3	1,270	C.
December	24	16	17.9	1,100	D.
January	20	17	17.1	1,050	C.
February	20	16	16.6	920	C.
March	17	16	16.3	1,000	C.
April	30	16	22.2	1,320	B.
May	410	26	161	9,900	C.
June	480	145	328	19,500	C.
July	280	170	220	13,500	B.
August	195	67	113	6,950	B.
September	69	40	49.5	2,940	C.
The year	480	16	85.1	61,800	

SOUTH FORK OF ARKANSAS RIVER AT PONCHA, COLO.

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

Drainage area.—140 square miles (Forest Atlas measurement).

Records available.—January 14, 1911, to September 30, 1914.

Gage.—Vertical staff; datum lowered 1 foot August 17, 1914.

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

Channel.—Somewhat shifting during 1914.

Extremes of discharge.—Maximum stage recorded during year: 3.2 feet during night of June 1 and 2; discharge, 665 second-feet. Minimum stage recorded: −0.40 [1] foot, September 16 to 29, inclusive; discharge, 5 second-feet.

Maximum stage recorded during 1911–1914: 4.2 feet during night of July 5, 1911; discharge not computed. Minimum stage recorded: −0.55 foot at 6 p. m. July 30 and 4 p. m. September 7, 1913; discharge, 2 second-feet.

Winter flow.—Stream kept open by springs.

Diversions.—There are court decrees for diversions of 114 second-feet from South Fork above station and 77 second-feet below, and of 85 second-feet from North Fork, which enters above.

Accuracy.—Owing to the high altitude of the station (7,200 feet), alternate melting and freezing cause diurnal fluctuations of stage during certain seasons. Mean stage determined from three readings a day—the maximum stage, which occurs during the night, and readings at 6 a. m. and 6 p. m.—may be somewhat in error; estimates good only.

Discharge measurements of South Fork of Arkansas River at Poncha, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	Robert Follansbee.....	−0.20	7.0	May 31	Robert Follansbee.....	2.30	385
Feb. 9	R. H. Fletcher.....	.30	29	Aug. 17	M. D. Anderson.....	[a] 1.10	32
May 6	.....do.....	− .09	11				

[a] Datum of gage lowered 1 foot.

Daily gage height, in feet, of South Fork of Arkansas River at Poncha, Colo., for the year ending Sept. 30, 1914.

[J. M. Cuenin, observer.]

Day.	Oct.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.07	0.38	0.15	0.00	0.00	2.7	0.70	1.05	0.80
2	− .03	.35	.25	− .08	.25	2.6	.63	1.00	.80
3	.03	.35	.15	− .10	.05	2.3	.67	1.25	.80
4	.00	.28	.25	− .12	.10	2.3	.80	1.20	.80
5	.02	.30	.25	− .08	− .05	1.95	.87	1.05	.80
6	− .15	.30	.35	− .05	− .12	1.85	.63	.80	.80
7	− .22	.32	.50	− .15	− .05	1.40	.68	.58	.75
8	− .20	.30	.50	− .12	+ .20	1.05	.65	.40	.75
9	− .15	.35	.45	− .12	.70	.78	.50	.40	.75
10	− .15	.32	.25	− .15	.87	1.35	.43	.57	.70
11	− .15	.32	.25	− .18	.95	1.55	.37	.57	.70
12	− .08	.30	.20	− .15	.72	1.95	.25	.42	.68
13	− .10	.25	.15	− .10	.55	2.0	.43	.33	.65
14	− .10	.35	.25	− .12	.60	1.70	.33	.32	.62
15	− .10	.30	.25	− .08	.70	2.1	.25	.23	.65
16	− .12	.30	.15	.03	.60	2.1	.23	.25	.60
17	− .20	.25	.20	− .10	.60	2.0	.40	1.15	.60
18	− .23	.30	.20	− .17	.63	1.90	1.35	1.03	.60
19	− .20	.32	.20	− .18	.87	1.85	1.35	1.03	.60
20	− .20	.32	25	− .25	1.25	1.70	1.35	1.10	.60
21	− .20	.28	.25	− .22	1.60	1.80	1.20	1.03	.62
22	− .25	32	.15	− .18	2.0	1.70	1.50	1.10	.60
23	− .25	.25	.15	− .10	1.85	1.60	1.00	1.10	.60
24	− .20	.15	.20	− .22	1.85	1.25	.70	1.00	.60
25	− .15	.15	.10	− .20	1.75	1.00	.78	1.00	.60
26	.....	.15	.00	− .32	1.85	.90	.70	1.10	.60
27	.....	.25	.00	− .30	1.75	.80	.72	.85	.60
28	.....	.15	.10	− .30	1.70	.80	1.60	.85	.60
29	.....	.....	.20	− .35	1.75	.83	1.45	.90	.60
30	.....	.....	.15	− .10	2.1	.65	1.35	.90	.68
31	.....	.....	.00	.....	2.5	.....	1.15	.85	.....

NOTE.—Gage datum lowered 1 foot Aug. 17.

[1] Original datum.

Daily discharge, in second-feet, of South Fork of Arkansas River at Poncha, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	13	36	20	14	14	515	88	183	13
2	15	34	26	11	26	485	76	173	13
3	18	34	20	10	16	397	86	227	13
4	16	29	26	9	18	397	110	213	13
5	17	30	26	11	12	324	123	183	13
6	10	30	34	12	9	302	79	133	13
7	8	32	48	8	12	209	91	91	10
8	9	30	48	9	23	139	86	67	10
9	10	34	43	9	74	88	63	67	10
10	10	32	2[illegible]	8	104	199	54	95	8
11	10	32	26	8	120	240	49	95	8
12	13	30	23	8	77	324	37	70	7
13	12	26	20	10	54	334	56	58	6
14	12	34	26	9	60	271	45	56	6
15	12	30	26	11	74	355	39	46	6
16	11	30	20	15	60	355	37	48	5
17	9	26	23	10	60	338	55	37	5
18	8	30	23	8	64	317	231	28	5
19	9	32	23	8	104	307	235	28	5
20	9	32	26	6	179	275	235	33	5
21	9	29	26	7	250	300	205	28	6
22	8	32	20	8	334	279	267	33	5
23	8	26	20	10	302	258	169	33	5
24	9	20	23	7	302	187	110	26	5
25	10	20	18	7	282	141	125	26	5
26	.....	20	14	5	302	121	110	33	5
27	.....	26	14	5	282	102	118	16	5
28	.....	20	18	5	271	102	296	16	5
29	.....	.....	23	4	282	112	265	19	5
30	.....	.....	20	10	355	79	244	19	7
31	.....	.....	14	.....	455	.....	203	16	.....

NOTE.—Discharge determined as follows: Feb. 1 to June 16, from a rating curve well defined between 10 and 400 second-feet; June 17 to Aug. 16, by the indirect method for shifting control; Aug. 17 to Sept. 30, from a fairly well-defined rating curve.

Monthly discharge of South Fork of Arkansas River at Poncha, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 1-25	18	8	11.0	546	B.
February	36	20	29.1	1,620	B.
March	48	14	24.6	1,510	B.
April	15	4	8.7	518	B.
May	455	9	148	9,100	B.
June	515	79	262	15,600	C.
July	296	37	129	7,930	B.
August	227	16	70.8	4,350	B.
September	13	5	7.6	452	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 mouth of creek.

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

Records available.—January 14, 1911, to September 30, 1914.

Gage.—Vertical staff, which was moved 20 feet downstream and placed on opposite side of creek May 6, 1914; datum lowered 1 foot.

Discharge measurements.—Made from bridge or by wading.

Channel.—Fairly permanent during 1914.

Extremes of discharge.—Maximum stage recorded during year: 3.2 feet during night of June 2; discharge, 298 second-feet. Minimum stage recorded during the year: —0.15 foot at 8 a. m. March 15 and 8 a. m. March 17; discharge, 0.4 second-foot.

Maximum stage recorded during 1911–1914: 3.2 feet, June 2, 1914 (the gage was washed out by high water May 27, 1912, and at that time the stage may have been higher). Minimum stage recorded: —0.15 foot, 8 a. m., March 15, and 8 a. m. March 17; discharge, 0.4 second-foot.

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

Diversions.—There are court decrees for diversions of 7 second-feet above station, but none for diversion below.

Accuracy.—Owing to high altitude of station (7,200 feet), alternate melting and freezing may cause considerable diurnal fluctuation of stage at certain seasons of the year, so that the mean daily gage height based on morning and evening readings and the maximum stage for the 24 hours may be somewhat in error. Estimates only fair for greater part of year.

Discharge measurements of Poncha Creek at Poncha, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	Robert Follansbee.....	0.25	5.0	May 31	Robert Follansbee.....	2.49	140
Feb. 9	R. H. Fletcher.....	.30	5.8	Aug. 17	M. D. Anderson.....	1.34	12
May 6	.....do.....	1.66	25				

NOTE.—New gage, at different location and datum, read May 6 and thereafter.

Daily gage height, in feet, of Poncha Creek at Poncha, Colo., for the year ending Sept. 30, 1914.

[J. M. Cuenin, observer.]

Day.	Oct.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.60	0.45	0.20	0.33	0.80	2.75	1.65	1.62	1.28
2	.53	.20	.10	.40	.95	2.70	1.63	1.60	1.28
3	.53	.15	.25	.50	.70	2.55	1.63	1.67	1.28
4	.55	.10	.20	.50	.65	2.45	1.67	1.65	1.28
5	.53	.15	.20	.47	.78	2.45	1.65	1.57	1.25
6	.35	.15	.30	.55	1.83	2.40	1.62	1.57	1.25
7	.62	.20	.45	.43	1.83	2.15	1.67	1.52	1.25
8	.30	.25	.50	.45	1.93	2.15	1.63	1.45	1.22
9	.32	.25	.45	.35	2.10	2.20	1.60	1.45	1.20
10	.25	.25	.27	.40	2.15	2.30	1.53	1.42	1.20
11	.35	.25	.23	.37	2.15	2.45	1.43	1.40	1.20
12	.50	.25	.07	.37	2.15	2.30	1.47	1.38	1.20
13	.53	.25	.10	.40	2.25	2.30	1.47	1.35	1.20
14	.42	.25	.00	.43	2.35	2.05	1.42	1.32	1.20
15	.38	.25	— .10	.55	2.30	2.45	1.40	1.37	1.20
16	.38	.25	— .05	.68	2.10	2.30	1.30	1.35	1.20
17	.33	.25	— .10	.50	2.05	2.35	1.50	1.35	1.20
18	.32	.27	.10	.45	2.35	2.10	1.63	1.37	1.20
19	.30	.27	.10	.47	2.50	2.05	1.80	1.35	1.20
20	.28	.25	.15	.60	2.40	2.05	1.75	1.33	1.20
21	.30	.25	.20	.65	2.55	2.05	1.62	1.63	1.22
22	.20	.27	.20	.70	2.55	1.98	1.70	1.60	1.20
23	.25	.25	.10	.77	2.65	1.88	1.67	1.60	1.20
24	.20	.15	.25	.65	2.65	1.83	1.58	1.50	1.20
25	.25	.20	.30	.73	2.75	1.77	1.55	1.50	1.20
26	.....	.25	.20	.77	2.75	1.77	1.52	1.60	1.20
27	.....	.10	.10	.63	2.70	1.70	1.57	1.60	1.20
28	.....	.20	.10	.65	2.55	1.70	1.92	1.32	1.20
29	.....	.....	.25	.70	2.55	1.67	1.87	1.30	1.22
30	.....	.....	.30	.90	2.70	1.47	1.73	1.30	1.20
31	.....	.....	.35	.....	2.70	.....	1.68	1.30	.....

NOTE.—Location of gage changed and datum lowered 1 foot May 6, 1914.

Daily discharge, in second-feet, of Poncha Creek at Poncha, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	12	3	7	30	193	26	24	8
2	16	3	2	10	41	182	25	23	8
3	16	2	4	14	24	152	25	27	8
4	16	2	3	14	22	132	27	26	8
5	16	2	3	13	29	132	26	22	8
6	8	2	6	16	40	123	24	22	8
7	20	3	12	11	40	80	27	19	8
8	6	4	14	12	50	80	25	16	7
9	7	4	12	8	72	87	23	16	6
10	4	4	5	10	80	104	20	14	6
11	8	4	4	9	80	132	14	13	6
12	14	4	2	9	80	104	16	12	6
13	16	4	2	10	96	104	16	11	6
14	11	4	1	11	114	65	14	10	6
15	9	4	.5	16	104	132	13	12	6
16	9	4	1	23	72	104	9	11	6
17	7	4	.5	14	65	114	18	11	6
18	7	5	2	12	114	72	25	12	6
19	6	5	2	13	142	65	37	11	6
20	5	4	2	19	123	65	33	10	6
21	6	4	3	22	152	65	24	25	7
22	3	5	3	24	152	56	29	23	6
23	4	4	2	28	172	45	27	23	6
24	3	2	4	22	172	40	22	18	6
25	4	3	6	26	193	35	20	18	6
26	.....	4	3	28	193	35	19	23	6
27	.....	2	2	20	182	29	22	23	6
28	.....	3	2	22	152	29	49	10	6
29	.....	.....	4	24	152	27	44	9	7
30	.....	.....	6	37	182	16	31	9	6
31	.....	.....	8	.....	182	.....	28	9	.....

NOTE.—Discharge determined as follows: Oct. 1 to May 5, from a well-defined rating curve; May 6 to Sept. 30, from a rating curve well defined below 40 second-feet.

Monthly discharge of Poncha Creek at Poncha, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 1–25	20	3	9.6	476	C.
February	12	2	3.8	211	C.
March	14	.5	4.0	246	C.
April	37	7	16.8	1,000	B.
May	193	22	107	6,580	C.
June	193	16	86.6	5,150	C.
July	49	9	24.5	1,510	B.
August	27	9	16.5	1,010	B.
September	8	6	6.6	393	B.

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.

Drainage area.—70 square miles.

Records available.—January 1, 1905, to September 30, 1914.

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 the year ending Sept. 30, 1914.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	9.97	613	May	142	8,730
November	8.08	481	June	114	6,780
December	7.23	445	July	113	6,950
January	5.01	308	August	61.7	3,790
February	7.07	393	September	23.3	1,390
March	14.6	898			
April	38.1	2,270	The year	45.3	33,000

CANADIAN RIVER NEAR SANCHEZ, N. MEX.

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

Drainage area.—Not measured.

Records available.—May 15, 1912, to September 30, 1914.

Gage.—Water-stage recorder.

Discharge measurements.—Made by wading at low stages and from cable at medium stages. Flood discharge determined by Kutter's formula from slope and cross section.

Channel.—Shifting.

Winter flow.—Discharge relation at times slightly affected by ice.

Diversions.—A large part of the flow is diverted for irrigation above station.

Accuracy.—Estimates poor.

Discharge measurements of Canadian River near Sanchez, N. Mex., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 18	J. E. Powers	1.90	40.4	June 17	Powers and Hank	3.84	749
Feb. 13	C. J. Emerson	1.83	43.4	Sept. 5	R. J. Hank	2.10	180

Daily gage height, in feet, of Canadian River near Sanchez, N. Mex., for the year ending Sept. 30, 1914.

