DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 439

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART IX. COLORADO RIVER BASIN

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Prepared in cooperation with
THE STATES OF ARIZONA, NEVADA, UTAH AND WYOMING

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SURFACE WATER SUPPLY OF COLORADO RIVER BASIN, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

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

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

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry 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, 1895–1917.

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 1917, 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 14.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are 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, miners' 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 and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 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 an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

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

The following terms not in common use are here defined:

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

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

The "point of zero flow" for a gaging station is that point on the gage—the gage height—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 a month multiply the run-off for one 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 one 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 one 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 one 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	2.65
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

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8	9.00	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

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

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 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-foot 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 miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
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, 1915, and ending September 30, 1916. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

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

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

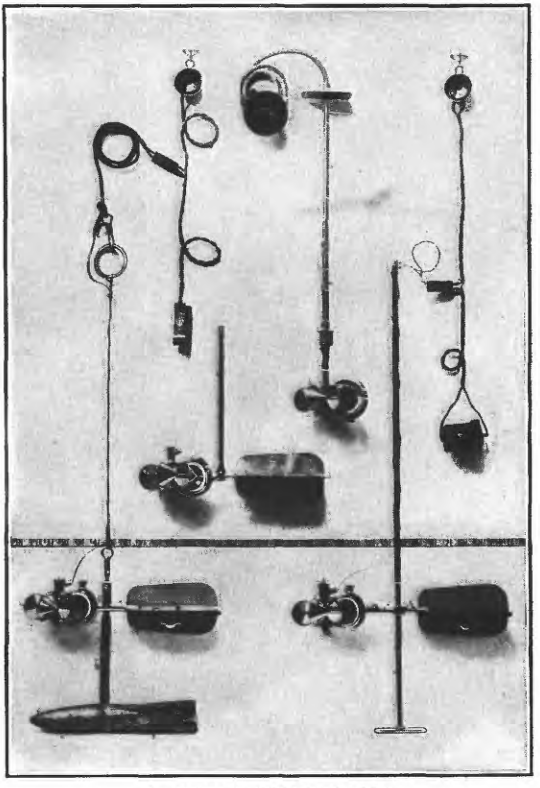
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

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

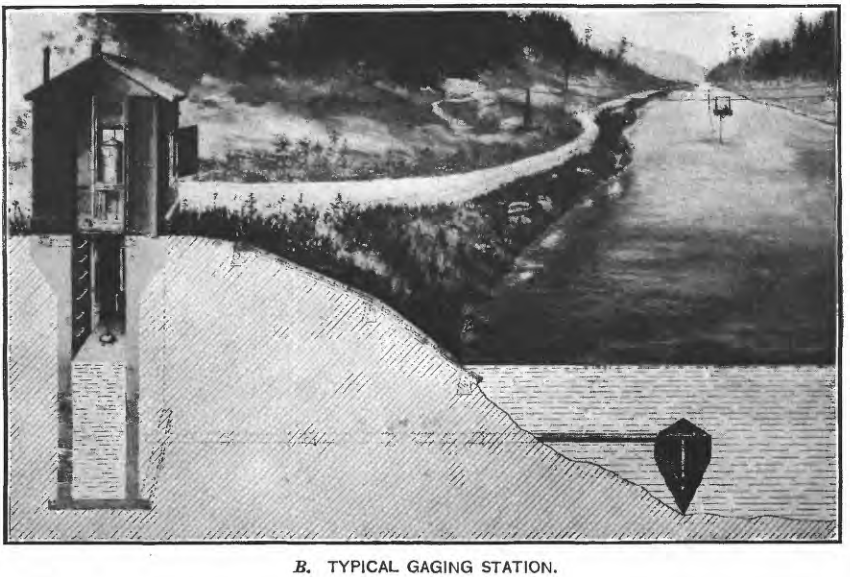
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of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

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuations the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

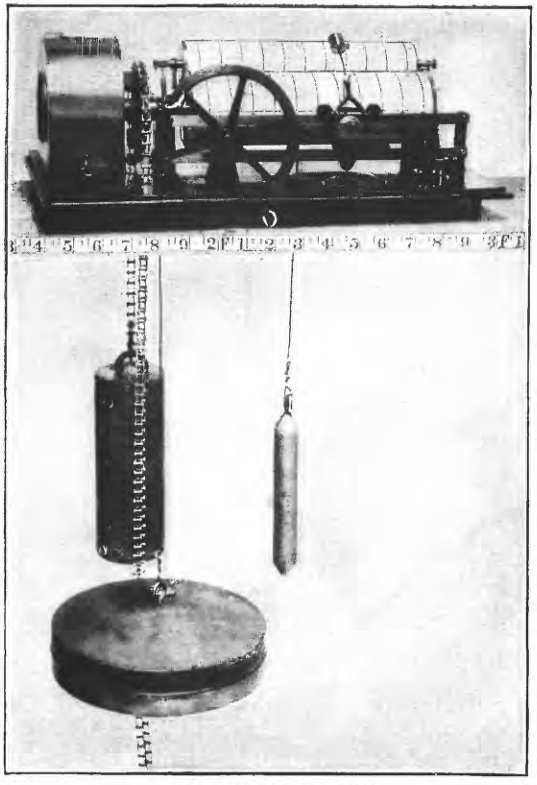
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



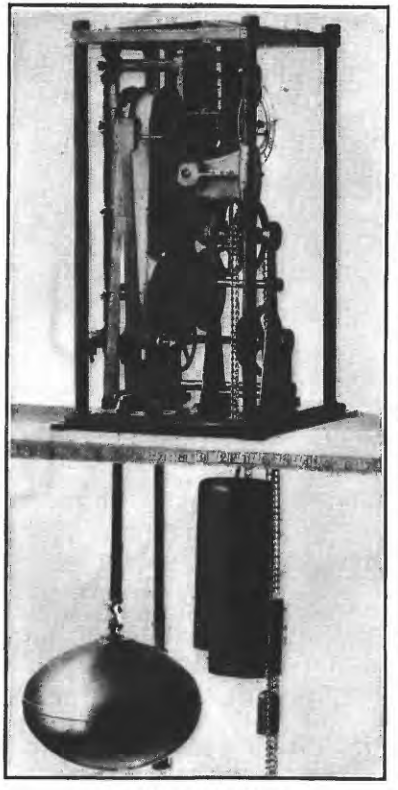
A. PRICE CURRENT METERS.



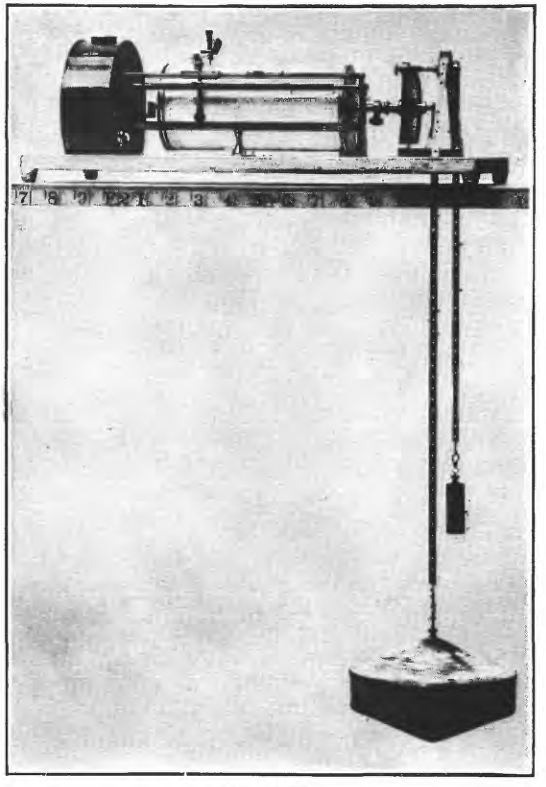
B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 6, are based.

The deficiency table presented for some of the gaging stations shows the number of days in each year on which the mean daily discharge was less than the discharge given in the table. By subtraction the table gives the number of days each year that the mean daily discharge was between the discharges given in the table and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given. If one discharge rating table was used throughout the period covered by the deficiency table, gage heights that correspond to the discharges are also given. For convenience the theoretical horsepower per foot of fall corresponding to the discharge is given in the table on page 8. In using the table for studies of power, allowance should be made for the various losses, the most important being wheel loss and head loss.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

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

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for

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

stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

The work in Arizona, Nevada, Utah, and Wyoming was carried on under cooperative agreement between the United States Geological Survey and the States, and special acknowledgments are due to the cooperating State officials, R. H. Forbes, director, and G. E. P. Smith, irrigation engineer, of the Arizona State Agricultural Experiment Station; W. M. Kearney, State engineer of Nevada; W. D. Beers, State engineer of Utah; and J. B. True, State engineer of Wyoming.

The State engineer of Colorado, John E. Field, paid the observers at the stations on North Fork of Grand River near Grand Lake, Grand River near Kremmling, and Williams Fork near Parshall, and cooperated in the maintenance of station on Yampa River near Maybell.

The United States Reclamation Service paid for a part of the maintenance of stations on Green River at Green River, Wyo., Black Fork at Granger, Wyo., Henrys Fork near Linwood, Utah, and Yampa River near Maybell, Colo.

The United States Forest Service furnished gage-height record for stations on Pine Creek at Fremont Lake outlet, and at Pinedale, Wyo.; also furnished the services of an hydrographer for two months, and all or a part of gage-height records for 20 stations in the Grand River basin in Colorado.

The Uinta County Irrigation Co. furnished gage-height record for North Piney Creek near Marbleton, Wyo.

Records of stage for Big Sandy Creek near Farson, Wyo., were furnished by C. E. Howell; for East Fork River at East Fork canal by S. E. Bartlett; for Grand River near Fruita, Colo., by United States Weather Bureau; and for Crystal River at Marble, Colo., by the Colorado-Yule Marble Co.

W. M. Tait furnished valuable assistance in maintaining station on Grand River at Glenwood Springs, Colo.

The Colorado Power Co. furnished the water-stage recorder used on Grand River at Glenwood Springs, Colo.

The Vernal Milling & Light Co. furnished records of stage for Ashley Creek and paid expenses of field engineers.

Acknowledgments are due to the United States Reclamation Service for financial cooperation in collection of records for stations in Utah.

Records of stage for Mill Creek near Moab, Utah, were furnished by Moab Light & Power Co.; for stations in vicinity of Monticello, Utah, by United States Forest Service and water users; for Leeds Creek near Leeds, Utah, by R. C. Savage; and for several of the stations on Muddy River near Moapa by Muddy Valley Irrigation District, who also furnished records of current-meter measurements.

The United States Indian Service cooperated in the maintenance of stations on Gila River at Guthrie, near Solomonville, near San Carlos, at Kelvin, and San Francisco River at Clifton, Ariz.

The United Verde Copper Co. cooperated in maintaining station on Verde River near Clarkedale, Ariz.

The Southwestern Arizona Fruit & Irrigation Co. furnished gage-height record for Gila River near Sentinel, Ariz.

DIVISION OF WORK.

Data for stations in Arizona were collected and prepared for publication under the direction of C. C. Jacob and C. E. Ellsworth, district engineers, who were assisted by J. B. Spiegel, M. D. Anderson, Wallace Adams, and Mrs. Carol H. Shrigley.

Data for stations in Colorado and Wyoming were collected and prepared for publication under the direction of Robert Follansbee, district engineer, who was assisted by R. H. Fletcher, W. R. King, H. W. Fear, P. V. Hodges, H. K. Smith, and Miss Jane Hanna.

For stations in Nevada and Utah data were collected and prepared for publication under the direction of E. A. Porter and C. C. Jacob, district engineers, who were assisted by Lynn Crandall, A. B. Purton, L. W. Jordan, J. J. Sanford, W. E. Dickinson, W. B. Maughan, and Miss Ruby Christensen.

The records were reviewed and assembled by B. J. Peterson, assistant engineer.

GAGING-STATION RECORDS.

GREEN RIVER AND THE MAIN COLORADO.

GREEN RIVER NEAR DANIEL, WYO.

LOCATION.—Near line between Tps. 32 and 33 N., R. 110 W., at highway bridge 6 miles southeast of Daniel, in Fremont County. No large tributary within several miles.

DRAINAGE AREA.—932 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain on downstream side of bridge; read by Mrs. A. P. Sommers.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control 100 feet downstream at small rapids; shifted during winter of 1915–16 and again during high water in June, 1916. Banks high; overflow unlikely.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet at 5.30 p. m. June 20 (discharge, 4,810 second-feet); minimum discharge probably occurred during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 212 second-feet from Green River above station near Daniel.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; changed during winter and again during high water in June. Rating curve used October 1 to December 4 well defined above and extended below 400 second-feet; curves used March 21 to June 20 and June 25 to September 30 fairly well defined above 240 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Green River near Daniel, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	R. H. Fletcher	2.48	397	June 17	R. H. Fletcher	4.63	3,550
Apr. 25	Robert Follansbee	3.30	1,250	Aug. 6	H. K. Smith	3.58	1,360
May 30	R. H. Fletcher	3.43	1,350				

Daily discharge, in second-feet, of Green River near Daniel, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	695	246	246	.....	590	1,850	2,030	1,730	1,280	515
2	640	238	246	.....	460	2,030	1,760	1,890	1,280	515
3	621	226	246	.....	500	2,210	1,670	1,890	1,280	494
4	592	226	246	.....	545	2,390	1,850	1,890	1,280	480
5	465	226	.....	.....	590	2,570	2,030	1,890	1,280	466
6	452	226	.....	.....	420	2,570	2,570	1,810	1,350	445
7	432	246	.....	.....	385	2,390	2,390	1,810	1,420	424
8	400	268	.....	.....	420	2,750	2,210	1,810	1,500	410
9	389	268	.....	.....	460	2,750	2,570	1,730	1,500	410
10	372	246	.....	.....	800	2,390	2,930	1,730	1,420	410
11	356	226	.....	.....	800	2,210	3,110	1,730	1,420	380
12	345	206	.....	.....	860	2,030	3,110	1,730	1,420	380
13	335	246	.....	.....	500	1,910	3,110	1,730	1,350	380
14	305	290	.....	.....	640	1,850	2,930	1,730	1,350	338
15	305	315	.....	.....	920	1,670	3,110	1,730	1,350	320
16	305	290	.....	.....	985	1,340	3,110	1,730	1,280	302
17	295	246	.....	.....	860	1,190	3,480	1,730	1,150	290
18	295	340	.....	.....	800	1,190	4,240	1,730	1,030	290
19	286	290	.....	.....	800	1,190	4,240	1,730	920	280
20	286	246	.....	.....	860	1,260	4,620	1,730	820	265
21	286	246	.....	1,670	920	1,850	4,520	1,730	770	250
22	272	246	.....	1,670	920	1,940	4,050	1,730	720	240
23	259	246	.....	1,500	1,050	1,670	2,840	1,730	720	240
24	250	246	.....	1,580	1,050	1,670	1,850	1,730	720	220
25	250	246	.....	1,420	1,190	1,500	1,730	1,730	675	230
26	250	246	.....	1,340	1,500	1,500	1,810	1,730	630	215
27	250	246	.....	1,340	1,850	1,340	1,810	1,730	590	215
28	250	246	.....	985	2,390	1,260	1,730	1,570	566	200
29	250	246	.....	920	2,390	1,190	1,730	1,420	550	200
30	250	246	.....	745	2,210	1,500	1,730	1,350	480	190
31	250	.....	.....	690	.....	1,850	.....	1,280	515	.....

NOTE.—Shifting-control method used June 21–24. Stage-discharge relation affected by ice Dec. 5 to Mar. 20; observation of stage discontinued.

Monthly discharge of Green River near Daniel, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	695	250	354	21,800
November	340	206	252	15,000
December 1-4	246	246	246	1,950
March 21-31	1,670	690	1,260	27,500
April	2,390	385	956	56,900
May	2,750	1,190	1,840	113,000
June	4,620	1,670	2,700	161,000
July	1,890	1,280	1,720	106,000
August	1,500	480	1,050	64,600
September	515	190	333	19,800

GREEN RIVER AT GREEN RIVER, WYO.

LOCATION.—In sec. 22, T. 18 N., R. 107 W., at highway bridge a quarter of a mile south of railroad station at Green River, in Sweetwater County. No tributary within several miles.

DRAINAGE AREA.—7,670 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 2, 1895, to October 31, 1906; March 1, 1915, to September 30, 1916.

GAGE.—Chain on upstream side of left span; read by William Hutton, jr. Gage used from 1895 to 1906 was vertical staff attached to submerged cribbing on east bank of river near pump house one-third mile above site of present gage. No determined relation between gages.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Bed composed of compact gravel and small boulders; sand bar on one side; slightly shifting. No well-defined control. Banks high and not subject to overflow at stages less than 10.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.0 feet at 8 a. m. June 22 (discharge, 14,100 second-feet); minimum discharge, 295 second-feet January 12.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 208 second-feet from Green River between this station and the one near Daniel.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changes between narrow limits at long intervals; affected by ice during winter. Rating curve well defined between 500 and 14,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying gage height to rating table. Records excellent except those for winter period, which range in accuracy from fair to good.

COOPERATION.—Gage-height record October 1 to November 30 and March 1 to September 30 furnished by United States Weather Bureau.

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Discharge measurements of Green River at Green River, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	R. H. Fletcher	4.24	1,270	Apr. 18	Robert Follansbee	5.84	3,040
Jan. 7	R. I. Meeker	[a] 4.52	456	May 15	H. K. Smith	6.69	4,510
27	do	[a] 4.98	452	June 5	R. H. Fletcher	6.35	3,910
Feb. 17	R. H. Fletcher	[a] 5.10	561	20	do	9.91	13,800
Mar. 10	do	[a] 5.24	697	Aug. 10	H. K. Smith	6.03	3,210

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Green River at Green River, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,620	910	625	320	422	595	1,890	4,000	3,130	9,040	2,970	1,290
2	1,520	910	835	345	478	595	1,890	3,630	3,630	9,040	2,970	1,290
3	1,160	910	690	345	478	595	1,890	3,290	2,530	8,450	2,970	1,200
4	1,160	910	690	395	535	595	2,260	3,290	4,000	7,880	2,970	1,200
5	1,420	910	910	395	535	595	2,130	3,290	4,000	7,880	2,670	1,200
6	1,470	910	835	450	535	658	2,130	4,000	4,820	7,880	2,530	1,030
7	1,470	910	910	450	798	658	1,890	4,600	6,540	7,060	2,530	1,030
8	1,380	910	835	422	798	725	1,670	4,820	6,800	6,540	3,130	1,030
9	1,380	910	910	395	595	1,030	1,670	5,290	6,800	6,540	3,130	950
10	1,290	910	835	370	595	950	1,670	5,290	7,060	6,800	3,290	950
11	1,240	872	835	345	565	950	2,390	5,780	8,160	6,800	3,130	950
12	1,240	798	690	295	565	798	3,810	5,780	9,340	6,280	2,820	950
13	1,240	690	690	345	565	990	3,810	5,290	9,650	6,030	2,530	870
14	1,240	690	565	345	565	910	2,970	4,820	9,650	5,530	1,890	870
15	1,240	690	625	395	565	1,240	2,670	4,390	9,040	5,050	2,130	870
16	1,240	760	625	345	565	1,780	2,670	4,000	9,650	5,290	1,890	870
17	1,160	760	505	345	565	2,070	3,290	3,630	10,600	5,530	1,890	870
18	1,070	760	395	450	565	2,260	2,970	3,290	11,600	5,290	1,890	870
19	1,070	835	505	505	565	4,390	2,970	2,970	12,800	5,290	1,780	795
20	1,070	910	450	565	565	3,290	2,970	2,970	13,500	4,820	1,780	795
21	1,070	910	450	505	565	4,000	2,530	2,970	13,800	4,190	1,670	795
22	990	910	565	505	565	6,280	2,390	3,290	13,800	4,000	1,670	725
23	1,070	835	690	450	565	4,190	2,130	3,290	12,500	3,630	1,670	725
24	1,030	835	625	450	565	3,630	2,260	3,630	10,600	3,460	1,470	725
25	990	798	625	450	565	3,290	2,390	3,630	8,450	3,130	1,380	725
26	990	760	535	450	565	2,390	2,670	3,630	7,060	2,970	1,380	725
27	910	690	450	450	565	2,130	3,290	3,630	7,060	2,820	1,380	660
28	950	625	345	450	565	2,260	3,630	3,290	7,060	2,820	1,380	660
29	910	625	395	450	565	2,390	4,000	2,970	7,880	2,970	1,290	660
30	910	625	370	450	.....	2,670	4,390	2,820	8,450	3,130	1,290	660
31	910	.....	345	450	.....	2,260	.....	2,670	.....	3,130	1,290	.....

NOTE.—Stage-discharge relation affected by ice Nov. 13 to Mar. 16; discharge determined from gage heights, discharge measurements, observer's notes, and weather records. Shifting-control method used Oct. 1–10.

Monthly discharge of Green River at Green River, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,620	910	1,170	71,900
November	910	625	816	48,600
December	910	345	624	38,400
January	565	295	416	25,600
February	798	422	569	32,700
March	6,280	595	1,970	121,000
April	4,390	1,670	2,640	157,000
May	5,780	2,670	3,880	239,000
June	13,800	2,530	8,330	496,000
July	9,040	2,820	5,460	336,000
August	3,290	1,290	2,150	132,000
September	1,290	660	898	53,400
The year	13,800	295	2,410	1,750,000

GREEN RIVER AT LITTLE VALLEY, NEAR GREEN RIVER, UTAH.

LOCATION.—In sec. 4, T. 22 S., R. 16 E., about a mile above old Little Valley ferry and about 6 miles downstream from Green River, Emery County.

DRAINAGE AREA.—41,000 square miles.

RECORDS AVAILABLE.—December 18, 1910, to September 30, 1916. Records obtained at Green River (known also as Elgin or Blake) from 1894 to 1899, and 1905 to 1911, give practically the same flow.

GAGE.—Friez water-stage recorder on left bank about a mile above old ferry cable. Various gages at cable were in use from December 18, 1910, to November 6, 1914, when the Friez recorder was installed. The records at Green River were obtained from chain gage at the Denver & Rio Grande Railroad bridge until December 2, 1910, when the gage was moved 200 feet upstream to the new highway bridge.

DISCHARGE MEASUREMENTS.—Made from a car on the ferry cable.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Control probably about two-thirds of a mile below the gage; apparently fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage during the year, from water-stage recorder, 8.48 feet at 10 a. m. May 13 (discharge 30,800 second-feet); minimum stage, below −0.5 foot on December 22, due to an ice jam above Green River (discharge probably less than 300 second-feet).

1894–1898 and 1905–1916: Maximum discharge recorded, 68,800 second-feet May 29, 1897; minimum discharge recorded, less than 300 second-feet December 22, 1915.

ICE.—Stage-discharge relation seriously affected by ice. Mean flow estimated for January and part of February from current-meter measurements, observer's notes, and weather records.

DIVERSIONS.—Station is below practically all diversions from Green River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 1,500 and 30,000 second-feet. Daily discharge ascertained by applying gage height to rating table except for periods indicated in footnote to daily-discharge table. Open water records considered good; winter records fair.

Discharge measurements of Green River at Little Valley, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	L. W. Jordan	1.37	2,880	Feb. 24[b]	A. B. Purton	1.20	2,570
Jan. 4[a]	Lynn Crandall	.76	1,770	May 11	W. E. Dickinson	8.15	28,200
28[a]	do	.81	1,930	June 26	do	7.01	23,700

[a] River full of floating slush ice. No great amount of backwater.
[b] Apparently natural conditions. Few cakes of ice floating.

Daily discharge, in second-feet, of Green River, at Little Valley, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2,800	2,080	.....	.....	2,720	8,700	21,300	18,500	15,400	6,720	2,970
2	8,000	2,720	1,780	.....	.....	2,630	8,880	22,800	19,900	14,900	6,280	2,970
3	.....	2,630	1,650	.....	.....	2,630	9,250	22,300	20,400	14,900	6,420	2,970
4	.....	2,630	1,620	1,760	.....	2,800	8,880	19,400	20,400	14,900	6,280	2,970
5	.....	2,540	1,870	.....	.....	2,880	8,170	18,000	20,800	14,900	6,720	2,800
6	.....	2,540	2,050	.....	.....	3,240	7,660	17,600	21,300	14,500	8,170	2,800
7	3,910	3,910	2,240	.....	.....	2,880	7,660	17,100	22,800	14,100	7,500	2,720
8	3,810	3,710	2,300	.....	.....	2,880	7,660	17,600	23,300	13,200	7,500	2,800
9	3,710	3,150	2,380	.....	.....	3,060	7,830	20,800	22,800	12,800	8,520	2,630
10	3,620	3,240	2,460	.....	.....	3,520	7,830	24,800	22,800	12,400	7,500	2,800
11	3,520	3,240	2,460	.....	.....	3,910	7,500	28,200	23,800	11,600	7,180	2,540
12	3,520	3,150	2,460	.....	.....	4,220	7,500	30,300	24,300	10,800	7,180	2,630
13	3,420	3,330	2,380	.....	.....	4,530	7,340	30,300	24,300	10,400	7,340	2,800
14	3,420	.....	2,460	.....	.....	6,040	7,500	30,300	25,200	10,000	6,720	2,720
15	3,330	.....	.....	.....	.....	10,400	8,170	28,200	26,200	10,000	6,870	2,630
16	3,240	.....	.....	.....	.....	15,100	10,000	26,200	26,200	10,000	7,180	2,540
17	3,240	.....	.....	.....	2,380	16,000	12,400	24,300	26,200	9,250	6,720	2,800
18	3,240	.....	.....	.....	2,380	14,900	12,400	22,300	25,200	8,880	5,730	2,800
19	3,240	.....	1,550	.....	2,380	14,500	12,400	19,400	24,800	8,520	5,340	2,630
20	3,240	2,380	450	.....	2,380	14,100	12,400	17,600	24,300	8,170	5,220	2,460
21	3,240	2,380	300	.....	2,380	13,200	12,800	16,700	25,200	7,830	4,750	2,380
22	3,240	2,380	250	.....	2,630	13,200	13,200	15,800	26,200	8,000	4,420	2,300
23	3,150	2,380	1,690	.....	2,540	15,400	13,200	15,800	26,200	7,660	4,110	2,270
24	3,150	2,460	1,620	.....	2,540	17,100	12,400	16,700	26,200	7,340	4,010	2,250
25	3,060	2,630	1,550	.....	2,540	17,600	11,600	19,400	25,200	6,870	3,810	2,300
26	3,060	2,880	.....	.....	2,540	16,700	11,600	18,500	23,800	6,570	3,620	2,300
27	2,970	2,970	.....	.....	2,630	13,700	12,400	17,600	21,300	6,420	3,420	2,190
28	2,970	2,800	.....	1,960	2,720	12,000	14,100	17,600	19,400	6,420	3,330	2,100
29	2,880	2,630	1,410	.....	2,720	10,800	15,800	17,600	17,100	8,340	3,240	2,060
30	2,800	2,380	1,480	.....	.....	9,820	18,500	17,600	15,800	8,340	3,240	1,990
31	2,800	.....	1,550	.....	.....	8,880	.....	17,600	.....	7,180	3,150	.....

NOTE.—Discharge estimated, on account of ice, from meter measurements, observer's notes, and weather records as follows: Dec. 15–18, 2,060 second-feet; Dec. 19–24, 30–31, as in table; Dec. 26–28, 1,480 second-feet; Jan. 1–3 (interpolated), 1,690 second-feet; Jan. 5–12, 1,720 second-feet; Jan. 13–27, 1,690 second-feet; Jan. 29–31, 1,760 second-feet; Feb. 1–5, 1,720 second-feet; Feb. 6–16, 2,140 second-feet. Discharge interpolated on account of break in gage-height record Oct. 1, 8,440 second-feet, 3–6, 5,960 second-feet; Nov. 14–19, 2,860 second-feet.

Monthly discharge of Green River at Little Valley, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8,440	2,800	3,940	242,000
November	3,910	2,380	2,830	168,000
December	.....	.....	1,770	109,000
January	.....	.....	1,720	106,000
February	2,720	.....	2,240	129,000
March	17,600	2,630	9,080	558,000
April	18,500	7,340	10,500	625,000
May	30,300	15,800	21,000	1,290,000
June	26,200	15,800	23,000	1,370,000
July	15,400	6,420	10,300	633,000
August	8,520	3,150	5,750	354,000
September	2,970	1,990	2,570	153,000
The year	30,300	.....	7,900	5,740,000

COLORADO RIVER AT YUMA, ARIZ.

LOCATION.—In sec. 35, T. 16 S., R. 22 E., at Southern Pacific Co.'s railroad bridge at Yuma, Yuma County, about 1½ miles below mouth of Gila River.

DRAINAGE AREA.—242,000 square miles (measured on map compiled from best available maps of Colorado River basin; supersedes previous determinations).

RECORDS AVAILABLE.—April 1, 1878, to September 30, 1916.

GAGE.—Vertical staff in two sections at the bridge. Zero of the gage, 102.79 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from cable 600 feet below gage.

CHANNEL AND CONTROL.—Shifting sand.

EXTREMES OF DISCHARGE.—1902–1916: Maximum mean daily discharge, 240,000 second-feet, January 22, 1916;[1] minimum mean daily discharge, 2,600 second-feet January 20, 1913 (stage, 13.95 feet).

DIVERSIONS.—Water is diverted for irrigation and power development from main river and tributaries above station.

REGULATION.—None.

ACCURACY.—Frequent discharge measurements necessitated by shifting of channel and control. Daily discharge computed by shifting-control method. Records considered good for a station of this type.

COOPERATION.—Record of daily discharge is published as furnished by United States Reclamation Service, through L. M. Lawson, project manager.

[1] For further particulars regarding this flood see article on Colorado River flood at Yuma: Eng. News, vol. 75, p. 246, 1916.

Discharge measurements of Colorado River at Yuma, Ariz., during the year ending Sept. 30, 1916.

[Made by U. S. Reclamation Service.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 1	15.40	4,040	Jan. 31	30.40	161,800	June 2	20.55	44,000
4	16.85	9,050	Feb. 2	21.8	67,600	5	20.80	46,600
6	16.50	9,120	4	20.1	44,590	7	21.25	49,900
8	16.60	7,890	7	17.3	23,950	9	21.80	54,200
11	16.70	8,362	9	16.8	19,900	12	22.00	56,900
13	16.50	9,050	11	16.65	19,430	14	22.50	59,900
15	16.30	8,700	14	17.10	18,520	16	22.40	57,700
18	16.00	6,670	16	17.8	22,990	19	22.90	63,700
20	15.90	6,300	18	18.0	22,990	21	23.25	66,700
22	16.00	5,970	21	18.3	22,690	23	23.80	70,200
25	16.00	6,460	23	18.4	20,350	26	23.65	71,400
27	15.95	6,900	25	19.1	25,760	28	23.55	72,000
29	16.00	6,410	28	18.5	22,800	30	23.10	68,300
Nov. 1	16.20	6,290	Mar. 1	18.60	20,710	July 3	22.05	63,000
3	16.25	6,540	4	19.25	23,830	5	20.75	53,900
5	15.85	4,980	6	19.20	22,650	7	20.20	46,200
8	16.00	5,680	8	18.85	22,400	10	19.75	39,900
10	16.25	4,530	10	18.90	22,580	12	19.50	37,600
12	16.35	5,760	13	18.55	21,900	14	19.25	34,400
15	16.25	5,670	15	19.75	28,000	17	19.30	34,200
17	16.35	6,190	16	19.60	26.790	19	19.15	32,300
19	16.90	7,910	17	19.90	26,540	21	18.50	28,700
22	16.45	6,290	20	20.00	28,580	24	17.90	25,200
24	16.30	6,360	22	20.65	34,090	26	17.60	24,100
26	16.10	6,510	24	22.50	50,110	28	17.30	21,300
29	15.80	5,000	26	24.60	67,380	31	18.05	24,400
Dec. 1	15.90	4,910	29	23.60	68,760	Aug. 2	18.60	27,400
3	16.00	5,160	31	23.05	65,550	4	18.00	22,500
6	16.05	5,800	Apr. 3	20.2	40,100	7	19.20	31,200
8	16.20	5,810	5	19.65	39,200	9	20.05	36,800
10	16.40	6,870	7	19.20	35,500	11	19.85	36,300
13	15.90	4,860	10	18.90	31,100	14	19.55	33,400
15	15.80	4,870	12	19.20	32,400	16	18.90	27.700
17	16.00	5,150	14	18.90	29,400	18	18.60	26,400
20	16.40	6,660	17	18.40	27,200	21	19.75	32,500
22	16.60	6,270	19	19.30	30,800	23	19.35	27,300
24	16.50	6,640	21	19 80	33,000	25	18.70	23,100
27	16.25	5,650	24	20.05	36,000	28	17.55	17,000
29	16.20	5,490	26	20.07	39,300	30	17.10	15,100
31	16.00	4,760	28	20.45	38,300	Sept. 1	17.00	13,600
Jan. 3	17.00	8,640	May 1	20.90	40,800	4	16.90	12,300
5	16.00	5,850	3	21.30	43,300	6	16.90	11,700
7	16.10	5,250	5	21.55	46,600	8	16.50	11,900
10	16.10	4,170	8	22.20	50,400	11	16.45	10,000
12	16.20	3,850	10	22.30	53,900	12	20.45	29,100
14	16.50	5,210	12	21.75	49,600	13	18.20	16,300
17	16.70	7,130	15	21.80	53,600	15	17.15	11,400
19	18.20	14,030	17	22.50	55,400	18	17.55	14,300
20	22.85	51,885	20	23.50	61,900	20	17.50	14,100
21	28.75	109,100	22	24.50	69,900	22	17.00	11,700
24	22.90	84,020	24	25.00	74,800	25	16.80	9,500
26	20.65	52,920	26	23.20	69,800	27	16.80	8,800
28	18.70	36,060	29	20.65	49,000	29	16.90	8,300
30	30.00	145,690	31	20.30	44,700			

Daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,200	6,300	4,900	5,000	113,000	20,000	59,000	40,300	44,300	65,600	26,500	13,600
2	3,500	6,400	5,200	5,000	67,500	25,200	44,700	41,000	44,500	64,500	27,400	12,500
3	4,100	6,500	5,200	7,500	44,800	22,500	40,000	43,300	44,500	62,700	23,300	14,000
4	9,300	6,300	6,200	5,300	41,000	23,500	39,600	47,000	47,200	57,700	22,500	12,300
5	9,300	5,000	5,300	5,900	34,500	24,500	39,200	47,200	47,000	53,600	22,500	12,000
6	9,100	5,500	5,800	5,300	30,800	22,600	38,800	49,200	46,500	49,500	29,200	11,700
7	7,700	5,300	5,800	5,500	23,900	23,000	35,500	50,200	49,900	47,000	31,800	11,500
8	8,700	6,000	5,800	6,000	21,000	22,400	35,000	50,400	53,200	44,800	34,700	11,900
9	10,200	5,700	6,500	4,200	18,800	23,200	32,500	52,600	54,200	41,000	36,500	11,600
10	9,400	4,800	6,900	4,200	18,300	22,600	31,100	53,500	56,000	39,900	37,300	11,800
11	9,000	5,500	6,800	4,100	19,400	20,200	32,400	52,300	56,800	38,700	36,000	10,800
12	8,200	5,800	4,900	3,800	18,300	20,700	32,400	49,000	57,200	37,600	36,300	27,000
13	9,000	5,900	4,900	3,800	19,300	23,000	32,100	51,300	58,800	36,000	36,500	16,300
14	8,800	5,500	4,900	5,200	19,700	27,500	29,400	54,000	59,200	34,400	33,400	13,300
15	8,700	5,700	4,900	5,500	22,000	28,500	29,400	53,600	58,000	34,000	30,800	11,400
16	7,800	5,700	5,000	7,800	23,500	26,500	27,500	55,000	57,000	34,200	27,400	12,200
17	6,500	6,200	5,200	7,100	24,000	27,700	27,500	55,400	59,200	34,200	26,800	15,000
18	6,700	7,900	7,000	7,300	23,000	29,300	29,000	57,700	61,700	33,500	26,100	14,300
19	6,700	7,800	6,800	15,200	20,500	28,800	30,800	59,000	63,700	32,100	27,700	14,100
20	6,300	6,300	6,700	46,800	21,500	29,000	33,700	62,700	65,200	31,800	32,200	14,100
21	6,300	5,600	6,500	101,000	22,700	30,400	33,100	66,500	66,700	28,500	32,700	13,500
22	6,000	6,300	6,300	240,000	20,300	34,500	34,000	70,500	69,000	27,500	31,300	11,700
23	5,600	6,500	6,500	202,000	20,300	42,500	33,700	74,300	70,000	26,100	27,100	11,500
24	5,700	6,400	6,600	97,200	22,000	50,100	36,700	74,800	72,200	25,200	24,400	10,500
25	6,500	7,700	6,500	79,500	25,000	60,400	37,700	72,200	71,700	24,600	22,700	9,500
26	6,700	6,500	4,800	51,500	22,600	68,000	39,300	67,500	71,400	23,900	21,600	9,100
27	6,900	6,300	5,600	43,500	22,500	65,500	40,200	54,800	70,000	21,800	17,900	8,800
28	7,000	4,000	5,500	37,100	22,800	65,700	38,300	49,300	71,200	21,300	16,600	8,500
29	6,400	5,000	5,500	72,000	21,200	68,400	37,000	47,500	70,200	20,400	15,400	8,300
30	6,300	5,000	5,000	158,000	.....	68,200	38,800	48,600	67,700	22,100	14,800	8,300
31	6,300	.....	5,000	177,000	.....	65,500	.....	44,700	.....	24,400	15,000	.....

NOTE.—Discharge records, Jan. 22 to Feb. 2 include estimates of discharge through breaks in levee above Yuma. See "Extremes of discharge" in station description.

Monthly discharge of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1916.

[Drainage area, 242,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October	10,200	3,500	7,190	0.030	0.03	442,000
November	7,900	4,000	5,980	.025	.03	356,000
December	7,000	4,800	5,760	.024	.03	354,000
January	240,000	3,800	45,800	.189	.22	2,820,000
February	113,000	18,300	28,400	.117	.13	1,630,000
March	68,400	20,000	35,800	.148	.17	2,200,000
April	59,000	27,500	35,600	.147	.16	2,120,000
May	74,800	40,300	54,700	.226	.26	3,360,000
June	72,200	44,300	59,500	.246	.27	3,540,000
July	65,600	20,400	36,700	.152	.18	2,260,000
August	37,300	14,800	27,200	.112	.13	1,670,000
September	27,000	8,300	12,400	.051	.06	738,000
The year	240,000	3,500	29,600	.122	1.67	21,500,000

NOTE.—Monthly and yearly discharge computed by engineers of the United States Geological Survey.

HORSE CREEK BASIN.

HORSE CREEK AT DANIEL, WYO.

LOCATION.—About sec. 2, T. 33 N., R. 111 W., at highway bridge three-fourths mile south of Daniel, Lincoln County. No tributary between station and mouth.

DRAINAGE AREA.—193 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on upstream side of left abutment; read by Richard Chenette.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading nearby.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 100 feet below gage at small rapids which shift at intervals.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 8 a. m. June 18 (discharge, 1,120 second-feet); minimum stage, 1.2 feet for part of August and September (discharge, 11 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 161 second-feet from Horse Creek, all above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent after ice went out. Rating curve fairly well defined between 11 and 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for high and fair for low stages.

Discharge measurements of Horse Creek at Daniel, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	R. H. Fletcher	1.13	17.1	June 16	R. H. Fletcher	4.32	920
Apr. 25	Robert Follansbee	2.50	257	Aug. 6	H. K. Smith	1.82	101
May 30	R. H. Fletcher	2.42	256				

Daily discharge, in second-feet, of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	237	280	382	78	11	16	.....	251	840	120	36	11
2	.....	251	294	340	75	11	17	.....	224	880	98	36	11
3	.....	251	324	340	54	11	18	.....	224	1,080	110	36	11
4	.....	251	324	408	55	11	19	.....	294	880	87	36	11
5	.....	442	309	390	75	11	20	.....	373	920	108	36	11
6	.....	442	460	356	64	11	21	.....	356	840	110	36	11
7	.....	530	600	309	82	11	22	.....	356	640	98	35	11
8	.....	460	530	324	84	11	23	.....	340	720	82	36	11
9	.....	530	720	373	82	11	24	.....	340	340	78	38	11
10	.....	495	880	294	49	11	25	265	340	373	60	35	11
11	.....	460	960	280	42	11	26	265	265	237	50	38	11
12	.....	408	720	120	35	11	27	530	294	390	75	30	11
13	.....	408	800	116	36	11	28	720	294	425	45	22	11
14	.....	408	760	106	36	11	29	530	309	373	77	22	11
15	.....	280	880	100	36	11	30	237	340	425	75	11	11
							31	.....	237	.....	78	11	.....

NOTE.—No record Sept. 1, 1915, to Apr. 25, 1916; observer not available.

Monthly discharge of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25-30	720	237	424	5,050
May	530	224	345	21,200
June	1,080	237	607	36,100
July	408	45	180	11,100
August	84	11	44.4	2,730
September	11	11	11.0	655
The period				76,800

COTTONWOOD CREEK BASIN.

COTTONWOOD CREEK NEAR BIG PINEY, WYO.

LOCATION.—In about sec. 21, T. 32 N., R 111 W., at highway bridge near Hayden's ranch, 16 miles north of Big Piney, Lincoln County.

DRAINAGE AREA.—241 square miles (measured on base map of Wyoming, compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—April 25 to September 30, 1916.

GAGE.—Creek flows in two channels a mile apart; vertical staff at highway bridge on each channel; read by Mrs. J. G. Hayden.

DISCHARGE MEASUREMENTS.—Made from bridge on each channel or by wading.

CHANNEL AND CONTROL.—Bed of north channel composed of coarse gravel; control practically permanent. Bed of south channel composed of sand and gravel; control badly shifting.

EXTREMES OF DISCHARGE.—North channel: Maximum stage recorded during period of record, 2.7 feet at 9.30 a. m. April 26 (discharge, 310 second-feet); minimum stage, 1.3 feet September 8–15 and 26–30 (discharge, 30 second-feet).

South channel: Maximum stage recorded, 4.10 feet June 20 (discharge, 166 second-feet); minimum stage recorded, 2.1 feet September 27–30 (discharge, about 3 second-feet).

ICE.—No information.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions from Cottonwood Creek of 38 second-feet above station and 55 second-feet below station.

REGULATION.—None.

ACCURACY.—North channel: Stage-discharge relation practically permanent. Rating curve fairly well defined between 44 and 300 second-feet. Gage read to half-tenths once daily. Discharge ascertained by applying daily gage height to rating table. Records good.

South channel: Stage-discharge relation not permanent. Rating curve used before June 5 fairly well defined between 25 and 200 second-feet; that used after June 24 poorly defined. Gage read to half-tenths once daily. Discharge ascertained by applying daily gage height to rating table; shifting-control method used June 6 to 23. Records fair.

Discharge measurements of Cottonwood Creek (north channel) near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	Robert Follansbee	2.62	274	May 31	R. H. Fletcher	1.69	66
May 6	H. L. Thackwell	2.20	214	June 17	do	2.21	144
30	R. H. Fletcher	1.66	60	Aug. 6	H. K. Smith	2.12	128

Daily discharge, in second-feet, of Cottonwood Creek (north channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	33	63	125	58	36	16	.....	48	145	170	53	40
2	.....	40	63	105	69	33	17	.....	75	170	124	44	40
3	.....	69	53	105	63	33	18	.....	63	198	89	44	40
4	.....	105	58	89	53	33	19	.....	44	248	75	44	40
5	.....	170	63	89	53	33	20	.....	58	230	53	44	40
6	.....	184	75	82	124	33	21	.....	63	198	53	53	36
7	.....	165	82	75	105	33	22	.....	48	145	44	44	36
8	.....	97	82	89	75	30	23	.....	36	124	44	44	33
9	.....	86	89	134	63	30	24	.....	36	105	36	44	33
10	.....	97	97	105	63	30	25	288	53	97	40	44	33
11	.....	75	105	89	53	30	26	230	44	97	44	44	30
12	.....	69	105	75	53	30	27	230	36	89	44	44	30
13	.....	63	124	63	53	30	28	192	44	105	63	44	30
14	.....	48	89	63	53	30	29	150	48	134	63	40	30
15	.....	53	105	75	53	30	30	89	53	145	53	40	30
							31	.....	58	.....	53	36	.....

Monthly discharge of Cottonwood Creek (north channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25–30	288	89	196	2,330
May	184	33	69.7	4,290
June	248	53	116	6,900
July	170	36	77.8	4,780
August	124	36	54.7	3,360
September	40	30	33.2	1,980
The period	288	30	75.0	23,600

Discharge measurements of Cottonwood Creek (south channel) near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	Robert Follansbee	3.80	168	May 31	R. H. Fletcher	2.68	43.4
May 6	H. L. Thackwell	3.43	121	June 17	do	3.61	123
30	R. H. Fletcher	2.66	39.9	Aug. 6	H. K. Smith	3.28	54

Daily discharge, in second-feet, of Cottonwood Creek (south channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	22	42	46	9	5.0	16	.....	47	112	67	9	4.5
2	.....	13	42	37	9	5.0	17	.....	47	130	46	8	4.5
3	.....	62	47	28	8	5.0	18	.....	37	142	28	8	4.5
4	.....	78	47	37	7	5.0	19	.....	22	166	10	10	4.5
5	.....	130	52	37	7	5.0	20	.....	68	166	7.0	10	4.5
6	.....	118	52	46	46	5.0	21	.....	68	148	7.0	10	4.0
7	.....	73	57	46	56	5.0	22	.....	57	118	6.0	8	4.0
8	.....	84	68	46	37	5.0	23	.....	57	78	5.0	8	3.5
9	.....	62	78	67	20	5.0	24	.....	52	67	5.0	7	3.5
10	.....	84	84	56	14	4.5	25	166	52	51	5.5	7	3.5
11	.....	62	100	46	10	4.5	26	106	47	51	6.0	6	3.5
12	.....	62	100	37	9	4.5	27	118	47	56	6.0	6	3.0
13	.....	62	95	28	9	4.5	28	106	42	62	8.0	6	3.0
14	.....	57	95	20	10	4.5	29	112	42	67	8.0	6	3.0
15	.....	52	100	20	9	4.5	30	84	52	56	7.0	6	3.0
							31	.....	47	.....	7.0	5	.....

Monthly discharge of Cottonwood Creek (south channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25-30	166	84	115	1,370
May	130	13	58.2	3,580
June	166	42	84.3	5,020
July	67	5	26.6	1,640
August	56	5	12.3	756
September	5.0	3.0	4.28	255
The period	166	3.0	40.0	12,600

EAST FORK BASIN.

EAST FORK AT EAST FORK CANAL, WYO.

LOCATION.—In sec. 10, T. 31 N., R. 106 W., 300 feet above intake of East Fork canal, 18 miles southeast of Boulder, in Fremont County.

DRAINAGE AREA.—106 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 14 to September 30, 1916.

GAGE.—Vertical staff on left bank; read by Thomas Cullen.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of small boulders. Control 100 feet downstream from gage; apparently permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 4.4 feet at 8.30 a. m. June 16; minimum stage 1.1 feet for several days in September.

ICE.—No information.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 37 feet from East Fork above station.

REGULATION.—None. Many small lakes on headwaters.

Data inadequate for determination of daily discharge.

Discharge measurements of East Fork at East Fork canal, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 29	R. H. Fletcher	2.40	228
Aug. 4	H. K. Smith	1.53	59

Daily gage height, in feet, of East Fork at East Fork canal, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	2.9	3.1	1.8	1.1	16	2.07	4.4	2.3	1.4	1.1
2	.....	2.8	3.1	1.7	1.1	17	2.22	4.2	2.2	1.3	1.1
3	.....	2.7	3.0	1.6	1.1	18	2.02	4.2	2.1	1.3	1.1
4	.....	2.8	2.9	1.6	1.1	19	2.22	4.3	2.0	1.2	1.1
5	.....	3.8	2.8	1.5	1.1	20	.....	3.9	2.0	1.2	1.2
6	.....	3.6	2.9	1.6	1.1	21	2.42	3.7	1.9	1.1	1.1
7	.....	3.2	2.9	1.5	1.1	22	2.22	3.4	1.9	1.1	1.1
8	.....	3.4	2.8	1.6	1.1	23	2.42	3.1	1.8	1.2	1.0
9	.....	3.6	2.8	1.6	1.1	24	2.32	2.8	1.9	1.1	1.1
10	.....	3.7	2.7	1.5	1.1	25	2.22	2.9	1.9	1.1	1.1
11	.....	4.1	2.6	1.5	1.2	26	2.12	3.1	1.9	1.1	1.2
12	.....	3.8	2.5	1.5	1.1	27	2.22	3.2	1.8	1.1	1.1
13	.....	3.3	2.4	1.4	1.1	28	2.12	3.6	1.8	1.1	1.1
14	2.5	3.5	2.3	1.5	1.1	29	2.32	3.4	1.9	1.1	1.2
15	2.37	3.8	2.4	1.5	1.1	30	2.5	3.1	1.9	1.1	1.2
						31	2.7	.....	1.8	1.1	.....

EAST FORK AT NEW FORK, WYO.

LOCATION.—About sec. 33, T. 32 N., R. 108 W., at highway bridge a quarter of a mile south of Newfork, in Fremont County. No tributary between station and mouth, 1 mile below.

DRAINAGE AREA.—348 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—April 1, 1905, to October 31, 1906; May 11, 1915, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left abutment; read by John Tarkelson. Gage used during 1905 was a quarter of a mile farther upstream; that used during 1906 was at bridge but was referred to datum 0.27 foot higher than present gage.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control 100 feet below gage at gravel bar which was permanent during 1916. Banks subject to overflow at stage of 6 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.78 feet at 6.30 a. m. June 17 (discharge, 2,180 second-feet); minimum, discharge probably occurs during winter period.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 82 second-feet from East Fork between New Fork and station at East Fork canal.

REGULATION.—None. Many small lakes at headwaters.

ACCURACY.—Stage-discharge relation practically permanent except for temporary change during high water in May and June; affected by ice during winter. Rating curve well defined between 60 and 560 second-feet, above which it is based on one current-meter measurement at 2,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table; shifting-control method used May 7 to June 18. Records excellent except those for high stages, which are good.

Discharge measurements of East Fork at Newfork, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharg.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	1.66	108	May 29	R. H. Fletcher	2.41	278
Jan. 10	R. I. Meeker	[a] 2.10	61	June 16	.....do	5.48	1,980
Apr. 26	Robert Follansbee	1.91	170	Aug. 5	H. K. Smith	1.53	80

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	125	78	.....	262	660	655	104	64
2	129	78	.....	231	660	605	102	62
3	140	76	.....	216	640	605	91	59
4	148	76	.....	216	931	515	82	59
5	140	75	.....	314	1,460	430	82	59
6	119	78	.....	390	1,640	410	87	59
7	109	75	.....	578	1,290	370	91	58
8	106	76	.....	650	1,350	351	96	56
9	104	78	246	745	1,720	410	89	56
10	106	78	279	799	2,030	370	85	59
11	109	75	370	794	2,040	314	83	56
12	104	72	216	740	1,850	262	78	56
13	104	75	162	685	1,550	231	78	54
14	100	.....	175	610	1,550	188	75	54
15	98	.....	216	450	1,800	216	75	53
16	96	.....	175	351	1,930	279	75	53
17	96	.....	145	293	2,120	262	72	53
18	94	.....	162	276	2,050	216	73	53
19	92	.....	140	256	2,000	175	64	52
20	91	.....	116	290	1,620	150	70	50
21	85	.....	96	340	1,260	131	62	50
22	85	.....	108	418	920	118	64	50
23	80	.....	104	394	655	102	62	50
24	83	.....	112	434	582	100	60	50
25	78	.....	140	332	705	102	62	50
26	78	.....	175	246	810	125	60	50
27	76	.....	216	228	920	123	65	50
28	73	.....	279	276	1,030	120	59	48
29	73	.....	262	228	1,030	129	59	50
30	75	.....	262	279	810	123	60	50
31	78	.....	.....	450	.....	114	60	.....

NOTE.—Gage not read Nov. 28 to Apr. 8. Discharge Nov. 14–27 not computed owing to backwater from ice.

Monthly discharge of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	148	73	99.2	6,100
November 1–13	78	72	76.2	1,960
April 9–30	370	96	189	8,240
May	799	216	412	25,300
June	2,120	582	1,330	79,100
July	655	100	268	16,500
August	104	59	75.0	4,610
September	64	48	54.1	3,220

NEW FORK NEAR BOULDER, WYO.

LOCATION.—About sec. 8, T. 32 N., R. 108 W., at highway bridge a mile west of Boulder, in Fremont County. Nearest tributary, Boulder Creek, enters one-eighth mile below.

DRAINAGE AREA.—578 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 11, 1915, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left abutment.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading near by.

CHANNEL AND CONTROL.—Bed composed of sand and gravel underlain by slate; shifts somewhat. No well-defined control. At high water there are two overflow channels, one around right end of bridge and the other from New Fork to Boulder Creek.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet at 6 a. m. June 22 (discharge, 3,200 second-feet); minimum discharge, 42 second-feet, December 15–17, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 199 second-feet from New Fork above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; control shifts between fairly well defined limits; affected by ice during winter months. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table except for periods indicated in footnote to discharge table. Open-water records good; winter records fair.

Discharge measurements of New Fork near Boulder, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	2.41	378	May 29	R. H. Fletcher	2.43	419
Jan. 10	R. I. Meeker	[a] 2.83	112	June 16	do	5.05	2,140
Feb. 21	R. H. Fletcher	[a] 3.40	151	Aug. 4	H. K. Smith	3.14	708
Apr. 27	Robert Follansbee	2.72	459				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	385	189	105	94	82	105	189	430	475	2,520	770	299
2	385	177	82	130	144	130	223	452	525	2,440	740	260
3	385	174	105	158	189	144	206	430	550	2,440	680	260
4	385	174	105	174	223	158	206	430	575	2,360	740	242
5	385	167	105	174	223	174	223	452	710	2,270	680	223
6	385	167	105	158	242	189	183	525	865	2,180	865	213
7	385	186	82	144	260	144	91	575	930	2,100	740	209
8	363	180	82	130	260	174	180	652	1,000	2,100	865	199
9	341	180	82	118	260	189	242	740	1,100	2,020	770	192
10	341	180	61	118	260	223	320	800	1,480	1,930	740	196
11	341	174	61	118	260	223	550	832	1,560	1,930	710	186
12	320	180	61	105	242	206	550	800	1,800	1,930	680	177
13	320	186	61	118	223	174	452	770	1,800	1,760	652	170
14	299	186	42	130	189	174	500	740	1,890	1,760	625	164
15	299	177	42	158	174	158	625	710	1,970	1,680	575	161
16	280	174	42	144	158	174	550	625	2,270	1,600	550	158
17	280	167	42	130	144	174	430	600	2,610	1,600	500	152
18	280	167	61	94	144	174	550	550	2,860	1,440	452	152
19	260	158	82	130	144	189	408	550	3,120	1,360	452	152
20	260	158	82	158	144	189	320	500	3,120	1,220	475	150
21	242	158	105	158	144	189	525	475	3,120	1,140	475	144
22	242	158	118	118	158	189	832	475	3,200	1,070	430	141
23	223	150	118	144	158	189	363	452	2,780	1,000	385	141
24	223	144	105	174	174	189	341	475	2,440	930	363	136
25	260	144	82	206	174	189	408	525	2,100	800	341	130
26	260	144	82	206	174	189	408	500	1,930	832	341	130
27	206	144	82	189	174	189	408	500	1,930	800	320	125
28	189	150	82	158	158	189	475	475	2,100	800	320	125
29	189	150	72	130	130	189	430	452	2,440	800	299	120
30	189	144	61	72	.....	206	430	452	2,520	800	299	120
31	189	.....	61	61	.....	206	.....	475	.....	800	299	.....

NOTE.—Stage-discharge relation affected by ice Dec. 1–Mar. 30; discharge estimated from gage heights, discharge measurements, observer's notes, and weather records. Shifting-control method used Oct. 1 to Nov. 30, and Mar. 31 to June 15.

Monthly discharge of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	385	189	293	18,000
November	189	144	166	9,880
December	118	42	79.3	4,880
January	206	61	139	8,550
February	260	82	187	10,800
March	223	105	180	11,100
April	832	91	387	23,000
May	832	430	562	34,600
June	3,200	475	1,860	111,000
July	2,520	800	1,560	95,900
August	865	299	553	34,000
September	299	120	174	10,400
The year	3,200	42	512	372,000

PINE CREEK AT FREMONT LAKE OUTLET, WYO.

LOCATION.—In sec. 22, T. 34 N., R. 109 W., at old Indian ford one-third mile below outlet of Fremont Lake, in Fremont County.

DRAINAGE AREA.—114 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—July 22, 1910, to June 30, 1912; October 11, 1915, to September 30, 1916. From April 2, 1905, to October 31, 1906, a station was maintained half a mile downstream. Records at two points not comparable as two ditches divert water between.

GAGE.—Chain on cantilever arm on left bank.

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

CHANNEL AND CONTROL.—Bed composed of small boulders; rough but apparently permanent. No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Data too meager for publication.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—One ditch diverts water above station.

REGULATION.—None. Fremont Lake is approximately 8 square miles in area.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve not well defined. Gage read at irregular intervals. Discharge for days on which gage was read ascertained by applying gage height to rating table; for other days estimated by comparison with records of flow at Pinedale. Records fair.

Discharge measurements of Pine Creek at Fremont Lake outlet, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 30	R. H. Fletcher	1.84	140
Aug. 4	H. K. Smith	2.31	353

Daily discharge, in second-feet, of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	110	54	30	38	62	a 151	a 1,130	384	a 75
2	110	53	a 30	38	66	152	a 1,160	374	a 73
3	110	52	a 30	38	70	172	1,150	363	73
4	108	51	a 30	38	a 75	190	1,140	353	72
5	106	50	a 30	39	a 88	200	1,130	342	71
6	105	49	a 30	40	98	200	a 1,120	a 330	70
7	100	a 48	29	40	109	200	1,120	330	69
8	100	46	a 28	40	120	225	a 1,120	a 330	69
9	100	44	28	40	a 130	275	a 1,080	a 340	68
10	100	a 42	27	40	a 130	a 330	a 1,080	335	68
11	a 100	a 40	26	40	a 148	a 380	1,070	a 330	67
12	100	40	25	40	a 148	391	1,050	308	67
13	100	39	24	40	148	402	1,040	287	66
14	100	38	24	40	148	a 413	1,020	266	66
15	a 100	37	23	40	a 148	500	1,000	245	65
16	100	36	22	a 40	148	725	960	a 224	a 65
17	a 100	35	21	a 40	a 148	925	920	216	64
18	a 88	a 34	20	a 40	148	1,100	880	208	62
19	a 75	a 34	a 20	a 40	148	1,080	840	199	60
20	75	a 33	a 20	a 40	a 148	1,060	780	190	a 59
21	a 75	32	a 20	40	148	a 1,050	720	181	56
22	a 75	31	a 20	a 40	147	a 1,040	620	a 172	52
23	a 75	a 30	20	41	147	1,020	a 556	a 165	a 49
24	68	a 30	20	42	146	a 998	538	a 165	47
25	61	a 30	20	44	146	975	a 520	a 151	45
26	a 55	a 30	18	45	145	1,000	478	a 151	44
27	55	a 30	18	46	145	1,020	a 435	138	42
28	a 55	a 30	18	a 48	144	1,040	425	126	a 40
29	a 55	a 30	18	52	a 144	1,070	415	113	a 40
30	55	30	18	57	a 144	1,100	405	100	39
31	a 55	.....	18	.....	148	.....	394	88	.....

a Gage read.

Monthly discharge of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	110	55	86.2	5,300
November	54	30	38.6	2,300
December	30	18	23.4	1,440
January	.....	.....	a 19.6	1,210
February	.....	.....	a 33.3	1,920
March	.....	.....	a 35.9	2,210
April	57	38	41.5	2,470
May	148	62	130	7,990
June	1,100	151	646	38,400
July	1,160	394	848	52,100
August	384	88	242	14,900
September	75	39	60.1	3,580
The year	1,160	.....	184	134,000

a Same as for Pine Creek at Pinedale.

PINE CREEK AT PINEDALE, WYO.

LOCATION.—In sec. 4, T. 33 N., R. 109 W., a quarter of a mile below bridge at Pinedale, Fremont County. No large tributary between station and mouth, 3 miles below.

DRAINAGE AREA.—128 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 8, 1915, to September 30, 1916. From April 2, 1905, to October 31, 1906, a station was maintained 1 mile below outlet of Fremont Lake, and from July 22, 1910, to June 30, 1912, one-third mile below lake outlet. Flow at different points not directly comparable as several ditches divert water between.

GAGE.—Vertical staff on left bank one-fourth mile below highway bridge and vertical staff on downstream side of bridge; read by forest ranger.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading a short distance below gage.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders which may shift during high water. Control 100 feet downstream from gage at small rapids which are practically permanent. Banks not subject to overflow except at extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet June 20 and 21 (discharge, 1,750 second-feet); minimum discharge, 6 second-feet January 28–30.

ICE.—Stage-discharge relation somewhat affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Pine Creek between station at Fremont Lake outlet and Pinedale, and 4 second-feet below Pinedale.

REGULATION.—None. Fremont Lake, which is approximately 8 square miles in area, drains 110 square miles.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined between 30 and 1,000 second-feet; determinations of flow above 1,000 second-feet possibly subject to some error. Gage read to hundredths twice daily. Daily discharge, except for periods indicated in footnote to daily-discharge table, ascertained by applying daily gage height to rating table. Records good except those for winter period and for high water, which are fair.

Discharge measurements of Pine Creek at Pinedale, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	1.68	117	May 30	R. H. Fletcher	[c] 1.68	112
Jan. 11	R. I. Meeker	[a] 1.34	23.1	June 16	do	[d] 3.10	762
Feb. 20	R. H. Fletcher	[a] 1.32	33.8	Aug. 5	H. K. Smith	2.32	323
Apr. 26	Robert Follansbee	[b] 1.34	52				

[a] Stage-discharge relation affected by ice.
[b] Gage on highway bridge read 1.31.
[c] Gage on highway bridge read 1.56.
[d] Gage on highway bridge read 2.75.

Daily discharge, in second-feet, of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	123	51	20	10	20	28	38	80	118	1,460	410	104
2	123	48	31	14	28	38	43	87	114	1,460	361	98
3	123	46	32	20	28	38	39	82	118	1,460	361	96
4	123	45	25	28	28	33	38	80	135	1,460	338	87
5	118	44	23	28	28	50	39	85	152	1,460	317	84
6	114	43	22	20	38	44	40	114	140	1,560	361	80
7	114	43	22	20	38	39	40	127	140	1,460	338	77
8	114	43	22	14	50	33	40	136	165	1,380	338	72
9	114	45	22	20	50	32	48	140	208	1,380	317	70
10	114	45	19	20	50	32	56	165	277	1,380	338	67
11	114	43	20	20	38	32	49	165	317	1,420	317	61
12	104	42	26	20	38	40	46	165	384	1,330	317	57
13	104	38	19	20	28	31	46	165	435	1,330	317	56
14	104	35	19	28	20	32	51	165	490	1,200	277	53
15	95	34	18	28	20	31	64	165	550	1,200	258	51
16	95	32	16	20	20	33	56	165	722	1,060	241	50
17	86	29	19	14	28	30	48	133	760	1,150	224	51
18	84	30	17	14	28	31	49	127	1,100	840	209	48
19	83	29	14	20	28	32	50	116	1,560	840	194	45
20	80	29	14	28	38	32	50	118	1,750	722	179	44
21	78	28	14	20	38	31	50	118	1,750	582	165	43
22	76	28	20	20	38	32	49	118	1,560	550	165	40
23	72	28	20	28	38	36	50	118	1,380	490	165	38
24	69	27	14	38	38	37	50	118	1,280	435	152	38
25	66	28	14	38	38	46	50	122	925	435	140	36
26	64	26	14	20	38	40	53	118	970	410	140	34
27	62	20	14	10	38	43	58	116	1,020	410	122	32
28	58	20	20	6	28	38	63	118	1,200	384	118	32
29	58	14	14	6	28	38	69	116	1,380	384	114	29
30	55	14	14	6	.....	42	77	118	1,460	410	114	28
31	54	.....	10	10	.....	39	.....	110	.....	384	114	.....

NOTE.—Because of ice, discharge Nov. 27-30, Dec. 19–Mar. 3, estimated from daily gage heights, discharge measurements, observer's notes, and weather records. Discharge Oct. 5, 24, Nov. 7, Apr. 5, 9, 16, June 4, Aug. 18–20, interpolated, as gage was not read. Shifting-control method used Nov. 1–25 and July 11 to Aug. 17.

Monthly discharge of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	123	54	91.6	5,630
November	51	14	34.2	2,040
December	31	10	19.0	1,170
January	38	6	19.6	1,210
February	50	20	33.3	1,920
March	50	28	35.9	2,210
April	77	38	50.0	2,980
May	165	80	125	7,690
June	1,750	114	752	44,700
July	1,560	384	981	60,300
August	410	114	243	14,900
September	104	28	56.7	3,370
The year	1,750	6	204	148,000

BOULDER CREEK NEAR BOULDER, WYO.

LOCATION.—In sec. 4, T. 32 N., R. 108 W., at Sandlin ranch, 2 miles northwest of Boulder, in Fremont County. No tributary between station and mouth, 2 miles below.

DRAINAGE AREA.—112 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—April 23, 1904, to October 31, 1906; May 10, 1915, to September 30, 1916.

GAGE.—Vertical staff on left bank 60 feet northwest of ranch house; read by Lewis Sandlin. Gage used 1904 to 1906 was a short distance farther upstream. Records obtained from the two gages are not comparable as high water cut a new channel and changed control.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge 1¾ miles downstream.

CHANNEL AND CONTROL.—Bed composed of gravel; deep pool at gage. Control 150 feet downstream at rapids; somewhat shifting. Banks high and not subject to overflow. Stage of zero flow, 0.3 foot.

EXTREMES OF DISCHARGE.— Maximum stage recorded during year, 5.5 feet at 7 a. m. June 18 (discharge, 2,420 second-feet); minimum stage, 0.48 foot for 14 days in September (discharge, 7.4 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 47 second-feet from Boulder Creek, all above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts between narrow limits; affected by ice during winter. Rating curve well defined between 8 and 500 second-feet, above which it is based on one current-meter measurement at 1,950 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Boulder Creek near Boulder, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	1.52	140	May 29	R. H. Fletcher	1.60	144
Jan. 10	R. I. Meeker	[a] 1.65	35.0	June 16	do	4.90	1,950
Feb. 20	R. H. Fletcher	[a] 2.70	38.4	Aug. 5	H. K. Smith	1.26	75
Apr. 26	Robert Follansbee	1.11	80				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.
1	184	30	.....	.....	.....	152	334	700	144	12
2	187	30	.....	.....	.....	147	352	808	114	12
3	190	30	.....	.....	33	141	352	1,100	109	12
4	190	30	.....	.....	49	130	447	925	91	12
5	190	30	.....	.....	56	155	700	865	85	11
6	175	29	.....	.....	46	155	925	808	83	11
7	160	30	.....	.....	49	264	925	808	81	11
8	148	30	.....	.....	56	352	1,040	808	94	11
9	135	30	.....	.....	87	408	1,240	808	98	10
10	130	30	35	.....	73	467	1,010	753	102	10
11	130	28	.....	.....	87	488	1,650	700	92	8
12	130	26	.....	.....	64	488	1,590	600	80	8
13	106	21	.....	.....	67	408	1,510	509	75	8
14	84	.....	.....	.....	43	334	1,440	488	92	8
15	84	.....	.....	.....	63	281	1,650	467	61	8
16	84	.....	.....	.....	78	264	2,020	509	54	8
17	84	.....	.....	.....	102	230	2,260	509	41	7.4
18	81	.....	.....	.....	87	164	2,340	509	32	7.4
19	75	.....	.....	.....	63	170	2,340	488	29	7.4
20	70	.....	.....	38	53	130	2,180	389	24	7.4
21	68	.....	.....	.....	46	158	1,720	334	26	7.4
22	67	.....	.....	.....	53	188	1,170	281	22	7.4
23	51	.....	.....	.....	49	208	753	230	18	7.4
24	51	.....	.....	.....	53	214	649	230	16	7.4
25	46	.....	.....	.....	49	230	808	204	15	7.4
26	41	.....	.....	.....	54	230	925	152	13	7.4
27	41	.....	.....	.....	64	208	1,170	102	13	7.4
28	41	.....	.....	.....	96	161	1,300	198	12	7.4
29	41	.....	.....	.....	130	147	1,440	182	12	7.4
30	36	.....	.....	.....	144	167	1,440	167	12	7.4
31	30	.....	.....	.....	.....	247	.....	167	12	.....

NOTE.—Gage read Nov. 14 to Dec. 31; discharge not computed because of ice. Gage not read Jan. 1 to Apr. 2.

Monthly discharge of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	190	30	101	6,210
November 1–13	30	21	28.8	742
April 3–30	144	33	67.6	3,750
May	488	130	241	14,800
June	2,340	334	1,270	75,600
July	1,100	102	510	31,400
August	144	12	56.5	3,470
September	12	7.4	8.79	523

PINEY CREEK BASIN.

NORTH PINEY CREEK NEAR MARBLETON, WYO.

LOCATION.—In sec. 19, T. 31 N., R. 113 W., 300 yards above head gate of North Piney canal and 20 miles northwest of Marbleton, in Lincoln County. No large tributary within several miles.

DRAINAGE AREA.—58 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—May 30, 1915, to October 8, 1916, when station was discontinued.

GAGE.—Lallie water-stage recorder on left bank 300 yards above head gate of North Piney canal.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet below gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 100 feet downstream at small rapids; apparently permanent. Banks not subject to overflow. Stage of zero flow, 1.2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 4.98 feet at noon June 19 (discharge, 613 second-feet); minimum discharge probably occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice. Observations discontinued.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 8 second-feet from North Piney Creek above the station and 209 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph. Records excellent except for period in which recorder was not used. See footnote to daily discharge table.

Discharge measurements of North Piney Creek near Marbleton, Wyo., during the period Oct. 1, 1915, to Nov. 6, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	R. H. Fletcher	2.22	30.0	June 23	H. L. Thackwell	3.86	260
June 1	do	2.96	92	30	do	4.13	320
16	H. L. Thackwell	4.47	430	Nov. 6	H. K. Smith	2.07	19.0

Daily discharge, in second-feet, of North Piney Creek near Marbleton, Wyo., for the period Oct. 1, 1915, to Oct. 8, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	33	.....	35	95	311	84	34	28
2	32	.....	40	94	316	80	33	28
3	32	.....	60	95	322	78	32	28
4	32	.....	79	105	273	78	32	28
5	30	.....	110	142	256	74	31	29
6	30	.....	120	161	261	73	30	30
7	29	.....	110	185	252	68	30	28
8	28	.....	50	203	243	88	30	28
9	28	.....	30	234	234	73	29	.....
10	28	.....	40	278	218	68	29	.....
11	27	.....	26	322	201	62	29	.....
12	27	.....	30	353	183	57	29	.....
13	27	.....	35	402	175	54	29	.....
14	27	.....	45	424	169	52	28	.....
15	27	.....	60	430	167	53	28	.....
16	26	.....	70	424	155	54	32	.....
17	26	46	75	480	146	52	37	.....
18	26	40	70	539	139	51	39	.....
19	26	35	70	591	126	48	38	.....
20	26	32	74	550	112	49	36	.....
21	26	70	88	469	99	50	31	.....
22	26	110	98	339	98	46	31	.....
23	26	150	99	263	92	44	29	.....
24	26	180	93	237	92	44	30	.....
25	.....	170	84	250	105	43	30	.....
26	.....	150	79	285	106	42	30	.....
27	.....	150	68	327	101	41	30	.....
28	.....	120	65	386	98	40	31	.....
29	.....	95	70	365	92	39	30	.....
30	.....	70	80	336	89	37	29	.....
31	.....	.....	90	.....	88	35	.....	.....

NOTE.—No record Oct. 25 to Apr. 16. No gage readings Apr. 18, 19, 21 to May 3, 5–10, 12–17, and Aug. 28 to Sept. 20; discharge estimated by comparison with records of flow of Cottonwood Creek near Big Piney.

Monthly discharge of North Piney Creek near Marbleton, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1-24	33	26	28.0	1,330
April 17-30	180	32	101	2,800
May	120	28	69.1	4,250
June	591	94	312	18,600
July	322	88	172	10,600
August	88	35	56.7	3,490
September	39	28	31.2	1,860

MIDDLE PINEY CREEK NEAR BIG PINEY, WYO.

LOCATION.—In sec. 30, T. 30 N., R. 113 W., at Black's ranch, 15 miles west of Big Piney, in Lincoln County. No large tributary within several miles.

DRAINAGE AREA.—46 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1916. State engineer maintained station at Budd's ranch during 1914.

GAGE.—Vertical staff on left bank 200 feet below house; read by Mrs. Orlin Black. Prior to 1916 gage was 1 mile downstream at C. P. Budd's ranch, about sec. 24, T. 30 N., R. 114 W.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 50 feet below gage at small rapids; permanent during 1916. Banks not overflowed except during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 1.50 feet at 6 a. m. and 7 p. m. June 20 and 6.30 a. m. June 21 (discharge, 134 second-feet); minimum flow occurred during the winter, when observations were discontinued.

ICE.—No data for present site.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 34 second-feet from Middle Piney Creek above the station and 72 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 100 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

Discharge measurements of Middle Piney Creek near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	R. H. Fletcher	[a] 1.02	4.5	June 17	R. H. Fletcher	1.16	86
Apr. 24	Robert Follansbee	.54	26.3	Aug. 7	H. K. Smith	.74	42.1
May 31	R. H. Fletcher	.32	12.4				

[a] Read on gage 1 mile downstream from site of present gage.

Daily discharge, in second-feet, of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.8	.....	23	12	88	51	22
2	9.8	.....	15	12	91	46	22
3	9.8	.....	16	12	98	44	23
4	9.8	.....	18	14	92	45	23
5	9.8	.....	18	26	86	42	22
6	9.8	.....	21	40	79	44	22
7	9.8	.....	27	40	73	40	21
8	9.8	.....	26	38	82	56	20
9	9.8	.....	28	42	77	42	19
10	13.0	.....	26	50	73	38	19
11	16.0	.....	22	55	66	36	18
12	15.0	.....	21	55	66	34	17
13	16.0	.....	18	55	62	32	17
14	16.0	.....	18	57	65	31	16
15	16.0	.....	17	59	66	29	16
16	16.0	.....	16	68	67	28	15
17	16.0	.....	16	84	63	24	15
18	16.0	.....	15	98	59	24	14
19	15.0	.....	14	112	54	23	14
20	14.0	.....	15	134	47	24	13
21	14.0	.....	15	126	49	26	12
22	14.0	.....	16	112	47	29	12
23	14.0	.....	14	91	45	30	12
24	.....	25	13	84	43	27	12
25	.....	28	12	81	42	24	11
26	.....	29	12	79	42	23	11
27	.....	32	12	82	43	23	11
28	.....	37	12	90	47	23	11
29	.....	35	12	98	46	22	11
30	.....	32	12	98	42	22	11
31	.....	.....	12	.....	48	22	.....

NOTE.—Discharge interpolated July 4–6, and Sept. 14–17, as gage was not read. No record Oct. 24 to Apr. 23.

Monthly discharge of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1–23	16	9.8	13.0	593
April 24–30	37	25	31.1	432
May	28	12	17.2	1,060
June	134	12	66.8	3,970
July	98	42	62.8	3,860
August	56	22	32.4	1,990
September	23	11	16.1	958

LABARGE CREEK BASIN.

LABARGE CREEK NEAR LABARGE, WYO.

LOCATION.—In sec. 29, T. 26 N., R. 113 W., at Welty's ranch, 3 miles west of Labarge, in Lincoln County. No large tributary between station and mouth, 6 miles below.

DRAINAGE AREA.—176 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—April 1, 1915, to November 8, 1916, when station was discontinued. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on right bank 250 feet downstream from highway bridge at Welty's ranch; read by Samuel Welty.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 50 feet downstream at gravel bar; shifted somewhat during 1916. Right bank high and not subject to overflow; left bank low and covered with dense underbrush; is overflowed during high water. Stage of zero flow, about 0.70 foot.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during the year, 302 second-feet on May 6 and 7; minimum discharge probably occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 185 second-feet from Labarge Creek above station and 103 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by shifting-control method. Records fair.

Discharge measurements of Labarge Creek near Labarge, Wyo., during the period Oct. 1, 1915, to Nov. 8, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Oct. 11	R. H. Fletcher.....	1.40	69	June 3	R. H. Fletcher.....	2.71	228
				Nov. 3	H. K. Smith.....	1.90	90
1916.							
Apr. 22	Robert Follansbee.....	2.03	153				

Daily discharge, in second-feet, of Labarge Creek near Labarge, Wyo., for the period Oct. 1, 1915, to Nov. 8, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	88	64	.....	280	236	170	154	110	82	98
2	76	64	98	269	236	170	110	98	82	98
3	76	63	104	269	236	170	110	98	88	93
4	76	64	115	269	247	170	110	98	88	98
5	76	64	115	291	247	159	110	98	88	98
6	76	64	115	302	258	137	110	98	93	98
7	71	62	115	302	274	137	110	98	93	98
8	71	62	120	291	274	137	110	98	88	93
9	71	61	120	302	274	137	110	98	88	.....
10	71	.....	120	302	280	126	110	98	88	.....
11	68	.....	126	291	296	126	110	98	88	.....
12	71	.....	126	280	286	115	110	98	88	.....
13	71	.....	126	269	264	104	98	98	88	.....
14	72	.....	132	247	258	104	98	93	88	.....
15	74	.....	142	247	258	104	98	92	88	.....
16	74	.....	142	236	252	126	98	91	88	.....
17	71	.....	148	236	252	120	98	90	88	.....
18	70	.....	170	236	247	115	98	88	88	.....
19	70	.....	170	236	247	126	93	82	88	.....
20	70	.....	170	236	247	126	98	82	88	.....
21	70	.....	148	236	242	115	98	82	88	.....
22	68	.....	148	236	230	126	93	82	88	.....
23	68	.....	181	236	214	115	93	82	88	.....
24	68	.....	181	236	214	115	98	82	93	.....
25	67	.....	192	236	203	115	93	82	93	.....
26	66	.....	203	236	192	115	98	82	93	.....
27	66	.....	247	236	181	115	110	82	93	.....
28	66	.....	247	225	181	126	110	82	93	.....
29	64	.....	247	214	181	126	110	82	93	.....
30	64	.....	258	214	181	115	110	82	98	.....
31	64	.....	.....	225	.....	126	110	.....	98	.....

NOTE.—Discharge interpolated Apr. 19, May 20–23, July 17, and Sept. 15–17, as gage was not read. No record Nov. 10, 1915, to Apr. 1, 1916.

Monthly discharge of Labarge Creek near Labarge, Wyo., for the period Oct. 1, 1915, to Nov. 8, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
October	88	64	70.8	4,350
November 1–9	64	61	63.1	1,130
1916.				
April 2–30	258	98	156	8,970
May	302	214	256	15,700
June	296	181	240	14,300
July	170	104	129	7,930
August	154	93	105	6,460
September	110	82	90.8	5,400
October	98	82	89.5	5,500
November 1–8	98	93	96.8	1,540

FONTENELLE CREEK BASIN.

FONTENELLE CREEK NEAR FONTENELLE, WYO.

LOCATION.—About sec. 3, T. 24 N., R. 113 W., at bridge at Holden's ranch, on stage road from Opal to Big Piney, 5 miles west of Fontenelle, in Lincoln County. No large tributary between station and mouth.

DRAINAGE AREA.—224 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—May 16, 1915, to September 30, 1916. State engineer maintained station at this point during 1914.

GAGE.—Vertical staff on downstream side of right abutment of bridge; read by Mrs. Howard Holden.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading below bridge.

CHANNEL AND CONTROL.—Bed composed of coarse gravel. Control at small rapids 100 feet below gage; shifts occasionally. Banks may be overflowed during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 2.05 feet at 5.35 p. m. April 28 (discharge, 565 second-feet); minimum discharge probably occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Fontenelle Creek; part above station not known.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve not well defined. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage height to rating table; shifting-control method used May 4 to June 15. Records good except those for high stages, which are fair.

Discharge measurements of Fontenelle Creek near Fontenelle, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	R. H. Fletcher	0.40	35.6	June 19	R. H. Fletcher	1.65	406
Apr. 21	Robert Follansbee	1.05	189	Aug. 8	H. K. Smith	.64	79
June 3	R. H. Fletcher	1.25	232				

Daily discharge, in second-feet, of Fontenelle Creek near Fontenelle, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	27	.....	76	367	233	150	73	50
2	39	27	.....	104	386	233	144	69	50
3	39	27	.....	98	330	216	138	69	50
4	39	27	.....	84	421	233	130	65	42
5	42	27	.....	104	517	341	138	69	34
6	39	27	.....	98	493	378	144	69	34
7	39	31	.....	80	549	378	130	69	34
8	39	34	.....	91	485	378	116	73	34
9	39	34	.....	91	501	398	96	87	34
10	39	34	.....	159	497	441	91	69	50
11	34	34	.....	367	437	445	91	65	42
12	34	50	.....	330	378	449	87	65	34
13	34	20	.....	258	378	413	80	60	34
14	34	.....	.....	223	304	398	80	60	34
15	37	.....	.....	330	233	402	87	54	34
16	37	.....	.....	367	233	425	116	54	37
17	34	.....	.....	348	200	425	91	60	37
18	34	.....	.....	406	200	425	87	54	34
19	34	.....	.....	311	216	425	87	54	34
20	34	.....	.....	190	184	386	69	50	34
21	34	.....	190	190	216	348	69	60	34
22	34	.....	159	223	233	330	69	60	34
23	34	.....	190	258	268	311	69	60	34
24	34	.....	190	406	268	258	69	50	37
25	34	.....	130	425	268	240	87	50	34
26	34	.....	80	445	216	240	69	50	34
27	34	.....	60	505	200	206	69	50	54
28	31	.....	130	565	200	206	69	50	54
29	31	.....	116	525	168	206	73	50	65
30	31	.....	91	425	200	150	69	47	69
31	27	.....	50	.....	216	.....	69	60	.....

Monthly discharge of Fontenelle Creek near Fontenelle, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	42	27	35.5	2,180
November 1–13	50	20	30.7	792
March 21–31	190	50	126	2,750
April	565	76	269	16,000
May	549	168	315	19,400
June	449	150	331	19,700
July	150	69	94.6	5,820
August	87	47	60.5	3,720
September	69	34	40.5	2,410

BIG SANDY CREEK BASIN.

BIG SANDY CREEK NEAR FARSON, WYO.

LOCATION.—In sec. 18, T. 27 N., R. 106 W., half a mile above head gate of Eden canal, 14 miles north of Farson, in Sweetwater County. No tributary within several miles of station.

DRAINAGE AREA.—322 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 10, 1915, to September 30, 1916.

GAGE.—Vertical staff on left bank half a mile above head gate of Eden canal, near Ten Trees; read by J. G. Hendreschke.

DISCHARGE MEASUREMENTS.—Made by wading at control.

CHANNEL AND CONTROL.—Bed composed of sand which may shift. Control 100 feet downstream; permanent during 1916. Creek overflows banks at stage of 3.7 feet. Stage of zero flow, 1.0 foot.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 10 a. m. June 24 (discharge not determined); minimum discharge occurs during winter.

ICE.—No information.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 38 second-feet from Big Sandy Creek above station and 4 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during 1916. Rating curve fairly well defined between 70 and 250 second-feet; extended above 250 second-feet and may be considerably in error. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for high water, which are roughly approximate.

Discharge measurements of Big Sandy Creek near Farson, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 7	R. H. Fletcher	2.00	79
May 28	....do	2.42	150
Aug. 3	H. K. Smith	2.01	82

Daily discharge, in second-feet, of Big Sandy Creek near Farson, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	146	340	440	116	63	16	156	640	244	57	44
2	178	390	390	99	64	17	178	740	267	60	37
3	167	365	365	92	64	18	178	740	244	63	30
4	146	365	390	99	64	19	200	690	211	65	22
5	178	490	340	92	64	20	222	690	200	67	23
6	290	590	315	116	64	21	244	665	200	70	23
7	290	490	340	92	64	22	267	590	189	61	24
8	440	540	315	84	64	23	315	540	189	52	25
9	415	590	290	78	64	24	290	490	146	43	47
10	415	640	278	84	64	25	302	390	135	34	69
11	390	690	315	99	64	26	278	440	146	40	91
12	390	690	267	84	61	27	222	490	135	46	113
13	365	565	315	78	58	28	222	490	156	52	135
14	315	540	267	65	55	29	244	490	189	57	114
15	256	590	222	62	51	30	290	440	178	59	93
						31	315	.....	135	61	.....

NOTE.—Discharge interpolated Aug. 17–20, 22–24, 26–28, 30–Sept. 1, 3–5, 7–10, 12–14, 16–18, 20–22, 24–27, 29–30, as gage was not read.

Monthly discharge of Big Sandy Creek near Farson, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May	440	146	268	16,500
June	740	340	547	32,500
July	440	135	252	15,500
August	116	34	71.8	4,410
September	135	22	60.6	3,610
The period	.....	.....	.....	72,500

BLACKS FORK BASIN.

BLACKS FORK NEAR URIE, WYO.

LOCATION.—In sec. 23, T. 16 N., R. 115 W., at highway bridge 4 miles northwest of Urie, in Uinta County. No tributary within 10 miles.

DRAINAGE AREA.—261 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1916.

GAGE.—Vertical staff on downstream side of center pier of bridge; read by Joseph Anderson. Datum lowered 0.50 foot August 19, 1915, to avoid negative readings.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading at point 100 feet downstream.

CHANNEL AND CONTROL.—Bed composed of well-compacted gravel. Control at small rapids just below bridge; practically permanent during 1916. Right bank high and not subject to overflow; left bank subject to overflow at gage height about 3 feet. Stage of zero flow, 0.3 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet from 7 p. m. June 11 to 7 p. m. June 12 (discharge 710 second-feet); minimum discharge probably occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 599 second-feet from Blacks Fork, all above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 10 and 1,000 second-feet. Gage read twice daily, chiefly to tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Blacks Fork near Urie, Wyo., during the year ending Sept. 30, 1916.

[Made by H. K. Smith.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 17	1.68	245
Aug. 10	.44	7.2

Daily discharge, in second-feet, of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	59	22	.....	46	193	420	23	8	2
2	62	22	.....	54	182	420	23	8	2
3	38	22	.....	70	193	465	23	8	2
4	46	22	.....	88	241	488	23	9	2
5	51	22	.....	79	258	560	23	10	2
6	46	20	.....	88	276	560	23	11	2
7	45	64	.....	88	465	560	19	13	2
8	43	62	.....	88	560	585	14	16	2
9	36	62	.....	98	510	660	14	14	3
10	36	62	.....	79	465	660	14	9	3
11	32	64	.....	88	420	685	14	6	3
12	42	56	131	70	398	710	14	6	3
13	38	46	193	70	182	660	11	6	3
14	40	46	155	62	62	660	11	4	2
15	45	46	155	79	88	635	26	4	2
16	32	46	155	70	155	585	25	4	2
17	33	46	155	70	208	465	22	4	1
18	42	46	155	98	224	420	18	4	1
19	40	46	155	88	241	420	18	4	1
20	40	54	148	70	258	420	17	4	1
21	40	.....	119	70	241	420	16	4	1
22	32	.....	124	88	193	420	13	3	1
23	32	.....	124	109	152	420	12	2	3
24	33	.....	119	119	128	420	10	2	3
25	31	.....	117	131	117	398	8	2	3
26	27	.....	119	155	128	295	8	2	3
27	25	.....	106	155	179	171	8	2	2
28	22	.....	109	168	241	81	8	3	2
29	22	.....	88	193	295	41	8	4	2
30	22	.....	62	182	535	23	8	4	2
31	22	.....	46	.....	488	.....	8	3	.....

NOTE.—Discharge July 17 to Aug. 13, estimated as stage was below gage.

Monthly discharge of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	62	22	37.2	2,290
November 1–20	64	20	43.8	1,740
March 12–31	193	46	127	5,040
April	193	46	97.1	5,780
May	560	62	267	16,400
June	710	23	458	27,300
July	26	8	15.5	953
August	16	2	5.90	363
September	3	1	2.10	125

BLACKS FORK AT GRANGER, WYO.

LOCATION.—In sec. 29, T. 19 N., R. 111 W., at highway bridge in Granger, Sweetwater County; just below mouth of Hams Fork.

DRAINAGE AREA.—2,840 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 16 to August 5, 1916, when station was discontinued.

GAGE.—Chain gage on downstream side of single-span bridge; read twice daily by M. J. Miller.

DISCHARGE MEASUREMENTS.—Made from bridge.

Data inadequate for determination of discharge; channel blocked by tie jam during almost entire period of records.

Discharge measurements of Blacks Fork at Granger, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 20	Robert Follansbee	.....	1,220	June 5	R. H. Fletcher	4.83	1,380
May 16	H. K. Smith	3.01	1,310	Aug. 9	H. K. Smith	1.96	96

Daily gage height, in feet, of Blacks Fork at Granger, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1	.....	4.24	.....	1.95	16	.....	5.30	1.95	.....
2	.....	4.99	3.05	1.55	17	.....	5.50	1.85	.....
3	.....	5.49	3.10	1.15	18	2.59	5.25	3.25	.....
4	.....	4.64	3.15	.85	19	2.39	5.10	3.40	.....
5	.....	4.39	3.05	.75	20	2.45	4.85	2.20	.....
6	.....	4.70	2.85	.....	21	2.59	4.40	2.95	.....
7	.....	5.50	2.60	.....	22	2.64	4.25	2.75	.....
8	.....	5.70	2.50	.....	23	2.59	4.15	2.70	.....
9	.....	6.30	3.00	.....	24	2.59	4.15	2.60	.....
10	.....	6.35	2.75	.....	25	2.74	4.10	3.00	.....
11	.....	6.45	2.65	.....	26	2.74	3.75	2.60	.....
12	.....	6.55	2.60	.....	27	2.54	3.35	2.55	.....
12	.....	6.00	2.30	.....	28	2.44	3.00	2.50	.....
14	.....	6.00	2.10	.....	29	2.49	2.95	2.00	.....
15	.....	5.70	2.00	.....	30	2.49	3.10	2.05	.....
					31	2.94	.....	2.00	.....

HENRYS FORK BASIN.

HENRYS FORK NEAR LINWOOD, UTAH.

LOCATION.—In sec. 30, T. 3 N., R. 21 E., at Finch's ranch 3 miles from Linwood, in Uinta County and 48 miles south of Green River, Wyo.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 19 to September 30, 1916, when station was discontinued.

GAGE.—Vertical staff on left bank 200 yards below observer's house; read by Miss Nora Finch.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Bed composed of compacted gravel. Control is a small riffle 50 feet below gage. Banks low; subject to overflow during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.1 feet at 5 p. m. May 10 (discharge, 313 second-feet); minimum stage, 2.6 feet for periods in July and September (discharge about 2 second-feet).