[Luther Hamilton, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.6	2.0	2.05	2.0	2.05	1.85	1.55	(b)	.....	.....	.....	2.1
2	a 4.0	2.0	2.0	2.05	2.0	1.9	1.55	.....	.....	.....	.....	2.05
3	.....	2.0	2.0	2.1	2.0	1.9	1.6	.....	.....	.....	.....	2.0
4	.....	2.0	2.2	2.2	2.0	1.9	1.55	.....	.....	5.2	.....	2.0
5	.....	2.05	2.2	2.4	2.05	1.9	1.5	5.2	.....	.....	.....	2.1
6	.....	2.05	2.1	2.4	2.05	1.9	1.5	.....	3.2	.....	.....	2.1
7	2.5	2.0	2.0	2.4	1.95	1.9	1.5	.....	3.15	.....	.....	2.1
8	2.5	1.9	2.0	2.4	1.95	1.9	1.5	.....	2.9	.....	4.45	2.05
9	2.5	1.85	2.15	2.5	1.95	1.9	1.5	4.9	.....	.....	4.45	1.95
10	2.4	1.8	2.2	2.6	1.9	1.9	1.5	4.9	.....	.....	4.0	1.95
11	2.4	1.8	2.2	2.5	1.9	1.9	1.55	4.7	.....	3.65	3.65	1.9
12	2.4	1.9	2.2	2.5	1.9	1.9	2.55	.....	.....	3.65	3.75	2.9
13	2.35	1.9	2.2	2.5	1.85	1.9	2.5	.....	2.5	3.7	3.65	2.05
14	2.0	1.9	2.2	2.5	1.9	1.85	2.45	.....	2.3	3.7	3.25	1.8
15	2.05	1.9	2.1	2.6	1.95	1.85	2.5	.....	2.25	3.85	4.55	1.7
16	2.05	1.9	2.0	3.6	2.0	1.85	2.55	4.0	.....	4.0	3.25	1.65
17	2.1	1.9	1.9	.....	1.9	1.85	2.6	4.1	3.85	4.0	2.75	1.5
18	2.1	1.9	1.95	.....	1.95	1.85	2.8	4.05	.....	3.75	2.75	1.4
19	2.1	1.95	2.0	.....	2.0	1.8	2.9	.....	.....	3.85	2.75	1.3
20	2.1	2.0	2.0	3.4	2.05	1.75	2.95	.....	3.45	3.85	2.75	1.25
21	2.0	2.0	2.05	3.05	2.1	1.75	2.9	.....	3.95	3.85	2.75	1.25
22	2.0	2.0	2.0	2.7	2.05	1.7	2.85	.....	3.85	3.9	2.8	1.2
23	2.0	1.9	2.0	2.45	2.05	1.65	2.85	4.8	3.75	.....	2.85	1.2
24	2.0	1.9	2.0	2.4	1.9	1.6	2.8	4.85	3.6	.....	2.8	.....
25	2.0	1.9	2.0	2.3	1.8	1.6	2.85	4.85	3.65	.....	2.75	.....
26	2.0	2.0	2.0	2.3	1.85	1.6	2.9	5.35	3.4	.....	2.5	1.2
27	2.0	2.0	2.0	2.15	1.85	1.55	2.8	5.1	3.1	.....	2.35	1.2
28	2.0	2.0	2.0	2.4	1.85	1.55	2.8	.....	3.1	.....	2.2	1.25
29	2.0	2.05	2.0	2.35	.....	1.5	2.8	.....	3.1	.....	2.1	1.2
30	2.0	2.05	2.0	2.25	.....	1.5	2.95	5.0	3.2	.....	2.1	1.2
31	2.0	.....	2.0	2.15	.....	1.5	.....	.....	.....	.....	2.1	.....

a Maximum stage recorded Oct. 2, 7.6 feet.

b Maximum stage recorded May 1, 11.8 feet, corresponding to a discharge of approximately 19,000 second-feet.

Daily discharge, in second-feet, of Canadian River near Sanchez, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	176	50	56	50	69	44	16	7,880	1,380	860	1,270	176
2	740	50	50	56	62	50	16	8,380	1,190	1,300	1,300	164
3	620	50	50	62	62	50	20	3,620	1,000	1,740	1,340	152
4	500	50	76	76	62	50	16	2,050	810	2,180	1,380	152
5	380	56	76	110	69	50	12	1,990	620	1,970	1,420	176
6	260	56	62	110	69	50	12	1,900	425	1,760	1,460	176
7	152	50	50	110	56	50	12	1,810	405	1,550	1,500	176
8	152	38	50	110	56	50	12	1,720	318	1,340	1,540	164
9	152	33	69	131	56	50	12	1,640	292	1,130	1,540	142
10	131	28	76	152	50	50	12	1,640	266	920	1,100	142
11	120	28	76	142	50	50	16	1,430	240	710	835	131
12	120	38	76	142	50	50	164	1,310	215	710	905	445
13	110	38	76	142	44	50	152	1,190	190	740	835	164
14	56	38	76	142	50	44	142	1,070	142	740	605	110
15	62	38	62	164	56	44	152	950	131	835	1,640	92
16	62	38	50	508	62	44	164	835	436	1,020	605	84
17	69	38	38	488	50	44	176	905	740	1,020	388	62
18	69	38	44	467	56	44	233	870	870	835	388	50
19	69	44	50	446	62	38	265	1,000	600	905	388	38
20	69	50	50	425	69	33	282	1,140	530	905	388	33
21	50	50	50	318	76	33	265	1,270	800	905	388	33
22	50	50	50	203	69	28	249	1,400	740	940	405	28
23	50	38	50	142	69	24	249	1,540	680	975	425	28
24	50	38	50	131	50	20	233	1,590	605	1,020	405	28
25	50	38	50	110	38	20	249	1,590	630	1,050	388	28
26	50	50	50	110	44	20	265	2,180	508	1,080	300	28
27	50	50	50	84	44	16	233	1,870	388	1,110	249	28
28	50	50	50	131	44	16	233	1,840	388	1,140	203	33
29	50	56	50	120	.....	12	233	1,800	388	1,170	176	28
30	50	56	50	101	.....	12	282	1,760	425	1,200	176	28
31	50	.....	50	84	.....	12	.....	1,570	.....	1,230	176	.....

NOTE.—Discharge determined as follows: Oct. 21 to Jan. 10 from a poorly defined rating curve; rest of year by indirect method for shifting channels. Discharge for days for which gage heights are not recorded determined by interpolation or from records of nearby stations, from information furnished by the observer and climatic data.

Monthly discharge of Canadian River near Sanchez, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	740	50	149	9,160	C.
November	56	28	44.2	2,630	C.
December	76	38	56.9	3,500	C.
January	508	50	180	11,100	C.
February	76	38	56.9	3,160	C.
March	50	12	37.0	2,280	C.
April	282	12	146	8,690	C.
May	8,380	835	1,990	122,000	D.
June	1,380	131	545	32,400	D.
July	2,180	710	1,130	69,500	D.
August	1,640	176	778	47,800	D.
September	445	28	104	6,190	C.
The year	8,380	12	440	318,000	

CANADIAN RIVER AT LOGAN, N. MEX.

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

Drainage area.—Approximately 12,000 square miles.

Records available.—June 29, 1904, to February 26, 1905; December 22, 1908, to May 20, 1914, when station was discontinued.

Gage.—Water-stage recorder installed August 5, 1910, and referred to a different datum from that of gage previously used. Original gage was a staff. On reestablishment of station in 1908 a gage was painted on one of the bridge piers and referred to a new datum; used until present gage was installed. June 12 to July 12, 1913, when automatic gage was removed because of high water, staff gage referred to datum of automatic gage was read. Automatic gage reinstalled July 12, 1913, and referred to its previous datum. May 1, 1914, automatic gage was washed out by severe flood.

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

Channel.—Shifting.

Winter flow.—Discharge relation at times slightly affected by ice.

Diversions.—Some water diverted from headwater streams for irrigation; none diverted from the Canadian in the vicinity of this station.

Discharge measurements of Canadian River at Logan, N. Mex., during the year ending Sept. 30, 1914.

[Made by C. J. Emerson.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 20	4.40	43.8	Feb. 12	4.30	44.3
Jan. 10	4.65	100	Mar. 24	3.80	7.1

Daily gage height, in feet, of Canadian River at Logan, N. Mex., for the year ending Sept. 30, 1914.

[Samuel Rufi, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	4.62	4.20	4.30	4.35	4.70	4.25	.....	[a] 20.7
2	4.88	4.20	4.30	4.35	4.55	4.20	.....	8.5
3	5.79	4.20	4.61	4.30	4.55	4.20	.....	.....
4	5.41	4.20	4.71	4.30	4.55	4.20	.....	.....
5	5.42	4.20	4.70	4.35	4.45	4.20	.....	.....
6	4.90	4.20	4.70	4.40	4.40	4.20	.....	.....
7	4.80	4.25	4.73	4.40	4.40	4.15	.....	.....
8	4.80	4.25	4.60	4.60	4.40	4.15	.....	.....
9	4.75	4.20	4.40	4.70	4.35	4.15	.....	.....
10	4.70	4.20	4.21	4.65	4.40	4.20	.....	.....
11	4.70	4.20	4.19	4.60	4.50	4.20	.....	.....
12	4.72	4.20	4.18	4.60	4.35	4.15	.....	.....
13	4.70	4.21	4.12	5.00	4.30	4.15	.....	.....
14	4.62	4.29	4.07	5.00	4.30	4.10	.....	.....
15	4.58	4.29	4.02	5.00	4.25	4.05	.....	.....
16	4.55	4.34	4.21	4.95	4.30	4.05	.....	.....
17	4.51	4.39	4.25	4.90	4.30	4.00	.....	6.00
18	4.45	4.39	4.30	5.25	4.30	3.95	.....	9.25
19	4.40	4.40	4.30	5.75	4.30	3.90	.....	9.00
20	4.30	4.42	4.25	5.65	4.25	3.85	.....	9.50
21	4.25	4.38	4.25	5.70	4.25	3.80	.....	.....
22	4.25	4.36	4.20	5.50	4.20	3.80	5.10	.....
23	4.30	4.34	4.20	5.25	4.20	3.80	5.10	.....
24	4.30	4.32	4.22	5.10	4.20	3.80	5.10	.....
25	4.24	4.30	4.21	4.95	4.20	3.75	5.10	.....
26	4.22	4.25	4.19	4.80	4.15	3.75	5.10	.....
27	4.21	4.22	4.21	4.70	4.20	3.65	5.10	.....
28	4.20	4.23	4.32	4.60	4.25	3.60	5.10	.....
29	4.20	4.24	4.31	4.55	.....	3.55	.....	.....
30	4.20	4.30	4.21	4.55	.....	.....	.....	.....
31	4.20	.....	4.20	4.76	.....	.....	.....	.....

[a] Maximum stage recorded on May 1, 30.2 feet.

NOTE.—Discharge relation slightly affected by ice Dec. 16 to Jan. 7; staff gage on railroad bridge read May 1, 2, and 17–20.

Daily discharge, in second-feet, of Canadian River at Logan, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	87	25	39	54	110	42	.....	110,000
2	165	25	39	54	82	36	.....	8,000
3	771	25	85	48	82	36	.....	.....
4	472	25	106	48	82	36	.....	.....
5	479	25	103	54	67	36	.....	.....
6	173	25	103	60	60	36	.....	.....
7	133	29	112	60	60	31	.....	.....
8	133	29	83	90	60	31	.....	.....
9	118	25	51	110	54	31	.....	.....
10	103	25	30	100	60	36	.....	.....
11	103	25	28	90	74	36	.....	.....
12	109	25	27	90	54	31	.....	.....
13	103	26	23	186	48	31	.....	.....
14	87	33	19	186	48	26	.....	.....
15	80	33	16	186	42	22	670	.....
16	75	38	35	172	48	22	580	.....
17	69	44	39	158	48	18	500	2,500
18	59	44	45	284	48	15	430	10,500
19	51	45	45	624	48	12	365	9,600
20	39	48	39	540	42	9.5	310	11,500
21	29	43	39	580	42	7.0	260	.....
22	29	40	34	428	36	7.0	220	.....
23	34	38	34	284	36	7.0	220	.....
24	34	36	36	220	36	7.0	220	.....
25	28	34	35	172	36	5.0	220	.....
26	27	29	33	134	31	5.0	220	.....
27	26	27	35	110	36	2.0	220	.....
28	25	27	47	90	42	1.0	220	.....
29	25	28	46	82	.....	.5	220	.....
30	25	34	35	82	.....	.....	900	.....
31	25	.....	34	124	.....	.....	.....	.....

NOTE.—Discharge determined from several poorly defined rating curves and by indirect method for shifting channels. Discharge estimated Dec. 16 to Jan. 7, Apr. 15–21, and Apr. 29 and 30. Discharge May 1, approximate only. Stream dry Mar. 30 to Apr. 14.

Monthly discharge of Canadian River at Logan, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	771	25	120	7,380	B.
November	48	25	31.8	1,890	B.
December	112	16	47.6	2,930	C.
January	624	48	177	10,900	C.
February	110	31	54.0	3,000	B.
March	42	0	19.8	1,220	B.
April	900	0	192	11,400	D.
The period				38,700	

CHICORICA CREEK NEAR RATON, N. MEX.

Location.—In sec. 28, T. 30 N., R. 24 E., 500 feet above St. Louis, Rocky Mountain & Pacific Railway bridge and 10 miles southeast of Raton, above Raton and Una del Gato creeks.

Drainage area.—Not measured.

Records available.—July 29, 1910, to September 30, 1914.

Gage.—Water-stage recorder. On May 1, 1914, the Friez gage was washed out by a flood. May 5 to June 8, 1914, a temporary staff gage was used and readings reduced to former datum. June 8, 1914, a Stevens automatic gage was installed 500 feet upstream from old site and referred to new datum, which on July 14, 1914, was lowered 0.44 foot.

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

Channel.—September 25, 1914, a concrete artificial control was installed a few feet below automatic gage. Zero flow was found to be at gage height 0.78 foot. Previous to installation of artificial control channel was shifting.

Winter flow.—Discharge relation affected by ice.

Diversions.—Greater part of normal flow diverted above station for irrigation.

Discharge measurements of Chicorica Creek near Raton, N. Mex., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	J. E. Powers	1.00	[a]0.7	June 9	Powers and Hank	.76	12.3
Nov. 13	do	1.02	[a].6	July 14	R. J. Hank	.65	9.8
Jan. 9	do	[b]1.90	[a].8	Aug. 6	J. E. Powers	1.26	37.4
Mar. 20	do	1.79	20.3	Sept. 14	Grover and Hank	.72	2.6
Apr. 27	do	1.80	33.5	25	R. J. Hank	.95	2.2

[a] Estimated. [b] Discharge relation affected by ice.

NOTE.—Gage height on June 9 refers to gage at different location and datum; datum lowered 0.44 foot, July 14. Sept. 25, discharge relation affected by concrete control below gage.