ICE.—No data.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions of 84 second-feet from Henrys Fork.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined between 30 and 250 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table; shifting-control method used April 19 to May 21. Records good.

Discharge measurements of Henrys Fork near Linwood, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 15	H. K. Smith	3.45	139	June 21	R. H. Fletcher	3.40	111
June 6	R. H. Fletcher	3.80	208	Aug. 11	H. K. Smith	2.96	36.0

Daily discharge, in second-feet, of Henrys Fork near Linwood, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	97	181	43	33	12	16	.....	125	122	10	33	12
2	.....	88	207	30	33	12	17	.....	112	122	10	33	12
3	.....	106	144	30	33	8	18	.....	101	122	10	33	12
4	.....	97	122	30	97	4	19	39	80	112	10	33	12
5	.....	106	133	30	33	4	20	39	79	112	2	21	12
6	.....	138	220	19	61	4	21	33	86	112	2	21	4
7	.....	161	181	10	61	4	22	46	66	112	2	21	4
8	.....	212	156	10	46	4	23	39	84	93	2	21	4
9	.....	226	168	10	33	4	24	39	75	75	2	16	4
10	.....	282	207	10	33	4	25	54	66	58	10	12	8
11	.....	282	220	10	33	8	26	54	58	58	14	12	12
12	.....	226	194	10	33	12	27	54	66	66	19	12	12
13	.....	199	144	10	33	12	28	54	58	58	36	8	12
14	.....	174	144	10	21	12	29	70	93	58	138	16	16
15	.....	127	144	10	27	12	30	106	133	43	97	12	21
							31	.....	168	.....	33	12	.....

Monthly discharge of Henrys Fork near Linwood, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 19–30	106	33	52.2	1,240
May	282	58	128	7,870
June	220	43	130	7,740
July	138	2	21.6	1,330
August	97	8	29.9	1,840
September	21	4	9.1	541
The period	.....	.....	.....	20,600

YAMPA RIVER BASIN.

YAMPA RIVER NEAR MAYBELL, COLO.

LOCATION.—In sec. 2, T. 6 N., R. 95 W., on highway bridge 3 miles east of Maybell, in Moffat County. Nearest tributary, Lay Creek, enters about a mile above.

DRAINAGE AREA.—3,410 square miles (measured on map issued by General Land Office).

RECORDS AVAILABLE.—April 25 to September 30, 1916. From April 17, 1904 to October 31, 1905 and June 12, 1910 to November 30, 1912, a station was maintained at Thornburg bridge 9 miles below Maybell.

GAGE.—Chain on upstream side of bridge, 55 feet from west abutment; read by Dr. L. B. Wheeler.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge.

CHANNEL AND CONTROL.—Bed composed of small boulders and gravel. Control not well defined; probably permanent. Banks high; not likely to be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 6.9 feet at 6 p. m., May 11 (discharge, 11,700 second-feet); minimum stage recorded, 0.35 foot at 10 a. m., September 7 (discharge, 329 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—There are court decrees for diversion of 618 second-feet from Yampa River above station and 82 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 150 and 12,000 second-feet. Gage read to quarter-tenths twice daily. Discharge determined by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Yampa River near Maybell, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 24	C. C. Hezmalhalch	3.61	3,860	Aug. 9	C. C. Hezmalhalch	1.38	1,020
May 8	do	6.12	9,750	Sept. 29	do	.40	354
June 19	do	4.78	6,440				
24	Follansbee and Hezmalhalch	3.36	3,710				

Daily discharge, in second-feet, of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	5,620	7,190	2,960	815	461	16	.....	5,400	6,500	970	890	367
2	.....	4,360	7,420	2,810	704	479	17	.....	4,360	6,060	890	740	379
3	.....	4,360	6,960	2,660	740	402	18	.....	3,980	6,280	890	668	384
4	.....	3,800	6,730	2,380	704	356	19	.....	3,620	6,280	890	740	379
5	.....	4,360	7,190	2,000	740	329	20	.....	3,980	6,280	852	600	362
6	.....	5,840	7,890	1,880	890	384	21	.....	5,180	5,840	740	523	356
7	.....	7,420	6,960	1,760	1,010	334	22	.....	6,500	5,180	668	485	362
8	.....	9,390	5,620	1,650	1,140	356	23	.....	6,280	4,360	634	473	345
9	.....	10,400	5,620	1,650	970	356	24	.....	3,980	5,180	3,820	600	449	356
10	.....	11,500	5,180	1,650	890	437	25	.....	4,980	5,180	3,280	568	419	362
11	.....	11,500	6,730	1,650	890	852	26	.....	5,970	6,060	3,620	568	407	367
12	.....	9,910	6,960	1,540	815	668	27	.....	6,960	5,620	3,620	568	384	402
13	.....	8,370	6,960	1,430	778	600	28	.....	7,890	5,180	3,280	600	362	362
14	.....	8,130	6,960	1,180	852	485	29	.....	8,610	5,620	3,280	600	379	356
15	.....	6,730	7,420	1,050	1,050	384	30	.....	8,370	6,060	3,280	970	402	356
							31	.....	6,500	.....	704	479	.....

NOTE.—Discharge interpolated Apr. 25–26, June 19, 24, and Sept. 25.

Monthly discharge of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 24–30	8,610	3,980	6,680	92,600
May	11,500	3,620	6,340	390,000
June	7,890	3,280	5,760	343,000
July	2,960	568	1,290	79,300
August	1,140	362	690	42,400
September	852	329	413	24,600
The period				972,000

SAVERY CREEK AT SAVERY, WYO.

LOCATION.—About in sec. 8, T. 12 N., R. 89 W., half a mile east of Savery in Carbon County. No tributary between station and mouth, 1½ miles below.

DRAINAGE AREA.—354 square miles (measured on base map of Wyoming compiled by United States Gelogical Survey, scale, 1 to 500,000).

RECORDS AVAILABLE.—May 1, 1915, to September 30, 1916.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 63 second-feet from Savery Creek.

REGULATION.—None.

COOPERATION.—Complete records furnished by State engineer of Colorado.

Discharge measurements of Savery Creek at Savery, Wyo., during the year ending Sept. 30, 1916.

[Made by C. C. Hezmalhalch.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 20	1.41	288	July 9	—.20	13.0
May 12	1.60	360	Aug. 10	.27	48.0
June 10	.99	189	Sept. 18	—.12	17.9

Daily discharge, in second-feet, of Savery Creek at Savery, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	15	52	.....	150	696	264	25	25	16
2	10	15	52	.....	150	650	250	19	9	13
3	10	15	46	.....	139	696	222	19	9	11
4	10	15	46	.....	150	743	208	16	11	11
5	10	15	65	.....	139	793	208	13	11	13
6	10	15	58	.....	139	768	183	9	9	16
7	15	15	65	.....	129	650	183	11	13	16
8	15	27	65	.....	110	562	183	13	16	19
9	15	27	65	.....	129	482	183	19	22	25
10	15	27	65	.....	183	446	183	19	25	22
11	15	27	65	.....	326	429	172	19	19	19
12	15	39	65	.....	376	394	172	19	16	16
13	27	39	65	.....	376	326	160	13	13	16
14	39	39	.....	.....	342	250	160	16	16	11
15	39	39	.....	.....	342	250	139	19	19	11
16	39	39	.....	.....	359	235	129	13	25	9
17	33	39	.....	.....	359	208	119	19	22	13
18	15	33	.....	.....	429	196	110	13	22	13
19	27	33	.....	250	412	183	100	11	22	16
20	15	33	.....	264	376	160	92	11	19	19
21	6	33	.....	250	280	482	83	9	16	16
22	10	33	.....	235	310	412	83	13	13	13
23	15	39	.....	222	412	376	83	7	19	13
24	15	33	.....	222	501	310	68	5	13	16
25	15	39	.....	196	606	295	68	3	19	13
26	15	46	.....	183	818	250	68	3	25	19
27	10	46	.....	196	896	235	54	5	25	16
28	21	46	.....	208	896	208	48	7	19	13
29	10	46	.....	196	793	208	48	11	22	13
30	10	46	.....	150	696	208	48	11	19	13
31	15	.....	.....	110	.....	235	.....	22	19	.....

Monthly discharge of Savery Creek at Savery, Wyo., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	39	6	17.0	1,050
November	46	15	31.8	1,890
December 1-13	65	46	59.5	1,530
March 19-31	264	110	206	5,310
April	896	110	377	22,400
May	793	160	398	24,500
June	264	48	136	8,090
July	25	3	13.3	818
August	25	9	17.8	1,090
September	25	9	15.0	893

MUDDY CREEK NEAR BAGGS, WYO.

LOCATION.—About in sec. 33, T. 13 N., R. 91 W., at highway bridge 1½ miles northeast of Baggs, in Carbon County. No tributary between station and mouth, a mile below.

DRAINAGE AREA.—904 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 4, 1915, to August 10, 1916.

GAGE.—Chain on upstream side of single-span bridge; read by Mrs. A. Blackmore.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and mud; will probably shift. Banks subject to overflow during extremely high water. Control shifting.

ICE.—No information; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 3 second-feet from Muddy Creek above station.

REGULATION.—None.

COOPERATION.—Complete records furnished by State engineer of Colorado.

Discharge measurements of Muddy Creek near Baggs, Wyo., during the year ending Sept. 30, 1916.

[Made by C. C. Hezmalhalch.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 14	2.39	63	July 4	0.30	3.6
May 11	2.75	76	Aug. 10	2.48	78
June 8	.98	20.5	Sept. 17	.19	2.4

Daily discharge, in second-feet, of Muddy Creek near Baggs, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.
1	44	.90	.....	83	78	66	0.2	40
2	40	77	.....	64	76	61	.0	50
3	58	56	.....	62	73	44	.0	78
4	67	58	.....	61	71	40	.2	106
5	77	32	.....	54	78	32	1.0	396
6	87	15	.....	52	76	22	1.0	270
7	99	12	.....	44	74	16	1.0	220
8	102	12	.....	46	73	15	.8	224
9	87	13	.....	50	74	10	.5	412
10	84	10	.....	52	80	6.0	1.0	99
11	72	6.5	314	52	82	6.0	1.0	.....
12	58	5.8	327	48	85	3.0	.8	.....
13	54	6.5	381	49	87	2.5	.5	.....
14	52	5.8	375	59	76	1.0	.5	.....
15	46	3.5	356	69	71	1.5	1.0	.....
16	54	4.2	369	80	68	1.0	1.0	.....
17	60	4.2	381	80	59	1.5	1.0	.....
18	96	3.0	399	78	44	.8	1.0	.....
19	102	.8	375	74	101	1.0	.8	.....
20	122	.0	372	76	354	1.0	.8	.....
21	122	.0	287	80	312	2.0	.5	.....
22	90	.0	183	87	297	1.5	.8	.....
23	159	0	146	85	254	1.0	.5	.....
24	159	.0	157	85	249	.8	1.0	.....
25	139	.0	157	76	236	.5	1.0	.....
26	77	.0	148	74	216	.2	1.0	.....
27	96	.0	140	73	202	.2	1.0	.....
28	93	.0	105	82	193	.2	.5	.....
29	122	.0	99	80	105	.2	.5	.....
30	179	.0	92	76	92	.2	1.0	.....
31	122	.....	92	.....	83	.....	.5	.....

Monthly discharge of Muddy Creek near Baggs, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	179	40	90.9	5,590
November	90	.0	13.8	821
March 11–31	399	92	256	10,400
April	87	44	67.7	4,030
May	354	44	130	7,990
June	66	.2	11.3	672
July	1.0	.0	.72	44.3
August 1–10	412	40	190	1,130

ASHLEY CREEK BASIN.

ASHLEY CREEK NEAR VERNAL, UTAH.

LOCATION.—In sec. 1, T. 3 S., R. 20 E., about one-fourth mile above head of power canal of Vernal Milling & Light Co., about 3½ miles above mouth of Dry Fork, and 12 miles northwest of Vernal, Uinta County.

DRAINAGE AREA.—101 square miles.

RECORDS AVAILABLE.—June 6, 1914, to September 30, 1916. From October 8, 1911, to June 5, 1914, fragmentary records were obtained at the power plant, the total flow of the creek being determined by including the discharge from the tailrace. Records are also available for a point below the mouth of Dry Fork from March 15, 1900, to December 31, 1904.

GAGE.—Lietz water-stage recorder on the right bank about 400 yards above diversion dam; installed April 15, 1915, at same site as vertical staff gage from which fragmentary records had been obtained since June 6, 1914. From October 8, 1911, to June 5, 1914, records were obtained at the power plant; until June 28, 1913, from a gage below the tailrace, and after June 28 from a gage above the tailrace. While the gage above the tailrace was in use supplementary readings in the tailrace were taken and the flow added to obtain the total of the creek. The gage used from March 15, 1900, to December 31, 1904, was at E. Marett's ranch about 5 miles downstream, and below Dry Fork. This gage was a vertical staff on the right bank at the wagon bridge.

DISCHARGE MEASUREMENTS.—Made from cable about 75 feet upstream from gage or by wading.

CHANNEL AND CONTROL.—Bed steep and rough. Control apparently fairly permanent at present site.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 4.44 feet at 7 p. m. May 8 (discharge 820 second-feet); minimum stage 1.38 feet for a few days during February and March (discharge 33 second-feet).

1911–1916: Maximum discharge recorded, 1,350 second-feet May 23, 1914; minimum discharge recorded 30 second-feet March 2, 1912, first 15 days of January, 1914, and during March, 1915.

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

DIVERSIONS.—Above all diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined from 30 to 400 second-feet. Water-stage recorder out of commission several times during year but stage during these periods was fairly steady. Records good except those for February and March, which are only fair.

Discharge measurements of Ashley Creek near Vernal, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	L. W. Jordan	1.64	76.4	May 28	W. E. Dickinson	2.84	327
Jan. 15	Lynn Crandall	1.42	39.4	29	....do	2.85	348

Daily discharge, in second-feet, of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	93	68	48	40	36	.....	48	227	381	143	112	70
2	93	68	50	40	36	.....	50	227	327	141	100	69
3	91	68	50	40	36	.....	50	227	340	135	98	69
4	91	68	48	40	36	.....	48	301	395	133	100	69
5	91	67	46	40	36	.....	48	381	452	131	95	67
6	93	67	46	39	36	.....	46	480	409	127	104	65
7	91	67	46	39	36	.....	46	525	368	125	95	65
8	91	66	45	39	35	.....	44	570	381	123	91	65
9	89	64	44	39	35	.....	45	555	423	123	91	64
10	84	62	44	39	35	.....	48	585	395	133	86	64
11	84	59	45	39	35	.....	51	540	340	131	86	64
12	84	57	45	39	33	33	54	495	327	119	84	64
13	86	57	45	39	33	36	57	381	327	116	84	64
14	84	57	45	39	.....	42	61	354	288	114	108	62
15	82	57	45	39	.....	50	61	276	276	118	89	61
16	80	57	45	39	.....	51	67	263	276	110	84	59
17	80	57	45	39	.....	51	88	276	264	112	84	57
18	82	57	45	39	.....	53	102	263	251	110	82	57
19	84	56	45	38	.....	51	102	314	251	106	81	57
20	82	54	45	38	.....	51	98	368	227	104	81	56
21	82	54	45	38	.....	51	98	395	216	102	80	54
22	80	54	45	38	.....	51	106	423	200	100	79	56
23	80	53	44	38	.....	53	119	381	191	98	78	56
24	80	51	44	38	.....	48	174	340	182	97	77	54
25	74	48	42	38	.....	51	209	288	174	95	76	54
26	74	48	42	38	.....	51	251	276	163	95	75	54
27	70	48	42	38	.....	51	301	301	159	95	74	54
28	70	48	42	38	.....	51	381	340	157	95	73	54
29	69	48	42	36	.....	51	314	381	153	95	72	53
30	69	48	40	36	.....	51	251	466	147	95	71	51
31	69	.....	40	35	.....	51	.....	466	.....	97	70	.....

NOTE.—Discharge interpolated Oct. 28 to Nov. 7, Jan. 11–15, 22, and Aug. 21 to Sept. 2 when recording gage was not operating. Discharge Feb. 14 to Mar. 11 estimated at 33 second-feet.

Monthly discharge of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	93	69	82.4	5,070
November	68	48	57.8	3,440
December	50	40	44.7	2,750
January	40	35	38.5	2,370
February	36	.....	34.0	1,950
March	53	.....	43.3	2,660
April	381	44	114	6,780
May	585	227	376	23,100
June	452	147	281	16,700
July	143	95	114	7,010
August	112	70	85.8	5,280
September	70	51	60.3	3,590
The year	585	.....	111	80,700

DUCHESNE RIVER BASIN.

DUCHESNE RIVER AT MYTON, UTAH.

LOCATION.—In the NW. ¼ sec. 25, T. 3 S., R. 2 W., Uinta special base and meridian, at highway bridge at Myton, Duchesne County, 3 miles below mouth of Lake Fork and 15 miles above mouth of Uinta River.

DRAINAGE AREA.—2,750 square miles.

RECORDS AVAILABLE.—October 26, 1899, to November 30, 1910; July 26, 1911, to September 30, 1916.

GAGE.—Chain gage on upstream rail near the left end of steel highway bridge; installed August 6, 1910, at a new datum; readings about 2.7 feet lower than those on old gage; read by Abe Smith. From October 26, 1899, to June 6, 1909, a chain gage was used at an old wooden bridge about half a mile below present site. June 6, 1909, the river cut a new channel and a new chain gage was installed July 9, 1909, about a quarter of a mile upstream and at a different datum. August 9, 1909, this gage was replaced by another chain gage about 100 feet downstream on right bank but at same datum.

DISCHARGE MEASUREMENTS.—Made from the highway bridge or by wading about 100 feet below the bridge.

CHANNEL AND CONTROL.—Stream bed of coarse gravel; banks comparatively low but not likely to be overflowed, although they are subject to erosion during high water. Current comparatively swift and makes an angle with the bridge at low stages. Control probably a gravel bar at the ford 100 or 200 feet below the gage; apparently fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.70 feet at 3.50 p. m. June 11 (discharge 4,560 second-feet); minimum stage 1.60 feet for several days in August and September (discharge 200 second-feet).

1899-1916. Maximum discharge recorded, 9,560 second-feet July 6, 1907; minimum discharge recorded, 100 second-feet August 28 to September 1, 1915.

ICE.—River generally frozen more or less completely over from middle of December to middle of March. Determinations of mean flow are based on two current meter measurements and study of weather records.

DIVERSIONS.—Much of the low-water flow of the river and its tributaries is diverted for irrigation above the station.

REGULATION.—Annual run-off is affected by storage in the United States Reclamation Service dam on Strawberry River, one of the main tributaries.

ACCURACY.—Stage-discharge relation permanent except during winter. Rating curve fairly well defined. Gage read twice daily. Daily discharge ascertained by applying daily gage height to rating table. Open-water records good; winter records roughly approximate.

Discharge measurements of Duchesne River at Myton, Utah, during the year ending Sept. 30, 1016.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec-ft.*
Nov. 5	L. W. Jordan	1.87	346	May 26	W. E. Dickinson	3.30	1,450
Jan. 14[a]	Lynn Crandall	2.61	355	June 6	....do	5.58	4.550
23[b]	....do	2.84	425	Aug. 27	E. S. Borgquist[c]	1.65	230

[a] River frozen over for two-thirds of its width at gage and at control. Floating mush ice.
[b] Frozen over except for 25 feet in mid-channel.
[c] Federal court water-commissioner.

Daily discharge, in second-feet, of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	635	335	410	.....	.....	670	1,900	3,280	995	500	240
2	710	335	410	.....	.....	710	1,700	3,000	955	500	210
3	670	310	385	.....	.....	725	1,800	2,705	940	530	220
4	600	295	385	.....	.....	750	1,950	3,250	855	565	200
5	530	285	440	.....	.....	750	2,225	3,940	790	955	220
6	500	285	440	.....	.....	670	2,520	4,285	750	805	240
7	500	440	440	.....	.....	635	2,900	4,110	670	870	235
8	500	500	440	.....	.....	620	3,180	3,860	650	910	200
9	470	470	440	.....	.....	620	3,320	4,195	670	790	235
10	410	530	385	.....	.....	695	3,545	4,470	725	565	250
11	385	310	385	.....	.....	855	3,395	4,565	670	500	285
12	440	285	360	.....	.....	955	2,900	3,780	580	440	250
13	440	285	335	.....	.....	910	2,705	3,545	550	490	260
14	500	260	385	355	.....	870	2,520	3,700	530	470	285
15	500	310	385	.....	.....	885	2,205	3,620	515	515	250
16	530	385	335	.....	1,040	970	2,060	3,470	620	440	260
17	440	345	360	.....	1,130	1,040	1,800	3,395	580	395	260
18	440	385	285	.....	1,315	1,130	1,650	2,970	635	410	275
19	470	385	285	.....	1,315	1,150	1,650	2,835	530	335	260
20	440	410	285	.....	1,315	1,060	1,600	2,640	450	360	240
21	440	410	310	.....	1,410	1,020	1,525	2,280	430	310	250
22	440	470	385	.....	1,315	955	1,600	1,880	430	295	285
23	440	440	500	425	1,175	1,020	1,650	1,600	430	310	335
24	440	440	500	.....	1,130	1,085	1,600	1,430	385	250	360
25	410	360	385	.....	910	1,220	1,580	1,315	395	240	360
26	410	385	335	.....	790	1,430	1,430	1,295	470	200	335
27	410	410	385	.....	790	1,700	1,430	1,240	620	260	325
28	385	385	285	.....	790	1,820	1,485	1,295	710	240	285
29	385	335	335	.....	830	2,205	1,680	1,150	710	260	335
30	385	410	335	.....	790	2,135	2,245	1,130	650	275	335
31	335	.....	335	.....	710	.....	2,945	.....	550	250	.....

NOTE.—Discharge estimated because of ice as follows: Jan. 1-31, 370 second-feet; Feb. 1-28, 400 second-feet; Mar. 1-15, 700 second-feet.

Monthly discharge of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	710	335	471	29,000
November	530	260	373	22,200
December	500	285	377	23,200
January	.....	.....	370	22,800
February	.....	.....	400	23,000
March	.....	.....	879	54,000
April	2,200	620	1,040	61,900
May	3,540	1,430	2,150	132,000
June	4,560	1,130	2,870	171,000
July	995	385	627	38,600
August	955	200	459	28,200
September	360	200	269	16,000
The year	4,560	200	857	622,000

STRAWBERRY RIVER AT DUCHESNE,[1] UTAH.

LOCATION.—In sec. 2, T. 4 S., R. 5 W., Uinta special base and meridian, at Winslow's ranch, about a mile west of post office at Duchesne, Duchesne County, half a mile above mouth of Indian Canyon a small tributary entering from the south, and 1½ miles above confluence of Strawberry River with the Duchesne.

DRAINAGE AREA.—1,040 square miles.

RECORDS AVAILABLE.—June 10, 1908, to November 30, 1910, and March 16, 1914, to September 30, 1916.

GAGE.—Inclined staff installed April 12, 1914, on right bank, about 50 feet below footbridge at Winslow's house; gage datum lowered 1 foot November 5, 1915; read by E. S. Winslow. Chain gage at approximately same site, but different datum was used 1908–1910.. A staff gage at the county bridge about a mile below was used from March 16 to April 11, 1914.

DISCHARGE MEASUREMENTS.—Made from cable just below footbridge or by wading.

CHANNEL AND CONTROL.—Banks comparatively low; covered with underbrush; left bank subject to overflow at very high stages. Control is gravel bar; apparently fairly permanent. Stage of zero flow, about −1.0 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.12 feet at 7 a. m. May 10 (discharge, 1,700 second-feet); minimum stage recorded 0.88 foot October 31 (discharge, 78 second-feet). Flow of 60 second-feet or less probably occurred in January.

1908–1916: Maximum discharge recorded, 1,860 second-feet April 22, 1910; minimum discharge, 30 second-feet November 20, 1914. Records obtained prior to 1914 for incomplete years only.

ICE.—Stage-discharge relation generally affected by ice from December to March. Estimates of winter flow based on discharge measurements and study of weather records.

DIVERSIONS.—Water stored in Strawberry Valley reservoir (capacity, 250,000 acre-feet), about 40 miles above station, is diverted by means of a tunnel to the Spanish Fork drainage basin. Some water is also diverted from the upper end of Strawberry Valley to the basin of Provo River.

REGULATION.—Since 1912 flow of river has been affected by operation of Strawberry Valley reservoir.

ACCURACY.—Stage-discharge relation shifted, presumably during spring high water; affected by ice December 13 to March 16. Rating curves fairly well defined between 50 and 1,200 second-feet. Gage read to hundredths twice daily; readings on supplementary gage used in obtaining daily mean July 24, 28, and August 4, on account of storms. Discharge ascertained by applying daily gage height to rating table; shifting-control method used May 11 to June 4. See footnote to daily-discharge table. Records fair.

Discharge measurements of Strawberry River at Duchesne, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 5	L. W. Jordan	[a] 0.92	79.3	June 5	W. E. Dickinson	[e] 3.02	686
Jan. 12	Lynn Crandall	[b] 1.35	64.4	Aug. 5	E. S. Borgquist [f]	1.97	346
24	do	[c] 1.70	75.7	Sept. 15	do	1.09	101
May 25	W. E. Dickinson	[d] 3.47	847				

[a] Datum lowered 1.00 foot.
[b] Riffle frozen over.
[c] River frozen over at gage; riffle open for about 4 feet.
[d] Stock runway of logs 6 feet below gage extends 15 feet out from bank.
[e] Stock runway removed.
[f] Federal court water commissioner.

[1] Described in report for 1910 as "Strawberry River at Theodore, Utah."

Daily discharge, in second-feet, of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	83	81	91	.....	237	1,120	763	275	194	114
2	81	81	85	.....	237	1,120	725	275	182	110
3	81	81	85	.....	252	1,120	725	261	194	106
4	81	81	85	.....	252	1,210	725	261	613	106
5	81	83	91	.....	237	1,290	687	261	275	106
6	83	93	101	.....	252	1,470	687	234	220	106
7	85	156	112	.....	228	1,510	687	234	220	106
8	91	129	97	.....	237	1,600	650	234	335	106
9	95	129	91	.....	237	1,650	613	234	220	106
10	95	101	81	.....	268	1,650	613	247	182	106
11	95	101	72	.....	284	1,500	613	234	177	106
12	91	101	72	.....	300	1,370	540	220	158	106
13	85	106	.....	.....	350	1,240	540	207	158	106
14	85	145	.....	.....	333	1,200	540	207	247	106
15	89	112	.....	.....	367	1,040	540	220	158	106
16	91	101	.....	.....	402	998	504	234	163	106
17	91	97	.....	350	420	918	486	234	163	106
18	91	124	.....	333	513	958	486	207	158	96
19	91	112	.....	420	513	998	469	207	154	96
20	91	112	.....	475	456	958	434	194	136	96
21	85	97	.....	438	402	958	434	187	136	96
22	85	91	.....	438	402	918	417	182	136	96
23	85	97	.....	438	456	958	400	182	125	96
24	85	97	.....	420	494	958	384	367	125	96
25	85	112	.....	316	630	918	367	182	119	96
26	85	112	.....	268	750	879	351	182	114	96
27	85	97	.....	252	831	840	335	207	114	96
28	81	85	.....	300	1,040	801	320	504	114	96
29	81	85	.....	268	1,250	801	304	320	114	96
30	81	91	.....	237	1,250	763	290	220	119	96
31	78	.....	.....	228	.....	763	.....	182	114	.....

NOTE.—Discharge estimated on account of ice: Dec. 13–31, 61 second-feet; Jan. 1–31, 66 second-feet; Feb. 1–29, 85 second-feet; Mar. 1–16, 268 second-feet.

Monthly dischare of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (totalin acre-feet).
	Maximum.	Minimum.	Mean.	
October	95	78	86.2	5,300
November	156	81	103	6,130
December	112	.....	71.7	4,410
January	.....	.....	66.0	4,060
February	.....	.....	85.0	4,890
March	475	.....	305	18,800
April	1,250	228	463	27,600
May	1,650	763	1,110	68,200
June	763	290	521	31,000
July	367	182	239	14,700
August	613	114	182	11,200
September	114	96	102	6,070
The year	1,650	.....	279	202,000

LAKE FORK NEAR MYTON, UTAH.

LOCATION.—In sec. 21, T. 3 S., R. 2 W., Uinta special base and meridian, 100 yards below highway bridge, half a mile above the confluence of Lake Fork with Duchesne River, and 3½ miles northwest of Myton, Duchesne County. From 1900–1903 this station was known as Lake Creek at mouth.

DRAINAGE AREA.—468 square miles.

RECORDS AVAILABLE.—July 3, 1900, to December 31, 1903; June 13, 1907, to November 30, 1910; July 26, 1911, to September 30, 1916.

GAGE.—Inclined staff installed September 13, 1912, on left bank at cable; read by J. R. Bywater and Taylor Beasley. From July 3, 1900, to June 30, 1907, records were obtained from a vertical staff gage near mouth of creek at an old bridge, which was washed out with the gage July 1, 1907. A chain gage installed August 18, 1907, on right bank about 250 feet below site of old bridge, at new datum, was used until December 31, 1907; in March, 1908, it was moved upstream about a quarter of a mile and installed at new datum on right bank, just below cable. This gage was moved to the left bank and established at same datum June 22, 1909, and used until August 10, 1912, when the chain was stolen. A temporary gage was used by the observer until September 12, 1912, when the present inclined staff was installed at the same site and datum as gage stolen August 10.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Banks perpendicular and comparatively high. Stream bed of gravel and control fairly permanent. Stage of zero flow about 0.9 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.2 feet at 9 a. m. June 6 (discharge, 1,300 second-feet); minimum stage 0.89 foot July 24 (discharge probably zero).

1900–1903 and 1907–1916: Maximum discharge recorded, June 7, 1912, 3,050 second-feet; minimum discharge recorded July 24, 1916, probably zero.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—No diversions below station; several canals of the United States Indian Office and some privately owned canals divert water above for irrigation.

REGULATION.—Flow affected by irrigation diversions above.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 4 and 1,400 second-feet. Gage read to hundredths once daily except during winter and early spring when it was read on alternate days. Daily discharge ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by ice (see note to table of daily discharge). Records obtained by use of rating table excellent; other records good.

Discharge measurements of Lake Fork near Myton, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 4	L. W. Jordan	1.72	52.9	May 25	W. E. Dickinson	1.80	62.0
Jan. 14[a]	Lynn Crandall	2.80	94.3	June 7	do	4.48	948
23[b]	do	3.15	126	Aug. 27	E. S. Borgquist[c]	1.15	31.0

[a] Complete ice cover at gage and control.
[b] Conditions about the same as on Jan. 14.
[c] Federal court water commissioner.

PRICE RIVER BASIN.

PRICE RIVER NEAR HELPER, UTAH.

LOCATION.—In sec. 36, T. 13 S., R. 9 E., at ford about 300 feet west of Denver & Rio Grande Railroad main line at settlement locally known as Spring Glenn, 2 miles south of Helper, Carbon County, 1 mile above diversion dam of Price River Irrigation Co., and 4 miles below White Creek.

DRAINAGE AREA.—530 square miles.

RECORDS AVAILABLE.—February 21, 1904, to September 30, 1916.

GAGE.—Vertical staff on left bank; installed July 16, 1907, to replace the old chain gage washed out April 11, 1907; read by D. S. Rowley. A temporary gage was read June 23 to July 15, 1907. All gage heights beginning June 23, 1907, are referred to a datum 0.7 foot above that of original chain gage.

DISCHARGE MEASUREMENTS.—Made from cable, or by wading.

CHANNEL AND CONTROL.—Bed of the stream composed of gravel and fine sand. Control is at riffle immediately below ford; shifts occasionally during floods. Stage of zero flow, determined January 8, 1916, 1.2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.0 feet at 12.30 p. m. July 28 (discharge about 3,800 second-feet); minimum stage, 2.20 feet December 19 (discharge 21 second-feet).

1904–1916: Maximum stage recorded, 7.0 feet July 28, 1916 (discharge 3,800 second-feet); minimum stage recorded 3.1 feet (old chain gage) during December, 1905, and January, 1906 (discharge, 4 second-feet).

ICE.—Stage-discharge relation affected by ice for short periods; estimates of flow based on weather records and observer's notes.

DIVERSIONS.—Main diversions from Price River are below station. About 10,000 acre-feet of water can be stored at the Mammoth reservoir of the Price River Irrigation Co. on Gooseberry Fork, about 40 miles above station.

REGULATION.—Flow of river is affected by storage at Mammoth reservoir.

ACCURACY.—Stage-discharge relation permanent until floods latter part of July and early part of August. Rating curve used until July 27 well defined between 20 and 1,300 second-feet. Rating curve used July 29 to September 30 defined by one measurement. Gage read to hundredths once daily after May 10. Daily discharge ascertained by applying daily gage height to rating table. Records good until July 28; fair July 29 to September 30.

Discharge measurements of Price River near Helper, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 8	Lynn Crandall	[a] 2.38	32.2	June 10	W. E. Dickinson	4.05	497
Mar. 27	A. B. Purton	[b] 3.38	227	July 2	.....do	3.11	140
May 4	W. E. Dickinson	[c] 4.44	823	Aug. 11	.....do	[d] 3.10	120

[a] Shore ice at gage; riffle clear; no backwater.
[b] Brush and drift lodged on control.
[c] Brush lodged on riffle.
[d] Channel silted in since last visit.

Daily discharge, in second-feet, of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	385	67	.....	.....	174	179	743	18	16	14
2	575	54	139	.....	179	204	535	12	28	12
3	372	54	146	.....	174	230	496	4	22	8
4	168	54	153	.....	168	204	873	9	22	9
5	156	58	160	.....	157	230	1,250	4	22	4
6	148	58	162	.....	146	273	1,300	4	51	14
7	117	70	163	.....	142	347	1,060	22	135	12
8	117	82	158	.....	139	421	964	28	102	16
9	117	88	154	.....	154	421	1,200	1	93	7
10	98	88	135	.....	168	516	1,300	4	24	9
11	98	74	116	.....	204	458	1,250	4	18	9
12	117	64	96	.....	180	421	830	4	16	14
13	117	67	.....	288	156	372	830	4	21	12
14	98	115	.....	298	222	322	919	4	17	11
15	98	155	.....	308	288	273	830	4	33	12
16	98	189	.....	319	246	226	874	1	22	14
17	98	184	.....	319	204	179	874	.9	18	11
18	98	152	.....	319	217	146	700	.6	21	12
19	117	119	.....	319	230	114	743	.6	21	13
20	117	.....	.....	319	199	82	575	0	18	13
21	117	.....	.....	312	184	66	351	0	18	13
22	107	.....	.....	304	170	51	258	6	11	15
23	107	.....	.....	296	174	54	156	.8	4	15
24	107	121	.....	288	179	58	74	0	4	12
25	107	.....	.....	273	184	68	35	3	4	11
26	98	.....	.....	258	189	60	35	6	2	10
27	82	.....	.....	244	172	51	36	51	3	8
28	82	.....	.....	212	156	104	51	26	9	10
29	82	.....	.....	179	217	156	41	15	10	10
30	82	.....	.....	174	198	385	30	16	12	11
31	74	.....	.....	168	.....	616	.....	14	14	.....

NOTE.—Discharge estimated because of ice from observer's notes, weather records, and two discharge measurements as follows: Nov. 20–23, 135 second-feet; Nov. 25 to Dec. 1, 130 second-feet; Dec. 13–31, 105 second-feet; Jan. 1–31, 120 second-feet; Feb. 1–29, 110 second-feet; and Mar. 1–12, 200 second-feet. Discharge interpolated for days when gage was not read.

Monthly discharge of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	575	74	140	8,610
November	189	54	108	6,430
December	.....	.....	120	7,380
January	.....	.....	120	7,380
February	.....	.....	110	6,330
March	.....	.....	245	15,100
April	288	139	186	11,100
May	616	51	235	14,400
June	1,300	30	640	38,100
July	51	0	8.61	529
August	135	2	26.2	1,610
September	16	4	11.4	678
The year	1,300	0	162	118,000

SAN RAFAEL RIVER BASIN.

HUNTINGTON CREEK NEAR HUNTINGTON, UTAH.

LOCATION.—In sec. 6, T. 17 S., R. 8 E., at the Cunha ranch, about 7 miles northwest of Huntington, Emery County. Below all main tributaries except Fish Creek.

DRAINAGE AREA.—158 square miles.

RECORDS AVAILABLE.—May 3, 1909, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on left bank; installed April 30, 1913, to replace the inclined staff used since October 7, 1912; set to read the same but is about 100 feet above inclined gage, which is 20 feet above cable. A vertical staff on right bank at same site and datum as inclined gage was used May 3, 1909, to October 6, 1912.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; shifts occasionally during high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 5.60 feet at 11 p. m. May 8 (discharge, 1,100 second-feet); minimum stage (staff), 2.30 feet at 3.20 p. m. November 12 (discharge 24 second-feet).

1909–1916: Maximum discharge 1,100 second-feet May 22 and 23, 1914, and May 8, 1916. Minimum discharge 12 second-feet March 20, 21, 22, and 23, 1912.

ICE.—Stream frozen entirely over during greater part of winter. Winter estimates based largely on study of weather records.

DIVERSIONS.—Several small ditches divert from tributaries above the station.

REGULATION.—A small storage reservoir on Huntington Creek above the station controls distribution of flow to a slight extent.

ACCURACY.—Stage-discharge relation shifted slightly; affected by ice November 26 to December 4 and December 12 to February 11. Rating curves well defined up to 500 second-feet, applicable October 1 to December 11, February 12 to May 5, and May 9 to September 30. Water-stage recorder generally operated satisfactorily but was not kept in use during winter. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph except for periods indicated in footnote to daily-discharge table.

Discharge measurements of Huntington Creek near Huntington, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 9[a]	Lynn Crandall.....	3.70	41.1	June 28	W. E. Dickinson.....	3.48	188
Mar. 24	A. B. Purton.....	2.82	64.2	Aug. 8	Dickinson and Jacob...	3.25	127
May 5	W. E. Dickinson.....	4.40	427				

[a] Measured at ford 2 miles below gage. Frozen over at station except for narrow channel in center.

Daily discharge, in second-feet, of Price River near Helper, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	31	33	31	34	.....	30	210	840	685	139	276	62
2	30	33	25	28	.....	30	258	800	685	148	184	65
3	33	33	31	36	.....	34	258	722	615	148	195	62
4	32	33	33	34	.....	.....	295	800	615	143	242	65
5	33	33	36	32	33	.....	258	920	615	143	210	62
6	34	46	33	34	34	.....	242	1,000	582	139	225	65
7	28	85	33	34	34	38	242	1,180	582	139	225	62
8	28	70	33	35	34	36	276	1,370	550	139	210	60
9	28	44	34	34	36	56	360	1,370	490	143	168	65
10	31	46	33	33	35	76	520	1,370	490	143	139	60
11	31	40	32	32	34	113	490	1,270	462	153	117	55
12	31	24	28	32	34	85	490	1,180	434	143	132	62
13	33	33	31	34	32	94	434	1,090	383	150	143	65
14	33	32	33	34	35	104	490	1,000	383	153	156	65
15	30	30	34	34	45	114	550	920	337	163	132	65
16	31	38	33	34	44	125	582	840	316	195	156	62
17	34	36	33	34	40	173	582	760	295	251	125	62
18	34	36	28	34	38	232	550	722	276	251	121	62
19	32	34	21	34	36	308	520	685	258	190	121	62
20	33	34	27	34	34	383	408	685	251	184	134	62
21	27	36	33	32	34	360	462	685	219	179	117	62
22	33	35	24	33	36	360	434	685	219	179	99	62
23	33	35	36	36	38	582	462	685	213	179	95	130
24	33	36	32	35	36	316	550	650	201	184	88	70
25	32	36	28	34	36	258	615	615	195	184	85	70
26	30	37	33	35	41	240	615	582	184	190	85	70
27	28	35	32	.....	39	222	800	550	163	225	76	67
28	29	27	31	.....	37	258	880	550	143	890	73	67
29	31	36	30	.....	27	276	1,000	550	143	242	67	67
30	30	38	32	.....	.....	238	1,000	650	143	207	99	65
31	30	.....	33	.....	.....	182	.....	650	.....	213	67	.....

NOTE.—Discharge estimated because of ice, as follows: Jan. 27–31, 33 second-feet; Feb. 1–4, 30 second-feet; Mar. 4–6, 32 second-feet.

Monthly discharge of Price River near Helper, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	34	27	31.2	1,920
November	85	24	38.1	2,270
December	36	21	31.2	1,920
January	36	28	33.5	2,060
February	45	27	35.2	2,020
March	582	30	175	10,800
April	1,000	210	494	29,400
May	1,370	550	851	52,300
June	685	143	372	22,100
July	800	139	195	12,000
August	276	67	141	8,670
September	130	55	66.0	3,930
The year	1,370	21	206	149,000

Daily discharge, in second-feet, of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	38	.....	.....	.....	62	316	664	166	141	74
2	38	39	.....	.....	.....	63	240	594	158	158	58
3	39	39	.....	.....	.....	64	330	636	151	149	57
4	42	39	.....	.....	48	64	420	688	143	151	53
5	42	42	45	.....	.....	64	511	734	141	180	53
6	43	54	40	.....	.....	63	613	713	143	158	53
7	41	58	35	.....	.....	63	755	640	143	138	52
8	42	45	31	.....	.....	64	824	640	153	134	52
9	43	35	39	.....	.....	68	894	664	147	126	56
10	43	35	46	.....	.....	75	786	664	153	128	54
11	43	35	43	.....	.....	95	713	617	143	125	53
12	41	24	.....	36	.....	91	684	576	134	120	53
13	44	34	.....	.....	.....	87	659	567	130	121	53
14	45	34	.....	.....	.....	92	541	528	132	111	52
15	43	34	.....	.....	.....	97	456	504	139	128	52
16	46	34	.....	.....	.....	99	417	483	136	138	52
17	43	43	.....	.....	.....	107	452	471	128	112	52
18	41	40	.....	.....	53	112	467	464	120	105	53
19	43	40	.....	36	.....	104	479	436	125	104	53
20	42	40	.....	.....	.....	90	475	406	118	104	52
21	41	40	.....	.....	.....	88	464	395	110	104	52
22	41	40	.....	.....	.....	92	631	365	138	100	52
23	41	40	.....	.....	.....	109	567	336	138	99	58
24	40	36	.....	.....	62	134	504	307	139	100	58
25	37	39	.....	.....	64	170	460	278	153	100	55
26	38	.....	.....	36	63	189	444	249	162	88	54
27	39	.....	.....	.....	66	230	467	220	162	86	55
28	38	.....	.....	.....	70	349	533	191	155	85	54
29	38	.....	.....	.....	65	468	580	194	141	88	55
30	38	.....	.....	.....	65	392	664	175	138	86	55
31	38	.....	.....	.....	62	.....	684	.....	143	82	.....

NOTE.—Discharge estimated on account of ice as follows: Nov. 26–30, 40 second-feet; Dec. 1–4, 42 second-feet; Dec. 12–31, 38 second-feet; Jan. 1–9, 40 second-feet; Jan. 10–31, 38 second-feet; Feb. 1–11, 35 second-feet. Discharge interpolated, because water-stage recorder was out of commission as follows: Nov. 9–11, 35 second-feet; Nov. 13–16, 34 second-feet; Nov. 18–23, 40 second-feet; Feb. 13–18, and 20–25, 36 second-feet; Feb. 27–29, 38 second-feet; Mar. 1–3, 45 second-feet; Mar. 5–17, 50 second-feet; Mar. 19–23, 58 second-feet. Staff gage was read once a week Feb. 11 to Mar. 24. Shifting-control method used May 6–8.

Monthly discharge of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (totalin acre-feet).
	Maximum.	Minimum.	Mean.	
October	46	37	41.0	2,520
November	58	.....	39.2	2,330
December	.....	.....	38.9	2,390
January	.....	.....	38.6	2,370
February	.....	.....	35.8	2,060
March	70	.....	54.6	3,360
April	468	62	128	7,620
May	894	240	549	33,800
June	734	175	480	28,600
July	166	110	141	8,670
August	180	82	118	7,250
September	74	52	54.5	3,240
The year	894	.....	144	104,000

HUNTINGTON CREEK NEAR CASTLEDALE, UTAH.

LOCATION.—In sec. 33, T. 18 S., R. 9 E., about half a mile below county bridge on road to Green River, 5 miles above mouth of Cottonwood Creek, and 6 miles east of Castledale, Emery County.

DRAINAGE AREA.—325 square miles.

RECORDS AVAILABLE.—May 12, 1911, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank; installed May 2, 1913, at same datum as vertical staff gage which it replaced.

DISCHARGE MEASUREMENTS.—Made by wading or from a cable just below gage.

CHANNEL AND CONTROL.—Bed composed of sand and small gravel. Banks fairly high; subject to erosion but not to overflow. Original control, which was formed by 2 by 12 inch planks, placed edgewise in a trench and anchored to pipes driven into stream bed, has been almost obliterated. Stage of zero flow about 0.9 foot.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 7.2 feet at 11 p. m. August 12 (discharge, 1,030 second-feet); minimum stage 1.19 feet October 1 (discharge, 6 second-feet).

1911–1916: Maximum stage recorded 7.2 feet at 11 p. m. August 12, 1916 (discharge, 1,030 second-feet); minimum stage 0.95 foot September 10, 1915 (discharge, 2.5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice. Winter flow determined largely by a comparison with the records of flow for station near Huntington. Ice forms 4 or 5 feet in thickness and the stream is often ice bound until April 1.

DIVERSIONS.—Station is below all diversions in Castle Valley.

REGULATION.—Flow affected by irrigation in Huntington district.

ACCURACY.—Stage-discharge relation not permanent; affected by ice November 26 to March 20. Rating curve used October 1 to May 6 well defined between 5 and 350 second-feet; curve used May 10 to September 30 rather poorly defined. Operation of water-stage recorder satisfactory except during periods indicated in footnote to daily-discharge table; gage not in operation, because of ice, January 12 to March 22. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph or, for days of considerable fluctuation in stage, by averaging the hourly discharge. Open-water records good; winter records roughly approximate.

Discharge measurements of Huntington Creek near Castledale, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 11[a]	Lynn Crandall	2.85	39.0	June 29	W. E. Dickinson	1.71	37.2
Mar. 25	A. B. Purton	2.21	66.0	Aug. 9	do	1.74	40.5
May 6	W. E. Dickinson	3.91	313				

[a] Stream entirely frozen over; stage read on outside staff gage.

Daily discharge, in second-feet, of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6	8	.....	47	128	338	24	15	14
2	6	8	.....	46	110	277	23	16	13
3	6	9	.....	46	123	277	22	16	12
4	6	10	.....	46	142	311	20	26	12
5	8	10	.....	46	211	430	22	45	12
6	8	66	.....	45	286	374	18	50	12
7	9	128	.....	55	420	311	18	34	12
8	8	36	.....	57	468	302	19	70	12
9	8	.....	.....	71	487	311	20	40	14
10	8	.....	.....	86	477	320	19	30	14
11	8	.....	.....	103	401	302	16	23	14
12	8	.....	.....	109	347	268	13	206	14
13	9	.....	.....	105	329	260	12	222	14
14	9	.....	.....	112	243	233	11	65	13
15	9	27	.....	126	189	209	13	56	13
16	8	29	.....	134	156	193	12	87	14
17	8	27	.....	141	161	193	13	67	14
18	8	29	.....	92	179	179	11	56	14
19	8	31	.....	86	178	174	11	46	14
20	8	32	.....	84	172	.....	12	42	14
21	8	32	99	99	149	.....	11	37	14
22	8	31	88	85	252	.....	11	29	14
23	9	29	99	92	277	.....	11	25	17
24	9	30	87	119	252	.....	12	.....	16
25	9	23	60	142	190	.....	15	.....	16
26	9	.....	61	134	166	60	16	.....	15
27	8	.....	59	161	164	52	21	.....	14
28	9	.....	60	211	222	44	18	.....	13
29	9	.....	54	268	253	36	17	.....	13
30	9	.....	51	198	294	30	22	.....	13
31	9	.....	49	.....	329	.....	16	.....	.....

NOTE.—Discharge estimated because of ice as follows: Nov. 26 to Jan. 31, 27 second-feet; Feb. 1–29, 40 second-feet; Mar. 1–10, 56 second-feet; Mar. 11–20, 112 second-feet. Water-stage recorder not in operation, discharge interpolated, as follows: Nov. 9–14, 32 second-feet; June 20–25, 117 second-feet; Aug. 24–31, 20 second-feet. Discharge June 26, 29, determined from readings on staff gage; June 27, 28, and 30, Sept. 1, 3, interpolated.

Monthly discharge of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9	6	8.13	500
November	128	8	30.7	1,830
December	.....	.....	27.0	1,660
January	.....	.....	27.0	1,660
February	.....	.....	40.0	2,300
March	.....	.....	78.9	4,850
April	268	45	105	6,250
May	487	110	250	15,400
June	430	30	206	12,300
July	24	11	16.1	990
August	222	.....	47.2	2,900
September	17	12	13.7	815
The year	487	6	70.8	51,500

SAN RAFAEL RIVER NEAR GREEN RIVER, UTAH.

LOCATION.—In sec. 27, T. 22 S., R. 14 E., at county bridge near Tomlinson ranch, on road from Green River to Hanksville; about 16 miles southwest of Green River, Emery County.

DRAINAGE AREA.—1,690 square miles.

RECORDS AVAILABLE.—May 5, 1909, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right crib abutment of bridge; read by Mrs. W. E. Tomlinson and Mrs. L. Presset.

DISCHARGE MEASUREMENTS.—Usually made from cable about 300 feet above the bridge, because of condition of bottom.

CHANNEL AND CONTROL.—Bed composed of mud and quicksand; shifting; control not well defined. Banks fairly high but left bank subject to overflow at extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet morning of August 6 (discharge estimated 3,750 second-feet); minimum stage, 1.52 feet October 1–5 (discharge 3 second-feet).

1909–1916: Maximum stage recorded 9.0 feet September 2, 1909 (discharge 4,720 second-feet); water standing in pools during August and September, 1910, and August 13 to September 8, 1915.

ICE.—Stage-discharge relation seriously affected by ice. Winter flow determined from discharge measurements and weather records.

DIVERSIONS.—Below practically all diversions from San Rafael River. The main diversions in this basin are made from the tributaries, for irrigation in Castle Valley.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice December 17 to February 24. Rating curve used October 1 to November 6 and March 15 to September 30 fairly well defined between 250 and 1,000 second-feet; curve used November 8 to March 13, poorly defined. Gage read to hundredths once daily October 1 to March 30 and twice daily April 1 to September 30. Daily discharge ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by shifting control or ice. Records fair.

Discharge measurements of San Rafael River near Green River, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 5[a]	Lynn Crandall	2.58	51.7	May 12	W. E. Dickinson	4.98	846
Mar. 8	A. B. Purton	3.16	263	June 26	do	3.90	354

[a] River frozen except for 10-foot strip in center at gage and control.

Daily discharge, in second-feet, of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	11	44	.....	70	130	258	841	258	152	90
2	3	12	43	.....	90	104	258	1,080	234	152	90
3	3	12	46	.....	109	104	258	1,200	234	592	90
4	3	12	48	.....	128	112	284	1,320	211	1,140	77
5	3	12	94	.....	128	112	472	1,380	190	1,780	77
6	3	12	97	.....	146	119	532	1,380	190	1,780	77
7	3	700	83	.....	306	119	592	1,380	152	311	77
8	4	368	83	.....	265	144	841	1,380	135	284	65
9	5	306	83	.....	252	170	1,140	1,440	234	259	65
10	6	228	83	.....	450	170	1,140	1,380	311	234	65
11	7	185	83	.....	648	211	898	1,440	170	190	65
12	7	172	76	.....	1,080	190	841	1,380	152	391	77
13	7	159	74	.....	558	190	958	1,320	152	592	84
14	7	146	73	.....	1,080	190	684	1,200	119	190	77
15	7	115	72	.....	592	190	510	1,200	112	258	77
16	7	112	70	.....	340	170	402	1,440	104	234	77
17	8	97	.....	.....	402	170	386	1,380	112	234	65
18	9	76	.....	.....	520	190	370	786	119	211	65
19	10	70	.....	.....	637	190	340	841	104	200	65
20	11	70	.....	.....	436	170	340	592	104	190	65
21	11	75	.....	.....	311	190	402	472	84	170	65
22	12	76	.....	.....	311	200	436	402	80	152	65
23	12	77	.....	.....	420	211	472	402	77	152	65
24	11	78	.....	.....	528	234	436	394	77	135	65
25	10	80	.....	128	637	234	436	386	77	127	65
26	10	80	.....	116	284	311	370	370	786	97	65
27	10	82	.....	104	258	311	403	326	152	90	65
28	10	70	.....	93	233	472	436	284	370	90	65
29	10	58	.....	82	207	472	514	271	403	90	65
30	10	48	.....	.....	182	436	592	284	436	90	65
31	11	.....	.....	.....	156	.....	786	.....	152	90	.....

NOTE.—Discharge estimated because of ice as follows: Dec. 17–31, 65 second-feet; Jan. 1–31, 58 second-feet; Feb. 1–24, 76 second-feet; Nov. 7 and Mar. 14 by indirect method for shifting control.

Gage not read, discharge interpolated Oct. 9, 10, 13, Nov. 12, 13, 23, Dec. 8, 10, 13–15, Feb. 26–29, Mar. 2, 3, 10, 18, 23, 24, 27–31, Apr. 1, 8, 22, May 6, 27, 29, June 3, 24, July 15, 22, 29, Aug. 9, 12, and 19.

Monthly discharge of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	12	3	7.52	462
November	700	11	123	7,320
December	97	.....	68.6	4,220
January	.....	.....	58.0	3,570
February	.....	.....	80.9	4,650
March	1,080	70	379	23,300
April	472	104	207	12,300
May	1,140	258	541	33,300
June	1,440	271	932	55,500
July	786	77	196	12,100
August	1,780	90	343	21,100
September	90	65	71.3	4,240
The year	1,780	3	251	182,000

NOTE.—Maximum discharge on Aug. 6, 3,750 second-feet.

COTTONWOOD CREEK NEAR ORANGEVILLE, UTAH.

LOCATION.—In sec. 9 or 10, T. 18 S., R. 7 E., at Robert Johnson's ranch, about 5 miles northwest of Orangeville, Emery County.

DRAINAGE AREA.—240 square miles.

RECORDS AVAILABLE.—May 1, 1909, to September 30, 1916.

GAGE.—Inclined staff on left bank just below corral at ranch house and about 300 feet above cable; used March 22, 1910, to November 23, 1913; and May 24, 1914, to September 30, 1916. Read by Robert Johnson. Records obtained November 24, 1913, to May 23, 1914, were referred to a different gage at independent datum installed November 20, 1913, at cable. From May 1, 1909, to August 21, 1909, stage was determined by measuring down from a nail in a tree at about the location of the present gage. August 22, 1909, an inclined staff was installed at the reference point; gage was washed out August 31, 1909, and from September 1, 1909, to March 22, 1910, the records were uncertain and unreliable. March 22 an inclined staff was installed at present site and at datum 0.8 foot lower than the datum used in 1909. An inclined staff was installed in 1911 about 400 feet below present gage but no published records have been referred to it, and it was destroyed by floods in the spring of 1913.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed rough; shifting. Banks fairly high but have been overflowed by the sudden floods, to which the stream is subject.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 7.0 feet at 4 p. m. June 10 (discharge, 950 second-feet); minimum stage 4.5 feet December 13 and 15 (discharge, 18 second-feet).

1909–1916: Maximum discharge recorded, 1,980 second-feet September 7, 1913; minimum discharge recorded, 5 second-feet September 21, 1910.

ICE.—Stage-discharge relation affected by ice; winter flow estimated from discharge measurements and weather records.

DIVERSIONS.—Two or three small ditches divert water above station but all the main ditches take out below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent until high water in June; affected by ice during winter. Rating curve used October 1 to December 31 and March 1 to May 31 fairly well defined; curve used July 23 to September 30 poorly defined. Gage read about four times a week, in the afternoon. Daily discharge for days on which gage was read ascertained by applying gage height to rating table; shifting-control method used June 1 to July 22; interpolated for other days. Records only fair owing to lack of gage readings and shifting control.

Discharge measurements of Cottonwood Creek near Orangeville Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	Lynn Crandall.....	4.85	31.1	May 7	W. E. Dickinson.....	6.12	404
Mar. 25	A. B. Purton.....	4.62	27.4	June 29	.....do.....	5.86	258
May 7	W. E. Dickinson.....	6.14	417	Aug. 9	.....do.....	4.81	65.5

[a] Frozen solid; water flowing over ice.

Daily discharge, in second-feet, of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	25	34	34	32	143	630	235	110	40
2	25	25	34	34	38	184	630	205	110	40
3	25	25	34	34	45	225	690	200	110	40
4	25	25	34	34	45	300	750	195	110	40
5	25	25	34	34	45	300	820	190	110	40
6	25	25	34	34	45	450	780	190	100	40
7	25	30	34	40	34	410	750	190	90	40
8	25	34	34	45	34	630	890	190	85	40
9	25	34	30	51	52	690	950	180	80	40
10	25	36	25	57	70	630	950	170	75	40
11	25	18	25	57	70	570	910	160	65	40
12	25	22	22	73	70	570	880	150	65	40
13	25	25	18	70	102	570	800	150	65	40
14	25	25	18	58	70	430	800	150	65	40
15	25	25	18	45	81	300	800	155	65	40
16	25	25	34	57	92	350	800	155	65	40
17	25	25	30	45	102	350	730	160	60	35
18	25	25	35	54	85	350	660	160	55	30
19	25	25	30	62	57	350	590	165	51	30
20	25	25	34	70	61	350	530	165	51	30
21	25	25	34	70	85	350	470	160	51	30
22	25	25	34	70	121	350	415	150	51	35
23	25	25	34	57	145	350	390	150	45	40
24	25	25	34	51	167	350	365	150	40	35
25	25	25	34	45	167	350	340	150	40	30
26	25	25	34	45	214	350	315	150	40	30
37	25	25	34	45	260	350	315	150	40	30
28	25	25	34	57	260	350	315	150	40	30
29	25	25	34	41	102	450	260	130	40	30
20	25	25	34	25	122	510	250	120	40	30
31	25	.....	34	25	.....	630	.....	110	40	.....

NOTE.—Discharge estimated because of ice as follows: Jan. 1–31, 27 second-feet; Feb. 1–29, 25 second-feet.

Monthly discharge of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	25	25	25.0	1,540
November	36	25	25.8	1,540
December	34	18	31.1	1,920
January	.....	.....	27.0	1,670
February	.....	.....	25.0	1,440
March	73	25	44.0	3,010
April	260	32	95.8	5,700
May	690	143	405	24,900
June	950	250	626	37,200
July	235	110	164	10,100
August	110	40	66.2	4,070
September	40	30	36.2	2,150
The year	950	18	104	95,200

FERRON CREEK (UPPER STATION) NEAR FERRON, UTAH.

LOCATION.—In sec. 1, T. 20 S., R. 6 E.; about a quarter of a mile below house at the Peterson ranch (formerly Christensen's), 1½ miles above grist mill and 5 miles northwest of Ferron, Emery County.

DRAINAGE AREA.—150 square miles.

RECORDS AVAILABLE.—May 6, 1911, to September 30, 1916.

GAGE.—Inclined staff on right bank at cable installed September 13, 1911, to replace the original vertical staff 150 feet above cable; read by Charles Carlson.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Banks high and not subject to overflow. Bed composed of sand and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.00 feet 8 p. m., June 5 (discharge, 561 second-feet); minimum stage, 0.36 foot April 6 (discharge, 16 second-feet).

1911–1916: Maximum stage recorded, 5.50 feet 4 p. m. June 1, 1914 (discharge, 1,100 second-feet); minimum discharge recorded, 1 second-foot March 22 and 23, 1912.

ICE.—Observations discontinued during winter.

DIVERSIONS.—Above all diversions except a small ditch for the Peterson ranch.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed radically during first half of June, owing to scouring of channel. Rating curves before and after change poorly defined. Gage read to hundredths twice daily after April 4, 1916. Discharge ascertained by applying daily gage height to rating table. Records only fair.

Discharge measurements of Ferron Creek (upper station) near Ferron, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	Lynn Crandall	.....	9.8	Jun. 30[c]	W. E. Dickinson	0.62	166
Mar. 26[b]	A. B. Purton	0.36	16.5	Aug. 10[d]	.....do.....	[d]1.88	45.6
May 8	W. E. Dickinson	2.62	372				

[a] Creek frozen over; no gage height.
[b] Stage of zero flow at −0.5 foot ±0.1 foot.
[c] Channel cut out to depth of about 2 feet below zero of gage.
[d] Gage datum lowered 2 feet Aug. 10.

Daily discharge, in second-feet, of Ferron Creek (upper station), near Ferron, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	12	.....	.....	.....	110	328	178	310	37
2	12	.....	.....	19	116	328	174	69	37
3	11	.....	.....	18	143	340	164	182	37
4	11	.....	.....	20	192	403	150	202	37
5	11	.....	.....	19	250	470	138	152	35
6	11	.....	.....	16	260	484	134	98	37
7	10	.....	.....	19	240	470	131	81	35
8	10	.....	.....	22	311	498	127	70	59
9	10	.....	.....	35	328	526	116	65	36
10	9	10	.....	71	333	526	113	44	35
11	9	.....	.....	56	284	540	109	44	34
12	9	.....	.....	34	284	526	106	320	32
13	9	.....	.....	27	226	512	98	46	31
14	9	.....	.....	42	198	512	92	242	30
15	9	.....	.....	76	176	498	89	136	29
16	9	.....	.....	88	164	416	89	71	28
17	.....	.....	.....	68	167	403	86	63	27
18	.....	.....	.....	65	192	416	78	60	25
19	.....	.....	.....	54	205	390	73	59	25
20	.....	.....	.....	41	203	385	65	60	24
21	.....	.....	.....	48	181	355	68	58	23
22	.....	.....	.....	65	226	300	65	59	23
23	.....	.....	.....	130	186	288	118	57	22
24	.....	.....	.....	150	169	290	70	53	21
25	.....	.....	.....	186	172	265	84	50	21
26	.....	.....	16	172	159	251	68	48	21
27	.....	.....	.....	185	164	242	218	44	22
28	.....	.....	.....	203	183	234	75	42	22
29	.....	.....	.....	75	220	222	68	50	22
30	.....	.....	.....	108	293	188	250	40	22
31	.....	.....	.....	.....	340	.....	65	39	.....

NOTE.—Observer absent from station Oct. 17 to Apr. 2; no record.

Monthly discharge of Ferron Creek (upper station) near Ferron, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 2-30	203	16	72.8	4,190
May	340	110	215	13,200
June	540	188	387	23,000
July	250	65	112	6,890
August	310	39	94.0	5,780
September	59	21	29.6	1,760
The period				54,800

GRAND RIVER BASIN.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

LOCATION.—In sec. 13, T. 3 N., R. 76 W., at highway bridge 3 miles southwest of Grand Lake, in Grand County. Nearest tributary, Grand Lake outlet, enters some distance below the station; no tributaries for several miles above.

DRAINAGE AREA.—101 square miles (revised, measured on topographic maps.)

RECORDS AVAILABLE.—July 29, 1904, to September 30, 1909; September 20, 1910, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by Mrs. Ethel M. Curry.

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

CHANNEL AND CONTROL.—Bed composed of boulders; rough. Gravity section which shifts slightly from year to year. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.37 feet at 7 p. m. June 16 (discharge, 666 second-feet); minimum stage, 3.37 feet February 9 and 10 (discharge, 33 second-feet).

ICE.—Stage-discharge relation only slightly affected by ice for short periods, as springs keep river open.

DIVERSIONS.—There are court decrees for the diversions of 699 second-feet from the headwaters above the station. Of this amount 525 second-feet are for diversions across the divide into the headwaters of the Cache la Poudre River; under this decree 14,518 acre-feet were diverted in 1916. There is also a reservoir decree for 19,000 acre-feet from floodwater.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent during 1916, but shifts slightly from year to year. Rating curve fairly well defined below 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

The following discharge measurement was made by T. J. Watkins: January 30, 1916: Gage height, 3.44 feet; discharge, 39.5 second-feet.

Daily discharge, in second-feet, of North Fork of Grand River at Grand Lake, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	61	48	41	36	36	34	52	225	420	322	107	56
2	59	46	39	36	36	34	52	172	395	322	90	63
3	66	45	37	36	35	34	54	135	370	300	128	60
4	64	45	38	36	34	34	55	155	420	280	197	62
5	62	43	39	36	35	34	48	190	560	260	152	74
6	61	43	38	36	34	34	41	260	472	242	128	69
7	57	43	37	37	34	34	42	345	420	214	152	72
8	57	45	36	38	34	34	45	345	370	181	142	74
9	55	46	36	36	33	34	48	445	420	214	128	76
10	55	48	37	36	33	34	55	560	560	225	111	78
11	55	48	36	37	34	34	62	445	472	242	107	78
12	55	49	37	38	35	34	69	445	420	181	94	102
13	49	49	37	38	36	34	77	395	472	152	88	107
14	55	49	38	37	34	34	80	370	530	128	107	102
15	55	49	38	36	35	34	82	300	590	152	98	84
16	55	48	38	36	34	34	80	260	652	169	88	74
17	55	48	37	37	34	34	92	242	530	169	84	74
18	55	46	36	36	34	34	113	225	590	152	88	74
19	54	45	36	36	34	37	109	197	530	148	74	72
20	54	45	36	35	34	37	105	225	500	128	69	69
21	54	45	35	36	34	38	109	242	420	107	69	67
22	52	46	35	36	34	41	109	242	500	102	65	63
23	52	46	35	36	34	53	131	260	395	102	65	63
24	52	45	35	36	34	51	155	190	322	94	65	88
25	51	42	35	35	34	51	260	260	322	88	65	78
26	51	46	36	36	34	51	242	242	322	88	65	74
27	49	49	36	35	34	50	345	260	345	88	74	74
28	48	48	37	36	34	50	300	260	322	96	65	74
29	48	45	38	36	34	50	345	260	322	102	63	74
30	48	43	37	38	.....	51	300	322	322	115	63	72
31	48	.....	36	38	.....	51	.....	370	.....	128	55	.....

NOTE.—Discharge Jan. 6–7, and 21–23 estimated because of ice.

Monthly discharge of North Fork of Grand River near Grand Lake, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	66	48	54.6	3,360
November	49	42	46.1	2,740
December	41	35	36.8	2,260
January	38	35	36.4	2,240
February	36	33	34.3	1,970
March	53	34	39.5	2,430
April	345	41	122	7,260
May	560	135	285	17,500
June	652	322	443	26,400
July	322	88	171	10,500
August	197	55	95.0	5,840
September	107	56	74.9	4,460
The year	652	33	120	87,000

GRAND RIVER AT HOT SULPHUR SPRINGS,[1] COLO.

LOCATION.—In sec. 2 T. 1 N,, R. 78 W., at the bridge connecting the Denver & Salt Lake Railway station with the town of Hot Sulphur Springs, in Grand County. Nearest tributary, Beaver Creek, enters two miles below.

DRAINAGE AREA.—946 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—July 22, 1904, to September 30, 1909; September 23, 1910, to September 30, 1916.

GAGE.—Chain on downstream side of bridge; read by employee of U. S. Forest Service. A staff gage 1,000 feet farther downstream, and set to a datum 6.07 feet lower was used to April 16, 1906.

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

CHANNEL AND CONTROL.—Bed composed of well compacted gravel. Control, 150 feet downstream, shifts from year to year. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.45 feet on May 10 and 8 a. m. May 11 (discharge, 3,540 second-feet); minimum discharge about 103 second-feet, February 26.

ICE.—Stage-discharge relation seriously affected by ice. Winter flow estimated from discharge measurements, observers' notes, and weather records.

DIVERSIONS.—Between this station and the mouth of North Fork there are court decrees for the diversion of 96 second-feet from Grand River; also a reservoir decree for 31,300 acre-feet from the flood waters of the Grand.

REGULATION.—None.

ACCURACY.—Stage-discharge fairly permanent during open water periods; shifts occasionally between narrow limits; affected by ice from November 11 to March 25. Rating curve well-defined above 250 second-feet and poorly defined below. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table. Open-water records good; winter records fair.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 1	T. J. Watkins	[a] 3.32	121	June 3	W. R. King	4.74	2,580
Mar. 2	W. R. King	[a] 3.37	107	26	H. K. Smith	4.47	2,160
May 15	....do	4.52	2,130				

[a] Stage-discharge relation affected by ice.

[1] Called "Sulphur Springs" in previous reports.

Daily discharge, in second-feet, of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	337	176	125	138	120	110	190	1,060	2,740	1,820	735	317
2	317	174	130	153	125	105	215	975	2,880	1,700	665	300
3	317	174	135	146	132	105	357	850	2,600	1,580	605	265
4	317	176	141	138	138	120	215	772	2,740	1,360	735	263
5	357	176	146	130	141	135	210	1,160	3,160	1,360	735	280
6	280	176	153	125	144	132	198	1,160	2,740	1,160	665	357
7	263	180	153	129	141	118	190	1,820	2,460	1,060	735	357
8	230	184	146	142	134	116	165	2,330	2,330	1,060	605	298
9	246	174	138	153	128	116	202	2,880	2,460	975	578	298
10	238	176	134	156	123	125	215	3,460	3,020	1,360	605	337
11	230	174	138	150	120	138	337	3,160	3,020	1,360	497	447
12	230	162	142	130	120	162	378	2,880	3,020	1,210	472	447
13	246	153	146	130	117	246	424	2,600	3,160	975	550	472
14	215	146	148	141	114	215	357	2,600	3,160	890	550	424
15	215	138	150	142	112	170	424	2,070	3,160	810	524	424
16	230	141	138	140	110	180	436	1,700	2,880	850	498	400
17	230	150	125	135	110	215	447	1,580	3,160	810	472	337
18	230	156	116	132	109	280	550	1,260	3,310	735	378	317
19	215	167	108	134	109	357	578	1,160	3,160	735	357	298
20	215	170	105	135	112	735	472	1,360	3,310	665	357	280
21	215	180	125	132	114	447	378	1,580	3,020	605	378	263
22	215	190	153	132	114	280	472	1,580	2,880	605	357	246
23	212	190	146	132	110	280	497	1,580	2,330	550	317	246
24	198	184	135	130	105	246	700	1,360	2,070	497	317	317
25	184	167	123	129	104	215	810	1,700	1,940	497	317	337
26	192	162	110	128	103	317	1,020	2,070	2,070	497	317	357
27	208	153	105	125	107	400	932	1,940	2,070	524	317	298
28	200	138	110	124	112	424	1,260	1,940	2,200	524	317	280
29	192	132	120	125	112	298	1,580	1,820	2,200	550	298	263
30	188	125	125	123	.....	230	1,700	1,820	1,940	810	298	263
31	172	.....	130	122	.....	180	.....	2,460	.....	700	420	.....

NOTE.—Discharge Nov. 11 to Mar. 25 estimated because of ice. Gage not read, discharge estimated Oct. 3, 10, 17, 21, 24, Nov. 7, Mar. 28, Apr. 16, Aug. 15–16, 30–31, and Sept. 1–3.

Monthly discharge of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	357	172	237	14,600
November	190	125	165	9,820
December	153	105	132	8,120
January	156	122	135	8,300
February	144	103	119	6,840
March	735	105	232	14,300
April	1,700	165	530	31,500
May	3,460	772	1,830	113,000
June	3,310	1,940	2,710	161,000
July	1,820	497	930	57,200
August	735	298	483	29,700
September	472	246	326	19,400
The year	3,460	103	652	474,000

GRAND RIVER NEAR KREMMLING, COLO.

LOCATION.—In sec. 23, T. 1 N., R. 81 W., at the entrance to Gore Canyon, 3 miles southwest of Kremmling, in Grand County. Nearest tributary, Blue River, enters a mile below Kremmling.

DRAINAGE AREA.—2,380 square miles.

RECORDS AVAILABLE.—July 24, 1904, to September 30, 1916.

GAGE.—Friez water-stage recorder on right bank 200 feet above wagon bridge, used since October 15, 1915. Original gage, a chain on left bank, 100 feet above present site, installed July 24, 1904, and used until October 17, 1906; datum 0.80 foot lower than present. Inclined staff directly opposite chain gage, at present gage datum, used October 18, 1906, to July 27, 1910. Friez water-stage recorder installed near staff gage and at same datum used July 28, 1910, to October 14, 1915, except during winter months, when staff gage was used.

DISCHARGE MEASUREMENTS.—Made from cable just above gage. Winter measurements made from bridge at head of rapids.

CHANNEL AND CONTROL.—Bed composed of sand, silt, and scattered boulders. Control is head of rapids, 250 feet downstream; shifts slightly as silt is deposited and later scoured out by high water. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum discharge during year, determined from comparative hydrograph, 8,100 second-feet, on June 12; minimum discharge 200 second-feet, December 27.

ICE.—Stage-discharge relation not seriously affected by ice except during occasional short periods when ice is jammed on rapids.

DIVERSIONS.—There are court decrees for the diversions of 35 second-feet from Grand River between this station and that at Hot Sulphur Springs.

STORAGE.—Station is at site of proposed Kremmling reservoir. A dam built 230 feet above the river bed at the mouth of Gore Canyon will impound nearly 2,200,000 acre-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts between narrow limits. Rating curve well defined between 200 and 15,000 second-feet. Operation of water-stage recorder satisfactory, except for occasional short periods; during the winter staff gage was read to hundredths twice daily. Daily discharge during open water ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph; during winter by applying to rating table mean of two daily readings of staff gage. Open-water records excellent; winter records good.

Discharge measurements of Grand River near Kremmling, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	W. R. King	[a] 2.06	651	May 17	W. R. King	8.24	3,750
Feb. 2	T. J. Watkins	1.08	316	June 7	.....do	10.16	5,510
Mar. 3	W. R. King	1.14	335	June 28	H. K. Smith	9.76	5,020

[a] Old gage 100 feet upstream read 2.02 feet.

Daily discharge, in second-feet, of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	858	545	325	425	300	365	630	2,730	5,990	4,490	2,430	1,090
2	822	515	260	455	315	365	660	2,550	6,210	4,130	2,130	975
3	822	515	328	420	328	340	765	2,250	6,100	3,970	2,080	905
4	822	515	365	390	352	328	695	2,130	6,100	3,730	2,430	905
5	788	500	405	352	378	390	660	2,250	6,650	3,490	2,550	920
6	770	515	435	352	340	435	630	2,670	6,430	3,270	2,310	940
7	740	545	435	300	328	378	600	3,570	5,460	3,130	2,550	1,050
8	710	560	405	360	340	365	570	4,760	5,700	2,990	2,190	905
9	680	530	365	415	340	378	600	5,770	6,800	3,200	2,030	870
10	680	545	325	460	328	405	630	6,880	6,880	3,340	2,080	1,050
11	650	530	305	405	328	495	835	7,120	7,500	3,410	1,880	1,330
12	680	410	328	300	328	570	1,050	6,430	8,100	3,130	1,680	1,370
13	680	356	365	315	315	660	1,130	6,100	7,500	2,730	1,880	1,330
14	650	302	378	352	290	695	1,090	5,660	7,000	2,550	2,080	1,330
15	650	328	390	365	290	600	1,090	4,960	7,000	2,370	1,930	1,210
16	680	315	350	352	315	600	1,130	4,050	7,240	2,430	1,680	1,090
17	680	328	305	340	328	660	1,170	3,650	7,480	2,490	1,580	975
18	680	378	260	315	328	765	1,370	3,130	7,600	2,430	1,450	905
19	650	420	225	328	340	835	1,490	2,850	7,600	2,310	1,330	870
20	650	495	205	328	340	975	1,330	2,920	7,720	2,130	1,250	835
21	635	480	300	290	328	1,330	1,170	3,490	7,120	1,990	1,250	800
22	635	510	450	328	340	1,050	1,210	3,490	6,540	1,830	1,170	765
23	635	510	350	365	328	975	1,450	3,340	5,770	1,730	1,090	730
24	620	495	350	352	340	870	1,780	3,130	5,160	1,630	1,050	800
25	605	405	300	365	340	730	2,080	3,570	5,060	1,580	1,010	870
26	575	450	250	340	340	730	2,430	4,400	4,960	1,580	1,050	800
27	575	405	200	328	340	695	2,730	4,310	4,960	1,680	1,050	765
28	575	288	260	340	365	765	3,060	4,310	4,960	1,980	1,010	730
29	560	250	270	325	365	870	3,570	4,400	4,960	1,880	940	695
30	545	230	325	300	.....	765	3,270	4,490	4,760	2,250	940	695
31	545	.....	370	285	.....	630	.....	5,260	.....	2,610	1,130	.....

NOTE.—Discharge estimated, because of ice, Nov. 13, 29–30, Dec. 1–2, 10–11, 16–21, 23–31, Jan. 1–3, 7–13, 28–31, and Feb. 1; estimated by hydrographic comparison with record of flow of Grand River at Glenwood Springs June 8–9 and 11–15; interpolated Sept. 5 and 28.

Monthly discharge of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre feet).
	Maximum.	Minimum.	Mean.	
October	858	545	672	41,300
November	560	230	439	26,100
December	450	200	329	20,200
January	460	285	353	21,700
February	378	290	332	19,100
March	1,330	328	646	39,700
April	3,570	570	1,360	80,900
May	7,120	2,130	4,080	251,000
June	8,100	4,760	6,380	380,000
July	4,490	1,580	2,660	164,000
August	2,550	940	1,650	101,000
September	1,370	695	950	56,500
The year	8,100	200	1,650	1,200,000

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

LOCATION.—In sec. 9, T. 6 S., R. 89 W., in front of electric power house at Glenwood Springs, in Garfield County. No Name Creek enters Grand River about 2 miles above station, and Roaring Fork half a mile below.

DRAINAGE AREA.—4,520 square miles (measured on Nell's map of Colorado).

RECORDS AVAILABLE.—January 1, 1900, to September 30, 1916; also May 12 to July 17, 1899, at point just above Roaring Fork.

GAGE.—Friez water-stage recorder on right bank in front of power house. Since 1902 a number of water-stage recorders referred to datum of staff gage installed in 1900, have been used. Chain gage at railroad bridge, just above mouth of Roaring Fork used before 1900.

DISCHARGE MEASUREMENTS.—Made from cable beneath the State Street bridge one-third mile below the gage.

CHANNEL AND CONTROL.—Bed composed of well compacted gravel, on which silt is deposited. Control is riffle 300 feet downstream; shifts slightly. Banks not subject to overflow except at extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 8.95 feet at 8 a. m. June 14 (discharge, 14,800 second-feet); minimum stage, 2.45 feet at noon December 21 (discharge, 260 second-feet).

ICE.—Stage-discharge relation not affected by ice; hot water from springs keeps river open.

DIVERSIONS.—Between this station and the one near Kremmling there are court decrees for a diversion of 13 second-feet of water from Grand River for irrigation, 1,250 second-feet absolute for power, and 14,400 second-feet conditional for power.

REGULATION.—The Shoshone power plant of the Colorado Power Co., 6 miles upstream, controls the flow during the day at low water, but has insufficient pondage to control it for more than a few hours.

ACCURACY.—Stage-discharge relation shifts occasionally but only between very narrow limits; not affected by ice. Rating curve well-defined between 500 and 15,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table daily gage height determined by inspecting gage-height graph, or for days of considerable fluctuation, by averaging discharge for two-hour intervals. Records excellent.

Discharge measurements of Grand River at Glenwood Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	W. R. King	3.49	814	Apr. 25	W. R. King	5.53	3,690
Jan. 8	T. J. Watkins	3.24	642	June 16	do	8.70	13,700
Feb. 6	do	3.42	772	July 22	do	5.36	3,170

Daily discharge, in second-feet, of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,430	1,000	525	722	584	706	1,240	5,360	10,400	8,300	4,440	1,750
2	1,430	875	785	707	566	685	1,200	4,700	11,100	7,950	4,090	1,820
3	1,370	860	672	837	590	633	1,280	4,320	11,100	7,300	3,660	1,640
4	1,320	838	713	800	706	672	1,390	3,870	11,100	7,000	3,870	1,510
5	1,280	830	755	815	792	822	1,290	4,090	11,800	6,550	3,980	1,530
6	1,260	830	838	808	755	934	1,250	4,960	12,200	6,100	4,090	1,630
7	1,200	748	800	672	720	862	1,200	6,400	11,100	5,800	4,090	1,730
8	1,140	969	792	608	778	830	1,190	8,650	10,000	5,650	4,090	1,870
9	1,140	945	800	646	734	815	1,140	10,000	10,800	5,650	3,660	1,730
10	1,110	898	770	682	713	854	1,100	11,800	12,200	6,100	3,660	1,880
11	1,150	905	755	770	699	934	1,220	12,600	13,400	6,250	3,550	2,360
12	1,110	845	748	678	723	1,040	1,570	11,800	14,200	5,650	3,140	2,600
13	1,040	706	762	602	627	1,170	1,940	11,100	14,200	5,220	3,240	2,600
14	1,060	574	770	688	694	1,280	2,010	10,400	14,600	4,700	3,870	2,600
15	1,040	620	785	785	647	1,230	1,940	9,350	14,200	4,320	3,870	2,440
16	1,100	762	808	792	668	1,200	2,010	7,950	13,800	4,200	3,340	2,080
17	1,110	713	699	699	673	1,230	2,080	6,700	13,800	4,320	3,040	1,880
18	1,110	734	581	706	672	1,340	2,220	6,100	14,200	4,200	2,860	1,780
19	1,120	785	562	734	726	1,510	2,520	5,500	14,200	4,090	2,440	1,690
20	1,130	868	519	672	580	1,630	2,520	5,220	14,200	3,760	2,360	1,590
21	1,120	822	495	692	716	1,880	2,290	5,800	13,400	3,550	2,290	1,520
22	1,080	945	685	672	699	2,290	2,150	6,400	12,200	3,240	2,150	1,450
23	1,100	969	727	706	659	1,940	2,290	6,100	11,100	3,140	2,010	1,360
24	937	921	822	770	713	1,880	2,770	5,800	10,000	2,950	1,820	1,450
25	1,180	890	741	808	700	1,630	3,340	6,100	9,700	2,950	1,750	1,530
26	1,110	755	672	785	770	1,390	3,980	7,000	9,350	2,950	1,750	1,570
27	945	699	607	720	594	1,390	4,570	7,600	9,350	3,140	1,820	1,500
28	945	741	490	741	664	1,390	5,360	7,600	9,350	3,550	1,750	1,410
29	937	594	588	720	720	1,450	6,250	7,950	9,000	3,760	1,690	1,380
30	945	543	594	720	.....	1,570	6,550	8,650	9,000	3,980	1,610	1,360
31	898	.....	659	626	.....	1,450	.....	9,350	.....	4,570	1,690	.....

NOTE.—Discharge Oct. 17–18 estimated. Daily discharge determined by averaging discharge for two-hour intervals, Jan. 1–3, 10–14, Feb. 11–28, Mar. 26, and Apr. 2 and 5.

Monthly discharge of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,430	898	1,120	68,900
November	1,000	543	806	48,000
December	838	490	694	42,700
January	837	602	722	44,400
February	792	566	686	39,500
March	2,290	633	1,250	76,900
April	6,550	1,100	2,400	143,000
May	12,600	3,870	7,390	454,000
June	14,600	9,000	11,800	702,000
July	8,300	2,950	4,870	299,000
August	4,440	1,610	2,960	182,000
September	2,600	1,360	1,770	105,000
The year	14,600	490	3,040	2,210,000

GRAND RIVER NEAR PALISADE, COLO.

LOCATION.—In sec. 2, T. 11 S., R. 98 W., at State bridge 2 miles above Palisade in Mesa County. Nearest large tributary, Plateau Creek, enters about 6 miles above.

DRAINAGE AREA.—8,550 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—April 9, 1902, to September 30, 1916.

GAGE.—Chain on downstream side of bridge near midspan; read by Mrs. Inez Nelson.

DISCHARGE MEASUREMENTS.—Made from new bridge 2 miles below gage.

CHANNEL AND CONTROL.—No information.

EXTREMES OF DISCHARGE.—No data.

ICE.—Stage-discharge relation affected by ice; data insufficient to warrant determinations of flow.

DIVERSIONS.—Between Palisade and the station at Glenwood Springs there are court decrees for the diversion of 1,828 second-feet from Grand River, 628 second-feet of which are for irrigation, and 1,200 second-feet for power in pumping to higher levels. The proposed high-line canal of the United States Reclamation Service will divert 700 second-feet 5 miles above Palisade station.

REGULATION.—None.

COOPERATION.—Complete records furnished by United States Reclamation Service.

Discharge measurements of Grand River near Palisade, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 29	Page and Lund	12.6	1,660
May 13	J. C. Page	19.1	19,700
Sept. 16	Page and Blackmer	13.9	3,260

Daily discharge, in second-feet, of Grand River near Palisade, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,250	1,420	1,230	.....	1,640	2,700	11,000	18,600	16,600	8,180	2,700
2	2,540	1,420	1,370	.....	1,580	2,540	9,260	19,200	15,600	7,590	2,700
3	2,250	1,370	1,470	.....	1,420	2,390	8,480	19,700	15,000	7,880	2,700
4	2,180	1,470	1,470	.....	1,470	2,780	7,730	19,900	14,300	8,480	2,460
5	2,000	1,420	1,530	.....	3,030	2,620	7,730	21,000	13,600	7,590	2,320
6	2,060	1,580	1,470	.....	2,180	2,780	9,420	21,200	12,000	7,300	2,540
7	2,120	1,580	1,530	.....	1,940	2,540	13,100	20,300	11,700	7,590	2,460
8	2,060	2,320	1,420	.....	1,880	2,540	16,000	19,000	11,400	7,180	2,180
9	1,880	1,880	1,420	.....	2,000	2,390	18,200	19,000	11,500	7,020	2,620
10	1,530	2,620	1,420	.....	2,000	2,390	20,500	21,200	11,900	6,210	3,300
11	1,640	1,820	1,420	.....	2,060	2,700	21,900	23,800	11,500	6,080	3,580
12	1,640	1,580	1,420	.....	2,120	2,940	21,200	24,800	11,200	5,600	3,880
13	1,760	1,530	1,420	.....	2,250	3,580	19,700	25,300	10,200	8,630	3,980
14	1,700	1,370	1,420	.....	2,460	3,980	18,400	25,800	9,580	7,590	3,980
15	1,700	1,320	1,420	.....	2,460	3,980	16,600	25,300	9,100	7,590	3,780
16	1,640	1,320	1,470	.....	2,320	3,980	14,300	24,000	8,480	6,740	3,580
17	1,760	1,530	1,420	.....	2,250	4,180	12,600	23,800	8,640	5,720	3,300
18	1,700	1,420	1,370	1,530	2,540	4,600	11,200	23,800	8,330	5,360	2,940
19	1,640	1,370	1,230	1,580	2,780	4,920	10,200	24,800	8,030	4,920	2,860
20	1,640	1,470	1,110	1,700	3,120	5,140	11,400	24,800	7,440	4,600	2,700
21	1,760	1,530	1,070	1,700	3,880	4,920	12,000	23,500	6,880	4,280	2,780
22	2,000	1,580	1,190	1,530	4,500	4,500	12,000	22,600	6,470	3,880	2,460
23	1,640	1,820	1,470	1,640	4,700	4,810	11,700	19,900	5,960	3,680	2,390
24	1,640	1,700	1,420	1,640	4,080	5,600	11,400	18,200	5,600	3,300	2,390
25	1,580	1,640	1,470	1,580	3,580	6,600	11,900	17,800	5,250	3,030	2,460
26	1,760	1,470	1,420	1,640	3,030	7,590	12,600	17,800	5,360	2,940	2,390
27	1,640	1,420	1,190	1,580	2,540	8,480	13,600	17,600	5,480	2,860	2,390
28	1,530	1,420	1,230	1,580	2,940	9,740	13,900	17,400	6,880	2,860	2,390
29	1,530	1,470	1,190	1,580	3,120	12,000	14,300	17,200	7,020	2,700	2,250
30	1,530	1,320	1,190	.....	3,030	12,400	15,400	17,000	6,740	2,700	2,250
31	1,530	.....	1,190	.....	2,940	.....	17,200	.....	7,300	2,780	.....

NOTE.—Stage-discharge relation seriously affected by ice Jan. 1 to Feb. 17; daily discharge not determined.

Monthly discharge of Grand River near Palisade, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,540	1,530	1,800	111,000
November	2,620	1,320	1,570	93,400
December	1,530	1,070	1,360	83,600
February 18–29	1,700	1,530	1,610	38,300
March	4,700	1,420	2,640	162,000
April	12,400	2,390	4,740	282,000
May	21,900	7,730	13,700	842,000
June	25,800	17,000	21,100	1,260,000
July	16,600	5,250	9,520	585,000
August	8,630	2,700	5,580	343,000
September	3,980	2,180	2,820	168,000

GRAND RIVER NEAR FRUITA, COLO.

LOCATION.—In sec. 20, T. 1 N., R. 2. W., at highway bridge 1½ miles south of Fruita, in Mesa County. Nearest large tributary, Little Salt Wash, enters a mile below station; Gunnison River enters at Grand Junction about 12 miles above .

DRAINAGE AREA.—16,800 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—Flood records during 1908, 1909, and 1910; continuous records April 1, 1911, to September 30, 1916.

GAGE.—Chain on downstream side of left span; read by Van Branstetter. Prior to May 3, 1911, gage was vertical staff attached to center pier, datum 0.05 foot lower.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of silt and gravel; shifts during high water. Control is riffle 600 feet downstream; slightly shifting. Banks are high and will not be overflowed except at stages above 18 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.2 feet June 14 and at 8 a. m. June 15 (discharge, 39,600 second-feet); minimum stage, 2.4 feet at 5 p. m. November 15 and 8 a. m. November 16 (discharge, 2,170 second-feet). Minimum discharge probably occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice; daily discharge not determined during winter months.

DIVERSIONS.—Between the Palisade station and Fruita there are court decrees for diversion of 788 second-feet from Grand River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts occasionally between narrow limits; affected by ice December 17 to February 18. Rating curve well-defined above 2,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Open-water records good; winter records fair.