Daily gage height, in feet, of Chicorica Creek near Raton, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.82	0.97	1.05	.....	.....	1.22	2.07	4.0	1.94	—0.12	1.75	.....
2	1.50	.97	1.08	.....	1.20	1.31	2.08	.....	.....	.00	1.69	.....
3	1.41	.98	1.10	.....	1.19	1.31	2.21	.....	1.77	.50	1.41	.....
4	1.32	.98	1.18	.....	1.25	1.42	2.19	.....	1.60	.12	1.65	.....
5	1.12	.98	1.20	2.21	1.35	1.40	2.41	2.72	.....	.02	1.60	.....
6	.....	.97	1.20	2.09	1.05	1.19	2.50	.....	1.62	.00	1.37	.....
7	.....	.93	.....	1.91	1.13	1.39	2.42	2.49	.....	.00	1.22	0.78
8	.....	.94	.....	1.93	1.15	1.42	2.06	2.33	1.59	— .05	1.46	.78
9	.....	.96	1.55	1.92	1.18	1.48	1.99	2.29	.78	— .02	1.22	.75
10	.....	.98	1.55	1.69	1.22	1.60	1.98	.....	.74	— .05	1.21	.75
11	.....	1.00	2.38	.....	1.27	1.49	2.03	2.09	.73	.20	1.19	.75
12	.....	1.02	.....	1.63	1.24	1.44	2.03	2.09	.72	.60	1.07	.....
13	1.00	1.03	1.85	1.50	1.24	1.45	2.07	2.11	.63	.41	1.23	.....
14	1.00	1.03	.....	1.47	1.22	1.60	2.09	2.10	.62	.67	1.16	.72
15	1.00	1.02	1.80	1.46	1.23	1.87	2.14	2.14	.62	.48	1.08	.73
16	1.01	1.02	1.80	1.57	1.27	1.96	2.28	2.09	.81	.40	.....	.72
17	1.02	1.02	1.82	1.80	1.26	2.04	2.36	.....	.68	1.92	.....	.74
18	1.03	1.03	1.67	.....	1.20	2.10	2.11	2.08	.45	1.85	.98	.73
19	1.00	1.03	1.67	1.85	1.18	1.97	2.08	.....	.35	2.41	.94	.74
20	1.00	1.04	1.72	1.51	1.27	1.81	2.21	2.06	.40	1.93	.94	.....
21	1.00	1.03	.....	1.26	1.30	1.80	2.25	.....	.32	2.30	.90	.....
22	1.00	1.02	2.02	1.24	1.28	1.76	2.28	2.01	.30	2.00	.89	.....
23	1.00	1.04	2.05	1.72	1.18	1.79	2.05	.....	.25	1.95	.91	.....
24	1.00	1.07	2.00	1.28	1.21	1.85	2.05	.....	.25	1.70	.93	.....
25	.90	1.04	.....	1.29	1.23	1.87	1.98	1.90	.22	1.33	.92	.95
26	.90	1.01	1.97	1.34	1.28	1.92	.....	.....	.20	1.23	.....	.96
27	.95	1.00	1.91	1.60	1.18	2.09	1.80	1.64	.15	1.32	.....	.96
28	.93	1.00	1.91	2.07	1.15	2.25	1.74	1.85	.10	1.22	.....	.96
29	1.03	1.01	2.00	1.23	.....	2.30	1.72	.....	— .05	1.05	.....	.96
30	.98	1.01	2.01	1.25	.....	2.17	.....	1.69	— .10	.98	.....	.97
31	.....	.....	2.03	1.21	.....	2.06	.....	.....	.....	1.55	.80	.....

NOTE.—Discharge relation affected by ice Dec. 1 to Feb. 6. Gage heights recorded since June 8 refer to new gage at different location and datum. This datum was lowered 0.44 foot July 14. Sept. 25–30 discharge relation affected by concrete control installed below gage.

Daily discharge, in second-feet, of Chicorica Creek near Raton, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	0.6	0.7	2.4	44	540	37	0.6	86	5.2
2	17	.6	.7	2.2	46	475	30	3.0	80	4.9
3	12	.7	.7	2.2	60	410	24	23.0	48	4.6
4	8.6	.7	.7	4.6	59	345	14	6.1	80	4.4
5	2.0	.7	.7	4.0	88	281	14	3.4	76	4.2
6	.0	.6	.7	1.8	104	242	15	3.0	48	4.0
7	.0	.4	.6	3.8	91	204	14	3.0	33	3.8
8	.0	.4	1.0	4.6	47	165	14	2.0	56	3.8
9	.0	.5	1.6	6.4	40	151	13	2.6	32	3.0
10	.0	.5	2.4	10	40	126	11	2.0	32	3.0
11	.0	.6	3.4	6.7	45	100	9.4	8.5	29	2.8
12	.0	.6	2.8	5.2	46	94	9.1	30	21	2.8
13	.7	.7	2.8	5.5	50	90	6.4	18	32	2.7
14	.7	.7	2.4	10	53	83	6.1	10	26	2.6
15	.7	.6	2.6	24	59	81	6.1	4.3	21	2.6
16	.7	.6	3.4	31	78	73	12	2.6	18	2.5
17	.8	.6	3.2	38	90	70	7.9	149	16	2.6
18	.8	.7	2.0	44	58	67	7.0	133	14	2.5
19	.7	.7	1.6	32	54	64	4.0	238	12	2.5
20	.7	.7	3.4	21	72	61	5.5	140	12	2.4
21	.7	.7	4.0	20	77	56	3.4	206	10	2.4
22	.7	.6	3.8	18	74	52	3.0	146	9.4	2.3
23	.7	.7	1.8	19	84	47	3.0	133	10	2.3
24	.4	.8	2.2	23	55	42	3.0	90	10	2.2
25	.5	.7	2.6	24	49	37	2.4	42	10	2.2
26	.4	.6	3.8	28	41	27	2.0	31	9.0	2.2
27	.6	.5	1.8	44	33	17	2.0	37	8.0	2.2
28	.6	.5	1.0	61	29	30	2.0	27	7.3	2.2
29	.6	.6	.....	69	28	24	2.0	15	6.7	2.2
30	.6	.6	.....	53	54	18	1.0	12	6.1	2.3
31	.6	.....	.....	43	.....	28	.....	56	5.5	.....

NOTE.—Discharge determined by indirect method for shifting channels. Discharge estimated on account of ice Feb. 1–6, and interpolated for days for which gage heights are not recorded except Oct. 6–12 when there was no flow.

Monthly discharge of Chicorica Creek near Raton, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	38	0.0	2.90	178	D.
November	.8	.4	.62	37	D.
December	.....	.....	a.6	37	
January	.....	.....	a.8	49	
February	4.0	.6	2.09	116	D.
March	69	1.8	21.3	1,310	C.
April	104	28	58.3	3,470	C.
May	540	17	132	8,120	D.
June	37	1.0	9.44	562	C.
July	238	.6	50.9	3,130	C.
August	86	5.5	27.9	1,720	C.
September	5.2	2.2	2.95	176	D.
The year	540	.0	26.1	18,900	

a Monthly mean estimated.

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.

Drainage area.—235 square miles (measured on General Land Office map).

Records available.—July 14, 1907, to September 30, 1914.

Gage.—Water-stage recorder installed in September, 1909, and referred to same datum as staff gage previously used.

Discharge measurements.—Made from bridge or by wading.

Channel.—Rough; shifts during high stages.

Winter flow.—Discharge relation affected by ice.

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

Discharge measurements of Cimarron River at Ute Park, N. Mex., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	J. E. Powers	0.40	16.5	May 1	J. E. Powers	1.66	371
Nov. 14	do	.40	15.0	June 10	Powers and Hank	.64	32.7
Jan. 10	do	a.40	16.9	Aug. 7	J. E. Powers	.73	43.5
Feb. 12	do	a.40	13.6	Sept. 15	Grover and Gray	.51	16.4
Mar. 23	do	.50	24.8	15	Grover and Powers	.51	17.8
Apr. 29	do	1.00	108	19	J. E. Powers	.44	12.0

a Discharge relation affected by ice.

Daily gage height, in feet, of Cimarron River at Ute Park, N. Mex., for the year ending Sept. 30, 1914.

[R. L. Gilluly, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.45	0.45	0.42	.....	0.59	0.42	0.60	1.75	.....	0.32	.....	0.51
2	.53	.44	.50	.....	.58	.46	.64	1.60	.....	.32	.....	.49
3	.46	.46	.73	0.35	.62	.44	.75	1.52	.....	.49	.....	.49
4	.45	.47	.71	.....	.57	.52	.87	1.51	.....	.57	.....	.....
5	.45	.45	.45	.40	.53	.46	.92	1.55	.....	.59	.....	.....
6	.45	.43	.36	.35	.43	.48	.88	1.61	0.83	.53	.....	.59
7	.43	.41	.....	.35	.56	.47	.79	1.60	.85	.52	0.74	.68
8	.43	.40	.30	.35	.79	.46	.88	1.60	.75	.58	.74	.75
9	.43	.39	.....	.34	.60	.47	.91	1.60	.68	.55	.....	.80
10	.41	.39	.33	.40	.52	.54	.88	1.59	.64	.58	.....	.80
11	.40	.38	.....	.38	.41	.51	.87	1.53	.62	.60	.....	.....
12	.40	.40	.....	.36	.39	.61	1.05	1.49	.60	.62	.....	.....
13	.40	.40	.38	.35	.41	.53	1.12	1.46	.59	.73	.....	.59
14	.40	.40	.....	.35	.50	.55	1.17	1.43	.61	.60	.....	.55
15	.40	.40	.29	.34	.45	.56	1.20	1.39	.66	.59	.....	.52
16	.40	.41	.....	.34	.44	.76	1.07	1.35	.66	.64	.82	.49
17	.41	.42	.30	.35	.38	.88	1.01	1.32	.63	.96	.79	.48
18	.40	.42	.....	.36	.36	.92	1.06	1.27	.63	.....	.79	.46
19	.40	.41	.....	.35	.34	.81	1.12	1.24	.63	.....	.78	.45
20	.39	.42	.37	.43	.37	.64	1.13	1.22	.63	1.00	.77	.45
21	.40	.39	.....	.50	.39	.46	1.20	1.19	.62	.....	.....	.44
22	.40	.34	.33	.49	.40	.58	1.14	1.16	.61	.....	.....	.43
23	.40	.32	.....	.43	.43	.56	1.08	1.13	.60	.....	.65	.42
24	.40	.32	.34	.47	.53	.69	1.09	1.11	.59	.....	.67	.41
25	.40	.35	.....	.43	.51	.54	1.09	1.10	.58	.....	.63	.40
26	.40	.37	.....	.40	.46	.65	.....	1.10	.56	.....	.62	.40
27	.41	.36	.35	.41	.48	.76	.....	1.08	.53	.97	.60	.40
28	.42	.33	.....	.42	.46	.75	.....	1.07	.35	.92	.....	.29
29	.42	.45	.36	.54	.....	.71	1.00	1.06	.32	.97	.....	.34
30	.44	.43	.....	.54	.....	.66	1.29	1.05	.32	.93	.59	.41
31	.45	.....	.35	.60	.....	.60	.....	.....	.....	.....	.57	.....

NOTE.—Discharge relation affected by ice Dec. 2 to Feb. 28.

Daily discharge, in second-feet, of Cimarron River at Ute Park, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	21	20	18	36	422	94	8.5	69	18
2	30	20	21	41	340	87	8.5	65	16
3	22	21	20	58	300	80	18	61	16
4	21	22	27	80	295	73	25	57	19
5	21	20	21	91	315	66	27	53	22
6	21	19	23	82	340	59	21	49	25
7	20	17	21	64	335	63	20	45	35
8	20	16	21	82	335	46	26	45	44
9	20	15	21	88	335	37	23	46	51
10	18	15	29	82	330	33	26	47	51
11	17	14	26	80	295	30	28	48	42
12	17	15	37	122	276	28	30	50	33
13	17	15	28	142	262	27	44	52	24
14	17	15	30	158	249	29	28	54	20
15	17	15	32	167	232	35	27	56	18
16	17	16	59	128	211	35	33	58	15
17	18	17	82	112	199	32	84	52	15
18	17	17	91	125	181	32	87	52	14
19	17	16	68	142	171	32	90	51	13
20	16	17	41	145	164	32	93	49	13
21	17	14	21	167	152	30	92	43	12
22	17	11	34	148	142	29	91	38	12
23	17	9.4	32	131	133	28	90	33	11
24	17	9.4	36	133	128	27	89	35	11
25	17	12	29	133	125	26	88	30	10
26	17	13	42	127	122	24	87	29	10
27	18	12	59	121	117	21	86	27	10
28	19	10	58	115	114	9.2	76	27	6.8
29	19	20	51	109	112	8.5	86	26	8.2
30	20	18	44	199	109	8.5	78	26	11
31	21	.....	36	.....	101	.....	73	24	.....

NOTE.—Discharge determined as follows: Mar. 1 to May 5 from a fairly well-defined rating curve; rest of year by indirect method for shifting channels. Discharge interpolated for days for which gage heights are not recorded.

Monthly discharge of Cimarron River at Ute Park, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	30	16	18.8	1,160	B.
November	22	9.4	15.7	934	B.
December	.....	.....	[a] 12	738	D.
January	.....	.....	[a] 14	861	D.
February	.....	.....	[a] 15	833	D.
March	91	18	37.4	2,300	B.
April	199	36	114	6,780	B.
May	422	101	224	13,800	B.
June	94	8.5	38.7	2,300	C.
July	93	8.5	54.3	3,340	C.
August	69	24	45.1	2,770	D.
September	51	6.8	20.2	1,200	C.
The year	422	.....	51.1	37,000	

[a] Monthly mean estimated.

RAYADO RIVER NEAR CIMARRON, N. MEX.

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

Drainage area.—Not measured.

Records availale.—May 8 to October 7, 1911; May 25 to October 10, 1913; June 1 to September 11, 1914.

Gage.—Vertical staff.

Discharge measurements.—Made by wading.

Channel.—Practically permanent during 1914.

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

Diversions.—None above station.

Accuracy.—Estimates good.

The following discharge measurement was made by Powers and Hank:

June 12, 1914: Gage height, 0.68 foot; discharge, 19.7 second-feet.

Daily gage height, in feet, and discharge, in second-feet, of Rayado River near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

[Valentine Shipley, observer.]

Day.	June.		July.		Aug.		Sept.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	0.99	48	0.68	21	0.62	16	0.65	18
2	.99	48	.68	21	.72	23	.65	18
3	.99	48	.65	18	.82	31	.60	15
4	.79	28	.65	18	1.05	54	.58	14
5	.84	33	.62	16	1.08	58	.55	12
6	.77	27	.57	14	.92	40	.55	12
7	.69	21	.56	13	.85	34	.55	12
8	.69	21	.55	12	.80	29	.55	12
9	.71	23	.55	12	.85	34	.55	12
10	.69	21	.55	12	.85	34	.55	12
11	.71	23	.55	12	.88	36	.55	12
12	.69	21	.55	12	1.25	80	.....	.....
13	.70	22	.55	12	1.05	54	.....	.....
14	.70	22	.55	12	1.02	51	.....	.....
15	.72	23	.55	12	.95	44	.....	.....
16	.80	29	.55	12	.90	38	.....	.....
17	.72	23	.80	29	1.05	54	.....	.....
18	.72	23	.72	23	1.10	60	.....	.....
19	.75	26	.88	36	1.08	58	.....	.....
20	.68	21	.78	28	1.00	49	.....	.....
21	.65	18	.85	34	.98	47	.....	.....
22	.65	18	1.05	54	.92	40	.....	.....
23	.65	18	1.10	60	.80	29	.....	.....
24	.62	16	1.10	60	.80	29	.....	.....
25	.60	15	1.02	51	.80	29	.....	.....
26	.60	15	1.02	51	.80	29	.....	.....
27	.58	14	.95	44	.75	26	.....	.....
28	.55	12	1.18	70	.70	22	.....	.....
29	.58	14	1.05	54	.70	22	.....	.....
30	.60	15	.98	47	.68	21	.....	.....
31	.....	.....	.95	44	.65	18	.....	.....

NOTE.—Discharge determined from well-defined rating curve.

Monthly discharge of Rayado River near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	48	12	23.5	1,400	B.
July	70	12	29.5	1,810	B.
August	80	16	38.4	2,360	B.
September 1-11	18	12	13.5	294	B.
The period	.....	.....	.....	5,860	

RAYADO RIVER ABOVE 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, and 15 miles southwest of Cimarron.

Drainage area.—Not measured.

Records available.—May 4, 1911, to September 30, 1914. June 17, 1908, to May 5, 1911, a station was maintained three-fourths mile 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.)

Gage.—Water-stage recorder 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.
Discharge measurements.—Made by wading.
Channel.—Slightly shifting.
Winter flow.—Discharge relation affected by ice.
Diversions.—None above station.
Accuracy.—Estimates fair.

Discharge measurements of Rayado River above Abreu's ranch, near Cimarron, N. Mex., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	J. E. Powers	0.65	9.5	Apr. 30	J. E. Powers	3.05	201
Nov. 15	do	.58	5.9	June 11	Powers and Hank	1.09	20.0
Jan. 12	do	[a].40	4.3	Aug. 8	J. E. Powers	1.32	35.1
Feb. 13	do	[a].50	5.3	Sept. 16	Grover and Powers	.75	9.2
Mar. 24	do	.80	13.3				

[a] Discharge relation affected by ice.

Daily gage height, in feet, of Rayado River above Abreu's ranch, near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.67	0.56	0.64	.....	.....	.....	0.99	2.87	1.75	1.12	1.15	0.92
2	.86	.56	.64	.....	.....	.....	1.05	2.65	1.51	1.16	1.08	.92
3	.87	.57	.64	.....	.....	.....	1.17	2.76	1.37	1.10	1.17	.91
4	.79	.55	.64	.....	.....	.....	1.18	2.92	1.27	1.01	1.30	.85
5	.78	.44	.....	.....	.....	.....	1.40	2.86	1.18	1.00	1.20	.87
6	.74	.58	.....	.....	.....	.....	1.49	2.75	1.12	1.04	1.13	.87
7	.71	.57	.....	.....	.....	.....	1.44	2.56	1.11	.95	1.11	.88
8	.70	.57	.....	.....	.....	.....	1.24	2.50	1.07	.88	1.38	.87
9	.70	.56	.....	.....	.....	.....	1.26	2.48	1.03	.83	1.30	.88
10	.70	.57	.....	.....	.....	.....	1.23	2.45	1.02	.83	1.53	.88
11	.70	.56	.....	.....	.....	.....	1.16	2.32	1.08	.89	1.63	.86
12	.69	.54	.....	0.50	.....	.....	1.21	2.27	1.14	.92	1.65	.94
13	.70	.56	.....	.51	0.40	.....	1.24	2.17	1.05	.90	1.62	.94
14	.70	.57	.....	.63	.....	.....	1.48	2.14	1.02	.81	1.53	.90
15	.69	.58	.....	.74	.....	.....	1.79	2.09	1.13	.84	1.48	.80
16	.67	.49	.....	.80	.....	.....	1.72	2.22	1.15	1.03	1.42	.76
17	.66	.42	.....	.80	.....	.....	1.62	1.92	1.11	1.09	1.43	.73
18	.65	.40	.....	.80	.....	.....	1.51	1.88	1.09	1.15	1.49	.72
19	.63	.39	.....	.87	.....	.....	1.50	1.84	1.06	1.60	1.45	.72
20	.62	.40	.....	1.03	.....	.....	1.57	1.78	1.06	1.39	1.44	.71
21	.60	.40	.....	1.14	.....	.....	1.65	1.74	.98	1.22	1.38	.71
22	.59	.31	.....	.....	.....	.....	1.66	1.71	.97	1.08	1.38	.71
23	.58	.26	.....	.....	.....	.....	1.89	1.72	.95	1.30	1.32	.70
24	.59	.28	.....	.....	.....	0.85	1.64	1.67	.93	.82	1.27	.70
25	.56	.29	.....	.....	.....	.84	1.62	1.60	.92	1.22	1.23	.69
26	.51	.41	.....	.....	.....	.87	1.61	1.51	.89	1.34	1.17	.68
27	.45	.57	.....	.....	.....	.97	1.55	1.48	.88	1.09	1.10	.66
28	.51	.59	.....	.....	.....	1.06	1.53	1.47	.87	1.10	1.05	.65
29	.55	.61	.....	.....	.....	1.06	1.59	1.41	.95	1.12	1.02	.65
30	.57	.63	.....	.....	.....	1.02	2.72	1.42	1.01	1.11	1.01	.65
31	.56	.....	.....	.....	.....	1.03	.....	1.41	.....	1.18	.97	.....

NOTE.—Discharge relation affected by ice Nov. 26 to Mar. 23.

Daily discharge, in second-feet, of Rayado River above Abreu's ranch, near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.5	5.4	.....	18	178	58	22	26	15
2	15	5.4	.....	20	150	42	23	23	15
3	16	5.6	.....	24	163	34	21	27	15
4	13	5.2	.....	24	186	28	18	34	13
5	12	3.1	.....	35	177	24	18	28	14
6	11	5.9	.....	40	162	22	19	26	13
7	10	5.6	.....	37	139	21	16	25	13
8	9.8	5.6	.....	27	132	20	14	39	13
9	10	5.4	.....	28	130	19	13	32	13
10	10	5.6	.....	26	126	19	13	43	13
11	11	5.4	.....	23	112	20	15	49	12
12	10	5.0	.....	26	107	23	16	50	14
13	11	5.4	.....	27	97	20	15	48	14
14	11	5.6	.....	40	94	19	12	43	13
15	11	5.9	.....	61	89	22	13	40	10
16	10	3.9	.....	56	102	23	19	36	9.5
17	9.8	2.8	.....	48	72	21	21	37	8.8
18	9.5	2.5	.....	42	68	21	24	40	8.5
19	8.5	2.4	.....	41	65	20	48	38	8.5
20	8.2	2.5	.....	45	60	20	36	37	8.2
21	7.3	2.5	.....	50	57	17	27	34	8.2
22	6.9	1.4	.....	51	55	17	21	34	8.2
23	6.3	1.0	.....	69	56	16	32	31	8.0
24	6.6	1.1	14	50	52	16	14	28	8.0
25	5.6	1.2	13	48	47	16	28	26	7.8
26	4.5	1.5	14	48	42	15	34	24	7.5
27	3.3	2.0	17	44	40	14	23	21	7.0
28	4.3	2.0	20	43	39	14	23	20	6.8
29	5.2	2.0	20	46	36	16	24	19	6.8
30	5.6	2.0	19	158	36	18	21	18	6.8
31	5.4	.....	19	.....	36	.....	27	17	.....

NOTE.—Discharge determined from two fairly well defined curves and by indirect method for shifting channels.

Monthly discharge of Rayado River aboev Abreu's ranch, near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	16	3.3	8.91	548	C.
November	5.9	1.0	3.70	220	C.
December	.....	.....	[a] 3.0	184	D.
January	.....	.....	[a] 5.0	307	D.
February	.....	.....	[a] 5.0	278	D.
March	.....	.....	[a] 10.0	615	D.
April	158	18	43.2	2,570	B.
May	186	36	93.7	5,760	B.
June	58	14	21.8	1,300	B.
July	48	12	21.7	1,330	B.
August	50	17	32.0	1,970	B.
September	15	6.8	10.6	631	B.
The year	186	.....	21.7	15,700	

[a] Monthly mean estimated on account of ice.

URRACA CREEK NEAR CIMARRON, N. MEX.

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

Drainage area.—6.3 square miles (private survey).

Records available.—November 25, 1912, to September 30, 1914.

Gage.—Water-stage recorder.

Discharge measurements.—Made by wading.

Channel.—September 21, 1914, a concrete artificial control was installed a few feet below gage box. Before contol was installed channel was shifting.

Winter flow.—Discharge relation affected by ice.

Diversions.—None above station.

Accuracy.—Estimates fair.

Discharge measurements of Urraca Creek near Cimarron, N. Mex., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	J. E. Powers	0.62	0.7	Aug. 8	J. E. Powers	0.70	5.2
Feb. 13	do	[a].70	[b].5	Sept. 15	Grover and Powers	.35	.8
Apr. 30	do	1.41	13.1	21	J. E. Powers	[c]1.30	1.2
June 13	Powers and Hank	.92	2.5				

[a] Discharge relation affected by ice.
[b] Estimated.
[c] Discharge relation affected by concrete control below gage.

Daily gage height, in feet, of Urraca Creek near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

[F. H. Brinkhaus, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.80	0.61	.....	.....	0.73	0.78	0.85	1.59	.....	0.40	0.90	0.42
2	.75	.61	.....	.....	.71	.78	.88	1.54	1.13	.44	.85	.42
3	.71	.60	0.70	.....	.70	.79	.90	1.50	1.13	.53	.85	.42
4	.70	.60	.70	.....	.70	.75	.90	1.45	1.10	.61	.80	.42
5	.70	.60	.71	.....	.70	.72	.92	1.40	1.08	.52	.....	.41
6	.....	.60	.71	.....	.71	.75	.....	1.40	1.07	.50	.....	.40
7	.....	.60	.....	0.62	.71	.78	.....	1.38	1.04	.50	.....	.38
8	.65	.60	.....	.68	.71	.75	.....	1.36	1.04	.47	.70	.36
9	.69	.60	.....	.70	.72	.75	.....	1.34	.98	.42	.69	.38
10	.69	.60	.64	.66	.72	.75	.84	1.32	.95	.40	.84	.40
11	.69	.60	.64	.62	.72	.80	.87	1.30	.95	.42	.98	.42
12	.68	.60	.64	.62	.72	.84	.91	1.30	.94	.44	.92	.41
13	.65	.60	.64	.65	.70	.86	.94	1.30	.92	.48	.86	.38
14	.62	.61	.64	.62	.70	.89	.92	1.28	.90	.47	.77	.35
15	.52	.62	.64	.63	.70	.93	.93	1.27	.91	.42	.70	.35
16	.62	.61	.64	.70	.70	.97	.95	1.26	.96	.40	.68	.....
17	.65	.60	.64	.70	.70	.99	.98	1.25	.62	.50	.....	.....
18	.67	.60	.64	.69	.70	.90	.99	1.24	.58	.48	.....	.....
19	.69	.60	.65	.68	.71	.95	1.00	1.23	.56	.57	.....	.....
20	.69	.62	.65	.76	.73	.98	1.00	1.22	.56	.62	.....	.....
21	.68	.65	.66	.75	.74	1.15	1.00	1.21	.55	.71	.....	1.30
22	.68	.67	.66	.70	.75	.....	.95	1.20	.50	.....	.....	1.30
23	.68	.67	.66	.72	.80	.....	.98	1.19	.45	.....	.....	1.30
24	.68	.66	.70	.73	.78	.....	1.00	1.18	.40	.....	.63	1.30
25	.68	.64	.74	.72	.75	.85	1.00	1.15	.40	1.20	.60	1.29
26	.68	.62	.75	.73	.80	.85	1.00	1.13	.35	1.25	.57	1.30
27	.....	.63	.75	.70	.82	.85	1.00	1.15	.35	1.19	.54	1.30
28	.60	.65	.71	.70	.79	.85	.98	1.15	.35	1.12	.51	1.30
29	.60	.67	.69	.70	.....	.85	1.45	1.15	.36	1.09	.48	1.29
30	.61	.66	.67	.71	.....	.85	1.64	1.15	.38	.97	.45	1.29
31	.61	.....	.65	.72	.....	.85	.....	.....	.....	.92	.42	.....

NOTE.—Discharge relation affected by ice Dec. 3 to Feb. 18 and by artificial control Sept. 21–30.

Daily discharge, in second-feet, of Urraca Creek near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.4	0.7	0.4	0.6	1.6	2.1	22	5.6	1.7	9.2	1.2
2	1.2	.7	.4	.5	1.6	2.3	20	5.4	2.0	8.0	1.2
3	1.0	.6	.4	.5	1.6	2.5	18	5.4	2.8	8.0	1.2
4	1.0	.6	.4	.5	1.4	2.5	15	4.9	3.6	6.7	1.2
5	1.0	.6	.3	.5	1.2	2.7	13	4.6	2.7	6.2	1.2
6	1.0	.6	.3	.5	1.4	2.6	13	4.5	2.5	5.8	1.1
7	.8	.6	.3	.5	1.6	2.5	12	4.1	2.5	5.4	1.0
8	.8	.6	.5	.5	1.4	2.4	11	4.1	2.3	4.9	.9
9	1.0	.6	.5	.5	1.4	2.2	11	3.3	1.9	4.8	1.0
10	1.0	.6	.4	.5	1.4	2.0	9.9	3.0	1.7	7.7	1.1
11	1.0	.6	.3	.5	1.7	2.3	9.2	3.0	1.9	8.7	1.2
12	.9	.6	.3	.5	2.0	2.6	9.2	2.9	2.0	7.2	1.2
13	.8	.6	.4	.5	2.2	2.9	9.2	2.7	2.3	6.0	1.0
14	.7	.7	.3	.5	2.4	2.7	8.7	2.5	2.3	4.5	.9
15	.7	.7	.4	.5	2.8	2.8	8.4	2.6	1.9	3.5	.8
16	.7	.7	.5	.5	3.2	3.0	8.2	3.1	1.7	3.3	.8
17	.8	.6	.5	.8	3.4	3.3	8.0	3.8	2.5	3.2	.9
18	.9	.6	.5	1.0	2.5	3.4	7.7	3.3	2.3	3.1	.9
19	1.0	.6	.5	1.2	3.0	3.5	7.4	3.1	3.2	3.0	1.0
20	1.0	.7	.6	1.3	3.3	3.5	7.2	3.1	3.8	3.0	1.1
21	.9	.8	.6	1.4	5.8	3.5	7.0	3.0	5.1	2.9	1.2
22	.9	.9	.5	1.5	4.8	3.0	6.7	2.5	9.4	2.9	1.2
23	.9	.9	.5	1.7	3.9	3.3	6.5	2.1	14	2.8	1.2
24	.9	.8	.6	1.6	3.0	3.5	6.3	1.7	18	2.8	1.2
25	.9	.8	.5	1.5	2.1	3.5	5.8	1.7	22	2.5	1.2
26	.9	.7	.6	1.7	2.1	3.5	5.4	1.4	25	2.3	1.2
27	.8	.7	.5	1.9	2.1	3.5	5.8	1.4	22	2.0	1.2
28	.6	.8	.5	1.6	2.1	3.3	5.8	1.4	18	1.8	1.2
29	.6	.9	.5	.....	2.1	15	5.8	1.5	17	1.6	1.2
30	.7	.8	.5	.....	2.1	24	5.8	1.6	12	1.4	1.2
31	.7	.....	.5	.....	2.1	.....	5.6	.....	9.9	1.2	.....