Discharge measurements of Grand River near Fruita, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 17	2.56	2,350
June 18	10.78	37,700
July 21	5.76	8,880

Daily discharge, in second-feet, of Grand River near Fruita, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,290	2,300	2,430	.....	2,990	5,450	19,200	28,600	21,400	11,400	4,110
2	3,290	2,430	2,700	.....	2,700	4,850	16,500	30,600	20,400	11,000	3,940
3	3,290	2,300	2,700	.....	2,700	5,250	14,800	29,900	19,200	12,100	3,610
4	3,140	2,430	2,560	.....	2,560	5,660	14,000	31,700	18,700	12,900	3,290
5	2,990	2,430	2,840	.....	3,290	5,660	15,600	33,100	17,600	12,900	3,290
6	2,990	2,430	2,990	.....	4,470	5,250	17,300	33,100	16,700	11,400	3,290
7	2,990	2,560	2,990	.....	3,450	5,660	22,000	32,400	16,000	12,100	3,290
8	2,990	2,990	2,990	.....	3,140	4,660	27,200	32,000	15,200	11,000	3,450
9	2,840	2,840	2,700	.....	3,140	4,660	31,300	28,600	15,400	10,700	3,610
10	2,700	3,290	2,700	.....	3,290	4,850	34,900	30,600	15,600	10,700	4,110
11	2,300	3,140	2,700	.....	3,940	5,250	38,100	34,100	15,400	10,700	5,450
12	2,430	2,990	2,700	.....	3,940	6,520	35,900	37,400	14,200	10,300	5,870
13	2,430	2,700	2,700	.....	4,110	7,220	33,800	38,800	12,900	10,000	5,870
14	2,430	2,300	2,700	.....	4,660	7,730	31,700	39,600	12,100	11,700	5,450
15	2,560	2,170	2,700	.....	4,660	7,470	27,900	39,200	11,400	12,100	5,250
16	2,700	2,300	2,700	.....	4,290	7,730	23,600	37,700	11,000	11,400	5,050
17	2,560	2,300	.....	.....	4,290	8,270	20,400	37,000	11,000	9,710	4,850
18	2,700	2,560	.....	.....	4,660	9,120	17,600	38,100	11,000	8,830	4,290
19	2,700	2,700	.....	2,990	4,850	10,300	16,900	38,800	10,300	8,550	4,110
20	2,700	2,700	.....	3,290	5,450	10,000	18,200	38,800	9,710	8,270	3,940
21	2,560	2,700	.....	2,990	6,750	8,830	20,100	35,900	8,830	6,750	3,610
22	2,700	2,990	.....	2,990	10,000	8,550	20,100	33,100	8,000	6,080	3,610
23	2,560	3,140	.....	2,990	8,830	9,710	20,400	30,600	7,470	5,450	3,450
24	2,700	2,990	.....	2,990	8,270	11,700	19,400	26,600	6,750	4,850	3,450
25	2,560	2,990	.....	3,140	7,220	14,000	18,900	25,600	6,980	4,470	3,450
26	2,560	2,990	.....	2,700	6,080	15,200	20,400	25,000	6,980	4,290	3,610
27	2,560	2,990	.....	2,990	5,450	16,500	21,700	24,800	8,000	4,470	3,610
28	2,560	2,840	.....	3,290	5,660	18,200	22,200	24,200	8,550	4,110	3,450
29	2,430	2,700	.....	3,290	5,870	21,700	22,800	23,900	10,000	3,940	3,450
30	2,430	2,430	.....	.....	6,080	22,200	23,900	22,800	9,710	3,940	3,450
31	2,300	.....	.....	.....	5,870	.....	26,600	.....	10,300	3,770	.....

NOTE.—Discharge estimated because of ice as follows: Dec. 17–31, 2,330 second-feet; Jan. 1–31, 2,650 second-feet; Feb. 1–18, 2,720 second-feet. Discharge July 12, interpolated.

Monthly discharge of Grand River near Fruita, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,290	2,300	2,710	167,000
November	3,140	2,170	2,690	160,000
December	.....	.....	[a] 2,540	156,000
January	.....	.....	[a] 2,650	163,000
February	.....	.....	[a] 2,850	164,000
March	10,000	2,560	4,920	303,000
April	22,200	4,660	9,270	552,000
May	38,100	14,000	23,000	1,410,000
June	39,600	22,800	32,100	1,910,000
July	21,400	6,750	12,500	769,000
August	12,900	3,770	8,710	536,000
September	5,870	3,290	4,040	240,000
The year	39,600	.....	9,000	6,530,000

[a] Estimated by hydrographic comparison with record of flow of Grand River at Glenwood Springs.

GRAND RIVER NEAR CISCO, UTAH.

LOCATION.—About sec. 7, T. 23 S., R. 24 E., at Dewey ferry, three-quarters of a mile below mouth of Dolores River, 90 miles above junction of Green and Grand rivers, and 14 miles southeast of Cisco, Grand County.

DRAINAGE AREA.—23,800 square miles.

RECORDS AVAILABLE.—November 10, 1914, to September 30, 1916, at present site; 25 miles downstream at Moab, October 1, 1913, to November 10, 1914; flow about the same at both places.

GAGE.—Stevens continuous water-stage recorder on left bank 500 feet above ferry cable.

DISCHARGE MEASUREMENTS.—Made from car on ferry cable and from highway bridge half a mile below gage.

CHANNEL AND CONTROL.—Channel straight for several hundred feet above and below station. Left bank high and not subject to overflow; right bank fairly high and will probably not be overflowed. Bed at the gage composed of sand and gravel. Control probably about a quarter of a mile below the gage; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 13.9 feet at 7 p. m. May 11 (discharge 47,800 second-feet); minimum stage probably occurred in December when clock was stopped.

1915–1916: Maximum stage recorded 13.9 feet at 7 p. m. May 11, 1916 (discharge 47,800 second-feet); minimum stage 1.55 feet September 10, 1915 (discharge 1,460 second-feet).

ICE.—Stage-discharge relation seriously affected by ice. Winter estimates based on current-meter measurements and observer's notes.

DIVERSIONS.—Below practically all diversions. A large amount of water is diverted in Colorado for irrigation.

REGULATION.—Station is too far below to be affected, except in a general way, by regulation in Colorado.

ACCURACY.—Stage-discharge relation permanent; affected by ice December 21 to February 21. Rating curve well defined for range in stage during year. Operation of water-stage recorder satisfactory except during winter when ice formed in well. Daily discharge ascertained by applying to rating table daily gage height taken from graph by inspection except for period when stage-discharge relation was affected by ice. Records obtained by use of rating table good; others fair.

Discharge measurements of Grand River near Cisco, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	L. W. Jordan	2.24	2,560	Feb. 27	A. B. Purton	2.52	3,220
Jan. 6[a]	Lynn Crandall	2.91	2,950	May 14	W. E. Dickinson	12.31	39,600
27[b]	do	4.95	3,190	June 23	do	10.68	33,500

[a] Ice along shore at riffle for a width of 40 feet; also between gage and riffle.
[b] 60 to 80 feet of ice along each bank at gage and control; floating slush ice.

Daily discharge, in second-feet, of Grand River near Cisco, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,340	2,470	2,380	.....	.....	3,440	7,690	28,200	30,900	23,700	12,500	4,640
2	3,340	2,380	2,470	.....	.....	3,140	7,130	22,400	32,700	22,400	13,100	4,760
3	3,340	2,470	2,560	.....	.....	2,940	6,860	19,000	33,200	21,600	13,800	4,530
4	3,340	2,380	2,750	.....	.....	2,750	7,690	17,300	33,200	20,300	17,300	4,310
5	3,140	2,380	2,660	.....	.....	3,440	8,270	17,300	34,600	18,600	14,200	4,090
6	3,140	2,380	2,750	2,950	.....	4,870	7,980	19,800	35,000	17,300	14,200	4,200
7	3,140	2,560	2,840	.....	.....	4,310	7,410	25,500	34,100	16,500	13,800	4,090
8	3,040	3,340	2,940	.....	.....	3,870	6,860	32,700	33,200	15,300	14,200	4,090
9	2,940	2,840	2,840	.....	.....	3,550	6,210	37,400	31,400	15,300	13,800	4,200
10	2,750	3,550	2,750	.....	.....	3,550	6,080	42,600	33,200	15,700	12,100	5,830
11	2,660	3,440	2,660	.....	.....	3,870	7,130	46,900	36,400	16,900	11,400	6,080
12	2,560	3,040	2,660	.....	.....	4,200	9,180	46,900	39,300	16,100	10,800	6,600
13	2,660	2,750	2,560	.....	.....	4,870	9,500	44,000	40,200	14,900	13,800	6,600
14	2,470	2,470	2,560	.....	.....	5,580	10,100	40,200	41,200	13,500	14,900	6,470
15	2,380	2,380	2,660	.....	.....	6,340	10,500	36,000	41,600	12,800	13,800	6,340
16	2,660	2,380	2,750	.....	.....	6,080	10,100	30,900	40,200	12,500	13,100	5,960
17	2,560	2,290	2,750	.....	.....	5,830	11,400	24,200	39,300	12,100	12,100	5,580
18	2,660	2,560	2,630	.....	.....	6,340	13,500	20,300	39,300	12,500	10,100	5,220
19	2,560	2,660	2,500	.....	.....	7,130	15,300	19,000	39,300	11,800	9,180	4,870
20	2,750	2,750	2,380	.....	.....	7,980	14,900	18,600	39,700	11,100	8,270	4,640
21	2,940	2,840	.....	.....	.....	9,500	13,100	22,000	38,800	10,500	7,690	4,530
22	2,750	2,940	.....	.....	.....	12,800	12,100	22,400	35,500	9,500	7,410	4,310
23	2,750	3,040	.....	.....	.....	16,100	13,500	22,400	32,700	9,180	6,860	4,200
24	2,660	3,240	.....	.....	.....	16,100	16,100	22,000	29,100	8,570	6,080	4,090
25	2,660	3,240	.....	.....	.....	12,100	18,200	21,100	26,400	8,270	5,830	3,980
26	2,470	3,140	.....	.....	.....	10,100	20,300	22,000	25,500	8,270	5,460	4,090
27	2,660	3,040	.....	3,190	3,340	8,870	22,000	22,800	25,000	8,870	5,340	4,090
28	2,660	2,750	.....	.....	3,660	7,980	23,700	23,700	24,600	11,100	5,100	4,090
29	2,560	2,750	.....	.....	3,660	8,270	26,300	24,600	24,600	12,100	4,870	3,980
30	2,470	2,660	.....	.....	.....	8,870	30,900	25,900	24,200	11,800	4,870	3,760
31	2,470	.....	.....	.....	.....	8,270	.....	28,200	.....	11,400	4,760	.....

NOTE.—Discharge estimated because of ice or lack of gage record, from observer's notes and 2 discharge measurements, as follows: Dec. 21–31, 2,300 second-feet, Jan. 1–5, 2,600 second-feet, Jan. 7–26, 3,000 second-feet, Jan. 28–31, 3,100 second-feet, and Feb. 1–26, 3,200 second-feet. Dec. 18 and 19, interpolated.

Monthly discharge of Grand River near Cisco, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,340	2,380	2,790	172,000
November	3,550	2,290	2,770	165,000
December	2,940	.....	2,530	156,000
January	.....	.....	2,950	181,000
February	.....	.....	3,240	186,000
March	16,100	2,750	6,870	422,000
April	30,900	6,080	12,700	756,000
May	46,900	17,300	27,300	1,680,000
June	41,600	24,200	33,800	2,010,000
July	23,700	8,270	13,900	855,000
August	17,300	4,760	10,300	633,000
September	6,600	3,760	4,810	286,000
The year	46,900	.....	10,300	7,500,000

FRASER RIVER NEAR ARROW, COLO.

LOCATION.—In sec. 4, T. 2 S., R. 75 W., one-fourth mile from Vasquez siding on Denver & Salt Lake Railroad in Arapaho National Forest, and 1½ miles southwest of Arrow in Grand County. Nearest tributary enters about half a mile above.

DRAINAGE AREA.—37 square miles for present location of station (measured on special map); 28 square miles for site 1 mile upstream used to June 3, 1916.

RECORDS AVAILABLE.—September 23, 1910, to September 30, 1916.

GAGE.—Friez water-stage recorder on left bank about 1 mile below bridge on road to Arrow. Prior to June 3, 1916, vertical staff attached to downstream side of bridge.

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

CHANNEL AND CONTROL.—Bed composed of boulders and coarse gravel; practically permanent. Control not well defined. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum discharge during year, from hydrographic comparison of North Fork Grand River near Grand Lake, 260 second-feet on May 10; minimum discharge, 6.8 second-feet, several days in March.

ICE.—Stage-discharge relation not seriously affected by ice except for short period early in winter. Ice forms complete cover and water flows freely beneath it.

DIVERSIONS.—There is court decree for diversion of 53 second-feet across divide from headwaters of Fraser River into headwaters of Clear Creek. During 1916, approximately 832 acre-feet were diverted under this decree. Below station there are court decrees for 74 second-feet for irrigation and 61 second-feet for placer and power.

REGULATION.—None.

ACCURACY.—Stage-discharge relation at upper station not permanent; at lower station practically permanent; affected by ice for short period. Rating curve for upper station poorly defined; for lower station well defined. Staff gage read to hundredths twice daily; operation of water-stage recorder satisfactory after June 10. Daily discharge ascertained by applying to rating table, daily gage height determined either by inspecting gage-height graph or from mean of two readings on staff gage. Records excellent after June; fair prior to that date.

Discharge measurements of Fraser River near Arrow, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	W. R. King	[a] 0.89	14.6	June 3	W. R. King	1.14	121
Jan. 29	T. J. Watkins	[a] .75	9.4	24	H. K. Smith	1.12	142
Mar. 1	W. R. King	[a] .70	6.6	Aug. 14	Follansbee and Hodges	.68	41.2
May 13	do	[b] 1.08	132	Sept. 29	Hodges and Keep	.46	19.7
13	do	.98	94	30	P. V. Hodges	.44	18.7

[a] Read on old gage, 1 mile upstream. [b] Old gage read 1.31 feet.

Daily discharge, in second-feet, of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	16	16	14	12	9.5	8.5	8.5	74	202	109	54	27
2	16	16	14	12	9.0	7.1	7.7	74	230	106	51	25
3	16	16	14	12	9.0	9.5	8.0	76	127	102	54	24
4	16	16	13	12	9.0	10.5	8.0	76	145	98	56	23
5	20	14	13	12	9.0	7.1	7.7	76	210	93	54	22
6	16	13	13	11	9.5	7.7	7.7	100	185	85	54	24
7	16	13	13	11	9.5	8.0	8.0	140	160	84	49	21
8	16	15	13	10	10	7.1	7.7	150	135	85	48	20
9	16	14	13	10	10	6.8	9.5	210	150	85	46	19
10	16	15	13	10	10	6.8	9.5	260	168	78	45	23
11	16	16	12	10	10	7.1	10.5	184	165	73	43	26
12	16	16	12	10	10	6.8	10.0	108	168	64	45	28
13	16	16	12	10	10	7.1	11	102	176	60	44	30
14	16	18	12	10	10	6.8	12	98	172	56	43	27
15	16	18	12	10	10	9.5	13	94	168	54	42	25
16	16	20	12	10	10	6.8	14	93	168	56	43	24
17	16	20	12	10	10	6.8	14	90	163	57	43	23
18	16	20	12	11	9.0	7.1	13	100	168	54	41	23
19	16	16	12	11	9.0	7.1	14	110	170	49	38	23
20	16	16	12	11	9.0	6.8	13	130	168	48	38	22
21	16	15	12	12	9.0	6.8	14	130	159	46	37	22
22	16	15	12	12	9.5	7.1	14	130	151	46	34	22
23	16	14	12	12	9.0	6.8	20	152	137	45	33	22
24	16	15	12	12	10	6.8	27	130	133	45	33	22
25	16	13	12	12	10	7.1	37	110	127	43	33	20
26	16	13	12	12	10	7.1	42	130	125	46	32	19
27	16	14	12	9	11	7.4	50	152	125	46	31	19
28	16	14	12	10	11	7.4	69	160	125	49	27	20
29	16	13	12	10	10	9.5	74	176	117	51	26	20
30	16	14	12	10	.....	9.5	69	202	111	52	32	20
31	16	.....	12	10	.....	9.0	.....	202	.....	57	31	.....

NOTE.—Discharge Nov. 12–17 estimated because of ice. Interpolated Dec. 20–24, 26, Jan. 1–2, Feb. 1, 3–4, 7–8, 10–11, 14–15, Apr. 13–16, and Aug. 13; estimated from hydrograph comparison of North Fork of Grand River near Grand Lake May 6–11, 14–18, 21, 25–26, 28, and June 4–9.

Monthly discharge of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	20	16	16.1	990
November	20	13	15.5	922
December	14	12	12.4	762
January	12	9	10.8	664
February	11	9	9.69	557
March	10.5	6.8	7.59	467
April	74	7.7	20.8	1,240
May	260	74	130	7,990
June	230	111	157	9,340
July	109	43	65.2	4,010
August	56	26	41.3	2,540
September	30	19	22.8	1,360
The year	260	6.8	42.5	30,800

WILLIAMS FORK NEAR SCHOLL, COLO.

LOCATION.—In sec. 3, T. 2 S., R. 78 W., at Horseshoe ranger station in Arapaho National Forest, about 5 miles southeast of Scholl in Grand County. Nearest large tributary, Keyser Creek, enters from east three-quarters of a mile above station.

DRAINAGE AREA.—141 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—September 22, 1910, to June 30, 1912; April 27, 1913, to September 30, 1916.

GAGE.—Vertical staff in pool near right bank 100 feet below bridge; read by forest ranger.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 400 feet above gage.

CHANNEL AND CONTROL.—Bed composed of boulders; rough. Control 25 feet below gage; will shift slightly. Banks not subject to overflow except during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.15 feet at 5 p. m. June 18, 19, 20 (discharge, 836 second-feet); minimum discharge probably occurred during the winter.

ICE.—Stage-discharge relation somewhat affected by ice; data insufficient for determinations of daily discharge November 11 to February 29.

DIVERSIONS.—There are court decrees for the diversion of 858 second-feet from Williams Fork above the station. Of this amount 700 second-feet is to be diverted to the eastern slope, but this diversion has not been made.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during 1916; shifts occasionally between narrow limits. Rating curve well-defined between 30 and 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Owing to high altitude of drainage basin (7,900 feet) there may be considerable diurnal fluctuation at certain seasons of year due to alternate melting and freezing of snow, and mean daily gage height may be somewhat in error. Records good except those for May which are fair.

Discharge measurements of Williams Fork near Scholl, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 5	1.08	37.5
June 5	2.70	548

Daily discharge, in second-feet, of Williams Fork near Scholl, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	83	52	40	48	136	440	469	266	122
2	85	49	39	48	139	498	469	246	116
3	85	48	40	45	146	498	469	246	111
4	83	48	44	48	152	498	440	246	109
5	82	49	43	48	152	498	412	246	109
6	82	46	43	42	180	528	412	246	105
7	77	48	44	54	200	528	412	239	105
8	75	49	44	54	240	528	384	239	103
9	75	49	45	50	310	528	384	235	103
10	72	50	44	60	400	528	384	224	101
11	70	.....	45	70	370	528	384	224	99
12	69	.....	45	72	340	528	384	190	99
13	69	.....	45	74	300	528	384	190	98
14	69	.....	46	72	220	588	384	190	96
15	69	.....	47	71	200	618	384	190	94
16	69	.....	48	69	200	678	286	187	92
17	69	.....	49	72	260	709	266	184	90
18	69	.....	50	80	270	740	266	180	87
19	69	.....	49	86	180	772	266	160	85
20	69	.....	50	71	180	804	266	155	80
21	69	.....	49	71	180	678	266	149	77
22	69	.....	50	82	185	709	266	146	77
23	69	.....	50	82	190	678	266	136	77
24	66	.....	50	92	200	678	266	136	77
25	66	.....	49	94	210	678	266	132	75
26	61	.....	49	99	230	618	266	132	74
27	56	.....	50	103	266	588	266	129	74
28	59	.....	50	103	384	588	266	126	74
29	55	.....	50	118	384	588	266	124	72
30	54	.....	50	136	384	528	266	122	72
31	54	.....	49	.....	412	.....	266	120	.....

NOTE.—Data insufficient to determine daily discharge, Nov. 11 to Feb. 29, because of ice. Discharge estimated Oct. 11, Apr. 3–19, July 23–27, and Sept. 15–16. Discharge estimated May 7–26 from hydrographic comparison with record of flow of Williams Fork near Parshall, because gage heights were apparently in error.

Monthly discharge of Williams Fork near Scholl, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	85	54	69.9	4,300
November 1–10	52	46	48.8	968
March	50	39	46.6	2,870
April	136	42	73.8	4,390
May	412	136	245	15,100
June	804	440	597	35,500
July	469	266	336	20,700
August	266	120	185	11,400
September	122	72	91.8	5,460

WILLIAMS FORK NEAR PARSHALL,[1] COLO.

LOCATION.—About sec. 36, T. 1 N., R. 79 W., at highway bridge at Field's ranch, 4 miles above the mouth of the river and 4 miles south of Parshall, in Grand County. Nearest tributary, Battle Creek, enters from the west 2 miles below station.

DRAINAGE AREA.—185 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—July 25, 1904, to September 30, 1916.

GAGE.—Vertical staff on downstream side of bridge pier; read by F. A. Field.

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

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; shifts. Control is gravel bar 50 feet downstream; shifts during high water. At stage of 4.1 feet water begins to flow through small overflow channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.68 feet at 8.40 a. m. June 19 (discharge, 1,030 second-feet); minimum discharge, 30 second-feet November 30, December 12, 20, 27, January 8 and 31, when stage-discharge relation was affected by ice.

ICE.—The main channel is kept open by springs, but ice forms along the banks, and slush ice also frequently forms. Morning readings are usually affected by backwater from ice, but afternoon readings are sometimes unaffected.

DIVERSIONS.—There are court decrees for the diversion of 558 second-feet from Williams Fork between the station near Scholl and that near Parshall. There are also two storage decrees for 80,700 acre-feet and 1,420 acre-feet, respectively, from Williams Fork.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts occasionally between narrow limits; affected by ice for short periods during winter. Rating curve well defined between 40 and 1,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for winter, which are fair.

Discharge measurements of Williams Fork near Parshall, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	W. R. King	3.03	82	May 16	W. R. King	3.56	210
Feb. 3	T. J. Watkins	2.78	46.9	June 5	do	4.12	522
Mar. 4	W. R. King	2.86	49.9	27	H. K. Smith	4.26	631

[1] Described in earlier reports as Williams Fork near Sulphur Springs, Colo.

Daily discharge, in second-feet, of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	96	70	40	40	32	47	74	172	475	590	195	111
2	100	69	35	42	33	46	71	169	475	550	169	96
3	89	73	50	36	34	50	71	134	475	510	169	114
4	93	76	56	44	34	54	66	140	475	510	275	114
5	93	77	52	42	31	54	73	151	550	475	300	103
6	91	71	52	36	42	49	58	182	475	440	210	116
7	76	77	45	33	42	56	68	280	440	408	225	105
8	73	74	40	30	40	50	68	370	475	375	203	96
9	77	68	38	38	43	50	61	408	510	375	195	96
10	74	74	35	34	43	53	71	510	630	353	206	116
11	73	89	32	33	40	57	80	440	630	315	166	122
12	76	56	30	32	42	61	84	440	710	310	178	114
13	78	69	37	31	40	53	86	408	795	285	192	129
14	83	50	46	40	40	62	83	300	750	266	199	134
15	86	59	50	48	40	73	82	252	750	261	172	120
16	77	57	56	34	48	71	80	225	750	248	162	114
17	86	56	50	40	50	73	83	342	750	234	159	96
18	80	80	44	44	46	68	98	252	795	225	142	96
19	77	86	37	44	40	68	105	206	940	206	132	96
20	76	84	30	40	48	69	83	230	840	195	118	96
21	80	64	52	36	47	74	83	218	840	178	122	94
22	76	50	52	34	42	89	89	243	795	162	120	94
23	76	61	50	32	40	68	118	218	710	151	109	96
24	76	59	50	32	40	68	129	243	710	132	105	107
25	74	89	61	40	42	77	151	336	630	132	103	98
26	73	68	40	42	48	59	162	364	630	140	114	94
27	69	57	30	41	52	74	192	336	630	134	118	91
28	71	40	40	39	49	71	225	331	630	162	111	91
29	68	35	50	36	48	76	252	358	630	159	98	93
30	64	30	61	33	.....	66	199	358	670	182	122	91
31	64	.....	48	30	.....	80	.....	440	.....	203	127	.....

NOTE.—Discharge estimated because of ice for following periods: Nov. 29–30, Dec. 1–2, 8–13, 17–20, 24, 27–28, Jan. 7–8, 11–13, 17, 20–23, 27–31, Feb. 1–2, 29, and Mar. 1–3. Shifting-control method used July 20 to Sept. 30.

Monthly discharge of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	100	64	78.9	4,850
November	89	30	65.6	3,900
December	61	30	44.8	2,750
January	48	30	37.3	2,290
February	52	31	41.9	2,410
March	89	46	63.4	3,900
April	252	58	105	6,250
May	510	134	292	18,000
June	940	440	652	38,800
July	590	132	286	17,600
August	300	98	162	9,960
September	134	91	104	6,190
The year	940	30	161	117,000

BLUE RIVER AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at cemetery bridge on outskirts of Dillon, in Summit County, on edge of Leadville National Forest. Nearest tributaries, Snake River, which enters a short distance below station, and Tenmile Creek, which also enters below.

DRAINAGE AREA.—110 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1916.

GAGE.—Vertical staff on right abutment of bridge facing channel; read by J. H. Woodward.

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

CHANNEL AND CONTROL.—Bed composed of compact gravel upon which lodge tailing slimes from hydraulic dredges near Breckenridge. Control is riffle 50 feet downstream from gage; permanent. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.19 feet at 6 a. m. June 20 (discharge, 520 second-feet); minimum stage, 1.27 feet at 5 p. m. April 8 (discharge, 18 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; discharge estimated by comparison with records of flow for Snake River and Tenmile Creek.

DIVERSIONS.—There are court decrees for the diversion of 2.3 second-feet for irrigation from Blue River above the station and 63 second-feet below, exclusive of a decree for 350 second-feet for the Green Mountain canal not yet built. In addition there are placer decrees for diversions of 118 second-feet from the Blue near Breckenridge. There is an unadjudicated diversion from the headwaters of the Blue across Boreas Pass to Tarryall Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by deposition of tailing slimes on control; shifts between narrow limits; affected by ice. Rating curve well defined between 20 and 700 second-feet. Gage read to hundredths twice daily except during winter, when it was read only occasionally. Daily discharge ascertained by applying daily gage height to rating table, except November 14 to March 31, April 2–4, 6, 7, 9–11, 13, 14, and 16, for which it was estimated from hydrographic comparison with records of flow of Snake River and Tenmile Creek at Dillon, and April 1 to September 30, for which shifting-control method was used. Records good except those for November to April, which are fair.

Discharge measurements of Blue River at Dillion, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 15	T. J. Watkins	a1.74	28.4
Feb. 12	....do	a1.75	28.6
July 13	Robert Follansbee	2.47	221

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Blue River at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	78	53	45	33	26	24	23	126	412	368	285	98
2	78	53	45	33	26	24	23	111	412	368	225	86
3	78	53	44	33	27	25	22	92	412	368	191	86
4	78	53	44	32	27	25	22	94	435	325	245	80
5	78	48	43	31	27	25	22	104	480	305	325	78
6	78	48	43	30	27	25	20	161	458	285	245	78
7	70	48	43	30	28	25	20	176	345	245	208	78
8	70	48	42	30	28	24	18	285	325	225	225	78
9	64	48	41	30	29	24	22	345	368	265	208	76
10	70	48	40	30	29	24	26	368	412	265	176	80
11	70	48	39	30	29	24	30	368	480	245	158	98
12	70	48	39	30	29	24	34	345	502	208	161	96
13	70	48	39	29	28	23	34	325	502	225	208	104
14	78	48	39	29	27	22	35	305	502	225	245	94
15	78	48	38	28	27	22	35	285	458	208	225	86
16	78	48	38	28	27	23	36	225	458	208	176	84
17	70	47	37	28	27	23	38	208	435	225	155	81
18	70	47	37	28	27	24	43	191	412	225	143	80
19	64	46	37	28	26	24	46	176	502	208	131	78
20	64	46	37	28	26	24	43	191	480	176	118	78
21	64	46	36	28	25	24	45	191	435	161	137	72
22	64	46	36	28	25	24	48	208	412	161	126	72
23	64	46	35	28	24	24	55	176	285	161	121	72
24	64	45	35	28	24	24	75	176	325	155	116	69
25	64	45	34	28	23	24	88	285	325	152	116	68
26	64	46	34	27	23	24	116	265	325	161	108	68
27	64	46	34	27	23	24	140	245	305	208	111	68
28	64	46	33	27	23	24	158	285	325	191	98	65
29	64	46	33	27	24	23	191	305	368	176	94	65
30	53	46	33	27	.....	24	158	325	368	285	108	64
31	53	.....	33	26	.....	23	.....	368	.....	265	98	.....

Monthly discharge of Blue River at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	78	53	68.9	4,240
November	53	45	47.7	2,840
December	45	33	38.3	2,360
January	33	26	29.0	1,780
February	29	23	26.2	1,510
March	25	22	23.9	1,470
April	191	18	55.5	3,300
May	368	92	236	14,500
June	502	305	409	24,300
July	368	152	234	14,400
August	325	94	171	10,500
September	104	64	79.3	4,720
The year	502	18	118	85,900

SNAKE RIVER AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 200 yards above mouth of river at Dillon, in Summit County. Nearest tributary, a small stream from the north, enters 1 mile above station.

DRAINAGE AREA.—92 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by J. H. Woodward. Prior to April 26, 1913, gage was 2 feet farther upstream, and although referred to same datum water piled up on gage during high water, giving a higher reading for same discharge.

DISCHARGE MEASUREMENTS.—Made from bridge, or by wading just below gage.

CHANNEL AND CONTROL.—Bed composed of small boulders; rough but permanent. Control 50 feet downstream will shift slightly at long intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.2 feet at 5.30 p. m. June 14, and 6 p. m. June 16 (discharge, 430 second-feet); minimum flow occurred during winter when discharge was estimated by comparison with records of flow of Blue River and Tenmile Creek.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observers notes, and weather records.

DIVERSIONS.—The Summit County Power Co. diverts about 30 second-feet from Snake River above Dillon. Water is usually diverted from April to November. There is also an irrigation decree for 4.5 second-feet above Dillon.

REGULATION.—See diversions.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 600 second-feet. Gage read to hundredths twice daily except during winter, when it is read only occasionally. Daily discharge ascertained by applying daily gage height to rating table, except November 14 to April 16, for which it was estimated by comparison with records of flow of Blue River and Tenmile Creek, based on occasional gage heights. Records good except November to April, for which they are fair.

Discharge measurements of Snake River at Dillon, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 15	T. J. Watkins	0.55	11.0
Feb. 12	....do	.60	13.1
July 14	Robert Follansbee	1.52	145

Daily discharge, in second-feet, of Snake River at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	14	12	11	10	11	12	47	249	262	136	49
2	15	13	12	11	10	11	12	44	240	244	128	41
3	14	13	12	11	10	11	12	37	254	236	116	41
4	14	13	12	11	11	11	12	45	280	228	121	33
5	14	13	12	11	11	11	11	45	285	216	131	38
6	14	13	12	10	11	11	11	74	249	193	126	40
7	13	13	12	10	11	11	11	94	196	168	111	31
8	13	13	12	10	11	11	11	126	216	168	121	28
9	14	13	.....	10	11	11	12	165	280	220	128	27
10	14	12	.....	10	11	11	13	212	330	204	105	33
11	14	12	.....	11	12	11	14	182	380	182	92	42
12	14	12	.....	11	13	11	16	190	380	176	92	42
13	13	12	.....	11	12	10	16	190	405	142	103	45
14	13	.....	.....	11	12	10	16	159	405	136	103	38
15	13			11	11	10	15	136	405	131	103	33
16	13	.....	.....	10	11	10	16	105	430	128	96	29
17	14	.....	.....	10	11	11	18	94	405	139	88	26
18	14	.....	.....	10	11	11	20	92	355	136	79	25
19	14	.....	.....	10	11	11	19	90	380	142	76	24
20	13	.....	.....	10	11	11	25	100	380	107	70	22
21	13	.....	.....	10	11	11	19	107	355	100	68	21
22	13	.....	.....	10	12	11	22	105	355	100	60	20
23	13	.....	.....	10	12	11	25	92	276	100	60	19
24	13	.....	.....	10	12	11	28	98	285	105	56	23
25	13	.....	.....	10	12	11	36	111	308	92	57	22
26	13	.....	.....	10	12	11	57	139	262	85	55	18
27	13	.....	.....	10	12	11	60	131	267	153	53	16
28	13	.....	.....	10	12	11	72	142	285	172	47	16
29	14	.....	.....	10	12	11	70	168	308	124	46	17
30	14	.....	.....	10	.....	11	58	190	280	258	58	14
31	14	.....	.....	10	.....	11	.....	200	.....	165	53	.....

NOTE.—Water diverted by the Snake River ditch not included in above table. Discharge, Oct. 1 and 2 estimated. Gage not read Nov. 14–30 and Dec. 9–31; discharge for each period estimated at 12 second-feet. Gage read twice weekly Jan. 1 to Apr. 16; discharge interpolated for days on which gage was not read.

Monthly discharge of Snake River at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	15	13	13.6	836
November	14	.....	12.3	732
December	.....	.....	12.0	738
January	11	10	10.3	633
February	12	10	11.3	650
March	11	10	10.9	670
April	72	11	24.6	1,460
May	212	37	120	7,380
June	430	196	316	18,800
July	262	85	162	9,960
August	136	46	88.3	5,430
September	49	14	29.1	1,730
The year	430	.....	67.5	49,000

NOTE.—Water diverted by Snake River ditch not included in the above table.

Daily discharge, in second-feet, of Snake River ditch near Dillon, Colo., for the period Aug. 1 to Sept. 30, 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	37	37	11	31	37	21	37	37
2	37	31	12	31	44	22	31	37
3	37	31	13	37	44	23	31	37
4	37	37	14	44	44	24	31	37
5	37	37	15	44	44	25	31	37
6	37	37	16	44	37	26	31	37
7	44	37	17	37	37	27	31	37
8	44	37	18	37	37	28	31	37
9	37	37	19	37	37	29	37	31
10	37	37	20	37	37	30	37	31
						31	37	.....

NOTE.—No records before Aug. 1, although ditch was carrying some water. Mean monthly discharge for August was 36.4 second-feet (2,240 acre-feet); for September, 37.1 second-feet (2,210 acre-feet).

TENMILE CREEK AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 300 yards above mouth of creek, in Dillon, Summit County. Nearest tributary, Canyon Creek, enters from the west about 4 miles above.

DRAINAGE AREA.—113 square miles (measured on map in Forest Atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1916.

GAGE.—Vertical staff on downstream of center pier of bridge; read by J. H. Woodward. Prior to June 10, 1914, gage was at side of pier and at same datum as present gage. During high stages the water piled up on the gage so that readings were higher than those obtained from gage in present position.

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

CHANNEL AND CONTROL.—Bed composed of small boulders; rough but permanent. Control 50 feet downstream from gage; permanent. Banks high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.51 feet at 5 p. m. June 12 (discharge, 902 second-feet); minimum discharge, 23 second-feet January 2 to February 1 (estimated because of ice).

ICE.—Stage-discharge relation seriously affected by ice; daily discharge estimated by comparison with records of flow of Snake and Blue rivers.

DIVERSIONS.—There are court decrees for the diversion of 11 second-feet from Tenmile Creek above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice December 1 to March 21. Rating curve well defined between 20 and 900 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table or (Nov. 14 to Apr. 16) by comparison with records of flow of Snake and Blue Rivers. Records good except those for November to April, which are fair.

Discharge measurements of Tenmile Creek at Dillon, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*
Jan. 15	T. J. Watkins	*a* 1.67	24.0
Feb. 12	....do	*a* 1.70	28.9
July 13	Robert Follansbee	2.49	213

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	40	36	25	23	24	31	137	715	540	170	64
2	52	40	36	25	24	24	31	125	680	470	167	55
3	52	40	36	25	24	24	31	110	680	400	159	55
4	52	40	35	25	24	24	31	108	750	376	174	54
5	46	38	35	25	24	24	31	119	645	352	192	54
6	46	36	35	25	25	24	31	178	540	322	159	61
7	46	36	35	25	25	24	30	202	505	280	151	55
8	42	36	34	25	26	24	30	435	575	247	151	50
9	40	36	34	25	27	24	33	540	715	292	167	52
10	40	36	33	25	28	24	36	575	820	292	134	67
11	40	36	33	25	28	24	39	575	820	304	122	75
12	40	36	32	24	29	24	41	575	858	247	148	66
13	40	36	32	24	28	24	41	540	820	230	148	82
14	46	36	31	24	28	24	40	376	820	216	163	80
15	46	36	31	24	27	24	40	334	820	202	131	69
16	46	36	31	24	26	25	44	264	858	206	113	62
17	40	35	31	24	26	25	48	220	785	216	110	58
18	40	35	30	24	25	26	51	206	715	216	96	55
19	36	35	30	24	25	26	52	202	750	197	91	55
20	36	36	29	24	24	26	50	211	715	174	86	54
21	36	36	28	24	24	27	48	211	680	151	86	50
22	36	36	28	23	24	28	55	183	610	151	80	48
23	36	36	28	23	24	28	60	192	540	151	78	45
24	36	36	28	23	24	28	62	220	505	159	75	48
25	36	36	27	23	24	28	84	292	540	131	75	47
26	40	36	27	23	24	28	119	394	470	131	73	45
27	40	36	26	23	24	28	148	352	470	151	67	44
28	40	36	26	23	24	29	197	376	505	148	64	44
29	40	36	26	23	24	29	225	505	505	148	61	44
30	40	36	26	23	.....	30	181	645	435	274	69	42
31	40	.....	26	23	.....	30	.....	680	.....	211	66	.....

Monthly discharge of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	52	36	41.9	2,580
November	40	35	36.5	2,170
December	36	26	30.8	1,890
January	25	23	24.0	1,480
February	29	23	25.2	1,450
March	30	24	25.8	1,590
April	225	30	64.7	3,850
May	680	108	325	20,000
June	858	435	662	39,400
July	540	131	245	15,100
August	192	61	117	7,190
September	82	42	56.0	3,330
The year	858	23	138	100,000

EAGLE RIVER AT REDCLIFF, COLO.

LOCATION.—In sec. 29, T. 6 S., R. 80 W., at footbridge in town of Redcliff, Eagle County. Nearest tributary, Turkey Creek, enters 100 yards below station; Homestake Creek enters 1 mile below.

DRAINAGE AREA.—74 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 8, 1911, to September 30, 1916.

GAGE.—Chain on downstream side of footbridge; read by forest ranger.

DISCHARGE MEASUREMENTS.—Made from highway bridge 800 feet above station, or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders; very rough. Control, short distance below gage, will shift at long intervals. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.18 feet at 6.30 a. m., May 10 (discharge, 582 second-feet); minimum stage, 0.33 foot at 8 a. m., November 24 (discharge, 5 second-feet).

ICE.—Stage-discharge relation not affected by ice except occasionally for short periods.

DIVERSIONS.—There are court decrees for the diversion of 6 second-feet from Eagle River above station, and also a decree for diversion to the Arkansas basin of 18.5 second-feet from Piney Creek, a tributary. From January 1 to September 30 2,260 acre-feet were diverted.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts between narrow limits; affected by ice November 16–18, and January 27 to February 3. Rating curve well defined below 500 second-feet. Gage read to hundredths twice daily except when forest ranger was away (see footnote to daily-discharge table). Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Eagle River at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	W. R. King	0.76	14.6	Feb. 13	T. J. Watkins	0.48	14.7
Jan. 14	T. J. Watkins	.68	14.8	June 9	W. R. King	2.43	304

Daily discharge, in second-feet, of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	21	13	13	11	12	17	27	170	410	127	64	25
2	20	12	14	11	14	21	35	147	370	121	53	25
3	20	12	14	12	17	20	36	147	430	118	51	24
4	21	12	13	12	20	22	36	170	410	115	51	24
5	20	12	13	13	18	19	35	147	470	112	50	24
6	19	13	13	14	22	22	33	147	385	109	48	26
7	19	13	14	12	16	20	32	184	300	106	46	24
8	19	13	14	13	19	18	32	220	265	92	44	29
9	17	14	13	11	17	19	30	510	390	93	40	22
10	16	16	14	14	16	22	38	550	350	94	38	30
11	16	12	12	14	18	15	51	450	330	95	36	38
12	16	13	15	13	20	18	57	430	315	109	35	30
13	17	12	13	13	12	20	62	470	350	84	35	32
14	18	12	13	13	17	20	62	368	350	80	36	33
15	18	12	14	14	18	20	64	265	280	78	36	28
16	20	12	13	13	20	22	62	182	280	76	38	30
17	20	11	12	14	29	24	69	178	270	74	37	28
18	20	10	12	16	25	28	89	175	260	72	36	27
19	20	10	13	16	22	33	92	172	250	67	32	24
20	20	10	14	14	20	35	65	168	220	62	32	24
21	20	10	14	15	17	39	73	165	220	52	32	27
22	17	10	13	14	21	33	89	161	195	51	32	23
23	17	8	13	15	37	36	104	158	182	47	30	23
24	17	5	13	16	25	35	83	147	174	44	30	23
25	17	8	12	15	22	28	170	170	165	43	29	23
26	16	11	12	14	18	28	208	250	156	48	28	23
27	16	12	12	13	21	29	170	220	147	55	27	23
28	16	12	12	12	24	35	170	235	147	57	26	23
29	15	13	12	11	13	35	170	250	137	59	24	23
30	15	15	15	10	.....	35	195	291	137	60	28	22
31	14	.....	12	10	.....	25	.....	332	.....	62	27	.....

NOTE.—Discharge Nov. 16–18, and Jan. 27 to Feb. 3, estimated because of ice. Gage not read, discharge estimated for following periods: Oct. 3, 10, 20, 24, Nov. 5, 7, 14, 19–23, 25, 28, Dec. 19, 24–26, Jan. 2–3, 12, 17, 26, Feb. 11, 18–20, 25, Mar. 1, 12, 26, May 7, 14, 17–22, 28, 30, June 6–7, 11, 17–18, 24–26, July 2–6, 9–10, 15–16, 23, 28–30, Aug. 5–7, 10–11, 13–14, 17, 20–21, 24, 26–27, Sept. 3, 10, 13, 17, 23–27.

Monthly discharge of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	21	14	18.0	1,110
November	16	5	11.6	690
December	15	12	13.1	806
January	16	10	13.2	812
February	37	12	19.7	1,170
March	39	15	25.6	1,570
April	208	27	81.3	4,840
May	550	147	246	15,100
June	470	137	278	16,500
July	127	43	79.4	4,880
August	64	24	37.1	2,280
September	38	22	26.0	1,550
The year	550	5	70.7	51,300

EAGLE RIVER AT EAGLE, COLO.

LOCATION.—In sec. 33, T. 4 S., R. 84 W., at highway bridge at Eagle, in Eagle County. Nearest tributary, Brush Creek, enters three-fourths mile below station.

DRAINAGE AREA.—630 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—January 17, 1911, to September 30, 1916. March 12, 1905, to February 10, 1907, station was maintained short distance below mouth of Brush Creek.

GAGE.—Chain on downstream side of bridge; read by D. L. Wedmore. Prior to August, 1915, vertical staff fastened to right abutment was used. This gage was referred to same datum as present gage and Weather Bureau gage near by.

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

CHANNEL AND CONTROL.—Bed composed of boulders; very rough. Control not well defined. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.21 feet at 8 a. m. June 20 (discharge, 3,770 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Between Eagle and the station at Redcliff there are court decrees for diversion of 380 second-feet from Eagle River, of which 300 second-feet is for power. Below Eagle there are decrees for 22 second-feet from Eagle River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve well-defined below 4,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good, except those for spring months, when one daily reading of gage may not give true mean for day because of diurnal fluctuation; spring record fair.

Discharge measurements of Eagle River at Eagle, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 10	0.38	164
Apr. 25	1.54	721
June 8	3.01	2,230

Daily discharge, in second-feet, of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	265	158	.....	217	825	2,340	2,660	1,120	400
2	246	158	.....	217	825	2,460	2,590	1,120	375
3	246	158	.....	221	825	2,460	2,340	1,080	375
4	227	158	.....	227	748	2,590	2,220	1,030	350
5	211	147	.....	211	785	2,720	1,980	1,030	350
6	211	147	.....	211	1,030	2,460	1,860	988	350
7	195	158	.....	195	1,510	2,220	1,740	988	328
8	195	147	.....	195	2,100	2,220	1,740	945	328
9	170	152	138	195	2,720	2,460	1,620	905	306
10	182	158	147	195	3,110	2,850	1,620	865	285
11	182	158	170	285	2,720	3,110	1,510	785	285
12	195	158	170	350	2,720	3,370	1,510	748	285
13	195	154	170	400	2,460	3,630	1,410	710	285
14	195	155	182	350	2,340	3,500	1,410	675	285
15	195	155	195	350	1,980	3,370	1,310	675	285
16	195	156	195	375	1,980	3,500	1,310	640	285
17	195	156	195	400	1,980	3,500	1,260	640	265
18	195	157	211	428	1,980	3,500	1,210	608	265
19	195	157	211	428	1,860	3,630	1,210	608	265
20	211	158	208	400	1,740	3,760	1,210	575	246
21	211	158	205	400	1,510	3,630	1,160	545	246
22	211	158	205	400	1,260	3,500	1,080	545	227
23	195	147	211	608	1,410	3,240	1,080	515	211
24	195	147	214	640	1,510	3,110	1,030	515	208
25	195	147	214	748	1,510	3,110	1,030	485	201
26	182	147	214	710	1,740	2,850	988	455	201
27	170	147	211	865	1,310	2,720	988	455	195
28	170	147	208	1,030	1,620	2,720	988	455	190
29	158	147	211	1,160	1,740	2,590	1,310	428	188
30	158	147	211	1,120	1,860	2,720	1,210	428	188
31	158	.....	214	.....	2,220	.....	1,210	400	.....

NOTE.—Discharge Nov. 15-21 and 30, estimated, because of ice; observations discontinued Dec. 1 to Mar. 8. Discharge Oct. 1-2, Nov. 14, 25, 28, and Apr. 9, estimated.