NOTE.—Discharge determined from a poorly defined rating curve Feb. 19 to June 16; rest of year by indirect method for shifting channels except as follows: Jan. 1 to Feb. 18 estimated on account of ice. Discharge interpolated for days for which gage heights are not recorded.

Monthly discharge of Urraca Creek near Cimarron, N. Mex., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	1.4	0.6	0.89	55	D.
November	.9	.6	.69	41	D.
December	.....	.....	[a].60	37	D.
January	.6	.3	.45	28	D.
February	1.9	.5	.90	50	D.
March	5.8	1.2	2.36	145	C.
April	24	2.0	4.00	238	C.
May	22	5.4	9.50	584	C.
June	5.6	1.4	3.11	185	C.
July	25	1.7	7.10	437	C.
August	9.2	1.2	4.40	271	C.
September	1.2	.8	1.10	65	C.
The year	25	.....	2.95	2,140	

[a] Estimated on account of ice.

OCATE RIVER AT OCATE, N. MEX.

Location.—In the SW. ¼ sec. 1, T. 22 N., R. 18 E., just below confluence of the two main forks of the stream, one-fourth mile below town of Ocate and 3 miles above point of diversion of Lake Charette Irrigation Co.'s canal.
Drainage area.—Not measured.
Records available.—March 15 to August 17, 1914, when station was discontinued.
Gage.—Water-stage recorder.
Discharge measurements.—Made by wading or from cable.
Channel.—Shifting.
Winter flow.—Discharge relation severely affected by ice.
Diversions.—Small quantities of water diverted from both forks of stream.

Data inadequate for estimates of discharge.

Discharge measurements of Ocate River at Ocate, N. Mex., during the year ending Sept. 30, 1914.

[Made by J. E. Powers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 15	0.73	[a] 0.8	June 22	0.60	4.4
Apr. 24	.75	3.5	Aug. 5	.50	23.4

[a] Estimated.

Daily gage height, in feet, of Ocate River at Ocate, N. Mex., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	.....	1.02	0.85	0.94	0.38	16	0.84	.....	0.92	0.76	0.44	0.11
2	.....	.....	.95	.81	.84	.36	17	.87	.....	.89	.71	.39	.07
3	.....	.....	.93	.78	.84	.32	18	.82	.....	.90	.87	.69	.....
4	.....	.....	.89	.89	.84	.66	19	.83	.....	.90	1.00	.65	.....
5	.....	.....	.89	.89	.82	.50	20	.82	.....	.91	1.28	.79	.....
6	.....	.....	.92	.90	.84	.40	21	.83	.....	1.50	1.08	.78	.....
7	.....	.....	.99	.91	.88	.28	22	.88	.....	[a]1.97	.72	.79	.....
8	.....	.....	1.08	.84	.80	.28	23	.78	.....	1.80	.59	.80	.....
9	.....	.....	.93	.75	.76	.26	24	.79	0.76	1.49	.45	.81	.....
10	.....	.....	.92	.75	.77	.58	25	.76	.78	1.37	.37	.87	.....
11	.....	.....	.90	.74	.73	.35	26	.76	.78	1.09	.32	1.02	.....
12	.....	.....	.90	.84	.68	.24	27	.75	.76	1.05	.29	.70	.....
13	.....	.....	.97	.76	.63	.12	28	.....	.75	1.17	.26	.62	.....
14	.....	.....	1.00	.73	.59	.22	29	.....	.74	1.03	.28	.54	.....
15	0.80	.....	1.01	.74	.50	.22	30	.....	.78	.85	.44	.40	.....
							31	.....	.....	.81	.....	.42	.....

[a] Maximum stage recorded on May 22, 3.2 feet.

SWEETWATER CREEK NEAR COLMOR, N. MEX.

Location.—In the NE. ¼ sec. 10, T. 23 N., R. 20 E., 100 feet upstream from highway bridge on Springer-Ocate road, 8 miles west of Colmor and 15 miles southwest of Springer; about 5 miles below point of diversion of Lake Charette Irrigation Co.'s canal.

Drainage area.—Not measured.

Records available.—March 17 to September 30, 1914.

Gage.—Water-stage recorder.

Discharge measurements.—Made by wading or from highway bridge.

Channel.—Hard clay; probably permanent.

Diversions.—Several small diversions above station.

Accuracy.—Estimates poor.

Daily gage height, in feet, of Sweetwater Creek near Colmor, N. Mex., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.56	0.53	0.46	0.52	.....	0.28
2	.....	.56	.55	.47	[a]1.18	.....	.28
3	.....	.56	.54	.44	1.32	.....	.29
4	.....	.57	.53	.42	.91	0.40	.29
5	.....	.55	.52	.42	.71	.40	.29
6	.....	.56	.52	.41	.58	.38	.30
7	.....	.56	.52	.38	.73	.37	.30
8	.....	.57	.51	.35	.70	.35	.30
9	.....	.55	.51	.32	.61	.35	.30
10	.....	.54	.48	.....	.52	.39	.30
11	.....	.54	.48	.....	.49	.44	.31
12	.....	.54	.47	.....	.51	.44	.....
13	.....	.53	.48	.....	.48	.42	.....
14	.....	.53	.48	.....	.43	.37	.....
15	.....	.51	.49	.....	.37	.35	.....
16	.....	.50	.50	.....	.33	.31	.....
17	0.50	.51	.50	.....	.32	.28	.....
18	.55	.51	.51	.....	.31	.26	.....
19	.53	.50	.50	.....	.38	.27	.....
20	.57	.50	.52	.....	.50	.30	.....
21	.57	.49	.84	.....	.46	.30	.....
22	.55	.50	[a]1.22	.50	.42	.30	.....
23	.54	.50	1.02	.50	.57	.29	.....
24	.55	.50	.75	.46	.89	.28	.....
25	.56	.52	.64	.45	.93	.29	.....
26	.56	.53	.55	.42	.79	.29	.30
27	.56	.54	.51	.40	.71	.28	.30
28	.57	.55	.49	.38	.61	.28	.29
29	.58	.55	.47	.38	.54	.28	.29
30	.56	.53	.48	.42	.47	.29	.29
31	.56	.....	.48	.....	.....	.28	.....

[a] Maximum stage recorded: 3. 7 feet, May 22 and July 2.

NOTE.—Discharge estimated by J. E. Powers at less than 1 second-foot Mar. 19, Apr. 25, May 2, June 22, Aug. 4, and Sept. 26. Discharge believed to be less than 1 second-foot at all times except May 21–26, July 2–9, and July 23–29. Maximum mean daily discharge probably less than 15 second-feet.

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 a mile above mouth of Alamo draw, 9 miles west of Tucumcari, and 3 miles northeast of Hanley, the nearest post office.

Drainage area.—About 350 square miles.

Records available.—May 21, 1912, to December 5, 1913, when station was discontinued.

Gage.—Water-stage recorder; not related to gage installed above mouth of Vigil Creek August 30, 1911.

Discharge measurements.—Made by wading or from cable.

Channel.—Shifting.

Diversions.—Very little water diverted above station.

Cooperation.—Gage-height record furnished by Mr. V. W. Moore, Tucumcari, N. Mex.

No discharge measurements made; discharge not estimated.

Daily gage height, in feet, of Pajarito Creek below Vigil Creek, near Hanley, N. Mex., for the year ending Sept. 30, 1914.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		[a]4.52	11			21	3.29	
2		4.46	12			22	3.22	
3		3.82	13			23	3.15	
4		3.52	14			24	3.15	
5		3.59	15			25	3.15	
6			16			26	3.14	
7			17			27	3.12	
8			18	3.09		28	3.12	
9			19	3.39		29	3.15	
10			20	3.32		30	3.31	
						31		

[a] Maximum stage recorded: 6.2 feet, Dec. 1.

NOTE.—No flow in creek on days for which gage heights are not recorded from Oct. 1 to Dec. 5.

UTE CREEK NEAR LOGAN, N. MEX.

Location.—In the northeast corner of T. 13 N., R. 32 E., 4 miles above the mouth; no important tributaries enter within several miles of station.

Drainage area.—Not measured.

Records available.—August 12, 1904, to June 30, 1906; April 13, 1909, to May 23, 1914, when station was discontinued.

Gage.—Water-stage recorder installed August 1, 1911, to replace original staff gage used since 1904 and washed out by a severe flood May 1, 1914; records May 1 to 23, 1914, were secured by a reference point. Datum of recording gage different from that of staff gage.

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.

Channel.—Shifting.

Winter flow.—Discharge relation little affected by ice.

Diversions.—A small quantity of water is diverted for irrigation above station.

No estimates of discharge made.

Daily gage height, in feet, of Ute Creek near Logan, N. Mex., for the year ending Sept. 30, 1914.

[Samuel Rufi, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	.....	.....	0.94	1.20	1.15	0.95	.....	[a]15.00
2	1.46	.....	.94	1.20	1.15	.95	.....	8.00
3	1.25	.....	.96	1.15	1.00	.90	.....	4.00
4	.....	.....	1.55	1.15	.95	.....	.....	3.00
5	.....	.....	2.02	1.60	.95	.....	.....	1.50
6	.....	.....	1.71	1.65	.95	.....	.....	1.25
7	.....	.....	1.54	1.65	.95	.....	.....	1.00
8	.....	.....	1.41	1.60	.90	.....	.....	.90
9	.....	.....	1.35	1.55	.90	.....	.....	.85
10	.....	.....	1.31	1.45	.90	.....	.....	.80
11	.....	0.91	1.29	1.35	.90	.....	.....	.80
12	.....	.91	1.23	1.30	.90	.....	.....	.75
13	.....	.91	1.21	1.45	.90	.....	.....	.75
14	.....	.93	1.21	1.45	.90	.....	.....	.75
15	.....	.94	1.21	1.45	.90	.....	.....	.75
16	.....	.89	1.21	1.15	.95	.....	.....	.95
17	.....	.89	1.20	1.50	1.00	.....	.....	1.00
18	.....	.95	1.20	1.70	1.00	.....	.....	3.00
19	.....	.95	1.20	1.80	1.00	.....	.....	4.00
20	.....	.95	1.20	1.55	1.00	.....	.....	4.50
21	.....	.95	1.20	1.50	1.00	.....	.....	1.50
22	.....	.95	1.20	1.45	1.00	.....	.....	1.25
23	.....	.95	1.20	1.45	1.00	.....	.....	1.00
24	.....	.95	1.20	1.40	.95	.....	.....	.....
25	.....	.95	1.20	1.30	.95	.....	.....	.....
26	.....	.95	1.20	1.30	.95	.....	.....	.....
27	.....	.95	1.20	1.20	1.00	.....	.....	.....
28	.....	.95	1.20	1.15	.95	.....	.....	.....
29	.....	.95	1.20	1.15	.....	.....	.....	.....
30	.....	.95	1.20	1.15	.....	.....	5.0	.....
31	.....	.....	1.20	1.15	.....	.....	.....	.....

[a] Maximum stage recorded: 22.95 feet, May 1.

NOTE.—Stream dry on days for which gage heights are not recorded Oct. 1 to May 23.
An estimate was made by C. J. Emerson as follows: Jan. 10, 1914, gage height, 1.30 feet; discharge, 5 second-feet.

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 station.

Drainage area.—Approximately 110 square miles.

Records available.—November 26, 1912, to September 30, 1914.

Gage.—Vertical staff; read morning and evening on and after February 18, 1914.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed of stream composed largely of ledge rock covered with some silt and gravel. Channel forms a pool one-third mile long; control is a rock ledge.

Extremes of discharge.—Maximum stage recorded during year: 6.5 feet during afternoon of August 25; discharge, 2,300 second-feet. Minimum stage recorded: 0.70 foot, March 25–27, June 26, 28–30; discharge, 0.2 second-foot.

Maximum stage recorded 1912–1914: 6.5 feet, August 28, 1914; discharge, 2,300 second-feet. Minimum stage recorded: 0.70 foot, March 25–27, June 26, 28–30, 1914; discharge, 0.2 second-foot.

Winter flow.—Discharge relation little, if any, affected by ice.

Regulation.—Flow regulated to a great extent by reservoir of Lawton waterworks a mile upstream; area of reservoir, 1,100 acres.

Natural flow.—The natural flow by months for 1913 and 1914 is shown in a table of corrected monthly discharge. This flow includes the measured discharge at the station, the gain or loss by storage and evaporation at the reservoir, and the amount diverted by the Lawton waterworks.

Accuracy.—Conditions favorable for accurate results; estimates reliable except for periods of low water, when water at times flows over the dam for a few hours. Since February, 1914, gage has been read twice a day and accuracy of records increased.

Discharge measurements of Medicine Bluff Creek near Lawton, Okla., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 5	F. B. King	4.55	773	May 3	F. B. King	3.60	329
Mar. 4	Follansbee and King	1.08	8.9				

Daily gage height, in feet, of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

[W. S. Kesler, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.98	0.82	3.05	2.00	0.80	0.80	0.89	1.90	3.00	0.73	1.22	1.02
2	.92	.82	4.65	2.35	.88	.78	.86	4.00	2.70	.72	1.22	.92
3	.90	.82	4.85	1.70	2.08	1.52	1.28	3.50	2.60	.86	1.22	.88
4	2.10	4.25	4.85	1.80	.82	1.04	.91	4.05	2.35	1.42	1.22	.86
5	1.30	4.95	5.55	1.62	.80	.85	.86	3.20	2.07	1.42	1.22	.86
6	1.18	3.65	3.85	1.65	2.60	.86	.85	2.55	1.94	1.40	1.22	.84
7	1.08	3.35	3.05	1.68	.82	.91	1.95	2.35	1.82	1.40	1.22	.83
8	1.00	2.60	2.75	1.68	.80	.76	1.50	1.96	1.71	1.71	1.22	.82
9	1.35	2.25	2.65	1.75	.80	.75	.79	1.86	1.63	2.02	1.22	.79
10	1.12	2.15	2.50	1.85	.80	1.72	.78	1.78	1 54	2.02	1.24	.78
11	1.05	2.05	2.40	1.10	.80	1.65	1.29	1.62	1.47	2.02	1.24	.76
12	1.02	1.90	2.30	1.35	2.05	.79	.78	2.55	1.37	2.02	1.32	.76
13	.98	1.85	2.80	1.50	1.08	.78	.78	1.78	1.26	1.57	1.32	.76
14	.95	1.82	2.60	1.50	1.05	.75	.78	.90	1.08	1.52	1.32	.76
15	.92	1.75	2.45	1.52	.80	.72	.76	.84	1.01	1.50	1.32	.74
16	2.25	1.55	2.45	1.55	.80	.72	.75	1.27	1.67	1.20	1.34	.74
17	1.55	1.55	2.60	1.48	.80	.92	.75	3.00	1.37	1.12	1.34	.74
18	1.32	1.52	2.65	1.52	.80	.74	.98	3.65	.92	1.12	1.34	.74
19	2.30	1.52	2.55	1.42	1.05	2.28	.80	3.00	.82	1.12	1.34	.74
20	1.08	1.50	2.75	2.20	.85	.76	.75	2.90	.81	1.12	1.34	1.04
21	1.12	1.45	1.95	.98	.90	.88	.75	2.65	.78	1.12	1.34	.80
22	2.40	2.15	2.05	1.05	1.20	.74	.75	2.45	.77	1.12	1.34	.79
23	1.02	1.75	2.25	1.98	1.90	.72	.78	2.30	.74	1.12	1.06	2.05
24	1.00	1.10	2.75	1.08	1.00	.72	.78	2.08	.72	1.22	.79	1.04
25	1.00	.98	2.35	2.00	.80	.70	.78	1.96	.71	1.22	2.04	1.04
26	2.10	1.15	1.85	.85	.78	.70	.78	2.46	.70	1.22	1.44	.94
27	1.10	1.25	2.25	.95	.85	.70	1.70	3.55	.70	1.22	1.14	.93
28	3.20	1.40	1.95	1.22	.80	.99	2.45	3.50	.70	1.22	1.34	.92
29	.88	1.85	1.95	3.25	.....	.96	2.25	2.90	.70	1.22	.99	.92
30	.82	2.95	2.00	.85	.....	.94	2.04	3.40	.70	1.22	1.60	.92
31	.82	.....	2.25	1.75	.....	.91	.....	3.40	.....	1.22	1.19	.....

Daily discharge, in second-feet, of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.7	0.9	194	56	0.7	0.7	1.4	48	184	0.4	9	3.4
2	1.8	.9	830	90	1.3	.6	1.2	500	135	.3	9	1.8
3	1.5	.9	950	34	63	23	11	310	121	1.2	9	1.3
4	65	615	950	41	.9	3.8	1.6	522	90	18	9	1.2
5	12	1,010	1,390	29	.7	1.1	1.2	228	62	18	9	1.2
6	7	358	435	31	121	1.2	1.1	114	51	17	9	1.0
7	5	266	194	33	.9	1.6	52	90	42	17	9	.9
8	3	121	142	33	.7	.5	22	53	35	35	9	.9
9	14	80	128	38	.7	.4	.6	45	30	58	9	.6
10	6	70	108	44	.7	35	.6	40	24	58	10	.6
11	4	60	96	5	.7	31	12	29	20	58	10	.5
12	3	48	85	14	60	.6	.6	114	16	58	13	.5
13	2.7	44	150	22	4.6	.6	.6	40	10	26	13	.5
14	2.2	42	121	22	4	.4	.6	1.5	5	23	13	.5
15	1.8	38	102	23	.7	.3	.5	1.0	3	22	13	.4
16	80	25	102	25	.7	.3	.4	11	32	8	14	.4
17	25	25	121	21	.7	1.8	.4	184	16	6	14	.4
18	13	23	128	23	.7	.4	2.7	358	1.8	6	14	.4
19	85	23	114	18	4	83	.7	184	.9	6	14	.4
20	5	22	142	75	1.1	.5	.4	166	.8	6	14	3.8
21	6	20	52	2.7	1.5	1.3	.4	128	.6	6	14	.7
22	96	70	60	4	8	.4	.4	102	.6	6	14	.6
23	3	38	80	54	48	.3	.6	85	.4	6	4	60
24	3	5	142	5	3	.3	.6	63	.3	9	.6	3.8
25	3	2.7	90	56	.7	.2	.6	53	.2	9	60	3.8
26	65	6.5	44	1.1	.6	.2	.6	103	.2	9	19	2.1
27	5	10	80	2.2	1.1	.2	34	325	.2	9	6	2.0
28	228	17	52	9	.7	2.8	102	310	.2	9	14	1.8
29	1.3	44	52	240	.....	2.4	80	166	.2	9	2.8	1.8
30	.9	175	56	1.1	.....	2.1	60	280	.2	9	28	1.8
31	.9	.....	80	38	.....	1.6	.....	280	.....	9	8	.....

NOTE.—Discharge determined from a curve well defined below 1,000 second-feet.

Monthly discharge of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	228	0.9	24.2	1,490	C.
November	1,010	.9	109	6,490	B.
December	1,390	52	235	14,400	B.
January	240	1.1	35.2	2,160	C.
February	121	.6	11.8	655	C.
March	83	.2	6.41	394	C.
April	102	.4	13.0	774	C.
May	522	1.0	159	9,780	B.
June	184	.2	29.4	1,750	B.
July	58	.3	17.2	1,060	B.
August	60	.6	12.7	781	C.
September	60	.4	3.30	196	D.
The year	1,390	.2	55.2	39,900	

Corrected monthly discharge of Medicine Bluff Creek near Lawton, Okla., for the years ending Sept. 30, 1913 and 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1913.				
January	8.1	3.5	5.12	315
February	7.1	3.1	5.34	297
March	37	4.4	9.70	596
April	127	6.6	26.9	1,600
May	103	3.0	18.9	1,160
June	32	.0	6.49	386
July	451	.7	26.8	1,650
August	5.0	1.0	2.04	125
September	240	3.0	34.5	2,050
The period				8,180
1914.				
October	153	10	46.7	2,870
November	1,200	5	123	7,320
December	1,500	47	235	14,400
January	200	6.7	34.6	2,130
February	72	4.8	13.9	772
March	94	5.0	15.2	935
April	283	5.9	30.1	1,790
May	802	25	172	10,600
June	164	10	34.4	2,050
July	8	.0	1.79	110
August	263	.4	23.0	1,410
September	38	1.0	6.33	377
The year	1,500	.0	61.9	44,800

NOTE.—Record corrected for storage, evaporation, and the diversion to Lawton

LITTLE MEDICINE BLUFF CREEK NEAR LAWTON, OKLA.

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

Drainage area.—Approximately 10 square miles.

Records available.—November 26, 1912, to September 30, 1914.

Gage.—Vertical staff; read once daily.

Discharge measurements.—Made by wading.

Control.—Rock ledge; should be permanent; between the station and the crest of the small dam on Medicine Bluff Creek, just below the mouth of Little Medicine Bluff Creek, there is a fall of about 8 feet.

Extremes of discharge.—Maximum stage recorded during year: 6.5 feet, afternoon of August 25; discharge, 1,800 second-feet, approximately (determined from slope measurements). Creek dry from July 12 to August 11, inclusive.

Maximum recorded stage 1912–1914: 6.5 feet; discharge, 1,800 second-feet, approximately, August 25, 1914. Creek dry July 12 to August 11, 1914, inclusive.

Winter flow.—Discharge relation little, if any, affected by ice.

Maximum discharge.—Maximum stage since establishment of station: 6.5 feet, as determined from high-water marks August 25, 1914; approximate discharge derived from slope measurements, 1,800 second-feet.

The following discharge measurement was made by F. B. King:

December 2, 1913: Gage height, 1.75 feet; discharge, 180 second-feet.

Daily gage height, in feet, of Little Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

[W. S. Kesler, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.28	0.20	0.85	0.42	0.20	0.20	0.35	0.40	0.60	0.08	.....	0.48
2	.25	.20	1.80	.40	.20	.20	.35	2.60	.55	.10	.....	.40
3	.22	.20	1.00	.38	.20	.20	.35	.80	.50	.10	.....	.35
4	1.00	1.90	1.20	.38	.20	.20	.35	.78	.45	.08	.....	.30
5	.52	1.00	1.00	.35	.20	.20	.35	.60	.40	.08	.....	.28
6	.48	.75	.80	.35	.20	.20	.32	.48	.35	.08	.....	.25
7	.42	.65	.70	.35	.20	.20	.32	.45	.30	.05	.....	.22
8	.38	.58	.65	.32	.20	.20	.30	.42	.28	.05	.....	.20
9	.52	.50	.58	.32	.20	.20	.30	.40	.25	.05	0.00	.18
10	.45	.45	.55	.32	.20	.20	.28	.38	.22	.05	.02	.15
11	.40	.42	.50	.30	.20	.20	.28	.35	.20	.05	.02	.12
12	.35	.40	.48	.30	.20	.20	.28	.32	.20	.02	.30	.10
13	.32	.38	.90	.30	.20	.20	.25	.30	.18	.02	.20	.12
14	.30	.35	.70	.28	.20	.20	.25	.28	.18	.02	.15	.12
15	.28	.35	.60	.28	.20	.18	.25	.28	.15	.00	.12	.12
16	.55	.32	.55	.28	.20	.18	.22	.32	.15	.....	.10	.12
17	.45	.32	.72	.28	.20	.18	.22	1.50	.15	.....	.10	.12
18	.42	.32	.65	.25	.20	.18	.22	.70	.12	.....	.10	.12
19	.38	.30	.60	.25	.20	.20	.22	.60	.12	.....	.08	.10
20	.35	.30	.55	.25	.20	.20	.22	.65	.12	.....	.08	.45
21	.32	.30	.52	.25	.20	.20	.20	.60	.12	.....	.05	.20
22	.30	.28	.52	.25	.20	.20	.20	.52	.10	.....	.05	.18
23	.28	.28	.55	.22	.20	.20	.22	.48	.10	.....	.05	.18
24	.28	.28	.55	.22	.20	.18	.28	.42	.10	.....	.08	.15
25	.25	.30	.52	.22	.20	.18	.28	.38	.10	.....	1.20	.15
26	.25	.32	.52	.22	.20	.18	.28	1.40	.10	.....	.70	.15
27	.25	.32	.50	.22	.20	.18	.80	1.00	.08	.....	.50	.12
28	.22	.32	.48	.20	.20	.40	.60	.68	.08	.....	.60	.12
29	.22	.60	.48	.20	.....	.38	.50	.62	.08	.....	.58	.12
30	.20	.80	.45	.20	.....	.38	.45	1.10	.08	.....	.72	.12
31	.20	.....	.45	.20	.....	.35	.....	.65	.....	.....	.55	.....

NOTE.—No flow July 16 to Aug. 8. Maximum stage on Aug. 25, 1914, 6.5 feet.

Daily discharge, in second-feet, of Little Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.1	0.4	28	3.5	0.4	0.4	2.2	3.0	9	0.1	0.0	5.0
2	.8	.4	189	3	.4	.4	2.2	365	7.2	.1	.0	3.0
3	.6	.4	45	2.7	.4	.4	2.2	23	5.5	.1	.0	2.2
4	45	211	75	2.7	.4	.4	2.2	21	4.2	.1	.0	1.3
5	6.2	45	45	2.2	.4	.4	2.2	9	3.0	.1	.0	1.1
6	5	19	23	2.2	.4	.4	1.6	5	2.2	.1	.0	.8
7	3.5	12	15	2.2	.4	.4	1.6	4.2	1.3	.1	.0	.6
8	2.7	8.3	12	1.6	.4	.4	1.3	3.5	1.1	.1	.0	.4
9	6.2	5.5	8.3	1.6	.4	.4	1.3	3.0	.8	.1	.0	.3
10	4.2	4.2	7.2	1.6	.4	.4	1.1	2.7	.6	.1	.0	.2
11	3.0	3.5	5.5	1.3	.4	.4	1.1	2.2	.4	.1	.0	.2
12	2.2	3.0	5.0	1.3	.4	.4	1.1	1.6	.4	.0	1.3	.1
13	1.6	2.7	33	1.3	.4	.4	.8	1.3	.3	.0	.4	.2
14	1.3	2.2	15	1.1	.4	.4	.8	1.1	.3	.0	.2	.2
15	1.1	2.2	9	1.1	.4	.3	.8	1.1	.2	.0	.2	.2
16	7.3	1.6	7.2	1.1	.4	.3	.6	1.6	.2	.0	.1	.2
17	4.2	1.6	17	1.1	.4	.3	.6	129	.2	.0	.1	.2
18	3.5	1.6	12	.8	.4	.3	.6	15	.2	.0	.1	.2
19	2.7	1.3	9	.8	.4	.4	.6	9	.2	.0	.1	.1
20	2.2	1.3	7.2	.8	.4	.4	.6	12	.2	.0	.1	4.2
21	1.6	1.3	6.2	.8	.4	.4	.4	9	.2	.0	.1	.4
22	1.3	1.1	6.2	.8	.4	.4	.4	6.2	.1	.0	.1	.3
23	1.1	1.1	7.2	.6	.4	.4	.4	5	.1	.0	.1	.3
24	1.1	1.1	7.2	.6	.4	.3	1.1	3.5	.1	.0	.1	.2
25	.8	1.3	6.2	.6	.4	.3	1.1	2.7	.1	.0	75	.2
26	.8	1.6	6.2	.6	.4	.3	1.1	109	.1	.0	15	.2
27	.8	1.6	5.5	.6	.4	.3	23	45	.1	.0	5.5	.2
28	.6	1.6	5.0	.4	.4	3.0	9	14	.1	.0	9	.2
29	.6	9	5.0	.4	.....	2.7	5.5	10	.1	.0	8.9	.2
30	.4	23	4.2	.4	.....	2.7	4.2	59	.1	.0	17	.2
31	.4	.....	4.2	.4	.....	2.2	.....	12	.....	.0	7.2	.....

NOTE.—Discharge determined from a well-defined curve.

Monthly discharge of Little Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	45	0.4	3.67	226	B.
November	211	.4	12.3	732	C.
December	189	4.2	20.3	1,250	C.
January	3.5	.4	1.30	79.9	B.
February	.4	.4	.40	22.2	D.
March	3.0	.3	.66	40.6	D.
April	23	.4	2.39	142	C.
May	365	1.1	28.7	1,760	B.
June	7.2	.1	1.29	76.8	C.
July	.1	.0	.04	2.5	
August	75	.0	4.54	279	B.
September	5	.1	.77	46.0	D.
The year	365	.0	6.44	4,660	

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, 1913, to September 30, 1914.

Equipment for measurement.—A galvanized iron pan 3 feet square and 18 inches deep floats 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. Observations are made once daily and represent total evaporation and not excess over rainfall. Rainfall measured by rain gage on the raft.