Monthly discharge of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	265	158	197	12,100
November	158	147	153	9,100
March 9-31	214	138	196	8,940
April	1,160	195	451	26,800
May	3,110	748	1,740	107,000
June	3,760	2,220	2,990	178,000
July	2,660	988	1,480	91,000
August	1,120	400	708	43,500
September	400	188	275	16,400

TURKEY CREEK AT REDCLIFF, COLO.

LOCATION.—In sec. 19, T. 6 S., R. 80 W., at highway bridge in Redcliff, Eagle County, 800 feet above mouth of creek.

DRAINAGE AREA.—27 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—June 30, 1913, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left bridge abutment; read by Forest ranger.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading nearby.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; will shift. Control not well defined. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.2 feet at 7 p. m. June 12 (discharge, 302 second-feet); minimum stage, 0.67 foot at 8 a. m. November 11, and 7.15 a. m. November 12 (discharge, 3.7 second-feet).

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

DIVERSIONS.—There is court decree for diversion of 5.5 second-feet from Turkey Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during 1916 until high water in June, when a boulder rolled under gage; not affected by ice. Rating curve fairly well defined below 200 second-feet. Gage read to hundredths twice daily except when forest ranger was away (see footnote to table of daily discharge). Daily discharge ascertained by applying daily gage height to rating table. Records October to June good; July to September fair.

Discharge measurements of Turkey Creek at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	W. R. King	0.90	7.0	Feb. 13	T. J. Watkins	.73	4.7
Jan. 14	T. J. Watkins	.70	4.1	June 9	W. R. King	2.26	154

Daily discharge, in second-feet, of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	6	4	4	4	4	7	38	182	94	16	11
2	8	6	5	4	4	4	6	29	182	88	16	13
3	8	6	4	4	4	4	7	25	166	82	16	12
4	9	6	4	4	4	4	7	26	182	76	17	11
5	9	6	5	4	4	6	7	25	198	70	16	10
6	8	6	5	4	4	4	6	50	270	64	15	12
7	8	6	4	5	4	4	7	75	240	58	14	11
8	8	7	5	4	4	4	7	100	222	45	13	11
9	8	7	4	4	4	4	7	111	159	38	13	12
10	8	5	4	4	4	5	9	174	238	40	13	13
11	8	4	4	4	4	4	15	152	270	39	13	14
12	8	5	4	4	4	5	11	144	302	34	13	11
13	9	5	4	4	5	7	11	108	238	35	13	12
14	8	5	4	4	5	7	11	130	238	30	13	12
15	9	5	4	4	5	6	12	111	222	27	13	10
16	8	5	4	4	5	6	11	82	222	24	13	10
17	8	4	4	4	5	7	11	78	222	22	13	13
18	8	5	4	4	4	7	14	75	222	23	13	16
19	7	5	4	4	4	4	20	70	222	22	11	10
20	7	5	4	4	4	8	18	64	206	22	11	10
21	7	4	4	4	4	9	15	60	206	18	11	10
22	8	4	4	4	4	8	18	58	190	18	11	10
23	8	4	4	4	4	8	21	52	174	18	10	10
24	8	4	4	4	5	8	27	47	160	18	10	10
25	8	4	4	4	5	7	28	75	148	16	11	10
26	10	4	4	4	5	6	29	92	134	20	11	9
27	9	4	4	4	4	5	38	110	120	24	10	9
28	8	4	4	4	4	7	43	140	114	27	10	9
29	7	4	4	4	4	7	62	129	110	30	11	9
30	7	4	4	4	.....	7	36	140	98	24	12	10
31	7	.....	4	4	.....	7	.....	165	.....	17	11	.....

NOTE.—Gage not read; discharge estimated: Oct. 3, 10, 20, 24, 27–31, Nov. 1–8, 14, 19–23, 25–26, 28, Dec. 12, 18–19, 23–26, 30, Jan. 2–3, 6, 9, 16, 22, 26–28, Feb. 11–12, 14, 17–21, 25, 29, Mar. 1–3, 12, 26, May 7, 14, 17–22, 28, 30–31, June 6–7, 11, 17–18, 24–26, July 2–6, 9–10, 15–16, 23, 28–30, Aug. 5–7, 10, 12–14, 17, 20–21, 24, 26–27, Sept. 3, 10, 13, 17, 23–27. Shifting-control method used June 27 to Sept. 30.

Monthly discharge of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	10	7	8.03	494
November	7	4	4.97	296
December	5	4	4.13	254
January	5	4	4.03	248
February	5	4	4.28	246
March	9	4	5.90	363
April	62	6	17.4	1,040
May	174	25	88.3	5,430
June	302	98	195	11,600
July	94	16	37.5	2,310
August	17	10	12.7	781
September	16	9	11.0	655
The year	302	4	32.7	23,700

HOMESTAKE CREEK AT REDCLIFF, COLO.

LOCATION.—In sec. 30, T. 6 S., R. 80 W., half a mile above mouth of creek at Forest Service bridge, and 1 mile from Redcliff, in Eagle County; below all tributaries.

DRAINAGE AREA.—64 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 17, 1914, to September 30, 1916. From January 8, 1911, to August 16, 1914, station was located quarter of a mile downstream.

GAGE.—Vertical staff on left abutment of bridge facing current; read by forest ranger. Gage used prior to August 17, 1914, was vertical staff attached to large boulder on right bank quarter of a mile downstream and just above the cascades.

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

CHANNEL AND CONTROL.—Bed composed of gravel well compacted. Control is 50 feet downstream at small rapids; apparently permanent. Several small overflow channels around left bank carry water at stages above 2.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.17 feet at 9 a. m., June 13 (discharge, 658 second-feet); minimum discharge probably occurred during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—There are court decrees for diversion of 1.2 second-feet from a tributary of Homestake Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; seriously affected by ice November 24 to March 31. Rating curve well-defined below 600 second-feet. Gage read to hundredths occasionally. Daily discharge April to September estimated from hydrographic comparison with records of flow of Eagle River and Turkey Creek, based on occasional gage heights. Records only fair owing to possible diurnal fluctuations and infrequent gage readings.

Discharge measurements of Homestake Creek at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 9	W. R. King	0.33	5.6
Jan. 14	T. J. Watkins	*a* .70	9.2
June 9	W. R. King	2.42	397

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Homestake Creek, at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	7	45	129	350	347	118	35
2	33	7	44	112	347	325	116	30
3	30	7	42	102	400	300	114	28
4	27	7	40	110	381	270	110	30
5	24	7	40	118	450	250	100	30
6	19	8	40	134	410	230	90	31
7	15	8	40	170	390	218	85	27
8	14	8	38	300	390	230	80	35
9	14	8	38	432	381	210	75	40
10	13	8	47	520	480	185	70	48
11	13	9	58	398	520	180	68	50
12	13	10	68	364	468	172	66	48
13	13	10	78	347	650	180	70	48
14	13	7	90	240	610	200	80	48
15	15	7	96	205	468	190	93	49
16	20	7	100	200	460	180	80	45
17	18	7	107	195	500	160	70	40
18	16	6	110	192	580	145	63	35
19	16	5	126	190	590	135	58	34
20	16	5	100	188	500	128	55	30
21	16	5	90	186	468	120	57	30
22	16	5	80	186	468	110	54	30
23	16	4	100	188	460	105	50	30
24	15	2	117	190	455	104	48	30
25	13	1	129	194	450	110	48	28
26	11	2	112	205	445	114	48	28
27	10	4	172	210	435	118	45	28
28	9	6	155	205	425	120	42	28
29	8	7	155	230	415	120	40	27
30	8	8	162	285	380	120	40	27
31	8	.....	.....	381	.....	120	39	.....

NOTE.—Gage read Oct. 5, 13, 16, 18, 23, 26, 29, Nov. 2, 9, 24, 27, Apr. 9–10, 17, 22, 24–27, May 1, 3, 9–13, 15, 25, 28, 30–31, June 2, 4, 9, 12–15, 19, 21–22, 29, July 1, 6–8, 12, 20, 22, 24, Aug. 3, 12, 15, 18, 21, 23, 31, Sept. 3, 6–7, 15, 20, 25, 29; discharge estimated between readings.

Monthly discharge of Homestake Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	37	8	16.4	1,010
November	10	1	6.4	381
April	172	38	87.3	5,190
May	520	102	229	14,100
June	650	347	458	27,300
July	347	104	177	10,900
August	118	39	70.1	4,310
September	50	27	34.9	2,080

ROARING FORK AT ASPEN, COLO.

LOCATION.—In sec. 7, T. 10 S., R. 84 W., at bridge near old power plant at Aspen, in Pitkin County. Castle, Maroon, and Hunter creeks enter below.

DRAINAGE AREA.—109 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 25, 1915, to September 30, 1916. From January 1, 1911, to February 24, 1915, station was maintained just below Cooper Avenue bridge three-quarters of a mile upstream.

GAGE.—Vertical staff at downstream end of right bridge abutment; read irregularly by forest ranger until May 9; after which read by Chas. Gerstle, jr. Gage used at original section was vertical staff fastened to old crib abutment on right bank, 25 feet below Cooper Avenue bridge: no determined relation between two gages.

DISCHARGE MEASUREMENTS.—Made by wading or from single span bridge.

CHANNEL AND CONTROL.—Bed composed of small boulders and is fairly smooth. Control not well defined; practically permanent. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.9 feet during night of June 13, as determined from high-water marks (discharge, 1,560 second-feet); minimum discharge estimated 26 second-feet March 2.

ICE.—Stage-discharge relation seriously affected by ice for short periods during the winter.

DIVERSIONS.—Salvation ditch, which has a decree for 58 second-feet, diverts water above station from middle of May to middle of September. About 6 second-feet is pumped into the river above station from mines at Aspen.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice for short periods during winter. Rating curve well defined below 1,200 second-feet. Gage read to hundredths occasionally until May 9, and thereafter twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair October to May, and good June to September.

Discharge measurements of Roaring Fork at Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 20	W. R. King	1.14	37.0	Feb. 9	T. J. Watkins	1.10	33.5
Jan. 10	T. J. Watkins	1.06	30.7	June 14	W. R. King	4.02	1,040

Daily discharge, in second-feet, of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	65	35	39	32	32	27	40	164	675	875	308	76
2	64	30	40	32	32	26	51	137	675	725	325	72
3	63	31	40	32	32	28	62	123	725	675	255	72
4	62	31	41	32	32	30	54	112	725	638	225	66
5	61	32	42	32	32	30	49	200	875	600	225	63
6	60	32	43	32	34	30	50	248	725	575	212	63
7	58	33	44	31	36	31	49	296	625	625	200	60
8	55	34	45	31	34	31	45	342	725	575	200	55
9	53	36	45	30	32	32	48	462	930	600	225	55
10	54	39	45	28	34	32	53	478	1,150	530	212	142
11	55	37	45	30	33	41	65	492	1,100	485	175	152
12	54	36	45	31	32	45	67	508	1,150	462	152	144
13	53	35	45	32	32	49	71	508	1,320	462	225	123
14	53	36	44	33	32	44	65	420	1,150	400	272	120
15	55	36	43	34	32	38	66	308	1,040	400	225	112
16	57	37	41	31	33	32	67	272	1,040	420	200	105
17	57	37	43	28	33	40	68	240	1,150	360	175	105
18	56	38	45	30	34	48	82	200	1,040	342	164	86
19	56	39	43	32	35	50	79	200	1,040	325	144	82
20	55	39	41	34	37	53	70	240	1,040	290	144	79
21	55	38	39	36	39	60	67	225	930	272	133	76
22	55	38	39	39	34	60	76	200	930	272	116	76
23	53	38	34	37	30	53	94	188	985	240	104	72
24	51	37	32	36	28	48	102	200	825	225	107	86
25	50	37	32	34	27	43	105	240	825	225	100	82
26	49	37	32	32	53	46	109	290	825	225	92	79
27	48	37	32	30	36	49	137	272	875	200	86	68
28	46	38	32	29	33	55	164	325	875	240	83	72
29	44	38	32	28	30	45	212	380	825	225	80	71
30	43	39	32	30	.....	40	188	462	875	255	77	67
31	39	.....	32	32	.....	40	.....	575	.....	308	75	.....

NOTE.—Discharge estimated because of ice Nov. 13, 27-30, Dec. 1-2, Jan. 8, Feb. 14-17, Mar. 3; also estimated when gage was not read as follows: Oct. 1-5, 7-8, 10, 12-15, 18-21, 23-26, 28-29, 31, Nov. 1, 3-5, 7-9, 11-12, 14-18, 21-26, Dec. 3-7, 9, 12, 14-15, 17, 19-20, 25-28, 30, Jan. 1-4, 6-7, 9, 11-12, 14, 16, 18, 20-21, 23, 25-28, 30, Feb. 1-2, 4, 6, 8, 11, 13, 18-20, 22, 24, 27-28, Mar. 1-2, 5, 7-9, 12, 14-15, 17, 19, 22-24, 26, 29-31, Apr. 1-2, 4, 16, 30, May 6-7, 10-11, and July 4.

Monthly discharge of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	65	39	54.2	3,330
November	39	30	36.0	2,140
December	45	32	39.6	2,430
January	39	28	31.9	1,960
February	53	27	33.6	1,930
March	60	26	41.2	2,530
April	212	40	81.8	4,870
May	575	112	300	18,400
June	1,320	625	922	54,900
July	875	200	421	25,900
August	325	75	171	10,500
September	152	55	86.0	5,120
The year	1,320	26	185	134,000

ROARING FORK BELOW ASPEN, COLO.

LOCATION.—In sec. 1, T. 10 S., R. 85 W., at first highway bridge 2 miles below Aspen, in Pitkin County. Nearest tributary above is Castle Creek; nearest below, Maroon Creek.

DRAINAGE AREA.—223 square miles (measured on topographic map).

RECORDS AVAILABLE.—October 18, 1913, to September 30, 1916.

GAGE.—Vertical staff on right abutment of bridge, facing channel; read at irregular intervals by forest ranger.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; shifts occasionally during high water. Control not well defined. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum discharge, 2,200 second-feet on June 13, estimated from comparative hydrograph; minimum stage recorded, zero March 3 (discharge, 87 second-feet).

ICE.—Stage-discharge relation not affected by ice except for occasional short periods.

DIVERSIONS.—Between this station and the one at Aspen there are a number of small diversions, some of which return the water to the river above the station. The Roaring Fork Light and Power Co. diverts water from Maroon Creek into Castle Creek and thence into Roaring Fork above the station.

REGULATION.—None so far as known.

ACCURACY.—Stage-discharge relation not permanent; shifts between very narrow limits; affected by ice only for short periods. Rating curve fairly well defined below 3,000 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying gage height to rating table, or for days when gage was not read by estimating from comparison hydrographic records of flow of Roaring Fork at Aspen. Records good, except those for spring months, which are only fair, owing to the probability that one reading does not give the true mean for the day because of diurnal fluctuation due to alternate melting and freezing of snow.

Discharge measurements of Roaring Fork below Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 21	W. R. King	0.25	144	Feb. 9	T. J. Watkins	0.10	104
Jan. 11	T. J. Watkins	.15	105	June 15	W. R. King	2.55	1,870

Daily discharge, in second-feet, of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	185	138	141	104	92	94	114	362	985	1,350	620	255
2	184	135	142	104	92	90	129	307	985	1,280	685	242
3	183	140	143	104	92	87	165	285	1,120	1,280	620	234
4	182	147	143	104	94	101	137	260	1,120	1,080	560	225
5	181	156	144	104	96	101	128	480	1,250	1,100	555	234
6	180	165	144	104	100	101	127	560	1,110	1,060	525	242
7	174	165	144	103	109	99	122	650	1,030	1,070	500	228
8	168	162	144	102	106	98	118	720	1,070	1,160	485	214
9	161	160	138	102	104	98	120	940	1,400	1,090	505	200
10	169	158	131	103	104	102	128	970	2,080	1,030	468	325
11	177	153	131	104	104	104	150	995	2,000	995	430	327
12	175	148	128	100	104	104	161	1,020	2,070	950	387	318
13	173	141	126	97	104	104	188	1,020	2,200	905	387	300
14	175	134	126	107	104	106	170	792	2,070	830	387	298
15	181	132	124	118	104	108	169	620	1,940	830	400	297
16	188	130	123	108	104	109	175	588	1,940	845	414	287
17	158	131	120	99	106	114	175	495	2,070	755	380	278
18	158	133	118	105	108	118	190	495	1,980	730	337	270
19	157	135	117	111	110	132	169	468	1,950	710	337	251
20	156	141	116	108	112	148	165	555	1,960	685	340	260
21	155	144	114	105	114	161	162	500	1,690	650	327	258
22	154	143	115	101	106	161	177	480	1,690	620	320	250
23	154	142	116	105	97	155	230	460	1,820	620	305	248
24	155	141	114	109	99	145	260	495	1,460	620	298	265
25	156	140	112	108	101	128	302	550	1,240	620	297	250
26	157	140	111	107	104	139	280	620	1,240	620	287	240
27	158	140	111	106	101	151	320	620	1,250	600	287	235
28	153	140	111	105	98	135	390	720	1,250	580	287	234
29	149	140	111	104	97	128	468	755	1,280	555	284	230
30	144	141	108	106	.....	122	420	790	1,350	555	272	225
31	141	.....	104	97	.....	116	.....	888	.....	588	260	.....

NOTE.—Discharge estimated by hydrographic comparison with records of flow of Roaring Fork at Aspen, Oct. 1–5, 7–8, 10, 12–15, 18–21, 23–26, 28–29, 31, Nov. 1, 3–5, 7–9, 11, 13–18, 22–26, 28–29, Dec. 1, 3–7, 9, 12, 15, 17, 19–20, 22, 24–28, 30, Jan. 1–3, 5–7, 9–10, 12, 14, 16, 18, 20–21, 23, 25–28, 30, Feb. 8, 11, 13, 15, 17–20, 22, 24–25, 27–28, Mar. 1–2, 5, 7–10, 12, 14–15, 17, 19–20, 22–24, 26, 29–31, Apr. 2, 4, 6–7, 9, 11, 13–14, 16–18, 20–21, 23–24, 26–28, 30, May 3–7, 9–13, 21–23, 25, 28, 30–31, June 4, 6, 9–11, 13–14, 16, 18–20, 22–23, 25–27, 29–30, July 2–6, 9–12, 16, 18–21, 23–25, 27–28, 30–31, Aug. 1, 3–4, 6–9, 11, 13, 15, 17, 20, 22–25, 27, 29–30, Sept. 1, 3, 5, 7–8, 10, 12–15, 17–18, 21–27, 29. Discharge estimated because of ice, Nov. 12, 27, Dec. 2, and Feb. 1–6. Shifting-control method used Oct. 1 to Nov. 10, and Dec. 8 to Jan. 24.

Monthly discharge of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	188	141	166	10,200
November	165	130	144	8,570
December	144	104	125	7,690
January	118	97	105	6,460
February	114	92	102	5,870
March	161	87	118	7,260
April	468	114	200	11,900
May	1,020	260	628	38,600
June	2,200	985	1,550	92,200
July	1,350	555	850	52,300
August	685	260	405	24,900
September	327	200	257	15,300
The year	2,200	87	388	281,000

ROARING FORK AT GLENWOOD SPRINGS, COLO.

LOCATION.—In sec. 9, T. 6 S., R. 89 W., about 1,500 feet above mouth of river in Glenwood Springs, Garfield County.

DRAINAGE AREA.—1,450 square miles (measured on Nell's map of Colorado, edition of 1903).

RECORDS AVAILABLE.—April 6, 1906, to September 30, 1909; September 21, 1910, to September 30, 1916.

GAGE.—Inclined staff on left bank 800 feet above highway bridge, used since November 20, 1915. Chain gage on downstream side of highway bridge previously used. Read by employees of United States Forest Service.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of boulders and coarse gravel; shifts slightly between narrow limits. Control not well defined. Banks high and not subject to overflow. Gage was moved to eliminate effect of backwater during extremely high stages on Grand River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.6 feet on June 13–14, 19 and 20 (discharge, 8,520 second-feet); minimum stage recorded, 0.70 foot at 4 p. m. March 3 (discharge, 300 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice, as river seldom freezes over and slush or anchor ice forms only occasionally.

DIVERSIONS.—There are court decrees for diversion of 164 second-feet from Roaring Fork between Glenwood Springs and lower Aspen station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifted between narrow limits; not affected by ice during 1916. Rating curves well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table Records good.

Discharge measurements of Roaring Fork at Glenwood Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	W. R. King	1.18	462	Apr. 25	W. R. King	2.28	1,640
20	do	[a] 1.00	477	June 16	do	5.33	7,780
Jan. 9	T. J. Watkins	.95	524	July 22	do	2.98	2,620
Feb. 6	do	.85	382				

[a] Stage read on new gage installed this date; reading on old gage 1.34 feet.

Daily discharge, in second-feet, of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	615	455	485	420	342	390	670	1,820	5,050	5,990	2,690	998
2	615	480	414	420	350	360	670	1,580	4,830	5,750	3,030	986
3	588	430	485	452	388	300	670	1,470	5,050	5,510	3,030	976
4	588	455	485	485	388	420	710	1,580	5,640	5,280	3,030	965
5	532	480	468	420	388	452	670	1,820	6,230	5,050	2,690	875
6	505	455	452	420	388	485	630	2,690	5,510	4,830	2,460	875
7	505	480	420	360	388	452	592	3,440	5,280	4,390	2,220	875
8	505	480	420	420	388	452	592	4,180	5,050	5,050	2,080	875
9	532	480	408	420	370	420	631	4,830	6,230	4,830	2,220	875
10	480	588	452	420	370	485	670	5,280	7,470	4,610	2,080	875
11	480	480	420	390	370	485	832	5,050	7,730	4,180	2,220	1,470
12	455	430	436	390	370	520	920	4,830	7,990	3,770	2,080	1,360
13	455	455	452	485	350	555	965	4,610	8,520	3,680	2,470	1,360
14	480	430	420	420	330	555	920	3,910	8,520	3,580	2,860	1,260
15	480	405	420	420	370	485	965	3,210	7,990	3,580	2,220	1,260
16	532	480	452	420	370	520	1,010	2,530	7,990	3,480	1,950	1,060
17	518	455	366	420	370	555	1,060	2,220	7,990	3,390	1,700	1,080
18	505	455	378	420	360	555	1,210	2,080	8,250	3,390	1,580	1,110
19	505	455	369	420	350	672	1,210	2,080	8,520	3,030	1,580	1,030
20	532	505	360	360	355	790	1,090	2,530	8,520	2,860	1,470	950
21	455	520	420	420	360	1,260	965	2,450	7,730	2,690	1,360	875
22	505	485	452	360	390	965	1,060	2,370	6,970	2,690	1,260	875
23	455	485	452	370	390	875	1,260	2,080	5,990	2,460	1,260	875
24	455	520	420	380	360	832	1,470	2,370	6,470	2,220	1,110	898
25	455	470	420	390	360	790	1,700	2,690	6,110	2,370	1,160	920
26	480	420	420	390	360	750	1,820	3,030	5,750	2,530	1,110	875
27	480	485	360	405	375	710	2,080	2,860	6,470	2,370	1,040	832
28	455	452	360	390	390	670	2,370	3,320	6,230	3,030	965	790
29	430	390	420	360	360	790	3,030	3,770	6,230	3,030	875	790
30	430	520	452	348	.....	710	2,420	4,180	6,110	3,030	1,060	832
31	455	.....	436	335	.....	630	.....	4,610	.....	3,030	1,010	.....

NOTE.—Discharge estimated or interpolated Oct. 17, 24, Nov. 25, Dec. 5, 12, 19, 25, 31, Jan. 9, 16, 23–24, 31, Feb. 13, 20, 27, Mar. 5, 12, 19, 25–26, Apr. 2, 9, 16, 23, 30, May 7, 12, 14, 21, 28, June 4, 11, 17–18, 25, 30, July 2, 9, 13, 16, 23, 29–30, Aug. 3, 6, 12–13, 19–20, 27, Sept. 1–3, 10, 17, 19–20, 22, 24.

Monthly discharge of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	615	430	499	30,700
November	588	390	469	27,900
December	485	360	425	26,100
January	485	335	404	24,800
February	390	330	369	21,200
March	1,260	300	609	37,400
April	3,030	592	1,160	69,000
May	5,280	1,470	3,080	189,000
June	8,520	4,830	6,750	402,000
July	5,990	2,220	3,730	229,000
August	3,030	875	1,870	115,000
September	1,470	790	989	58,800
The year	8,520	300	1,700	1,230,000

CASTLE CREEK NEAR ASPEN, COLO.

LOCATION.—In sec. 35, T. 10 S., R. 85 W., 75 feet below highway bridge, in Sopris National Forest, 4½ miles above Aspen, in Pitkin County. No inflow below except spring run-off from small gulches; Conundrum Creek, enters about a mile upstream.

DRAINAGE AREA.—72 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 16, 1911, to September 30, 1916.

GAGE.—Gurley water-stage recorder on left bank 75 feet below bridge. Staff on opposite bank at datum 1.0 foot higher than present gage, used February 16, 1911, to February 28, 1912. Vertical staff on right abutment of bridge at present datum used February 29, 1912, to April 11, 1915, but owing to slope of stream gage readings were somewhat higher.

DISCHARGE MEASUREMENTS.—Made from cable 22 feet below gage or by wading nearby.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; shifts during high water. Control is small rapids just below cable. Left bank high and not subject to overflow; right bank is overflowed for 75 feet at gage height 4.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.22 feet at midnight June 17 (discharge, 577 second-feet); minimum stage, 0.42 foot on February 1 (discharge, 26 second-feet).

ICE.—Stage-discharge relation affected by ice occasionally for short periods.

DIVERSIONS.—No water diverted above station except possibly for a small amount of meadow irrigation; there are court decrees for diversion of 160 second-feet below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during year; affected by ice for a few short periods. Rating curve well defined below 500 second-feet. Operation of water-stage recorder satisfactory. Daily discharge determined by applying to rating table daily gage height obtained by inspecting gage-height graph. Records excellent.

Discharge measurements of Castle Creek near Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 22	W. R. King	0.70	37.8	Feb. 8	T. J. Watkins	0.60	29.2
Jan. 11	T. J. Watkins	.52	27.3	June 14	W. R. King	2.73	446

Daily discharge, in second-feet, of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	53	37	36	34	31	33	33	77	206	494	280	165
2	52	37	35	34	34	32	34	74	206	452	260	103
3	53	37	35	34	34	33	34	68	219	502	249	97
4	52	37	35	34	32	33	34	70	253	458	244	95
5	51	37	34	34	32	33	34	81	270	473	237	95
6	50	37	34	34	32	33	34	105	246	445	230	99
7	48	38	34	34	32	32	34	139	249	432	206	92
8	48	37	34	33	32	32	34	156	270	455	199	86
9	48	37	34	33	32	32	35	181	322	370	223	141
10	48	37	34	31	32	33	36	186	382	372	219	150
11	46	34	34	29	32	34	38	184	412	330	195	133
12	45	32	34	32	32	33	39	184	434	324	188	113
13	43	31	34	34	32	34	40	181	455	337	221	107
14	43	34	34	34	34	32	37	169	463	334	244	101
15	43	37	33	34	34	32	37	141	468	334	203	95
16	43	41	33	33	34	32	38	125	478	350	190	81
17	43	40	33	33	34	33	41	117	484	347	173	85
18	43	40	31	32	36	34	42	111	504	352	181	81
19	42	40	31	33	34	34	42	119	510	322	158	78
20	42	38	31	32	33	35	40	129	481	317	154	75
21	42	37	31	31	32	37	40	121	455	310	143	74
22	42	36	31	30	32	35	42	113	422	297	135	72
23	42	36	31	30	33	36	46	105	394	290	129	74
24	42	36	31	30	32	35	49	103	430	280	129	75
25	40	34	31	30	32	34	51	109	438	314	129	72
26	40	34	32	30	32	35	56	115	448	310	123	70
27	38	35	32	30	34	34	63	115	457	284	117	67
28	37	34	32	30	33	35	72	129	466	260	111	67
29	37	35	33	32	32	34	92	148	475	255	111	64
30	37	36	34	32	.....	34	86	175	484	250	115	64
31	37	.....	34	31	.....	34	.....	199	.....	244	109	.....

NOTE.—Discharge estimated because of ice, Dec. 13–16, 20–24, Jan. 23–27; also estimated when water stage recorder failed to operate, Nov. 12, 14–15, 17, 21, Dec. 25–27, 29, 31, Jan. 1–2, 4–10, June 25–30, and July 29–30. Shifting-control method used July 4 to Sept. 30.

Monthly discharge of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	53	37	44.2	2,720
November	41	31	36.4	2,170
December	36	31	33.1	2,040
January	34	29	32.2	1,980
February	36	31	32.8	1,890
March	37	32	33.6	2,070
April	92	33	44.4	2,640
May	199	68	130	7,990
June	510	206	393	23,400
July	502	244	351	21,600
August	290	109	182	11,200
September	150	64	90.4	5,380
The year	510	29	117	85,100

MAROON CREEK NEAR ASPEN, COLO.

LOCATION.—In sec. 22, T. 10 S., R. 85 W., just above the Roaring Fork Light & Power Co.'s head gate, and 5 miles above Aspen, Pitkin County, in the Sopris National Forest. Nearest tributary, Willow Creek, enters just below station.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 1, 1911, to September 30, 1916.

GAGE.—Vertical staff on right bank 100 feet above canal head gate; read by Harry Burnett.

DISCHARGE MEASUREMENTS.—Made by wading at points near gage.

CHANNEL AND CONTROL.—Bed composed of compacted gravel; shifts occasionally. Banks not subject to overflow to any great extent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.20 feet at 5.45 a. m. July 4 (discharge, 365 second-feet); minimum stage, 0.40 foot at 8.40 a. m. March 6 caused by snow slide (discharge, 16 second-feet).

ICE.—Stage-discharge relation not affected by ice except occasionally for short periods.

DIVERSIONS.—One or two small diversions above station; the Roaring Fork Light & Power Co. diverts water just below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during year; affected by ice for a few short periods. Rating curve fairly well-defined below 300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good, except those for spring months which are only fair, owing to the diurnal fluctuation due to alternate melting and freezing of snow.

Discharge measurements of Maroon Creek near Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 11	T. J. Watkins	0.68	25.3
Feb. 8	do	.65	21.5
June 13	W. R. King	1.90	340

Daily discharge, in second-feet, of Maroon Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	31	28	26	24	22	23	40	155	334	272	129
2	37	31	28	25	25	22	23	40	163	334	288	117
3	37	31	28	24	27	22	23	39	171	350	272	110
4	37	30	28	24	25	22	23	42	182	365	272	103
5	37	30	28	24	24	22	23	44	199	350	266	103
6	36	29	28	24	24	23	23	53	196	350	260	98
7	36	29	28	24	24	24	23	68	196	350	253	96
8	36	28	27	25	24	23	24	83	205	350	247	92
9	35	28	28	26	24	22	24	96	220	350	241	96
10	34	28	27	26	24	23	24	110	235	334	241	117
11	34	28	28	26	23	23	25	115	256	334	229	115
12	34	28	27	24	23	22	26	117	272	334	226	105
13	34	28	27	25	23	22	25	119	272	318	235	103
14	34	29	26	25	23	23	25	115	288	318	247	96
15	36	30	27	25	23	22	25	110	288	303	229	92
16	36	29	26	25	23	22	26	107	303	303	226	90
17	34	28	26	25	23	22	27	105	303	303	217	90
18	34	28	26	26	23	23	28	105	318	303	214	83
19	34	29	27	28	23	25	27	105	334	303	208	83
20	33	29	28	30	23	24	28	77	334	303	205	79
21	33	29	28	27	22	28	28	112	318	288	196	79
22	33	29	27	27	22	25	28	110	318	288	194	75
23	33	29	27	24	22	25	29	105	303	288	191	75
24	33	29	26	24	22	24	30	101	303	272	182	72
25	31	28	26	24	22	24	34	103	303	288	179	72
26	31	28	26	24	22	24	36	105	303	272	174	66
27	30	28	26	24	22	24	39	110	318	272	168	64
28	30	28	30	27	22	24	41	115	318	272	160	64
29	30	30	26	24	22	24	45	122	334	272	155	61
30	31	29	26	24	.....	23	42	129	334	272	155	61
31	31	.....	26	24	.....	23	.....	145	.....	272	145	.....

NOTE.—Discharge estimated Dec. 18–20, 25, Jan. 7–9, 18, Feb. 13, and Mar. 5–6, because of snow and ice.

Monthly discharge of Maroon Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	38	30	33.9	2,080
November	31	28	28.9	1,720
December	30	26	27.1	1,670
January	30	24	25.2	1,550
February	27	22	23.2	1,330
March	28	22	23.3	1,430
April	45	23	28.2	1,680
May	145	39	95.1	5,850
June	334	155	268	15,900
July	365	272	311	19,100
August	288	145	218	13,400
September	129	61	89.5	5,330
The year	365	22	97.9	71,000

FRYINGPAN CREEK AT NORRIE, COLO.

LOCATION.—In sec. 28, T. 8 S., R. 83 W., at highway bridge in Norrie, Pitkin County in the Sopris National Forest. North Fork enters 1 mile below.

DRAINAGE AREA.—92 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 18, 1911, to September 30, 1916.

GAGE.—Vertical staff on downstream side of center pier; read by forest ranger. From February 18, 1911, to July 13, 1915, gage was located at side of pier and although referred to same datum gave a considerably higher reading during high-water stages as the water piled up against it. On August 20, 1915, gage datum was raised 1 foot.

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

CHANNEL AND CONTROL.—Bed composed of boulders. Current not greatly disturbed as at ordinary stages a pool is formed by the control located 100 feet downstream at well-defined rapids which are practically permanent. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum discharge of 1,040 second-feet June 11 (estimated from comparative hydrograph); minimum discharge of 17 second-feet occurred November 17 when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; daily discharge determined from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—None above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice for occasional short periods. Rating curve well defined below 1,000 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying to rating table daily-gage height, or for days on which gage was not read, by estimating discharge from hydrographic comparison with records of flow of Fryingpan Creek at Thomasville and North Fork of Fryingpan Creek near Norrie. Records only fair because of infrequent gage readings, and probable error due to diurnal fluctuation.

Discharge measurements of Fryingpan Creek at Norrie, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	a1.59	26.4	Feb. 10	T. J. Watkins	1.48	24.4
23	....do	a1.58	25.1	June 12	W. R. King	3.82	788
Jan. 12	T. J. Watkins	1.45	20.8				

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Fryingpan Creek at Norrie, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	45	26	24	24	25	32	60	180	605	515	298	83
2	50	25	22	24	26	32	40	130	620	650	262	79
3	50	23	26	24	25	32	47	103	650	580	250	72
4	44	22	26	24	24	33	47	166	640	480	228	65
5	37	22	26	24	24	34	45	220	620	435	195	58
6	37	23	26	24	25	35	40	280	605	375	190	74
7	37	24	26	24	26	37	37	495	605	395	185	70
8	37	26	26	24	25	40	37	455	605	420	180	65
9	37	22	26	24	25	42	46	628	740	440	210	96
10	44	26	28	23	24	44	56	560	930	455	210	126
11	55	32	26	23	25	47	76	605	1,040	395	166	114
12	37	31	25	22	26	48	78	605	930	380	166	103
13	38	29	26	22	26	50	69	538	785	355	190	108
14	40	26	26	23	26	52	69	509	760	315	245	96
15	38	21	26	23	25	54	69	375	740	298	220	83
16	37	18	26	24	25	57	60	315	740	280	180	78
17	44	17	26	24	26	60	65	315	785	260	180	76
18	40	19	26	22	27	65	95	280	840	245	147	74
19	37	19	26	22	27	70	90	228	740	262	139	65
20	37	21	26	22	28	103	80	195	695	240	134	65
21	38	24	26	23	28	139	89	210	680	210	126	62
22	37	26	25	24	29	85	103	245	645	200	117	58
23	40	26	23	25	29	62	108	195	620	180	110	62
24	40	30	22	26	30	79	120	375	605	180	103	66
25	36	25	22	25	30	53	126	460	605	180	114	69
26	32	28	23	24	31	65	152	375	605	180	114	62
27	30	30	24	24	31	65	186	335	605	195	106	58
28	27	26	24	24	32	65	287	380	605	228	99	54
29	26	24	24	24	32	58	262	435	605	228	93	50
30	26	24	24	24	.....	50	210	495	550	260	93	50
31	26	.....	24	24	.....	69	.....	560	.....	315	90	.....

NOTE.—Discharge estimated Nov. 12 to Dec. 2, Feb. 19–25, Mar. 13–19, because of ice; also estimated from hydrographic comparisons for the following days on which gage was not read: Oct. 1, 3, 6–7, 10–11, 13, 15, 17–18, 25, 27, 31, Nov. 2–3, 6–7, Dec. 5–6, 8, 12, 15–16, 18–20, 22–23, 25–26, 28–29, 31, Jan. 1–3, 5, 7, 10–11, 13–16, 21–23, 25, 27–28, 30, Feb. 1, 3–4, 6, 8–9, 13, 16, 18, 20, 26–27, 29, Mar. 4–6, 9, 12, 22, 27, Apr. 2, 9, 14, 16, 19–20, 23–24, 30, May 2, 5, 14, 18, 21, 25, 28, June 2, 4–5, 11, 14, 18, 21–23, 30, July 3–4, 8–9, 12, 16–17, 20, 22, 26, 30, Aug. 3, 6–7, 13, 15, 20, 23, 27, 31, Sept. 3–4, 7, 9, 11, 14, 17, 21, 23–24, 30.

Monthly discharge of Fryingpan Creek at Norrie, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	55	26	38.0	2,340
November	32	17	24.5	1,460
December	28	22	25.0	1,540
January	26	22	23.6	1,450
February	32	24	27.0	1,550
March	139	32	56.7	3,490
April	287	37	95.0	5,650
May	628	103	363	22,300
June	1,040	550	693	41,200
July	650	180	327	20,100
August	298	90	166	10,200
September	126	50	74.7	4,440
The year	1,040	17	159	116,000

FRYINGPAN CREEK AT THOMASVILLE, COLO.

LOCATION.—In sec. 7, T. 8 S., R. 83 W., at private bridge 1,000 feet southwest of railroad station at Thomasville, in Pitkin County. Nearest tributary, Deadman Gulch, enters a quarter of a mile below.

DRAINAGE AREA.—175 miles (measured on Forest atlas and topographic maps).

RECORDS AVAILABLE.—February 26, 1915, to September 30, 1916. From January 2, 1911, to February 25, 1915, station was maintained 1 mile downstream where drainage area was 190 square miles.

GAGE.—Vertical staff on upstream side of right-bridge abutment; read by J. H. Swineford. Gage at original section was vertical staff attached to side of center bridge pier. No determined relation between two gages.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders; rough. Control not well defined; shifts between narrow limits. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.9 feet at 2.50 p. m. June 20 (discharge, 1,580 second-feet); minimum discharge, 33 second-feet December 29, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—No court decrees for diversion of water above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent; shifted between narrow limits at very low stages; affected by ice for occasional short periods. Rating curve well defined below 1,800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good, except those for spring months, which are only fair, owing to possible error in mean gage height due to diurnal fluctuation caused by alternate melting and freezing of snow.

Discharge measurements of Fryingpan Creek at Thomasville, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	1.31	48.1	Feb. 10	T. J. Watkins	1.22	47.5
Jan. 12	T. J. Watkins	*a* 1.45	42.8	June 11	W. R. King	4.75	1,490

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	72	46	46	40	40	81	130	285	675	575	480	87
2	76	43	43	39	41	85	120	320	625	575	355	87
3	76	44	50	40	42	85	102	480	675	550	355	87
4	72	44	46	38	43	94	106	575	675	550	395	94
5	69	44	43	40	44	90	102	575	725	525	355	102
6	68	41	44	38	45	102	116	625	775	525	320	87
7	70	44	42	37	46	90	116	575	775	525	320	87
8	84	46	44	38	47	102	111	525	940	525	338	90
9	75	48	44	38	48	102	102	435	1,100	525	320	221
10	69	57	43	37	49	102	116	480	1,100	525	302	221
11	87	56	45	38	48	102	111	480	1,160	502	285	221
12	86	55	40	36	48	111	141	480	1,160	502	302	215
13	72	51	41	37	48	106	135	480	1,160	480	302	206
14	68	46	42	40	48	106	135	435	1,220	435	302	192
15	64	46	40	38	48	120	153	435	1,280	395	320	165
16	66	45	40	42	49	116	192	502	1,280	355	320	130
17	75	42	38	40	51	120	165	525	1,400	338	252	124
18	70	46	39	37	54	124	160	550	1,460	320	221	120
19	66	46	38	38	56	130	178	550	1,400	320	192	116
20	69	49	37	40	58	153	178	550	1,520	320	187	111
21	70	49	39	39	60	192	170	502	1,460	320	165	111
22	68	45	40	39	62	170	187	525	1,400	320	170	111
23	64	46	39	42	64	153	192	525	1,100	285	170	102
24	57	56	38	42	66	160	206	575	995	320	165	99
25	56	46	37	44	68	178	178	600	940	302	170	87
26	51	52	36	44	71	141	187	600	885	285	160	85
27	51	55	35	43	73	137	187	600	725	285	120	85
28	49	46	34	44	75	124	221	600	625	320	106	81
29	49	46	33	42	77	124	187	575	675	320	124	85
30	49	46	35	41	.....	124	192	625	625	355	130	81
31	51	.....	37	40	.....	137	.....	625	.....	502	111	.....

NOTE.—Discharge, Nov. 29–30, Dec. 24–31, Jan. 30–31, Feb. 1–6 and 16–29 estimated because of ice. Shifting-control method used Feb. 7–8.

Monthly discharge of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	87	49	66.7	4,100
November	57	41	47.5	2,830
December	50	33	40.3	2,480
January	44	36	39.7	2,440
February	77	40	54.1	3,110
March	192	81	121	7,440
April	221	102	153	9,100
May	625	285	523	32,200
June	1,520	625	1,020	60,700
July	575	285	419	25,800
August	480	106	252	15,500
September	221	81	123	7,320
The year	1,520	33	238	173,000

NORTH FORK OF FRYINGPAN CREEK NEAR NORRIE, COLO.

LOCATION.—In sec. 21, T. 8 S., R. 83 W., at highway bridge about a mile from Norrie, Pitkin County, in the Sopris National Forest. No tributaries below station.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 18, 1911, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by employees of United States Forest Service.

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

CHANNEL AND CONTROL.—Bed composed of small boulders; rough. Control not well defined; shifts between narrow limits. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.45 feet June 14 (discharge, 418 second-feet); minimum discharge 6 second-feet during January and February when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation affected by ice; discharge determined from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve fairly well defined below 450 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying to rating table daily gage height, or, for days when gage was not read, by estimating from a hydrographic comparison with records of flow at other stations on Fryingpan Creek. Records only fair because of infrequent gage readings and probable error due to diurnal fluctuation.

Discharge measurements of North Fork of Fryingpan Creek near Norrie, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	0.32	14.5	Feb. 10	T. J. Watkins	.20	7.4
Jan. 12	T. J. Watkins	*a*.25	5.7	June 12	W. R. King	2.30	383

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	17	8	13	6	6	9	35	105	248	198	77	25
2	16	8	13	6	6	9	38	82	255	186	84	19
3	14	8	13	6	6	9	41	58	262	174	84	18
4	13	8	12	6	6	9	36	110	262	162	84	16
5	13	8	12	6	6	8	32	120	262	152	74	16
6	12	8	12	6	7	8	32	152	262	141	52	16
7	10	9	12	6	7	8	28	222	222	141	52	16
8	10	9	11	6	7	8	25	235	263	141	52	16
9	10	10	10	6	7	8	29	319	304	141	52	16
10	10	10	10	6	7	9	33	304	366	141	42	34
11	10	10	10	6	7	10	56	262	383	152	32	52
12	10	9	11	6	7	11	58	255	400	114	42	41
13	11	9	11	6	7	12	60	248	383	101	42	41
14	12	9	12	6	7	14	58	200	400	92	120	41
15	12	8	11	6	7	15	58	152	366	92	120	33
16	12	8	11	6	7	16	58	141	319	92	46	25
17	11	8	10	6	8	18	58	130	334	92	44	25
18	10	10	10	7	8	24	77	120	350	92	41	25
19	14	12	10	7	8	31	64	110	350	92	38	23
20	12	14	10	7	8	36	52	110	366	64	36	22
21	12	14	10	7	8	101	58	110	335	64	34	19
22	12	14	9	7	8	58	64	115	304	64	32	18
23	11	14	9	7	8	41	82	120	283	62	28	18
24	11	14	9	7	8	58	101	152	262	60	25	18
25	11	14	8	7	8	31	106	163	242	58	26	19
26	10	14	8	7	9	41	110	174	222	55	26	19
27	10	14	8	6	9	41	100	152	216	52	28	18
28	9	14	7	6	9	36	152	169	210	64	22	16
29	9	13	7	6	9	36	174	186	216	64	22	16
30	8	13	7	6	.....	32	130	204	222	82	22	16
31	8	.....	7	6	.....	32	.....	222	.....	101	24	.....

NOTE.—Discharge Nov. 13-17, and Dec. 23 to Feb. 7 estimated because of ice; also estimated Oct. 3, 10, 17, 24, 29-31, Nov. 2-3, 5, 8-9, 11-12, 18-19, 21-22, 24, 26, 28-29, Dec. 2, 5, 8, 10, 12-13, 15-16, 18-20, 22, Feb. 8, 12-13, 15, 18, 20, 24, 26-27, 29, Mar. 1, 4-6, 8-9, 12, 15-16, 18, Apr. 1-2, 9, 12, 15-16, 19, 23, 25, 27-28, May 2, 12, 14, 18, 20, 22, 25, 28, 30, June 2, 4-5, 8, 17-18, 21, 23, 25, 27, 29, July 2-4, 7, 9, 15-16, 21, 23-24, 26, 30, Aug. 3, 7-8, 10, 12-13, 15, 17, 19-21, 23, 29, 31, Sept. 3, 5-6, 8, 10, 15, 17, 23-25, 29-30. Shifting-control method used Nov. 20 to Dec. 21.