Daily evaporation, in inches, at Lawton reservoir near Lawton, Okla., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.12	0.06	0.00	.03	0.10	0.11	0.08	0.18	0.10	0.31	0.34	0.22
2	.08	.07	.01	.05	.09	.08	.12	.05	.10	.32	.22	.20
3	.04	.05	.00	.07	.10	.....	a.12	.12	.16	.20	.23	.21
4	.05	.00	.00	.04	.11	b.18	.12	.07	.19	.28	.27	.24
5	.10	.02	.02	.04	.05	.15	.10	.18	.21	.30	.29	.30
6	.07	.02	.02	.03	.08	.12	.13	.15	.20	.32	.30	.33
7	.06	.06	a.10	.05	.04	.15	.15	.18	.21	.29	.32	.24
8	.05	.11	.06	.04	.05	.14	a.12	.19	.22	.30	.35	.23
9	a.15	.13	.08	.06	.07	.16	.09	.21	.23	.29	.37	.24
10	.11	.09	.06	.07	.07	.15	.21	.24	.22	.31	.19	.25
11	a.15	.08	.05	.05	.04	.18	.21	.26	.19	.34	.20	.29
12	.15	.07	.08	.06	.07	.12	.14	.22	.23	.33	.12	.35
13	.17	.09	.03	.05	.06	.16	.11	.24	.25	.32	.20	.25
14	.24	.05	.05	.05	.06	.15	.10	.26	.25	.38	.23	.25
15	.13	.01	.07	.04	.08	.19	.12	.00	.24	.42	.22	.18
16	.25	.03	.02	.08	.07	.16	.25	.37	.26	.45	.21	.20
17	.23	.02	.03	.06	.08	.15	.20	.07	.28	.42	.23	.18
18	.17	.04	.06	.03	a.06	.18	.18	.08	.25	.38	.24	.21
19	.23	.04	.03	.07	.02	a.16	.23	.10	.27	.35	.27	.20
20	.18	.02	.06	a.08	.03	.10	.21	.06	.30	.37	.30	.12
21	.17	.01	.04	.08	.03	.15	.30	.04	.26	.39	.31	.25
22	.12	.10	.05	.10	.10	.18	.00	.07	.29	.42	.29	.26
23	.06	.06	.02	.13	.07	.11	.24	.11	.30	.40	.30	.28
24	.10	.00	.04	.12	.10	.15	.05	.13	.31	.37	.25	.30
25	.15	.00	.03	.11	.06	.11	.05	.15	.35	.35	.15	.14
26	.26	.01	.02	.09	.07	.14	.11	.07	.38	.34	.22	.16
27	.17	.00	.04	.06	.06	.08	.06	.03	.36	.35	.25	.27
28	a.20	.00	.06	.04	.06	.16	.11	.12	.40	.38	.18	.22
29	.09	.00	.03	a.05	.....	.10	.13	.15	.42	.37	.15	.19
30	.08	.00	.04	a.05	.....	.09	.17	.13	.41	.39	a.15	.20
31	.11	.....	.05	.06	.....	.07	.....	.08	.....	.35	.21	.....

a Estimated; record spoiled by wind.

b Total for Mar. 3 and 4.

Monthly evaporation, in inches, at Lawton reservoir near Lawton, Okla., for the year ending Sept. 30, 1914.

October	4.24	May	4.31
November	1.24	June	7.84
December	1.25	July	10.79
January	1.94	August	7.56
Februsry	1.88	September	6.96
March	4.13		
April	4.21	The year	56.35

MISCELLANEOUS MEASUREMENTS.

Miscellaneous measurements in Arkansas River drainage basin during the year ending Sept. 30, 1914.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec. ft.*
Oct. 15	Cimarron River	Canadian River	Cimarron, N. Mex.		17.0
Nov. 14	do	do	do		16.2
Feb. 12	do	do	do		19.7
May 23	do	do	do		31.4
June 11	do	do	do		29.6
Aug. 7	do	do	do		46.8
Sept. 15	do	do	do		12.7
12	Mora River	do	Near Wagon Mound, N. Mex.		45.8

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

1885–1914

PART VII.—LOWER MISSISSIPPI RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES, 1885-1914.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, and annual reports.

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

Part I. North Atlantic basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific basins in California.
XII. North Pacific basins (in three parts).

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

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

1. Copies may be 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.

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

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

Boston, Mass., Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., Federal Building.
Sante Fe, N. Mex., Capitol Building.
Honolulu, Hawaii, Kapiolani Building.

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

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,400 points in the United States, and the data obtained have been published in the reports tabulated below:

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

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

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	....do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 to 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.

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

Report.	Character of data.	Year.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394 [a]	do	1914.

[a] In preparation.

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

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1913. The data for any particular station will, in general, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1913, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, and 381, which contain records for the New England streams from 1903 to 1914. Results of miscellaneous measurements are published by drainage basins.

Number of water-supply papers containing results of stream measurements, 1899–1914.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope (St. John River to York River).	South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	Ohio River.	St. Lawrence River and Great Lakes.	Hudson Bay and upper Mississippi River.	Missouri River.	Lower Mississippi River.	Western Gulf of Mexico.	Colorado River.	Great Basin.	Pacific slope in California.	Pacific slope in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope in Oregon.
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 78	66, 75
1902	82	[b] 82, 83	83	[b] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[h] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [t] 177	176, [r] 177	177	178	178	[j] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Estimates for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific coast basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Estimates for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

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

PART VII. LOWER MISSISSIPPI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams flowing to the Mississippi below the mouth of the Missouri on the west and the Ohio on the east, are Meramec, White, Arkansas (whose chief tributaries are Huerfano, Purgatory, Cimarron, Verdigris, Neosho, Canadian, and Mora rivers), Yazoo, Homochitto, and Red rivers. The streams drain wholly or in part the States of Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. xx.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1914; period after a date indicates discontinuance.

MERAMEC RIVER BASIN.

Meramec River near Meramec, Mo., 1903–1906.
Meramec River near Eureka, Mo., 1903–1906.
Meramec River (Station No. 1) at Fenton, Mo., 1903.
Meramec River (Station No. 2) below Fenton, Mo., 1903.
  Dry Fork of Meramec River near St. James, Mo., 1903.
  Spring Branch:
    Meramec Spring near Meramec, Mo., 1903–1906.
  Courtois Creek at Scotia, Mo., 1905–1906.

WHITE RIVER BASIN.

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

ARKANSAS RIVER BASIN.

Arkansas River, East Fork (head of Arkansas River), near Leadville, Colo., 1890; 1911–
Arkansas River at Granite, Colo., 1897–1899; 1910–
Arkansas River at Salida, Colo., 1895–1903; 1909–

Arkansas River at Canon City, Colo., 1888–1913.
Arkansas River near Rock Canyon, Colo., 1889.
Arkansas River at Pueblo, Colo., 1885–1889; 1894–
Arkansas River near Nepesta, Colo., 1897–1903; 1909–1913.
Arkansas River near Manzanola, Colo., 1898.
Arkansas River near Rocky Ford, Colo., 1897–1903.
Arkansas River at La Junta, Colo., 1889; 1894–1895; 1901; 1903; 1908; 1912–13.
Arkansas River at Las Animas, Colo., 1898; 1909.
Arkansas River at New Fort Lyons, Colo., 1911.
Arkansas River near Prowers, Colo., 1903.
Arkansas River at Prowers, Colo., 1900–1901.
Arkansas River near Amity canal head gates, Colo., 1898–99; 1901.
Arkansas River near Lamar, Colo., 1913.
Arkansas River near Granada, Colo., 1898–1901; 1903.
Arkansas River near Holly (Barton or Byron), Colo., 1894; 1901–2; 1907–1913.
Arkansas River near Coolidge, Kans., 1903.
Arkansas River near Syracuse, Kans., 1902–1906.
Arkansas River at Dodge, Kans., 1903–1906.
Arkansas River near Hutchinson, Kans., 1895–1905.
Arkansas River at Arkansas City, Kans., 1902–1906.
Tennessee Fork near Leadville, Colo., 1890; 1903; 1911–
Lake Fork of Arkansas River near Arkansas Junction, Colo., 1890; 1903.
Half Moon Creek near Leadville, Colo., 1911–
Lake Creek near Twin Lakes, Colo., 1899–1900.
Twin Lakes outlet near Twin Lakes, Colo., 1910.
Clear Creek near Granite, Colo., 1890; 1910.
Cottonwood Creek near Buena Vista, Colo., 1890.
Cottonwood Creek at Hot Springs tunnel, near Buena Vista, Colo., 1910–11.
Cottonwood Creek below Hot Springs, near Buena Vista, Colo., 1911–
South Fork of Cottonwood Creek near Buena Vista, Colo., 1890.
North Cottonwood Creek near Buena Vista, Colo., 1911–1914.
Chalk Creek (upper station) near St. Elmo, Colo., 1913–
Chalk Creek near St. Elmo, Colo., 1911–
Chalk Creek near Buena Vista, Colo., 1910.
South Fork of Arkansas River at Poncha, Colo., 1911–
Poncha Creek at Poncha, Colo., 1911–
Grape Creek near Canon City, Colo., 1907–1909.
Oil or Fourmile Creek near Canon City, Colo., 1910.
West Beaver Creek (head of Beaver Creek), near Victor, Colo., 1905–
Huerfano River at Badito, Colo., 1912.
Huerfano River near Undercliffe, Colo., 1908.
Cucharas River at Walsenburg, Colo., 1907–8.
Purgatory (Las Animas) River at Trinidad, Colo., 1896–1899; 1905–1912.
Purgatory River near canyon entrance (Alfalfa), Colo., 1905–1907.
Purgatory River at J. J. ranch near La Junta, Colo., 1898.
Purgatory River near Las Animas, Colo., 1889 and 1909.
Big Sandy Creek at Hugo, Colo., 1910–1912.
Big Sandy Creek near Kit Carson, Colo., 1910–1912.
Big Spring Creek near Arena, Colo., 1910–1912.
Walnut River near Arkansas City, Kans., 1902–3.
Salt Fork of Arkansas River near Alva, Okla., 1904–5.
Salt Fork of Arkansas River near Tonkawa, Okla., 1903–1905.
Medicine Lodge River near Kiowa, Kans., 1895–96.
Cimarron River near Arkalon, Kans., 1895–96; 1903–1905.

Arkansas River tributaries—Continued.
Cimarron River near Kenton, Okla., 1904–5.
Cimarron River near Garrett, Okla., 1905–1907.
Cimarron River near Waynoka, Okla., 1903–1905.
Verdigris River near Independence, Kans., 1904.
Verdigris River near Liberty, Kans., 1895–1903.
Verdigris River near Catoosa, Okla., 1903–1905.
Fall River at Fall River, Kans., 1904–5.
Neosho River near Neosho Rapids, Kans., 1904.
Neosho River near Iola, Kans., 1895–1903.
Neosho River near Humboldt, Kans., 1904.
Neosho River (or Grand River) near Fort Gibson, Okla., 1899; 1903–1905.
Canadian River near Sanchez, N. Mex., 1912–
Canadian River at Logan, N. Mex., 1904–5; 1908–1914.
Canadian River at Calvin, Okla., 1905–1908.
Chicorica Creek near Raton, N. Mex., 1910–
Una del Gato Creek near Raton, N. Mex., 1910–1913.
Cimarron River at Ute Park, N. Mex., 1907–
Cimarron River at Springer, N. Mex., 1907–1909.
Rayado River near Cimarron, N. Mex., 1911; 1913; 1914.
Rayado River above Abreu's ranch, near Cimarron, N. Mex., 1911–
Rayado River at Abreu's ranch; near Cimarron, N. Mex., 1908–9.
Rayado River below Abreu's ranch, near Cimarron, N. Mex., 1912–13.
Rayado River near Springer, N. Mex., 1907–1909.
Urraca Creek near Cimmaron, N. Mex., 1912–
Ocate River at Ocate, N. Mex., 1914.
Sweetwater Creek near Colmar, N. Mex., 1914–
Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1911.
Mora River near Weber, N. Mex., 1903–4.
Mora River near Watrous, N. Mex., 1894–1896.
Sapello River at Sapello, N. Mex., 1903–4.
Sapello Mill tailrace at Sapello, N. Mex., 1903–4.
Sapello River at Los Alamos, N. Mex., 1903–1911.
Manuelitos River near Sapello, N. Mex., 1903–4.
Pajarito Creek near Hanley, N. Mex., 1911–1913.
Pajarito Creek below Vigil Creek near Hanley, N. Mex. 1912–13.
Ute Creek near Logan, N. Mex., 1904–1906; 1909–1914.
Beaver Creek (head of North Fork of Canadian River) at Beaver, Okla., 1904–5.
North Fork of Canadian River near Woodward, Okla., 1903–1906.
North Fork of Canadian River near El Reno, Okla., 1902–1908.
North Fork of Canadian River near Oklahoma, Okla., 1899.
North Fork of Canadian River near Eufaula, Okla., 1899.

ARKANSAS RIVER CANALS.

Oxford Farmers canal near Nepesta, Colo., 1902–3.
Colorado-Kansas canal near Prowers, Colo., 1903.
Keese ditch near Prowers, Colo., 1903.

YAZOO RIVER BASIN.

Tallahatchie River (head of Yazoo River) at Batesville, Miss. 1906–1912.
Tallahatchie River at Phillip, Miss., 1908–1913.
Yazoo River at Greenwood, Miss., 1908–1913.

Yazoo River at Yazoo City, Miss., 1900–1905.
Coldwater River at Savage, Miss., 1908–1912.
Yalobusha River at Grenada, Miss., 1906; 1908–1912.
Sunflower River near Ruleville, Miss., 1909–1912.
Sunflower River at Baird, Miss., 1908–1912.

HOMOCHITTO RIVER BASIN.

Homochitto River at Rosetta, Miss., 1906.

RED RIVER BASIN.

Red River at Arthur City, Tex., 1905–1911.
Salt Fork of Red River at Mangum, Okla., 1905–6.
Turkey Creek [Deep Red Run] at Olustee, Okla., 1905–1908.
North Fork of Red River near Granite, Okla., 1903–1908.
North Fork of Red River near Snyder, Okla., 1905.
North Fork of Red River near Headrick, Okla., 1905–1908.
Elm Fork of Red River near Mangum, Okla., 1905–1908.
Elk Creek near Hobart, Okla., 1904–1908.
Otter Creek near Mountain Park, Okla., 1903–1908.
Horse Creek near Mountain Park, Okla., 1905–6.
Dry Fork of Otter Creek near Mountain Park, Okla., 1905–6.
Cache Creek:
Medicine Bluff Creek near Lawton, Okla., 1912–
Little Medicine Bluff Creek near Lawton, Okla., 1912–
Evaporation station near Lawton, Okla., 1913–
Wichita River at Wichita Falls, Tex., 1910–11.
Washita River at Anadarko, Okla., 1902–1908.
Washita River near Pauls Valley, Okla., 1899.
Ouachita River near Malvern, Ark., 1903–1905.
Ouachita River near Arkadelphia, Ark., 1905–6.

REPORTS ON WATER RESOURCES OF THE LOWER MISSISSIPPI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls. 10c.

Describes reservoirs for storm and pumped waters, ditching, methods of distributing water, cultivation and subirrigation, duty of water, and winter irrigation.

*6. Underground waters of southwestern Kansas, by Erasmus Haworth. 1897. 65 pp., 12 pls. 15c.

Describes physiography, drainage, geologic formation and water supply, and irrigation development in Meade, Dodge, and Garden quadrangles, including all of Meade County, nearly all of Seward, Haskell, and Gray counties, about one-third of Ford County, and one-fourth of Finney County; discusses waters of Dakota sandstone and of the Tertiary formations.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes the location and construction of various types of canals for irrigation.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River drainage and irrigation, and gives records of stream flow.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

101. Underground waters of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping, and treats briefly of rice cultivation.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on springs and wells of Arkansas and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams, including Red and Canadian rivers.

*107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Appendix contains gage heights, rating tables, estimates of monthly discharge of Yazoo River.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge, 1905. 211 pp., 5 pls. 10c.

Contains a "Summary of the water supply of the Ozark region in northern Arkansas, by George I. Adams"; describes the drainage and some of the immense springs of the area, many of which have been developed as resorts.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:
Mississippi, by L. C. Johnson.
Louisiana and southern Arkansas, by A. C. Veatch.
Northern Arkansas, by A. H. Purdue.
Each of these reports discusses the geologic formation as related to water supply, treats particularly of the mineral waters, and gives a list of the principal publications.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains five short reports relating to areas draining to the lower Mississippi River:

Water resources of the Joplin district, Missouri-Kansas, by W. S. Tangier Smith. Describes topography, geology, streams, springs, and wells; gives analyses of waters.

Water resources of the Winslow quadrangle, Arkansas, by A. H. Purdue. Area includes a few square miles of Oklahoma, discusses water-bearing formation and the quality of spring and well waters.

Notes on certain hot springs of the southern United States, by Walter Harvey Weed. Gives an account of the history, topography, geology, flow, temperature, and composition of the Hot Springs of Arkansas, including many analyses.

Notes on certain large springs of the Ozark region, Missouri and Arkansas, compiled by Myron L. Fuller. Treats briefly of the conditions under which the springs emerge, and of their flow, temperature, and quality.

Water resources of the contact region between the Paleozoic and Mississippi embayment deposits in northern Arkansas, by A. H. Purdue. Describes geology and water resources of a belt 12 to 15 miles wide extending along the western edge of the Mississippi embayment deposits from Arkansas River northward to the Missouri line. Considers source of water, amount, chemical character and use of water, prospects for flowing wells, etc.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 15c.

Kansas floods, by E. C. Murphy. Describes floods on Kansas, Neosho, Verdigris, Osage, Arkansas, Canadian, and Purgatory rivers, discussing the streams, precipitation, damages, prevention of future damages, etc.

*148. Geology and water resources of Oklahoma, by C. N. Gould. 1905. 178 pp. 20c.

Describes topography, geology, climate, streams, springs, deep wells (water and oil and gas), and artesian water, and discusses the water supply by counties; treats of irrigation from reservoirs, springs, and wells; gives analyses of well waters and table of well records.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height, of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*153. The underflow in Arkansas Valley in western Kansas, by C. S. Slichter. 1906. 90 pp., 3 pls. 15c.

Discusses origin and extent of the underflow, fluctuations of ground water level, the chemical composition of the waters (including analyses); gives results of measurements at various points and summaries and details of pumping tests.

*154. The geology and water resources of the eastern portion of the Panhandle of Texas, by C. N. Gould. 1906. 64 pp., 15 pls. 10c.

Discusses topography, geology, streams, springs, ground waters, and irrigation; gives details by counties.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 86 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters, artesian requisites, and special conditions in the coastal plain formations; gives notes on wells by counties, deep-well records, and selected records in details; treats of sanitary aspect of wells and gives analyses.

*160. Underground-water papers. 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Contains brief report entitled "Drainage of wet lands in Arkansas by wells," by A. F. Crider.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives account of flood on Purgatory River, Colo., and estimates of flood flow and discharge of Arkansas River at Pueblo, Colo.; contains also index to literature on flood flow in American streams.

*164. Underground waters of Tennessee and Kentucky west of Tennessee River and of adjacent area in Illinois, by L. C. Glenn. 1906. 173 pp., 7 pls. 25c.

Describes physical features, static level, and uses of waters, artesian conditions, and source properties of underground water; discusses topography, geology, and water resources by counties; gives logs of wells, analyses of waters, bibliography of most important reports.

*191. Geology and water resources of the western portion of the Panhandle of Texas, by C. N. Gould. 1907. 70 pp., 7 pls. 15c.

Describes the topography and general geology of the area, the deep-seated waters, springs, and streams, and the use of the waters for irrigation; discusses details of topography, geology, and water supply by counties.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of waters, and many well records.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Mississippi, Arkansas, and Red rivers.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters, in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and method of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from Sapello River, Salt, North, and Elm forks of Red River, and Turkey Creek.

276. Geology and underground waters of northeastern Texas, by C. H. Gordon. 1911. 78 pp., 2 pls. 10c.

Describes geography, physiography, and geology of area comprising Bowie, Red River, Lamar, Delta, Hopkins, Franklin, Titus, Morris, Camp, and Cass counties; discusses the source and availability of underground waters, artesian waters of the various formations, and reviews the geographic relations, geology, and water resources by counties.

317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls. 10c.

Describes the physiography, climate, surface and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

(*a*) Preliminary report on ground water for irrigation in the vicinity of Wichita, Kans., by O. E. Meinzer, pp. 1–9.

Scope indicated by title.

(*b*) Ground water for irrigation in the vicinity of Enid, Okla., by A. T. Schwennesen, pp. 11–23, pl. i.

Scope indicated by title.

(*d*) Ground water for irrigation in the valley of North Fork of Canadian River near Oklahoma City, Okla., by A. T. Schwennesen, pp. 41–51.

Scope indicated by title.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, fields and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xiv, 395, 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xviii, 576, 93 plates. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Chaffee, Custer, Fremont, Park, El Paso, Pueblo, Huerfano, Las Animas, Bent, Otero, Baca, Kiowa, and Lake counties, Colo.; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III. Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

*Engineering results of irrigation survey by H. M. Wilson, pp. 351–437, Pls. CXLVII-CLXXXII. Describes the engineering work at Twin Lakes reservoir and Twin Lakes dam, Colorado.

*Report upon the construction of topographic maps and the selection and survey of reservoir sites in the hydrographic basin of Arkansas River, Colo., by A. H. Thompson, pp. 429–444. Scope indicated by title.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV-XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. $2.35. Contains:

The underground water of the Arkansas Valley in eastern Colorado, by G. K. Gilbert, pp. 561–601, Pls. LVI-LXVIII. Describes the geology and topography of the district, the general conditions under which artesian water occurs, the gathering grounds, capacity, distribution, and quality of the water of the Dakota sandstone, the water of the upland sands, the terraces, and the dune sands, and the underflow of rivers and creeks.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, pp. 768, 156 pls. $2.35. Contains:

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. CXIII–CLVI. Describes the area lying in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, Pls. LI–LXV. ($2.20.)

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D.C. Bulletins are of octavo size.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Arkansas, Colorado, New Mexico, Oklahoma, Kansas, Missouri, Tennessee, and Texas, and detailed records of wells in Otero County, Colo.; Greenwood, Montgomery, and Neosho counties, Kans.; and St. Louis County, Mo. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas; and detailed records of wells in Hempstead County, Ark.; Fremont and Pueblo counties, Colo.; Allen, Chase, Coffey, and McPherson counties, Kans.; Panola County, Miss.; Nowata, Washington, Tulsa Murray, Okmulgee, and Pawnee counties, Okla.; and Clay and Roberts counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*32. Geology and underground water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes altitudes and slopes, climate, drainage, stratigraphic structure, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota, Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*46. Geology and underground water resources of northern and southern Arkansas, by A. C. Veatch. 1906. 422 pp., 51 pls. $1.50.

Describes the historical geology and topographic development of a portion of the Coastal Plain; discusses the fundamental principles governing underground waters and their application to this region; contains account of methods and costs of well making, gives well predictions and a short discussion of the underground conditions in each county, and data in regard to wells arranged in tables by counties, followed by notes giving sections, analyses of waters, etc.; contains also a dictionary of altitudes, arranged by counties.

*52. Geology and underground waters of Arkansas Valley in eastern Colorado, by N. H. Darton. 1906. 90 pp., 28 pls.

Describes the stratigraphic, structural, and historical geology of the Arkansas Valley and the relation of the geologic formations to the underground waters; discusses the source, depths, areas of flow, head, quantity, and quality of the waters of the "Dakota" sandstone, and the waters of the Red Beds and Morrison formations, the Laramie and associated formations, the later Tertiary deposits, and the dune sands. "An extension of the preliminary examination of the region by G. K. Gilbert in 1894 and 1895." See Seventeenth Annual Report, part 2, 1896, pp. 1–51.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed, they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

[1] Index maps showing areas in the lower Mississippi River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

36. Pueblo, Colorado. 5c.

Describes the relations of geologic formations to underground waters.

58. Elmoro, Colorado. 5c.

Discusses artesian water of the Dakota formation.

68. Walsenburg, Colorado. 5c.

Describes artesian waters.

*71. Spanish Peaks, Colorado. 5c.

Describes artesian waters of the area.

122. Tahlequah, Oklahoma-Arkansas. 5c.

Gives a brief account of the springs and underground waters.

*132. Muscogee, Oklahoma. 5c.

Discusses springs, wells, and surface waters.

135. Nepesta, Colorado. 5c.

Describes the surface and underground waters; discusses the source, head, and chemical properties of the artesian waters, gives records of deep borings, and treats briefly on irrigation by ditches from Arkansas River; gives analyses of water from wells at Pueblo and from a spring at Fowler.

148. Joplin district, Missouri-Kansas. 50c. (Reprinted in 1914.)

Under "Economic geology" discusses the water power of Spring River, Shoal Creek, and Center Creek, the municipal water supplies of Carthage, Webb City, Joplin, and Galena, and the dug wells and springs of the country districts, and artesian wells.

186. Apishapa, Colo.[1]

Mentions briefly the development of irrigation in the quadrangle; discusses water-bearing beds, artesian head, and the most favorable places for borings for artesian waters.

198. Castle Rock, Colo. 25c.

Describes storage of water near the head of Monument Creek (tributary to Arkansas River) and treats briefly of the underground waters.

[1] Issued in two editions—library (18 by 22 inches), 5c. and octavo (6 by 9 inches), 50c. Specify edition desired.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the lower Mississippi River drainage basin are the reports of the State geologists of Kansas, Tennessee, Louisiana, and Texas, the Mississippi Agricultural Experiment Station, the Chief of Engineers, United States Army, the Mississippi River Commission, and the Tenth Census, volume 17. The following reports deserve special mention:

Special report on well waters in Kansas, by Erasmus Haworth, State geologist: Kansas Univ. Geol. Survey Bull. 1, 1913.

Report of the Board of Irrigation Survey and Experiment for 1895 and 1896 to the Legislature of Kansas, 1897.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others: Louisiana Geol. Survey Bull. 1, 1905.

Geology and underground water resources of northern Louisiana, with notes on adjoining districts, by A. C. Veatch: Louisiana Geol. Survey Bull. 4, 1906.

Report on water purification investigation and of plans proposed for sewerage waterworks systems: New Orleans Sewerage and Water Board, 1903.

Water powers of Arkansas: A preliminary report on White River and some of its tributaries, by W. N. Gladson. 1911.

Preliminary report on drainage of lands overflowed by the North and Middle forks of Forked Deer River and Rutherford Fork of Obion River in Gibson County, Tenn., by A. E. Morgan and S. H. McCrory: Tennessee Geol. Survey Bull. 3-B, 1910.

The delta of the Mississippi: The physics of the river, the control of its floods, and the redemption of the alluvion, by Col. Caleb G. Forshey, Cambridge, 1873.

Report on the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbot: Prof. Papers Corps Top. Eng. U. S. Army, No. 4, 1861.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kansas; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood, 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage disposal plants by States; contains bibliography of publications relating to sewage, utilization and disposal.

32. Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.

Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 15c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distance along rivers of the United States, also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. (See also Nos. 64, 94, and 95.)

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.

Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, fauna of the island, the springs, running streams and wells, and discusses the utilization of the surface and underground waters.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane-table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.
The California or "stovepipe" method of well construction, by Charles S. Slichter.
Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.
Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.
Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.
Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

115. River surveys and profiles made during 1903, by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of undeveloped power sites.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties) location, depth, diameter, yield, height of water, and other available information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the law forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists of publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

163. Bibliographic review and index of underground-water literature, published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl. 10c.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage purification processes, recovery of copperas from acid iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.

Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.

Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipes lines, and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies by E. B. Phelps. 1908. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.

Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool-scouring, bleaching, and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

255. Undergound waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.

Contains results of work at gaging stations.

315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 32 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

336. Water resources of Hawaii, 1912, by C. H. Pierce and G. K. Larrison. 392 pp. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

342. Surface water supply of the Yukon-Tanana region, Alaska, by C. E. Ellsworth and R. W. Davenport. 1915. 343 pp., 13 pls. 45c.

Presents results of 6 years' observations of the water supply of the Yukon-Tanana region, discusses climate and precipitation, and gives station records.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65.

Scope indicated by title.

(f) The discharge of Yukon River at Eagle, Alaska, by E. A. Porter and R. W. Davenport, pp. 67–77, Pls. IV–V. 5c.

Describes briefly the location and size of the Yukon basin, the climatic conditions in the basin, and methods of collecting hydrometric data; compares run-off with precipitation, and gives table showing the discharge of some of the large rivers in the United States as compared with the discharge of the Yukon and the Nile.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

373. Water resources of Hawaii, 1913, by G. K. Larrison. 1915. 190 pp. 20c.

Contains results of stream measurements on the islands in 1913.

375. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls.

(c) Relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77–84.

A paper presented at the conference of engineers of the water-resources branch in December, 1914.

(e) A method for correcting river discharge for changing stage, by B. E. Jones, pp. 117–130.

A paper presented at the conference of engineers of the water resources branch in December, 1914.

(f) Conditions requiring the use of automatic gages in obtaining stream-flow records, by C. H. Pierce, pp. 131–139.

A paper presented at the conference of engineers of the water-resources branch in December, 1914.

400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer.

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, Pl. XXI. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 368–561, Pls. CVII to CXLVI. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, Pls. CXI to CXLV. Discusses the economical aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; described perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, pp. xx, 597, 73 pls. $2.10. Contains:

*Potable waters of the eastern United States, by W J McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, Pls. III and IV. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretical nature, pp. v, 958, 172 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, Pls. VI to XVII. Discusses the amount of watser stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous media, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, Pls. XVII. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 plates. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, Pls. LXIV to LXXV. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute; discusses rainfall, temperature, and relative humidity, evaporation, resources, and productions; the ship, railway, and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, Pls. XXXVII to L. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharges of many of the streams, rainfall, and evaporation tables at various points.

PROFESSIONAL PAPERS.

72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; give details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 265 pp., 3 pls. 70c

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

A highly technical report.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Bulletins 264 and 298 discuss the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells by States, and detailed records selected as affording valuable stratigraphic information.

*319. Summary of the controlling conditions of artesian flows, by Myron L. Fuller. 1908. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

INDEX OF STREAMS.