Monthly discharge of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	17	8	11.3	695
November	14	8	10.7	637
December	13	7	10.1	621
January	7	6	6.29	387
February	9	6	7.41	426
March	101	8	25.1	1,540
April	174	25	67.8	4,030
May	319	58	168	10,300
June	400	210	296	17,600
July	198	52	106	6,520
August	120	22	48.5	2,980
September	52	16	23.2	1,380
The year	400	6	64.9	47,100

CRYSTAL RIVER AT MARBLE, COLO.

LOCATION.—In sec. 26, T. 11 S., R. 88 W., at electric railway bridge of Colorado-Yule Marble Co. at Marble, in Gunnison County. Nearest tributary, Carbonate Creek, enters at Marble.

DRAINAGE AREA.—77 square miles (measured on map in Forest Atlas).

RECORDS AVAILABLE.—November 1, 1910, to September 30, 1916.

GAGE.—Vertical hook gage on downstream side of left abutment; read by F.V. Mueller.

DISCHARGE MEASUREMENTS.—Made by wading or from cable a short distance below bridge.

CHANNEL AND CONTROL.—Bed slightly rocky but has been cleared and is smooth at measuring section; shifts between narrow limits. Banks subject to slight overflow but all water passes under cable and bridge.

EXTREMES OF STAGE.—Maximum stage recorded during year, 7.34 feet at 10 p. m. June 29; minimum stage recorded, 1.24 feet at 5 p. m. January 25 (caused by snowslide).

ICE.—Stage-discharge relation little if at all affected by ice but occasionally affected by snowslides.

DIVERSIONS.—Court decrees for diversion of 114 second-feet below station; none for diversions above.

REGULATION.—None.

No discharge measurements were made at this station during the year. Data inadequate for determination of flow.

Daily gage-heights, in feet, of Crystal River at Marble, Colo., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.88	1.81	1.88	2.10	2.24	4.08	6.36	4.06	2.70
2	.....	1.64	1.72	1.83	2.06	2.28	4.14	.....	3.97	2.67
3	.....	1.70	1.85	1.82	2.09	2.28	4.28	.....	4.00	2.70
4	.....	1.90	.....	1.80	2.16	2.34	4.24	.....	3.96	2.60
5	.....	1.92	.....	1.80	2.10	2.38	4.51	.....	3.91	2.58
6	.....	1.87	.....	1.86	2.11	2.36	4.56	.....	3.87	2.58
7	.....	1.84	.....	1.85	2.19	2.46	4.56	.....	3.88	2.44
8	.....	1.90	1.68	1.73	2.10	2.42	4.64	.....	3.84	2.48
9	.....	1.79	1.71	1.82	2.14	2.52	4.60	.....	3.49	2.46
10	.....	1.80	1.82	1.85	2.15	2.60	4.76	.....	3.54	2.42
11	.....	1.84	1.81	1.84	2.14	2.56	4.82	.....	3.42	2.46
12	.....	1.84	.....	1.76	2.12	2.49	5.02	.....	3.42	2.74
13	.....	1.76	.....	1.74	2.10	2.55	4.80	.....	3.35	2.95
14	.....	1.92	.....	1.70	2.12	2.54	4.84	.....	3.22	3.10
15	1.92	1.87	.....	1.72	2.08	2.56	4.90	.....	3.18	2.90
16	1.93	1.86	.....	1.82	2.06	2.48	4.83	4.84	3.18	2.76
17	1.89	1.78	.....	1.86	2.21	2.61	4.90	4.70	3.12	.....
18	1.89	1.91	.....	1.82	.....	2.56	5.18	4.78	3.13	.....
19	1.92	1.88	.....	1.85	2.18	2.70	5.40	4.72	3.08	.....
20	1.91	1.85	.....	[a]1.58	2.16	2.72	5.40	4.60	3.03	2.54
21	1.90	1.84	.....	1.78	2.12	2.84	5.38	4.55	2.97	2.54
22	1.83	1.74	.....	1.80	2.15	3.06	5.44	4.63	2.98	2.53
23	1.76	1.85	.....	1.88	2.25	2.98	5.56	4.54	2.92	2.57
24	.....	1.88	.....	1.83	2.21	3.16	5.64	4.40	2.91	2.55
25	.....	[a]1.30	.....	1.86	2.20	3.25	5.71	4.28	2.76	2.60
26	1.85	1.90	.....	1.86	2.20	3.22	5.83	4.12	2.84	2.50
27	.....	1.86	.....	1.85	2.23	3.38	5.32	4.22	2.73	2.48
28	1.80	1.80	.....	1.90	2.23	3.59	6.66	4.20	2.84	2.46
29	1.89	1.78	.....	1.92	2.12	3.89	6.90	4.08	2.78	2.45
30	1.94	1.82	.....	1.94	2.16	4.10	6.57	4.14	2.84	2.50
31	1.98	1.76	.....	2.01	.....	4.24	.....	4.10	2.72	.....

[a] Affected by snowslide above gage.

TAYLOR RIVER AT ALMONT, COLO.

LOCATION.—In sec. 22, T. 51 N., R. 1 E., at highway bridge at Almont, in Gunnison County, 300 feet above junction of Taylor and East rivers.

DRAINAGE AREA. 413 square miles (measured on map in Forest Atlas).

RECORDS AVAILABLE. July 27, 1910, to September 30, 1916.

GAGE.—Vertical staff on downstream side of center pier; read by Sam Ogden.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of small boulders and coarse gravel; banks not subject to overflow. Control practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.20 feet at 6.05 a. m. June 17 (discharge, 2,980 second-feet); minimum discharge occurred during winter, when record was discontinued.

ICE.—Stage-discharge relation affected by ice during winter months. Data insufficient to determine winter flow.

DIVERSIONS.—No court decrees for diversions from Taylor River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifted between narrow limits; affected by ice December 1 to March 6. Rating curves fairly well defined below 2,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of Taylor River at Almont, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Fttt.*	*Sec.-ft.*
Apr. 28	W. R. King	2.71	565	July 10	Robert Follansbee	3.15	1,030
June 20	do	3.70	1,920	Sept. —	B. T. Chase	2.10	242

Daily discharge, in second-feet, of Taylor River at Almont, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	258	178	.....	258	478	1,140	1,380	780	276
2	258	178	.....	258	415	1,340	1,310	690	276
3	235	178	.....	258	385	1,640	1,310	650	276
4	215	178	.....	258	478	1,640	1,180	650	276
5	215	178	.....	258	778	1,480	1,180	610	276
6	178	178	.....	258	968	1,340	1,050	500	276
7	178	178	305	258	1,200	1,340	935	500	276
8	178	178	258	258	1,410	1,480	935	500	276
9	178	178	258	258	1,640	1,710	990	500	276
10	178	178	280	258	1,780	1,940	1,050	500	405
11	178	178	280	258	1,640	2,240	1,050	378	455
12	178	178	258	280	1,340	2,240	1,050	435	378
13	178	178	258	280	1,080	2,240	990	500	325
14	178	178	258	280	1,080	2,380	935	435	325
15	195	178	235	280	1,080	2,380	830	535	325
16	195	178	215	305	968	2,380	830	572	325
17	178	178	215	305	968	2,740	735	500	325
18	178	178	215	305	868	2,510	735	435	325
19	178	178	258	305	868	2,280	650	405	325
20	178	178	258	330	778	1,880	650	378	325
21	178	178	258	415	778	1,980	572	378	325
22	178	178	258	415	778	1,700	572	378	300
23	178	178	280	415	778	1,380	500	325	276
24	178	178	305	415	778	1,240	500	325	276
25	178	178	305	510	778	1,380	500	325	276
26	178	178	305	545	778	1,380	435	300	276
27	178	178	305	580	778	1,380	435	276	276
28	178	195	258	655	778	1,380	535	276	276
29	178	178	258	695	868	1,380	610	276	232
30	178	178	258	618	968	1,380	735	276	232
31	178	.....	258	.....	1,140	.....	780	276	.....

NOTE.—Discharge Nov. 29–30 estimated because of ice. Gage read but data inadequate for determination of discharge Jan. 1 to Mar. 6.

Monthly discharge of Taylor River at Almont for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	258	178	188	11,600
November	195	178	179	10,700
March 7–31	305	215	264	13,100
April	695	258	359	21,400
May	1,780	385	948	58,300
June	2,740	1,140	1,760	105,000
July	1,380	435	837	51,500
August	780	276	447	27,500
September	405	232	301	17,900

GUNNISON RIVER NEAR GUNNISON, COLO.

LOCATION.—In sec. 3, T. 49 N., R. 1 W., at highway bridge 2 miles southwest of Gunnison, in Gunnison County. Nearest tributary, Tomichi Creek, enters 1 mile below.

DRAINAGE AREA.—1,010 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—November 27, 1910, to November 30, 1914; April 27 to September 30, 1916.

GAGE.—Bristol water-stage recorder on downstream side of right abutment used April 27 to September 30, 1916; datum 0.15 foot higher than that of chain gage on upstream side of bridge used prior to November 30, 1914. Observer, C. W. Chinery.

DISCHARGE MEASUREMENTS.—Made from single-span bridge, or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; will shift during high water. Control at well-defined rapids below bridge; will shift occasionally. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 3.35 feet at 2 p. m., June 14 (discharge, 4,890 second-feet); minimum discharge not known.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued.

DIVERSIONS.—There are court decrees for the diversion of 274 second-feet of water from Gunnison River between this station and the forks at Almont.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifted during year; affected by ice. Rating curve fairly well defined between 400 and 6,000 second-feet. Operation of water-stage recorder fairly satisfactory until August 15, when diaphragm bulb became full of silt. Daily discharge ascertained by applying to rating table daily gage height determined by inspecting gage-height graph; discharge after August 15 estimated as sum of discharge of East and Taylor rivers at Almont. Records good, except those for August and September, which are fair.

Discharge measurements of Gunnison River near Gunnison, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 28	1.98	2,300
June 20	3.20	4,610
July 20	1.15	1,400

Daily discharge, in second-feet, of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	.....	1,990	3,320	3,160	1,450	16	.....	2,520	4,530	1,850	.....
2	.....	1,990	3,320	3,000	1,580	17	.....	2,360	4,620	1,640	.....
3	.....	1,920	3,400	2,920	1,520	18	.....	2,130	4,530	1,580	.....
4	.....	2,130	3,560	2,680	1,450	19	.....	2,200	4,530	1,520	.....
5	.....	2,600	3,640	2,600	1,330	20	.....	2,280	4,530	1,450	.....
6	.....	2,680	3,560	2,600	1,330	21	.....	2,200	4,170	1,390	.....
7	.....	3,160	3,480	2,440	1,220	22	.....	2,200	3,900	1,330	.....
8	.....	3,400	3,400	2,440	1,220	23	.....	2,130	3,560	1,280	.....
9	.....	3,730	3,640	2,520	1,160	24	.....	1,990	3,400	1,250	.....
10	.....	3,990	4,080	2,600	1,220	25	.....	2,130	3,240	1,220	.....
11	.....	3,990	4,170	2,280	1,110	26	.....	2,200	3,160	1,280	.....
12	.....	3,820	4,260	2,060	950	27	1,810	2,200	3,160	1,220	.....
13	.....	3,730	4,530	2,060	1,060	28	2,240	2,280	3,240	1,390	.....
14	.....	3,240	4,620	1,990	1,220	29	2,550	2,440	3,240	1,390	.....
15	.....	2,760	4,530	1,850	.....	30	2,160	2,840	3,240	1,330	.....
						31	.....	3,080	.....	1,390	.....

NOTE.—Discharge estimated by hydrographic comparison with sum of records of flow of East and Taylor rivers as follows: Aug. 15–31, 730 second-feet; Sept. 1–30, 535 second-feet. Shifting-control method used Apr. 27 to June 9.

Monthly discharge of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 27-30	2,550	1,810	2,190	17,400
May	3,990	1,920	2,660	164,000
June	4,620	3,160	3,820	227,000
July	3,160	1,220	1,930	119,000
August	1,580	.....	a 975	60,000
September	.....	.....	a 535	31,800
The period	.....	.....	.....	619,000

a Estimated.

EAST RIVER AT ALMONT, COLO.

LOCATION.—In sec. 22, T. 51 N., R. 1 E., at highway bridge at Almont, in Gunnison County, 100 feet above junction of East and Taylor rivers.

DRAINAGE AREA.—295 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—July 27, 1910, to September 30, 1916. From April 15 to October 8, 1905, a station was maintained at this point, gage being referred to different datum.

GAGE.—Vertical staff on downstream side of right abutment; read by Sam Ogden.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Bed composed of small boulders and coarse gravel. Control shifts slightly at ordinary stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.80 feet at 6 a. m. June 17 (discharge, 3,220 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation affected by ice during winter; data insufficient to determine winter flow.

DIVERSIONS.—There are court decrees for diversion of 78 second-feet from East River.

REGULATION.—

ACCURACY.—Stage-discharge relation fairly permanent; seriously affected by ice. Rating curve well-defined between 150 and 2,800 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of East River at Almont, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 28	W. R. King	2.40	1,120	July 19	W. R. King	2.01	721
June 20	do	3.25	2,340	Sept. 3	B. T. Chase	1.30	215

Daily discharge, in second-feet, of East River at Almont, Colo., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	192	1,020	1,530	1,260	850	232
2	.....	192	905	1,820	1,200	745	232
3	.....	192	850	1,890	1,200	605	232
4	.....	192	962	1,890	1,080	650	232
5	.....	192	1,080	1,890	1,080	695	232
6	.....	192	1,260	1,740	1,080	745	232
7	75	192	1,600	1,740	962	745	232
8	80	192	1,740	1,600	962	650	232
9	100	192	1,960	1,670	1,200	650	232
10	92	200	2,110	2,260	1,200	565	380
11	92	285	1,890	2,420	1,080	565	348
12	92	285	1,820	2,420	1,080	488	315
13	92	285	1,740	2,580	962	565	285
14	92	285	1,600	2,900	962	605	255
15	100	315	1,600	2,980	850	695	232
16	110	348	1,460	2,980	850	650	232
17	110	348	1,330	3,060	850	565	232
18	110	348	1,330	2,820	745	488	232
19	110	348	1,260	2,740	745	415	232
20	110	348	1,140	2,340	695	348	232
21	120	380	1,080	2,420	650	348	232
22	132	450	1,080	2,110	650	348	232
23	132	605	1,080	1,890	565	348	232
24	132	650	1,080	1,670	565	348	232
25	132	695	1,080	1,670	565	285	210
26	132	795	1,080	1,670	565	285	192
27	132	962	1,080	1,670	525	285	192
28	132	1,080	1,200	1,670	605	255	192
29	132	1,200	1,260	1,530	695	232	192
30	132	1,080	1,400	1,400	1,020	232	192
31	132	.....	1,460	.....	962	232	.....

Monthly discharge of East River at Almont, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 7–31	132	75	112	5,550
April	1,200	192	434	25,800
May	2,110	850	1,340	82,400
June	3,060	1,400	2,100	125,000
July	1,260	525	884	54,400
August	850	232	499	30,700
September	380	192	239	14,200
The period	.....	.....	.....	338,000

UNCOMPAHGRE RIVER AT OURAY, COLO.

LOCATION.—In sec. 31, T. 44 N., R. 7 W., near highway bridge half a mile south of Ouray, in Ouray County. Nearest tributary, Canyon Creek, enters 150 feet below; nearest tributary above is Bear Creek.

DRAINAGE AREA.—44 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 25, 1911, to September 30, 1916. From January 7 to March 17, 1908, records were kept at dam of Ouray Electric Light & Power Co., 1 mile south of present station, and were furnished through courtesy of Wheeler & Whinnerah.

GAGE.—Vertical staff attached to rock cliff at left side of river 150 feet above mouth of Canyon Creek. In addition to river gage a vertical staff gage was installed February 25, 1916, near downstream end of covered wooden flume in tailrace just below power house of the Ouray Electric Light & Power Co. The river and flume gages are read at as nearly the same time as possible by T. J. Watkins.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage, or by wading. Measurements of diversion through power house are made from a footbridge across tailrace a short distance below flume.

CHANNEL AND CONTROL.—Bed composed of small boulders; rough and shifting. Control short distance downstream, will shift somewhat after high water. Station is in box canyon with high vertical walls.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.20 feet during nights of June 11 and 13 (discharge, 638 second-feet; no diversion through power plant); minimum stage estimated at 0.00 foot on January 31 and February 1 (discharge, 0.5 second-foot; diversion through power plant not included).

ICE.—Stage-discharge relation not affected by ice, as warm springs keep the stream open.

DIVERSIONS.—The Ouray Electric Light & Power Co. diverts approximately 16 second-feet of water 2 miles above station and returns it to the river a short distance below. No other diversions above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation for river gage not permanent; shifts occasionally. Rating curve fairly well defined below 700 second-feet Gage read to hundredths once daily. Discharge ascertained by applying gage height to rating table; indirect method for shifting control used April 28 to June 24 and September 27–30.

Stage-discharge relation for tailrace gage practically permanent. Rating curve well defined. Gage read to half-tenths once daily. Discharge ascertained by applying gage height to rating table.

Records prior to March 1, 1916, do not include diversion through power plant. Records beginning March 1 show total flow of river, the discharge through the power plant being added to that past the river gage.

Records good except those for spring months which are only fair owing to the possible error due to diurnal fluctuation caused by alternate melting and freezing.

Discharge measurements of Uncompahgre River at Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15	W. R. King	0.30	4.8	June 6	T. J. Watkins	2.15	325
Jan. 9	T. J. Watkins	.15	1.8	15	do	2.56	362
Feb. 25	do	.04	1.0	Aug. 4	do	1.62	107
Mar. 17	do	.99	42.3	24	do	1.26	65
May 19	do	1.60	131				

NOTE.—The above measurements do not include the diversion through the power house.

Discharge measurements of power-house flume at Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 25	T. J. Watkins	1.60	17.0	May 19	T. J. Watkins	1.55	15.5
Mar. 17	do	1.55	15.5	Sept. 19	Robert Follansbee	.20	*a* 3

a Estimated.

Daily discharge, in second-feet, of Uncompahgre River at Ouray, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	3.0	8.0	1.8	0.5	17.6	46	85	335	187	92	58
2	15	3.0	6.0	1.8	.7	17.8	48	74	346	160	99	58
3	14	3.0	6.0	2.1	.9	17.8	36	64	412	169	106	58
4	11	3.0	6.0	2.1	.9	17.8	36	88	345	169	106	58
5	8.0	3.0	7.0	1.3	1.3	17.8	43	119	345	169	106	58
6	8.0	3.0	8.0	.7	1.1	17.8	43	138	367	169	106	48
7	8.0	8.0	6.0	.7	.9	18.0	46	199	448	159	106	48
8	8.0	7.0	5.0	.9	2.4	19.7	48	201	422	159	106	48
9	8.0	5.0	4.2	.9	.9	22	48	268	451	150	106	48
10	8.0	4.6	4.2	1.1	.9	25	51	299	543	140	106	58
11	8.0	3.0	3.0	.9	.9	28	53	302	555	131	92	58
12	8.0	1.3	2.7	.7	.9	29	55	290	527	131	92	58
13	26	1.3	2.4	.7	.9	30	51	223	503	122	92	58
14	29	2.1	1.8	6.5	.9	30	51	199	440	122	92	58
15	30	5.0	1.5	3.8	.9	32	49	136	437	122	92	58
16	11	4.2	1.5	.9	.9	32	57	136	397	122	86	58
17	8.0	3.0	1.3	.9	1.1	31	61	119	393	114	86	58
18	7.0	4.6	1.3	.7	1.1	45	65	127	373	106	80	58
19	7.0	6.0	1.3	.7	1.1	45	69	145	370	92	80	64
20	6.0	8.0	1.3	.9	1.1	45	73	145	367	92	80	68
21	6.0	10	1.3	.9	1.5	54	77	145	363	92	75	68
22	6.0	9.0	1.3	.9	1.8	62	94	136	299	86	75	62
23	5.0	9.0	1.1	.9	26	46	84	178	241	86	64	58
24	5.0	8.0	1.1	.9	15	46	80	204	252	86	64	56
25	5.0	1.8	1.1	.9	.9	36	100	206	236	86	58	52
26	4.2	3.0	1.1	.7	.9	35	120	221	236	80	58	48
27	4.2	4.6	1.1	.7	.9	36	140	199	211	92	58	55
28	3.8	7.0	1.3	.7	.9	36	162	226	211	96	48	54
29	3.4	7.0	1.3	.7	.9	48	126	229	211	96	48	53
30	3.0	8.0	1.5	.7	.....	38	72	258	187	96	40	50
31	3.0	.....	1.5	.5	.....	36	.....	358	.....	106	48	.....

NOTE.—From Oct. 1 to Feb. 29, the record shows the flow past the river gage at the time when gage was read. From Mar. 1 to Sept. 30, the record shows the total flow of river, the discharge through power plant having been added to that past the river gage. See "Accuracy" in station description.

Monthly discharge of Uncompahgre River at Ouray, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	30	3.0	9.41	579
November	10	1.3	4.95	295
December	8.0	1.1	2.97	183
January	6.5	.5	1.25	76.9
February	26	.5	2.38	137
March	62	17.6	32.6	2,000
April	162	36	69.5	4,140
May	358	64	184	11,300
June	555	187	361	21,500
July	187	80	122	7,500
August	106	40	82.2	5,050
September	68	48	56.4	3,360

NOTE.—Diversion through power plant not included in above record from October to February. Diversion included from March to September. See "Accuracy" in station description.

UNCOMPAHGRE RIVER BELOW OURAY, COLO.

LOCATION.—In sec. 30, T. 44 N., R. 7 W. New Mexico principal meridian, near lowest bridge in Ouray, Ouray County, one-third mile below railroad station. Below all tributaries in Ouray.

DRAINAGE AREA.—76 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 12, 1913, to September 30, 1916.

GAGE.—Vertical staff attached to rock cliff 500 feet above bridge; used since March 22, 1916; read by T. J. Watkins. Original gage, a vertical staff attached to downstream side of right bridge abutment, was used prior to March 22, 1916.

DISCHARGE MEASUREMENTS.—Made from single span bridge, or by wading nearby.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; shifts during high water. Control not well defined. Banks not subject to overflow except at extreme high-water stage of 6.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.10 feet at 7.40 p. m. June 9 (discharge, 1,100 second-feet); minimum stage, 1.96 feet at 8.40 a. m. Jan. 28, caused by snow slides (discharge, 18 second-feet).

ICE.—Stage-discharge relation not affected by ice. Warm springs keep the river from freezing.

DIVERSIONS.—All diverted water returned to river above station except 5.2 second-feet from Oak Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts between narrow limits. Rating curve used prior to March 22 fairly well defined below 1,200 second-feet; curve used after March 22 well defined below 200 second-feet and fairly well defined between 200 and 1,200 second-feet. Gage read to hundredths once daily except for occasional short periods when it is read twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for spring months which are fair owing to possible error due to diurnal fluctuation from alternate melting and freezing.

Discharge measurements of Uncompahgre River below Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height in feet.		Discharge.	Date.	Made by—	Gage height in feet.		Discharge.
		Original gage.	Gage installed Mar. 22, 1916.				Original gage.	Gage installed Mar. 22, 1916.	
				Sec.-ft.					*Sec.-ft.*
Nov. 15	W. R. King.....	2.11	.....	27.2	June 6	T. J. Watkins....	3.58	3.48	515
Jan. 4	T. J. Watkins....	2.15	.....	29.6	15	.....do.....	.....	3.60	695
Feb. 25	.....do.....	2.12	.....	30.7	July 26	E. H. Swett.....	3.00	2.60	192
Mar. 17	.....do.....	2.47	.....	74	Aug. 4	T. J. Watkins...	3.10	2.80	298
May 19	.....do.....	2.90	2.54	194	23	.....do.....	2.70	2.10	105

Daily discharge, in second-feet, of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	51	31	32	28	28	32	56	142	658	402	258	91
2	51	31	29	28	28	33	58	155	650	402	264	91
3	49	31	29	29	29	33	45	122	690	402	290	91
4	44	31	29	29	29	33	45	107	860	402	296	91
5	42	31	29	29	31	35	56	125	533	402	293	91
6	41	30	31	30	21	35	54	207	592	397	290	75
7	41	35	29	26	29	35	45	406	592	397	286	75
8	41	33	28	29	32	38	39	397	910	379	283	75
9	39	32	26	28	28	42	54	384	931	388	280	75
10	39	32	26	31	28	47	58	520	1,010	388	220	96
11	38	28	25	29	30	53	80	514	820	384	217	91
12	38	21	25	26	30	53	80	402	1,050	374	214	71
13	38	22	26	29	27	58	61	249	1,070	374	212	71
14	38	26	28	31	30	63	58	249	1,040	374	210	71
15	38	26	28	31	27	66	61	249	784	384	207	71
16	37	26	28	28	30	71	80	189	1,040	379	204	71
17	35	29	28	28	30	69	80	142	920	379	160	71
18	33	29	28	28	33	69	95	155	766	370	160	71
19	33	34	28	19	35	69	110	217	757	304	160	71
20	33	34	28	28	32	72	125	198	706	237	160	69
21	35	36	28	28	34	75	140	198	698	170	160	69
22	35	34	28	28	36	77	156	198	457	191	160	71
23	35	34	26	28	34	65	155	217	457	170	110	71
24	35	34	26	27	32	65	156	222	457	170	110	65
25	35	28	26	27	31	46	197	252	457	191	110	59
26	32	29	26	27	31	46	238	283	457	191	96	54
27	32	32	26	28	31	43	279	290	457	195	96	56
28	32	34	26	18	31	46	321	290	457	200	96	56
29	32	34	28	23	31	58	238	397	402	204	91	54
30	32	34	28	27	.....	43	155	552	402	210	82	54
31	31	.....	28	27	.....	46	.....	546	.....	252	91	.....

NOTE.—Shifting-control method used to determine discharge Oct. 1 to Nov. 10, Jan. 21 to Mar. 21, and May 30 to Aug. 16. Discharge July 19–20 estimated, as gage heights were in error.

Monthly discharge of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	51	31	37.6	2,310
November	36	21	30.7	1,830
December	32	25	27.6	1,700
January	31	18	27.5	1,690
February	36	21	30.3	1,740
March	77	32	52.1	3,200
April	321	39	112	6,660
May	552	107	277	17,000
June	1,070	402	703	41,800
July	402	170	312	19,200
August	296	82	189	11,600
September	96	54	72.9	4,340
The year	1,070	18	156	113,000

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

LOCATION.—In sec. 31, T. 49 N., R. 9 W., at highway bridge one-fourth mile west of Montrose, in Montrose County. Nearest large tributary, Happy Canyon Creek, enters about 2 miles below.

DRAINAGE AREA.—565 square miles.

RECORDS AVAILABLE.—April 22, 1903, to September 30, 1916.

GAGE.—Vertical staff attached to bridge; read by L. R. Allen.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifts occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.42 feet on August 14 (discharge, 1,200 second-feet); minimum discharge probably occurred during the winter.

ICE.—Ice forms along the banks during winter, but river is not frozen over. Observations discontinued during winter.

DIVERSIONS.—The water of Uncompahgre River is so overappropriated that the United States Reclamation Service has constructed a tunnel and canal to divert 1,300 second-feet from Gunnison River into the Uncompahgre above Uncompahgre.

ACCURACY.—Stage-discharge relation not permanent; shifts occasionally; somewhat affected by ice which forms along banks. Rating curve fairly well defined below 1,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for June and July, which are only fair owing to shifting of control.

COOPERATION.—Field data furnished by the United States Reclamation Service.

Discharge measurements of Uncompahgre River at Montrose, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	W. T. Ferguson	2.40	36.9	July 13	E. H. Swett	4.08	403
Apr. 5	E. H. Swett	2.60	54	Aug. 4	Swett and Chase	4.85	881
21	do	3.33	200	Sept. 5	B. T. Chase	3.35	215
June 12	do	4.28	512	19	do	3.05	143
13	do	5.05	820				

Daily discharge, in second-feet, of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	8	70	.....	188	264	320	196	232
2	124	8	78	.....	136	355	351	481	202
3	367	9	78	.....	114	463	328	375	248
4	232	13	85	.....	114	392	355	703	217
5	208	13	114	54	202	405	324	500	238
6	169	13	85	.....	271	486	254	703	153
7	94	13	85	.....	316	477	523	832	124
8	73	13	82	.....	264	547	328	532	124
9	74	13	78	.....	367	575	211	454	180
10	78	13	85	.....	396	518	673	396	343
11	64	13	78	.....	335	248	458	248	107
12	52	13	70	.....	258	388	504	281	202
13	46	12	70	.....	238	728	295	316	174
14	29	13	57	.....	238	594	264	1,200	180
15	78	13	57	.....	238	384	267	463	148
16	50	42	.....	136	281	401	405	509	136
17	46	42	.....	148	298	379	347	509	114
18	40	46	.....	136	298	422	331	355	114
19	188	52	.....	94	375	427	281	281	114
20	33	49	.....	52	396	427	284	217	107
21	32	57	.....	217	375	384	254	174	124
22	22	57	.....	226	418	316	258	136	114
23	29	57	.....	238	335	339	261	217	114
24	29	57	.....	305	264	409	375	202	114
25	29	57	.....	248	328	371	359	238	99
26	20	37	.....	238	298	401	542	217	94
27	12	57	.....	169	298	445	547	161	114
28	42	57	.....	217	343	396	392	169	94
29	13	46	.....	375	335	703	316	217	70
30	8	57	.....	202	375	355	585	248	57
31	8	.....	.....	.....	440	.....	405	217	.....

NOTE.—Discharge, June 4 to Aug. 2, determined by shifting-control method.

Monthly discharge of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	367	8	77.8	4,780
November	57	8	31.7	1,890
December 1–15	114	57	78.1	2,320
April 16–30	375	52	200	5,950
May	440	114	295	18,100
June	728	248	433	25,800
July	673	211	368	22,600
August	1,200	136	379	23,300
September	343	57	148	8,810

UNCOMPAHGRE RIVER NEAR DELTA, COLO.

LOCATION.—In T. 15 S., on line between Rs. 95 and 96 W., at highway bridge 2 miles south of Delta, in Delta County. No tributaries below station and none for several miles above.

DRAINAGE AREA.—1,130 square miles.

RECORDS AVAILABLE.—April 29, 1903, to September 30, 1916.

GAGE.—Vertical staff read by Mrs. W. J. Lance. Original gage was at a highway bridge one-fourth mile above Denver & Rio Grande Railroad bridge; moved to latter bridge November 17, 1903; replaced by an inclined gage installed near bridge April 21, 1904, which was used until November, 1906, when a staff gage was placed at present site. April 16, 1910, a new gage was installed at slightly different datum. No determined relation between gages at the various sites.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of silt and gravel. Banks not subject to overflow. Control shifts at intervals.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.8 feet at 5.30 p. m. August 14 (discharge, 1,310 second-feet); minimum discharge occurred during winter.

ICE.—Ice forms along banks and slush ice frequently occurs, but the stage-discharge relation is probably not materially affected thereby. Observations discontinued during winter.

DIVERSIONS.—Ditches above station divert the normal flow during irrigation season; records represent largely return seepage water.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts considerably; affected somewhat by ice which forms along banks. Rating curves not well-defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

COOPERATION.—Field data furnished by United States Reclamation Service, which maintains the station.

Discharge measurements of Uncompahgre River near Delta, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	W. T. Ferguson	1.40	169	June 22	E. H. Swett	1.90	232
Apr. 25	E. H. Swett	1.94	282	July 31	do	2.58	477
May 4	do	1.21	83	Sept. 12	B. T. Chase	1.55	149
19	do	1.55	179				

Daily discharge, in second-feet, of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	191	98	206	.....	338	73	92	227	148
2	220	152	206	.....	124	136	64	457	136
3	345	140	206	.....	92	124	69	367	148
4	365	129	206	.....	82	188	56	457	148
5	285	140	206	.....	82	161	82	506	136
6	268	140	206	.....	202	182	40	642	161
7	220	152	206	.....	330	224	40	730	113
8	220	178	191	.....	397	188	82	506	113
9	285	164	178	.....	424	117	88	506	136
10	164	191	152	.....	452	233	326	354	402
11	164	191	191	.....	420	161	218	227	346
12	191	152	191	.....	310	141	88	202	141
13	206	164	191	.....	302	166	213	202	218
14	206	164	191	.....	250	410	77	1,210	202
15	152	191	191	.....	180	166	82	410	188
16	250	191	.....	48	146	211	113	559	161
17	220	220	.....	82	141	96	124	481	136
18	191	220	.....	161	146	102	82	402	124
19	164	220	.....	124	153	174	82	326	136
20	140	220	.....	64	188	224	77	244	136
21	129	220	.....	73	338	166	64	161	131
22	140	220	.....	113	334	166	64	131	136
23	140	191	.....	188	268	102	73	136	136
24	140	164	.....	306	244	174	73	148	174
25	118	178	.....	287	371	161	73	136	136
26	98	191	.....	306	233	174	367	113	156
27	108	191	.....	196	161	174	306	102	141
28	118	191	.....	218	188	148	306	92	156
29	118	164	.....	148	188	136	218	109	136
30	118	178	.....	367	188	148	346	174	92
31	118	.....	.....	.....	148	.....	410	218	.....

NOTE.—Discharge, May 7 to Sept. 30, determined by shifting-control method.

Monthly discharge of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	365	98	187	11,500
November	220	98	177	10,500
December 1–15	206	152	195	5,800
April 16–30	367	48	179	5,330
May	452	82	239	14,700
June	410	73	168	10,000
July	410	40	142	8,730
August	1,210	92	340	20,900
September	402	92	161	9,580

MILL CREEK NEAR MOAB, UTAH.

LOCATION.—In sec. 8, T. 26 S., R. 22 E., about a quarter of a mile above the dam, about half a mile below mouth of Dry Fork, and about three-quarters of a mile above power plant of Moab Light & Power Co.; 1½ miles above confluence with Pack (Deep) Creek, and 2 miles southeast of Moab, Grand County.

DRAINAGE AREA.—76 square miles.

RECORDS AVAILABLE.—October 24, 1914, to September 30, 1916.

GAGE.—Vertical staff on left bank; read by Bruce Cox and Peter Shumway, operators at the plant.

DISCHARGE MEASUREMENTS.—Made by wading in the vicinity of the gage.

CHANNEL AND CONTROL.—Stream bed rocky and banks high. Control is a rock ledge a few feet below the gage and probably is fairly permanent. Stage of zero flow about —0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.3 feet at 6.30 p. m. August 12 (discharge estimated by prolonging rating curve, 235 second-feet); minimum stage recorded, 0.56 foot in September (discharge 8.8 second-feet).

1915–1916: Maximum stage recorded, that of this year; minimum stage recorded, 0.52 foot September 11–23, 1915 (discharge 7.4 second-feet).

ICE.—Stage-discharge relation affected at times by ice. No records of stage were kept during December and January.

DIVERSIONS.—Above practically all diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 5 and 60 second-feet. Gage not read regularly. Gage readings on many days not a true index of flow because of extreme diurnal fluctuation. Monthly mean discharge not computed.

Discharge measurements of Mill Creek near Moab, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 19	L. W. Jordan	0.55	8.1
Feb. 28	A. B. Purton	.60	10.6
June 14	W. E. Dickinson	.98	38.6

Daily discharge, in second-feet, of Mill Creek near Moab, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	June.	July.	Aug.	Sept.
1		9				24	30	10
2	8					27		
3						22	22	10
4		9				24		10
5		9					42	
6		50		11		22		11
7		50				22	30	
8	8	12				24		9
9	8	9				25	24	
10						54		13
11	8					25	18	
12							100	12
13		7		13		19	44	11
14	8				40	20		
15						24		9
16	8	14				60	24	
17						25		9
18								
19						16	16	11
20	9			15				
21	9	11				16	15	
22		11				15		9
23					32		13	
24		9			32	14		11
25					30		13	
26					30		13	11
27	9			15	30	40		
28			11		30	60	11	11
29					30	32		11
30					30	28	14	
31						50		

NOTE.—Discharge estimated from observer's notes because of daily fluctuation, Nov. 6, 7, July 16, 28, 31, and Aug. 12.

SAN JUAN RIVER BASIN.

SAN JUAN RIVER NEAR BLUFF, UTAH.

LOCATION.—In sec. 7, T. 42 S., R. 19 E., at the suspension bridge about a quarter of a mile from Spencer's trading post at Goodridge, a quarter of a mile below Gypsum Creek, 6 miles below Lime Creek, and 25 miles southwest of Bluff, San Juan County.

DRAINAGE AREA.—24,000 square miles.

RECORDS AVAILABLE.—October 30, 1914, to September 30, 1916.

GAGE.—Chain gage on right bank about 150 feet above the suspension bridge read by A. H. Spencer. Gage was moved upstream about 50 feet and datum changed March 4, 1916.

DISCHARGE MEASUREMENTS.—Made from a cable 200 feet below the bridge.

CHANNEL AND CONTROL.—Bed composed of shifting sand. Stream confined between rock walls; one channel only. Stage of zero flow is about −2 feet. Control probably a rock ledge three-eighths mile below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 12.8 feet at noon March 24 (discharge 16,200 second-feet); minimum stage 0.05 foot at 9 a. m. December 28 (discharge 388 second-feet).

1915–1916: Maximum stage recorded, 15.06 feet at 7 p. m. July 28, 1915 (discharge 26,400 second-feet); minimum stage, 0.05 foot at 10 a. m. September 24, 1915 (discharge 380 second-feet).

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

DIVERSIONS.—No diversions between Bluff and the gaging station. Considerable water is diverted farther up the stream.

REGULATION.—Regulation of the stream probably does not affect the diurnal flow at the gage.

ACCURACY.—Stage-discharge relation permanent; not seriously affected by ice. Rating curve well defined for range in gage heights. Gage read to half tenths once daily, except during November, December, and January, when it was read at least every alternate day. Daily discharge determined by applying daily gage height to rating table except for days when gage was not read and when stage-discharge relation was affected by ice for which it was interpolated. Records good.

Discharge measurements of San Juan River near Bluff, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	L. W. Jordan	0.79	723	Mar. 4	A. B. Purton	[a] 4.15	1,490
24	do	.74	716	June 19	W. E. Dickinson	[a] 10.46	11,100

[a] Gage height read on new gage established Mar. 4, 1916.

Daily discharge, in second-feet, of San Juan River, near Bluff, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,960	576	601	550	1,060	1,830	7,130	12,000	10,200	6,450	8,030	2,490
2	1,540	564	601	600	1,310	2,190	6,860	12,000	9,750	6,280	9,550	2,290
3	1,540	552	654	585	1,570	1,380	6,110	8,780	8,970	6,110	14,500	2,100
4	1,380	589	707	575	1,830	1,500	6,280	7,920	9,750	6,110	13,300	1,970
5	1,310	626	780	530	1,830	1,340	6,790	6,960	9,950	5,630	10,400	1,880
6	1,380	552	854	760	1,340	1,580	9,750	7,310	10,200	5,470	8,300	1,880
7	1,190	552	809	840	2,390	3,020	7,490	9,950	11,500	4,700	11,400	1,830
8	1,620	707	764	920	854	2,800	5,890	10,800	10,200	4,780	11,200	1,740
9	1,020	666	707	850	1,190	1,830	5,470	12,800	11,400	4,410	8,400	2,060
10	1,090	626	680	1,040	1,120	2,800	4,850	14,000	11,000	5,790	7,310	2,010
11	1,020	710	652	1,230	1,120	4,410	5,310	14,900	12,200	6,960	8,210	5,550
12	886	793	722	1,230	1,050	5,790	6,450	15,500	13,300	7,670	8,970	5,790
13	886	778	793	865	1,270	6,110	8,030	15,000	14,400	6,620	8,970	4,270
14	764	764	793	505	1,190	7,490	7,670	13,000	13,700	6,880	8,210	3,870
15	764	658	793	550	1,050	8,400	7,850	14,000	13,500	6,110	9,550	3,610
16	764	552	778	485	984	6,790	6,450	9,950	13,000	5,790	8,590	3,370
17	764	576	764	955	1,190	6,110	5,950	8,210	12,400	5,790	9,350	2,910
18	764	601	738	1,380	1,500	7,130	6,790	7,490	12,300	5,310	7,850	2,590
19	707	682	707	3,610	1,580	6,620	7,850	6,790	11,200	4,920	7,130	2,490
20	652	764	626	2,100	1,540	8,210	8,400	6,330	11,200	4,270	7,490	2,390
21	652	707	545	2,010	1,660	8,210	6,790	6,620	11,400	3,870	5,470	2,390
22	601	735	464	1,460	1,660	9,550	6,530	7,490	10,600	3,370	4,550	2,390
23	652	721	474	920	1,660	15,800	6,450	7,130	9,550	3,250	3,490	2,190
24	707	707	485	985	1,500	16,200	7,940	6,620	8,880	2,910	3,130	2,060
25	735	824	464	1,050	1,120	13,300	9,550	6,280	8,030	2,800	2,910	2,030
26	679	794	444	1,380	1,420	8,500	9,950	5,470	7,850	3,020	2,690	2,010
27	707	764	416	1,700	1,340	6,450	10,800	5,950	7,490	3,020	2,390	1,920
28	679	652	388	5,790	1,580	5,630	10,600	6,450	7,130	5,150	2,390	1,920
29	601	626	470	2,590	1,740	5,950	10,200	6,960	7,310	5,790	2,290	1,830
30	552	601	552	1,690	.....	6,960	11,000	8,030	7,130	4,480	2,490	1,830
31	601	.....	507	795	.....	8,590	.....	8,780	.....	6,280	2,390	.....

NOTE.—Discharge Feb. 1–3, interpolated because of ice; for Nov., Dec., and Jan., interpolated for days when gage was not read.

Monthly discharge of San Juan River, near Bluff, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,960	552	941	57,900
November	824	552	667	39,700
December	793	388	637	39,200
January	5,790	505	1,310	80,600
February	2,390	854	1,400	80,500
March	16,200	1,340	6,210	382,000
April	11,000	4,850	7,570	450,000
May	15,500	5,470	9,340	574,000
June	14,400	7,130	10,500	625,000
July	7,670	2,800	5,160	317,000
August	14,500	2,290	7,120	438,000
September	5,790	1,740	2,590	154,000
The year	16,200	388	4,460	3,240,000

NORTH FORK OF NORTH MONTEZUMA CREEK AT MONTICELLO, UTAH.

LOCATION.—In the NE. ¼ sec. 35, T. 33 S., R. 23 E., 200 yards below the heading of Middle canal, 300 yards below the ranger's cabin, three-quarters of a mile west of Monticello, San Juan County, and a mile east of the boundary of the La Sal National Forest.

DRAINAGE AREA.—About 10.5 square miles.

RECORDS AVAILABLE.—June 4, 1914, to September 30, 1916.

GAGE.—Vertical staff on right bank; read by J. W. Palmer, forest ranger. Datum raised 1.50 feet on July 22, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed of gravel and boulders. Right bank high; left bank fairly high but may be overflowed. Control consists of boulders set in a trench at the head of a riffle about 10 feet below the gage. Stage of zero flow about 0.3 foot on March 1, 1916.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.06 feet April 10 and 11 (discharge not determined); minimum stage 0.04 foot July 21 and 22 (discharge not determined).

1914–1916: Maximum stage recorded 1.70 feet at 9.30 a. m. May 18, 1915 (discharge 54 second-feet); minimum stage recorded, that of this year.

ICE.—There is heavy snowfall, but stage-discharge relation does not seem to be greatly affected by ice. Observations discontinued during winter.

DIVERSION.—Middle canal diverts about 200 yards above the gage. During the winter only a small quantity of water is carried in this ditch and the rest wastes into the creek above the gaging station. The Wood high line and North canals also take water by means of a common diversion about a mile upstream. Water from the South Fork of Montezuma Creek is carried by means of the South canal and turned into the North Fork just above the heading of the Middle canal.

REGULATION.—Flow affected by the diversions noted above.

Data inadequate for determination of discharge.

Discharge measurements of North Fork of North Montezuma Creek at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Foot.	*Sec.-ft.*
Mar. 1[a]	A. B. Purton	0.58	0.4
June 16	W. E. Dickinson	.11	.2

Daily gage height, in feet, of North Fork of North Montezuma Creek at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.58	0.90	0.30	0.14	0.12	0.42	0.20
2	.58	.92	.40	.16	.14	.44	.22
3	.58	.92	.20	.18	.12	.42	.18
4	.58	.92	.30	.18	.12	.40	.18
5	.58	.94	.40	.16	.14	.36	.20
6	.59	.94	.30	.16	.16	.40	.18
7	.59	.96	.20	.14	.18	.36	.20
8	.59	.98	.18	.12	.16	.32	.20
9	.60	1.04	.20	.12	.14	.32	.24
10	.60	1.06	.20	.14	.12	.30	.18
11	.60	1.06	.30	.14	.12	.30	.20
12	.62	1.00	.20	.14	.10	.30	.22
13	.62	.80	.28	.18	.10	.50	.22
14	.63	.78	.20	.16	.09	.50	.16
15	.63	.74	.30	.16	.09	.48	.22
16	.64	.72	.20	.18	.08	.44	.20
17	.63	.70	.22	.16	.07	.44	.16
18	.63	.70	.20	.14	.06	.42	.14
19	.64	.69	.14	.14	.05	.42	.12
20	.65	.69	.16	.16	.05	.24	.14
21	.65	.60	.16	.14	.04	.22	.16
22	.65	.58	.14	.14	.04	.20	.20
23	.65	.40	.12	.12	.10	.20	.22
24	.67	.30	.14	.10	.12	.19	.16
25	.68	.20	.16	.10	.16	.20	.12
26	.68	.20	.14	.10	.18	.20	.16
27	.68	.10	.16	.12	.18	.20	.12
28	.70	.20	.14	.12	.20	.22	.16
29	.74	.30	.16	.10	.30	.20	.14
30	.76	.30	.14	.12	.48	.22	.12
31	.80	.....	.12	.....	.45	.19	.....

MIDDLE CANAL AT MONTICELLO, UTAH.

LOCATION.—In the NE. ¼ sec. 35, T. 33 S., R. 23 E., 100 feet below the head of the canal, at the ranger station about three-quarters of a mile west of Monticello, San Juan County, and a mile east of the Forest boundary.

RECORDS AVAILABLE.—May 24 to July 31, 1914; May 26 to August 31, 1915; April 1 to September 30, 1916.

GAGE.—Vertical staff. Datum lowered 1.0 foot, May 26, 1915.

DISCHARGE MEASUREMENTS.—Made from a footplank at the gage.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control formed by a 2-inch plank with a Cippoletti weir notch set in the ditch just below the gage. Point of zero flow about 2.1 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.92 feet June 2 and 4 (discharge 13 second-feet); minimum stage recorded April 2 and September 25 (discharge less than 0.1 second-foot).

1914–1916: Maximum stage recorded 2.2 feet (3.2 feet referred to present datum) July 11, 1914 (discharge 23.6 second-feet).

ICE.—No records during winter. A small flow is probably maintained to supply domestic needs practically all the year.

DIVERSIONS.—Above all diversions. There is a wasteway just below the heading.

REGULATION.—Flow regulated at waste gate.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve well defined between 0 and 14 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Middle canal diverts water from North Fork of North Montezuma Creek for irrigation and domestic use in and around Monticello. The water is not returned directly to the stream. Part of the water carried in the Middle canal is brought around from South Fork of North Montezuma Creek in South canal and emptied into North Fork just above the heading of Middle canal.

Discharge measurements of Middle canal at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21[a]	L. W. Jordan	2.22	0.6
Mar. 1[b]	A. B. Purton	2.20	.2
June 16	W. E. Dickinson	2.76	8.4

[a] No ice. Water apparently running freely under 2 feet of snow.
[b] Stage-discharge relation affected by snow in canal.

Daily discharge, in second-feet, of Middle canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.2	0.1	4.8	12	7.5	1.6	0.8
2	.....	.....	.1	4.8	13	7.0	1.7	.8
3	.....	.....	.2	5.2	12	6.6	1.6	.8
4	.....	.....	.2	5.7	13	6.1	1.1	.8
5	.....	.....	.4	6.1	12	5.7	.9	.8
6	.....	.....	.5	6.1	11	5.2	1.1	.9
7	.....	.....	.5	7.0	11	5.7	.9	1.0
8	.....	.....	.6	7.0	11	4.8	1.0	1.1
9	.....	.....	.7	8.0	10	4.8	1.0	1.7
10	.....	.....	1.1	9.4	9.9	4.5	.9	1.1
11	.....	.....	1.1	8.9	9.9	4.1	.9	1.1
12	.....	.....	1.4	6.1	9.4	3.8	.9	1.0
13	.....	.....	1.7	4.5	8.9	3.4	1.6	.9
14	.....	.....	2.6	6.1	8.9	3.4	1.6	.8
15	.....	.....	6.1	7.0	9.4	3.1	1.4	.7
16	.....	.....	9.4	8.4	9.9	3.8	1.1	.6
17	.....	.....	8.9	9.4	9.4	4.1	.9	.5
18	.....	.....	8.4	12	9.4	3.8	.7	.4
19	.....	.....	8.0	7.5	8.9	3.8	.6	.4
20	.....	.....	7.5	8.4	8.9	4.1	.6	.3
21	0.7	.....	7.0	8.9	8.4	4.5	.7	.2
22	.....	.....	6.6	8.9	8.0	1.9	.8	.2
23	.....	.....	6.1	9.4	7.5	1.9	.8	.1
24	.....	.....	5.7	10	7.0	1.9	.7	.1
25	.....	.....	5.2	11	7.0	1.7	.8	.1
26	.....	.....	4.8	11	7.0	1.7	.8	.1
27	.....	.....	5.7	12	7.0	1.9	.8	.2
28	.....	.....	5.2	11	6.6	2.1	.7	.2
29	.....	.....	4.8	11	7.0	4.8	.8	.6
30	.....	.....	4.5	12	7.5	2.6	.8	1.6
31	.....	.....	.....	11	.....	1.6	.8	.....

Monthly discharge of Middle canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	9.4	0.1	3.84	228
May	12	4.5	8.34	513
June	13	6.6	9.36	557
July	7.5	1.6	3.93	242
August	1.7	.6	.987	60.6
September	1.7	.1	.663	39.5
The period	.....	.....	.....	1,640

SOUTH CANAL AT MONTICELLO, UTAH.

LOCATION.—In sec. 35, T. 33 S., R. 23 E., about 200 yards above point where canal empties into North Fork of North Montezuma Creek, 300 yards south of ranger station, 1½ miles below the head of the canal, and about three-quarters of a mile west of Monticello, San Juan County.

RECORDS AVAILABLE.—May 24 to July 29, 1914; May 28 to August 31, 1915; May 12 to September 30, 1916.

GAGE.—Vertical staff on left bank.

CHANNEL AND CONTROL.—Bed consists of earth and gravel. Control is Cippoletti weir notch in plank set in bed of canal just below gage. Stage of zero flow 1.63 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.4 feet, June 3 (discharge 11 second-feet); minimum stage recorded, 1.70 feet, March 1 (flow estimated 0.15 second-foot).

1914–1916: Maximum stage recorded, 2.8 feet, July 10, 1914 (discharge 15.4 second-feet).

ICE.—The ditch freezes and fills with snow, but there is usually a small quantity of water running. Observations of stage discontinued during winter.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 0 and 14 second-feet. Gage read daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Record good.

South canal is a feeder for Middle canal. Water is diverted from South Fork of North Montezuma Creek near the center of sec. 2, T. 34 S. R. 23 E., and emptied into North Fork of Montezuma Creek just above the heading of Middle canal in the NW. ¼ sec. 35, T. 33 S., R. 23 E.

Discharge measurements of South canal at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 1[a]	A. B. Purton	1.70	0.15
June 16	W. E. Dickinson	2.16	4.2

[a] Discharge estimated; 2 feet of snow over 4-inch ice cover, but water was apparently flowing freely under ice.

Daily discharge, in second-feet, of South canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Mar.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	May.	June.	July.	Aug.	Sept.
1	0.1	.....	9.0	2.2	1.5	0.7	16	.....	3.3	3.3	2.7	1.9	5.4
2	.....	.....	10	2.5	1.7	.7	17	.....	5.4	3.0	2.9	1.7	5.0
3	.....	.....	11	2.7	1.5	1.9	18	.....	7.9	3.0	2.7	1.5	4.6
4	.....	.....	10	3.0	.7	5.4	19	.....	5.4	2.7	2.6	1.5	4.6
5	.....	.....	9.6	3.3	.5	6.4	20	.....	5.4	3.0	2.5	.8	3.7
6	.....	.....	9.0	3.7	.9	7.4	21	.....	5.4	2.7	2.5	.7	3.3
7	.....	.....	8.5	3.7	.6	7.9	22	.....	3.3	2.5	2.3	.6	3.0
8	.....	.....	7.9	1.9	.7	7.9	23	.....	3.7	2.5	1.0	.6	2.7
9	.....	.....	7.9	1.9	.7	10.	24	.....	4.1	2.2	1.2	.5	2.7
10	.....	.....	7.4	1.9	.6	7.9	25	.....	5.0	1.9	1.4	.6	2.5
11	.....	.....	6.9	3.3	.6	7.9	26	.....	4.6	1.9	1.5	.6	2.7
12	.....	0.3	5.9	3.2	.6	7.4	27	.....	5.4	2.2	1.7	.6	3.0
13	.....	.3	5.0	3.0	2.5	6.9	28	.....	5.9	2.2	5.4	.5	3.3
14	.....	.4	4.6	2.9	2.5	6.4	29	.....	6.4	1.9	5.4	.6	5.4
15	.....	.6	4.1	2.7	1.9	5.9	30	.....	7.4	2.2	1.9	.5	9.6
							31	.....	7.9	.....	1.5	.6	.....

Monthly discharge of South canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 12–31	7.9	0.3	4.40	175
June	11	1.9	5.13	305
July	5.4	1.0	2.62	161
August	2.5	.5	1.01	62.1
September	10	.7	5.07	302

SPRING (VAGA) CREEK NEAR MONTICELLO, UTAH.

LOCATION.—In the SE. ¼ sec. 7, T. 33 S., R. 23 E., at the Trujillo ranch, 40 feet below the head of Green canal and 8 miles northwest of Monticello, San Juan County.

DRAINAGE AREA.—8.5 square miles.

RECORDS AVAILABLE.—May 26 to August 25, 1914; April 6 to September 30, 1915; April 1 to August 31, 1916.

GAGE.—Vertical staff on the right bank. Datum lowered 0.70 foot May 27, 1915. Read by Gusman Trujillo.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed of gravel. Channel crooked and banks overgrown with grass and weeds. Control of rocks placed in a trench just below the gage. Stage of zero flow about 0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.50 feet at 4.30 p. m. July 22 and afternoons of July 31, August 1 and 2 (discharge 28 second-feet); minimum stage recorded, 0.15 foot, April 1 (no flow, water standing in pools).

1914–1916: Maximum discharge recorded, 33 second-feet, July 26, 1914.

ICE.—Ordinarily no flow during winter.

DIVERSIONS.—Above all diversions except Green canal and Davenport & Campbell canal.

REGULATION.—Affected by the operation of the two ditches.

ACCURACY—Stage-discharge relation probably permanent during year. Rating curve fairly well defined between 0 and 10 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Spring (Vaga) Creek near Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	L. W. Jordan	0.29	0.2
June 16	W. E. Dickinson	.91	9.1

Daily discharge, in second-feet, of Spring (Vaga) Creek near Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	0.0	6	18	3	17	16	0.2	12	10	3	9
2	.0	4	18	2	17	17	.6	9	14	2	9
3	.0	8	18	.9	10	18	.6	8	12	.9	7
4	.1	10	18	3	10	19	2	11	14	.9	7
5	.1	12	18	2	9	20	.1	8	12	.9	6
6	.0	14	18	2	10	21	.1	7	10	.9	5
7	.1	12	17	2	9	22	.0	10	7	10	5
8	.1	18	22	3	9	23	.6	10	7	4	5
9	.1	20	20	7	9	24	.6	8	6	.9	5
10	.1	12	18	3	9	25	2	12	6	9	4
11	.6	10	18	3	9	26	2	12	4	4	3
12	.2	11	18	3	10	27	2	12	3	9	3
13	.1	10	14	3	11	28	4	12	4	3	2
14	.6	8	14	3	10	29	4	15	2	3	6
15	.2	8	17	3	9	30	4	18	4	3	.2
						31	.....	18	.....	17	.2

Monthly discharge of Spring (Vaga) Creek near Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	4	0	0.837	49.8
May	18	4	11.1	682
June	22	2	12.7	756
July	17	.9	3.69	227
August	17	.2	7.56	465
The period				2,180

GREEN CANAL NEAR MONTICELLO, UTAH.

LOCATION.—In sec. 7, T. 33 S., R. 23 E., 50 feet below the head of the canal, near Trujillo ranch, and 8 miles northwest of Monticello, San Juan County.

RECORDS AVAILABLE.—May 26 to August 21, 1914; June 8 to August 16, 1915; April 1 to September 30, 1916.

GAGE.—Vertical staff set at new datum in 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Earth section. Stage of zero flow about 1.9 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.8 feet, May 20 and 31 (discharge 3.7 second-feet).

1914–1916: Maximum stage not recorded, as water was over gage on June 11, 1915; mean flow for the day estimated at 5 second-feet.

ICE.—No information.

DIVERSIONS.—Above all diversions.

REGULATION.—By head gate at point of diversion.

ACCURACY.—Stage-discharge relation probably permanent. Rating curve well defined for range in stage during period. Gage read to half tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Green canal diverts water from Spring Creek in the SW. ¼ sec. 7, T. 33 S., R. 23 E., for irrigation use on Green ranch. The water is not returned directly to the creek.

The following discharge measurement was made by W. E. Dickinson:

June 16, 1916: Gage height, 2.60 feet; discharge, 2.2 second-feet.

Daily discharge, in second-feet, of Green canal near Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		0.0	1.9	0.5	0.9	16		0.3	2.5	1.1	
2		.0	1.9	.5	.5	17		.4	2.2	.7	
3		.5	1.4	.4	.5	18		.7	1.4	.0	
4		.7	.9	.4	.4	19		.9	.5	.0	
5		.3	.5	.5	.4	20		3.3	.5	.0	
6		.3	1.4	.1	.5	21		1.9	.2	.0	
7		.3	.9	.2	.4	22	0.9	2.5	.1	.0	
8		.3	.9	.1	.4	23	1.2	1.9	.0	.0	
9		.9	.7	1.4	.4	24	.9	2.5	.0	.9	
10		.9	.7	1.1	.5	25	.9	2.5	.0	.9	
11		.3	.5	.9	.4	26	1.1	2.5	.7	1.1	
12		.5	.5	1.1	.4	27	1.6	2.5	.4	2.2	
13		.3	.5	1.1		28	1.9	2.5	.3	.9	
14		.5	.5	.7		29	1.9	1.9	.4	.5	
15		.3	.7	.4		30	.0	2.2	.7	.5	
						31		3.3		.7	

NOTE.—No record Oct. 1 to Mar. 31; ditch probably dry. Ditch dry Apr. 1–21 and Aug. 13 to Sept. 30.

Monthly discharge of Green canal near Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 26–30	1.9	0	1.16	20.7
May	3.3	0	1.22	75.0
June	2.5	0	.793	47.2
July	2.2	0	.610	37.5
August 1–12	.9	0	.475	11.3
The period				192

NOTE.—See footnote to table of daily discharge.

LITTLE COLORADO RIVER BASIN.

LITTLE COLORADO RIVER NEAR WOODRUFF, ARIZ.

LOCATION.—In T. 16 N., R. 22 E., at highway bridge about 1½ miles below Woodruff, Navajo County, and about 4 miles below Silver Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 16, 1905, to December 31, 1908; December 5, 1915, to September 30, 1916.

GAGE.—Stevens water-stage recorder on right bank just below highway bridge.

DISCHARGE MEASUREMENTS.—From bridge or by wading near bridge.

CHANNEL AND CONTROL.—Channel consists of bedrock covered with thin deposit of sand and silt. Control not well defined; likely to shift considerably because of the large quantities of silt that are constantly being deposited at low stages and scoured out at each rise. Both banks are clean of vegetation, high, not subject of overflow, and fairly permanent.

EXTREMES OF STAGE.—Maximum stage during year, from flood marks on gage, 12.7 feet on evening of January 19 (discharge not determined); river dry for about 2 weeks during June and July.

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

DIVERSIONS.—Much of the low-water flow is diverted for irrigation in the vicinity of St. Johns and Snowflake, amount unknown.

REGULATION.—There are several small reservoirs in the headwaters of this stream and on Silver Creek that no doubt regulate the flow to some extent.

ACCURACY.—Stage-discharge relation not permanent. Rating curve not developed. Mean daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage height. The operation of the recorder was unsatisfactory throughout the year because of unreliable attendant and also because of excessive silt deposits in float well. The gage heights are subject to considerable error and should be used with caution

Discharge measurements of Little Colorado River near Woodruff, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6	M. D. Anderson	1.10	45.9	May 30	D. M. Anderson	1.12	48.7
6	do	1.10	47.1	Aug. 23	Ellsworth and Anderson.	1.18	47
Feb. 10	do	2.15	360				
10	do	2.15	372	23	do	1.19	49
Apr. 11	do	2.32	290	Sept. 24	C. E. Ellsworth	1.03	33.2
20	do	2.46	357	24	do	1.03	32.1
May 30	M. D. Anderson	1.12	48.2				

Daily gage height, in feet, of Little Colorado River near Woodruff, Ariz., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.65	.....	2.68	2.80	1.90	1.00	0.78	.....	.....
2	.....	1.55	.....	2.68	2.90	1.90	.97	.79	.....	.....
3	.....	1.50	.....	2.65	2.90	1.88	.93	.90	.....	.....
4	.....	1.50	.....	2.58	2.85	1.84	.90	1.15	.....	.....
5	1.12	1.50	.....	2.60	2.90	1.80	.88	1.10	.....	.....
6	1.10	1.55	.....	2.53	2.90	1.75	.88	1.10	.....	.....
7	.....	1.60	.....	2.50	2.75	1.70	.80	1.10	1.40	.....
8	.....	1.55	.....	2.52	2.60	1.65	.64	1.10	1.50	.....
9	.....	1.40	.....	2.52	.....	1.60	.54	1.10	1.50	.....
10	.....	1.35	2.20	2.50	.....	1.55	.45	1.78	1.50	.....
11	.90	2.22	2.35	.....	2.30	1.50	.68	1.45	1.50	.....
12	.89	2.05	2.44	.....	2.27	1.45	.90	.....	1.50	.....
13	.89	1.65	2.40	3.30	2.28	1.40	.75	.....	2.50	.....
14	.85	1.42	2.40	3.23	2.28	1.35	.65	.....	.....	.....
15	.91	1.38	2.55	3.16	2.27	1.30	.63	.....	.....	.....
16	.93	1.40	2.58	3.08	2.27	1.30	.98	.....	.....	.....
17	.90	2.83	2.55	3.00	2.30	1.35	.89	.....	.....	.....
18	.90	5.25	2.54	2.93	2.35	1.40	.83	.....	.....	.....
19	.85	8.86	2.53	2.86	2.40	1.46	.81	.....	.....	.....
20	.85	.....	2.50	2.79	2.47	1.52	.92	.....	.....	.....
21	.85	.....	2.53	2.72	2.40	1.58	.98	.....	.....	.....
22	.93	.....	2.52	2.67	2.40	1.64	.90	.....	.....	.....
23	1.05	.....	2.50	2.68	2.34	1.70	.85	.....	1.19	.....
24	1.03	.....	2.48	3.25	2.30	1.62	.80	.....	1.25	1.03
25	.95	.....	.....	3.35	2.25	1.54	.80	.....	1.46	1.02
26	1.10	.....	.....	3.35	2.20	1.46	.80	.....	.....	1.00
27	1.28	.....	2.61	3.1	2.15	1.35	.76	.....	.....	.97
28	1.30	.....	2.65	3.05	2.07	1.27	.74	.....	.....	.94
29	1.32	.....	2.65	2.95	2.02	1.20	.73	.....	.....	.90
30	1.10	.....	.....	2.85	1.95	1.11	.77	.....	.....	.88
31	1.30	.....	.....	2.85	.....	1.09	.....	.....	.....	.....

NOTE.—See "Accuracy" in station description.

ZUNI RIVER AT BLACK ROCK, N. MEX.

LOCATION.—At the reservoir of the Zuni Indian Reservation at Black Rock, McKinley County. Rio de Los Nutrias, the nearest large tributary, enters from the north, about 4 miles above.

DRAINAGE AREA.—About 660 square miles.

RECORDS AVAILABLE.—Yearly flow July 1, 1903, to June 30, 1905; July 1, 1908, to June 30, 1910. Monthly flow October 1, 1910, to September 30, 1916. Record since July 1, 1908, shows inflow into reservoir.

METHOD OF COLLECTING DATA.—From July 1, 1903, to June 30, 1905, the records were obtained by the ordinary stream-gaging methods. Reservoir completed in 1908. Record beginning July 1, 1908, obtained by means of a gage in the reservoir and a capacity curve for the reservoir, the quantity of water released from the reservoir during the periods of inflow being taken into consideration.

FLOODS.—Channel dry the greater part of the year below the point where it leaves the mountains, but stream is subject to sudden floods of considerable volume and usually of short duration. An account of the flood of September 6, 1909, which damaged the reservoir, is given in Water-Supply Paper 269, pages 206-210.

DIVERSIONS.—A reservoir at Ramah, about 18 miles above the station (the capacity of which is given as 4,240 acre-feet), is used to irrigate about 1,150 acres in T. 11 N., R. 16 W. There are other small ponds or reservoirs in the drainage area.

COOPERATION.—Record furnished by the Office of Indian Affairs, Irrigation Service, through H. F. Robinson, supervising engineer, Alburquerque, N. Mex.

Monthly run-off of Zuni River at Black Rock, N. Mex., for the year ending Spet. 30, 1916.

Month.	Run-off (total in care-feet).	Month.	Run-off (total in acre-feet).
October	0	May	60
November	30	June	0
December	10	July	1,440
January	5,010	Angust	1,280
February	8,570	September	1,320
March	20,200		
April	4,780	The year	42,700

SILVER CREEK NEAR SNOWFLAKE, ARIZ.[1]

LOCATION.—In T. 13 N., R. 21 E., near mouth of canyon, about 1 mile below Snowflake, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 4, to December 31, 1906, and December 14, 1915, to December 31, 1916, when station was discontinued.

GAGE.—Inclined staff on right bank about 300 feet below mouth of canyon; read by T. W. Tanner. A Richard Fréres water-stage recorder on left bank about 1 mile below the inclined gage was used from December 14, 1915 to January 19, 1916, when it was destroyed by flood.

DISCHARGE MEASUREMENTS.—Made from cable about 100 feet below staff gage, or by wading near staff gage.

CHANNEL AND CONTROL.—At the staff gage the bed is composed of constantly shifting sand and gravel. At the water-stage recorder a concrete control was constructed which assured a fairly constant stage-discharge relation. It was destroyed at the same time as the gage. The banks at both gages are high, rocky, fairly clean of vegetation, and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage from December 14, 1915, to December 31, 1916, 20 feet on January 19, 1916, ascertained from flood marks at location of water-stage recorder (discharge not determined). It is reported that the stream is practically dry for various periods during the irrigation season nearly every year, the only flow being return water from the irrigated areas near Snowflake.

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

DIVERSIONS.—Much of the low-water flow is diverted for irrigation above the station.

STORAGE.—Some storage is developed above the station for irrigation. Amount unknown.

ACCURACY.—Stage-discharge relation not permanent because of shifting control (see "Channel and control"). Rating curve not developed. Gage read to tenths twice a week. Data inadequate for determination of discharge.

Discharge measurements of Silver Creek near Snowflake, Ariz., for period December 14, 1915, to December 31, 1916.

Date.	Made by—	Gage height[b]	Discharge.	Date.	Made by—	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 14	Anderson and Guthrie	1.65	8.3	Ang .24	Ellsworth and Anderson	0.95	3.8
Feb. 12	M. D. Anderson	2.00	510	24	do	.95	3.2
Apr. 20	do	.85	25.6	Sept. 23	C. E. Ellsworth	1.20	10.6
20	do	.85	25.2	23	do	1.20	11.2

[a] Measurement on Dec. 14 referred to water-stage recorder; all other measurements referred to inclined staff gage 1 mile upstream. No determined relation between the two gages.

[1] In report for 1906 called "Silver Creek at Canyon Station" near Snowflake, Ariz.

Daily gage height, in feet, of Silver Creek near Snowflake, Ariz., for the period Dec. 14, 1915, to Dec. 31, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.95						0.8	1.5				
2		1.95				0.3				0.9			1.4
3		1.8					0.5				1.4		
4		1.95		1.1	1.5			.7				1.4	
5		1.9							1.4	1.0			1.0
6		1.85				.3	.8						
7		1.8		1.6							1.4	1.1	
8		1.85			1.3			1.0	1.0				
9		1.85				.5				1.5			1.0
10		2.90					.8				3.1		
11		2.5		1.3	1.5			1.2				1.1	
12		2.0	2.0						.9	1.7			1.15
13		1.7				.5	.8						
14	1.55	1.8	1.9	1.1							3.2	1.4	
15	1.65	1.7			1.4			1.4	3.0				
16	1.65	1.8				.6				2.5			1.2
17	1.7						.8				2.1		
18	1.65		1.5	1.0	1.0			1.0				1.2	
19	1.6								1.3	1.7			1.1
20	1.65					.7	.8						
21	1.65			1.1							1.5	1.4	
22	1.8		1.9		.8			.9	1.2				
23	1.75					.7				1.1			1.15
24	1.75						.8				1.1	1.3	
25	1.75			3.9	.8			2.4					
26	1.7		1.5						1.4	1.4			1.2
27	1.7					.7	.8						
28	1.75			2.5							1.2	1.5	
29	1.75		2.1		.3			2.0	1.3				
30	1.9					.5				1.5			1.35
31	1.75			1.4							1.4		

NOTE.—See "Gage" and "Accuracy" in station description.

CHEVELON FORK NEAR WINSLOW, ARIZ.

LOCATION.—In T. 18 N., R. 17 E., 300 yards below highway bridge, 1 mile above concrete division dam, about 1½ miles above junction with Little Colorado River, and about 14 miles southeast of Winslow, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 18, 1905, to December 12, 1908; December 18, 1915, to September 30, 1916.

GAGE.—Stevens water-stage recorder attached to rock ledge on right bank 300 yards below highway bridge.

DISCHARGE MEASUREMENTS.—Made from cable, or by wading.

CHANNEL AND CONTROL.—Channel bed consists of fairly permanent sand and gravel. Both banks clean, gradually rising to well above high water. Control is at diversion dam about 1 mile below gage; practically permanent for high and medium stages; at low stages it shifts considerably owing to unstable conditions at canal heading.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 13.2 feet at 9 a. m., January 19 (discharge not determined); minimum discharge about 2 second-feet for several days during June, July, and August.

ACCURACY.—Stage-discharge relation practically permanent, except at low stages, when it is affected by the operation of a loosely constructed canal heading below the gage. Three poorly defined rating curves used as follows: December 18 to January 17, February 8 to May 29, and August 23 to September 30. Operation of recorder satisfactory except as indicated in footnote to monthly-discharge table. Daily discharge ascertained by shifting-control method or by applying to rating table daily gage height determined by inspecting gage-height graph, or by averaging hourly gage heights during rapidly fluctuating stages. Daily discharge not published because of insufficient discharge measurements and shifting control at low stages. Records roughly approximate.

Discharge measurements of Chevelon Fork near Winslow, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 18	M. D. Anderson	0.65	4.6	Aug. 22	Ellsworth and Anderson	0.92	3.9
May 29	do	.90	6.7	Sept. 25	C. E. Ellsworth	.94	4.0
29	do	.90	6.7	25	do	.94	5.4
Aug. 22	Ellsworth and Anderson	.92	4.0				

NOTE.—High-water portion of rating curve based on measurement made Apr. 5, 1917. Gage height, 2.52 feet; discharge, 283 second-feet.

Monthly discharge of Chevelon Fork near Winslow, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 18-31	6	4	5.1	142
January 1-18	944	3	58.9	2,100
February 8-29	924	250	439	19,200
March	1,350	196	629	38,700
April	417	19	124	7,380
May	18	2	7.2	443
June	6	2	3.6	214
July	10	2	3.8	234
August	70	2	6.2	381
September	366	3	32.0	1,900

NOTE.—Gage heights Jan. 10-14 have no significance on account of operation of canal head gate; discharge interpolated. Mean daily gage height Jan. 20, 10.6 feet; discharge not determined. Recorder not working properly Apr. 8-11; May 5-13 and 24-28; June 12-24; discharge interpolated. See "Accuracy" in station description.

VIRGIN RIVER BASIN.

VIRGIN RIVER AT VIRGIN, UTAH.

LOCATION.—In the NW. ¼ sec. 27 or the NE. ¼ sec. 28, T. 41 S., R. 12 W., a few hundred feet above point where river enters a steep, narrow gorge and three-quarters of a mile west of Virgin, Washington County. Station replaces the one maintained prior to February, 1915, at a site half a mile above Virgin and gives practically the same record of flow.

DRAINAGE AREA.—1,010 square miles.

RECORDS AVAILABLE.—April 18, 1909, to September 30, 1916.

GAGE.—Chain gage on the right bank near the lower end of sandstone bluff. Installed February 1, 1915; read by Niles Earl. Gage used April 18 to August 31, 1909, was an inclined staff on right bank half a mile above Virgin and a few hundred feet below North Creek; washed out August 31, 1909, and replaced October 14 by an inclined staff on left bank at a new datum. This gage was damaged by flood January 1, 1910, and on January 25 a new inclined staff was installed also on left bank about 65 feet upstream and at datum 0.8 foot higher than the gage installed October 14, 1909. This gage was used until chain gage was installed below Virgin February 1, 1915.

DISCHARGE MEASUREMENTS.—Made by wading below the gage except during high water, when the old cable above Virgin must be used.

CHANNEL AND CONTROL.—Bed consists of sand and gravel. Right bank high; left bank low and is overflowed. One channel at all stages. Control is a gravel bar a short distance below the gage; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.6 feet at 7.35 p. m. July 26 (discharge, 4,350 second-feet); discharge at 7 p. m. August 3, estimated at 6,000 second-feet by C. S. Jarvis, civil engineer; minimum stage recorded, 2.38 feet February 1 (discharge, 117 second-feet).

1909–1916: Maximum stage recorded, 11.6 feet at upper station October 27, 1912 (discharge estimated 12,000 second-feet). The flood of August 31, 1909, probably equaled or exceeded this flow. Minimum discharge, 24 second-feet July 1, 2, 4, and 5, 1909.

ICE.—Stage-discharge relation not affected by ice to any extent.

DIVERSIONS.—Above all important diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation usually changed by floods, which occurred frequently during year but was fairly constant for periods of ordinary flow. Rating curves used as standard, fairly well defined for range in stage except for peaks of floods of short duration; other curves drawn parallel to these through single discharge measurement used November 8 to March 20 and March 25–31. Gage read to hundredths once a day about five or six times a week. Daily discharge determined by applying daily gage height to rating table, except for periods when stage-discharge relation was affected by shifting control and during floods. Discharge interpolated for days when gage was not read. Records fair.

Discharge measurements of Virgin River at Virgin, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 11	L. A. Snow	2.50	164	May 25	A. B. Purton	2.69	456
Mar. 31	C. C. Jacob	2.90	535	July 27	L. A. Snow	3.02	692

Daily discharge, in second-feet, of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	131	189	236	209	117	224	586	801	357	200	375	176
2	131	200	248	206	156	212	657	801	357	200	575	166
3	131	212	248	203	156	200	728	844	357	200	2,000	156
4	145	224	284	200	156	200	1,030	906	334	192	500	146
5	145	236	278	224	162	652	879	968	357	176	3,000	150
6	156	248	272	248	167	444	728	1,030	346	168	350	153
7	156	1,050	236	189	236	236	675	810	335	168	263	150
8	156	178	224	212	254	272	622	788	324	184	2,000	146
9	156	320	236	200	272	424	622	767	313	200	250	292
10	156	232	212	189	272	424	860	728	308	184	200	242
11	145	145	206	162	266	424	793	767	303	160	200	192
12	145	138	200	131	260	615	726	731	282	153	200	168
13	150	152	236	144	212	690	660	696	282	153	200	530
14	156	167	248	156	200	765	698	660	268	233	403	400
15	167	167	260	224	189	690	784	645	254	313	209	269
16	178	167	254	192	260	615	869	313	249	235	196	138
17	178	156	248	359	200	615	1,230	484	244	209	184	153
18	178	156	260	1,080	167	578	1,140	655	235	168	188	168
19	178	172	200	578	236	690	1,050	826	226	176	192	160
20	178	189	200	236	248	842	784	318	222	176	168	153
21	167	189	200	145	290	3,300	831	535	218	172	184	164
22	167	178	194	131	333	2,600	878	752	214	168	172	174
23	178	178	189	145	272	1,900	965	612	209	168	160	184
24	178	189	178	131	212	1,200	965	472	209	184	173	153
25	189	200	178	189	167	720	1,330	446	200	1,480	186	146
26	212	200	178	254	212	844	1,100	424	209	2,180	200	168
27	212	224	178	320	236	844	1,240	403	209	1,190	192	153
28	248	224	224	652	424	886	1,090	392	200	790	168	164
29	248	224	224	395	272	929	947	380	192	391	200	176
30	189	230	224	138	.....	645	801	403	196	357	196	188
31	200	.....	212	128	.....	530	.....	334	.....	313	192	.....

NOTE.—Daily discharge Aug. 1–9 determined from a rough hourly, discharge hydrograph plotted from observer's gage-height record and estimates of floods on Aug. 3, 5, and 8 furnished by C. S. Jarvis, civil engineer, Salt Lake City, Utah; results only roughly approximate.

Monthly discharge of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	248	131	171	10,500
November	1,050	138	224	13,300
December	284	178	225	13,800
January	1,080	128	257	15,800
February	424	117	228	13,100
March	3,300	200	781	48,000
April	1,330	586	876	52,100
May	1,030	313	635	39,000
June	357	192	267	15,900
July	2,180	153	363	22,300
August	3,000	160	441	27,100
September	530	138	193	11,500
The year	3,300	117	389	282,000

LEEDS (QUAIL) CREEK NEAR LEEDS, UTAH.

LOCATION.—In the N. ½ sec. 36, T. 40 S., R. 14 W., just above heading of R. C. Savage's canal and about a quarter of a mile above head of Leeds canal, three-quarters of a mile north of the abandoned mining camp of Silver Reef, and 2½ miles north of Leeds, Washington, County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 31, 1915, to September 30, 1916.

GAGE.—Vertical staff on left bank 60 feet above the head of the Savage ditch. Read by R. C. Savage.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed consists of gravel and boulders; shifts occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet, August 3 (discharge not determined); minimum stage recorded, 2.00 feet in November and December (discharge 4.2 second-feet).

1915–1916: Maximum stage recorded, that of this year; minimum stage, 1.98 feet, January 31, 1915 (discharge 3.9 second-feet).

ICE.—Stage-discharge relation probably not seriously affected by ice for any length of time.

DIVERSIONS.—Above all diversions. R. C. Savage diverts water about 60 feet below the station for irrigation and domestic uses. Measurements of this ditch have shown from 1 to 3 second-feet. Measurements of Leeds canal which diverts about a quarter of a mile below have shown discharges up to 18.5 second-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed by high water January 18 and again August 3. Rating curves fairly well defined between 3 and 30 second-feet. Gage read to hundredths two or three times a week. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Leeds (Quail) Creek during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. [a]13	L. A. Snow	2.20	6.74	May 26	A. B. Purton	2.48	21.5
Mar. 31	C. C. Jacob	2.55	28.0	July 27	L. A. Snow	3.20	14.8

[a] Stage-discharge relation probably affected by ice gorges.

Daily discharge, in second-feet, of Leeds (Quail) Creek near Leeds, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.2			4.2		10	17				10	
2	5.2		4.2			10			23			
3						10			23	31		
4			5.5			12		24			8.9	
5							24	23	24			
6	4.8						24	23		31		
7			4.2				24				8.6	
8				4.2		18	24	23				
9	4.8					24			23			
10						24			23	31		
11		5.0	4.2			38		23				7.2
12		5.0					22	23	24		8.6	
13				6.7			20	23		28		7.2
14				5.0			20		24			
15						18	22	23		27	8.3	
16	4.8				10	18		24				7.0
17			4.2		10	18			27			
18			4.2		10	17			28	17		
19					10		23			12	8.3	7.0
20				5.2						10		
21						24	23		28	10		
22				5.2		25	23			10		
23	4.8					30						7.0
24					10	20			28	10	8.3	
25			4.2		10	25						5.5
26					10		22	22				5.5
27		4.2			10		23	23		15		
28					10		23		31			
29					10		23	23	31	10		
30						17			31			
31						22						

NOTE.—Daily discharge is given for days on which gage was read.

SANTA CLARA CREEK NEAR CENTRAL, UTAH.

LOCATION.—In sec. 11, T. 39 S., R. 16 W., just above ford at R. H. Hunt's ranch, about a mile southeast of Central, Washington County, on road to Pine Valley. Hunt's spring, which has fairly constant discharge of about 3 second-feet, enters 10 feet below the gage.

DRAINAGE AREA.—84 square miles.

RECORDS AVAILABLE.—April 21, 1909, to September 30, 1916.

GAGE.—Vertical staff nailed to cottonwood tree on left bank about 20 feet above the ford; read by R. H. Hunt. Datum of gage was raised 0.45 foot on January 20, 1910, and 2 feet on February 22, 1916.

DISCHARGE MEASUREMENTS.—Made by wading, or from footbridge.

CHANNEL AND CONTROL.—Stream bed consists of gravel and boulders. Both banks fairly high but may be overflowed at extreme stages; one channel at all stages. Control is at a riffle formed by small boulders just below ford; shifts at times. Stage of zero flow about 0.2 foot, February 22, 1916 datum.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.90 feet (5.35 original 1909 datum) at 7.30 a. m. March 29 (discharge 407 second-feet); minimum stage 0.95 foot (3.40 original datum), December 14–29 (discharge 12 second-feet).

1909–1916: Maximum stage recorded 7.5 feet (5.05 feet present datum) January 1, 1910 (discharge estimated by extending later rating curves and assuming no backwater effect from drift, etc., to be probably 1,200 or 1,300 second-feet. This result is only roughly approximate as no discharge measurements have been made above about 400 second-feet). Minimum discharge, 5 second-feet, February 6–8 and September 10–17, 1914.

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

DIVERSIONS.—The New Castle Reclamation Co. has constructed a reservoir on Grass Valley Creek with a capacity of 23,000 acre-feet. Water is taken from Santa Clara Creek above the town of Pine Valley, stored in the reservoir, and diverted by means of a tunnel through the rim of the Great Basin to irrigate lands outside the Colorado River basin. The Central canal diverts water about 2 miles above station for irrigation of lands near Central. This canal has been measured when it was carrying 16 second-feet.

REGULATION.—Flow affected by the diversions and storage noted above.

ACCURACY.—Control fairly permanent. Rating curve is well defined from 0 to 100 second-feet and fairly well defined up to 400 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Santa Clara Creek near Central, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 22	L. A. Snow	1.05	17.0
May 28[a]	A. B. Purton	1.27	34.8
June 19	L. A. Snow	1.38	47.9

[a] Stage of zero flow, 0.2 ±0.1 foot.

Daily discharge, in second-feet, of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	22	17	14	20	22	66	42	32	30	68	19
2	20	22	17	16	20	23	61	39	30	30	50	18
3	20	22	17	19	24	22	56	42	30	30	46	18
4	20	22	17	18	24	74	50	42	30	30	93	16
5	20	22	17	16	24	106	46	58	30	28	104	19
6	20	32	17	14	20	32	37	66	34	28	52	20
7	20	28	17	15	20	28	33	83	37	28	37	20
8	20	24	17	15	20	32	33	72	46	28	30	20
9	20	20	17	20	20	35	33	66	54	28	30	20
10	20	20	17	17	20	149	33	61	56	26	30	20
11	20	20	17	14	28	93	33	56	56	26	26	20
12	20	20	17	14	28	74	41	50	54	25	26	20
13	20	19	14	14	26	54	37	44	50	25	26	20
14	20	18	12	14	26	46	37	41	50	28	25	19
15	20	17	12	14	26	42	39	37	48	33	25	19
16	20	18	12	14	26	39	41	37	44	28	22	19
17	20	19	12	15	26	35	41	37	42	30	19	19
18	20	19	12	116	26	37	42	39	42	32	18	19
19	20	18	12	37	26	57	42	50	41	33	18	19
20	20	17	12	32	24	63	44	48	42	33	18	19
21	20	17	12	28	20	407	46	37	39	33	15	19
22	20	17	12	24	17	142	54	37	39	33	15	19
23	20	17	12	20	20	154	58	35	37	33	14	19
24	20	17	12	18	22	166	61	35	37	34	13	19
25	20	16	12	17	22	112	66	35	38	35	13	19
26	22	15	12	17	23	329	71	35	39	35	13	19
27	22	15	12	56	23	133	61	33	39	33	14	19
28	22	16	12	37	23	112	104	33	35	44	15	19
29	22	17	12	30	22	92	83	33	32	37	23	19
30	22	17	14	24	.....	71	62	32	32	36	23	19
31	22	.....	14	19	.....	71	.....	32	.....	35	19	.....

NOTE.—Gage not read, discharge interpolated, for following days: Oct. 4, 11, 14, 18, 21, 24, 28, 30, Nov. 1, 4; about every other day Nov. 10 to Dec. 28; Jan. 2, 4, 10, 14, 16, 22, 24, 29, Feb. 1, 4, 7, 9, 14, 17, 21, 23, 25, 27, 29, Mar. 8, 12, 15, 23, 29, Apr. 1, 3, 9, 18, 23, 30, May 16, June 6, 18, 25, July 2, 7, 24, 30, Aug. 9, Sept. 6, 8, 9, 12, 20, and 27.

Monthly discharge of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	22	20	20.4	1,250
November	32	15	19.4	1,150
December	17	12	14.1	867
January	116	14	23.8	1,460
February	28	17	23.0	1,320
March	407	22	92.0	5,660
April	104	33	50.4	3,000
May	83	32	44.7	2,750
June	56	30	40.5	2,410
July	44	25	31.2	1,920
August	104	13	30.3	1,860
September	20	16	19.1	1,140
The year	407	12	34.2	24,800

MUDDY RIVER NEAR MOAPA, NEV.

LOCATION.—In the SE. ¼ sec. 15, T. 14 S., R. 65 E., at the concrete weir about three-quarters of a mile below Home ranch, 6 miles northwest of Moapa, Clark County, a short distance below the springs that form the source of the stream.

DRAINAGE AREA.—1,080 square miles. A large drainage area above Arrow Canyon is tributary to Muddy River but produces no surface run-off except during cloudbursts or periods of heavy rainfall.

RECORDS AVAILABLE.—July 1, 1913, to September 30, 1915, and April 20 to September 30, 1916.

GAGE.—Stevens water-stage recorder in pool above weir.

DISCHARGE MEASUREMENTS.—Made from a footplank below weir.

CONTROL.—A 10-foot Cippoletti weir. Stage of zero flow, zero on gage.

EXTREMES OF DISCHARGE.—The actual maximum stage was not recorded as the pencil carriage stuck, but from comparison with the record at the Indian reservation it occurred about midnight July 24. Discharge estimated from record below at 68 second-feet, corresponding to a stage of about 2.3 feet. Minimum stage determined by inspection of trace when clock was stopped to be 1.05 feet between July 2 and 14 (discharge, 36 second-feet).

1913–1916: Maximum stage recorded, 9.9 feet at 11 p. m. February 21, 1914 (discharge estimated 765 second-feet); minimum discharge 36 second-feet between July 2 and 14, 1916.

ICE.—Stage-discharge relation not affected by ice but stream is subject to sudden freshets in winter.

DIVERSIONS.—Several ranch ditches divert water for irrigation above station.

REGULATION.—Flow affected somewhat by diversions above.

ACCURACY.—Deposition of sand above weir increases velocity of approach and changes stage-discharge relation. Range of stage small except for short peak floods; curves reasonably well defined between 40 and 50 second-feet. Operation of water-stage recorder satisfactory except during a few short periods. Daily discharge ascertained by applying to rating table gage height obtained from recorder graph or, for days of considerable fluctuation, by averaging hourly discharge. Records good.

Discharge measurements of Muddy River near Moapa, Nev., during the year ending Sept. 30, 1916.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
May 1	1.14	39.2	Sept. 6	1.20	44.7
July 16	1.22	45.6	17	1.24	45.6
19	1.26	47.0			

Daily discharge, in second-feet, of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	40	43	44	49	46	16	.....	47	43	47	42	46
2	.....	40	43	45	50	46	17	.....	46	44	47	42	46
3	.....	42	43	.....	54	46	18	.....	46	46	46	42	46
4	.....	44	43	.....	55	46	19	.....	46	46	46	42	46
5	.....	43	43	.....	49	45	20	46	45	45	46	42	46
6	.....	43	43	.....	48	44	21	44	45	42	46	42	47
7	.....	45	44	.....	48	43	22	45	44	46	47	42	47
8	.....	45	43	38	48	42	23	45	45	46	46	42	47
9	.....	44	40	45	47	42	24	46	46	47	51	44	45
10	.....	43	40	42	47	42	25	.....	46	46	57	46	43
11	.....	44	39	40	47	43	26	.....	46	46	45	46	44
12	.....	46	41	38	46	43	27	.....	47	46	52	46	43
13	.....	45	42	40	45	45	28	.....	46	46	54	46	43
14	.....	46	42	43	44	46	29	.....	46	43	52	46	43
15	.....	47	42	45	44	46	30	.....	46	43	49	46	43
							31	.....	46	.....	49	46	.....

NOTE.—Discharge estimated, because of breaks in gage-height record, by comparison with records of flow for station at the Indian reservation, as follows: Apr. 25–30, 43 second-feet; July 3–7, 42 second-feet.

Monthly discharge of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 20–30	46	.....	44.0	960
May	47	40	44.8	2,750
June	47	39	43.5	2,590
July	57	38	45.5	2,800
August	55	42	45.9	2,820
September	47	42	44.7	2,660
The period	.....	.....	.....	14,600

MUDDY RIVER ABOVE MOAPA RIVER INDIAN RESERVATION, NEAR MOAPA, NEV.

LOCATION.—In the SW. ¼ sec. 26, T. 14 S., R. 65 E., about a quarter of a mile above upper end of the Moapa River Indian Reservation, and 5 miles west of Moapa, Clark County.

DRAINAGE AREA.—1,100 square miles.

RECORDS AVAILABLE.—August 24, 1914, to September 30, 1916. Several current-meter measurements were made in 1914 before the gage-height record was started.

GAGE.—Stevens water-stage recorder installed August 24, 1914; moved 90 feet downstream December 14, 1915, and datum lowered 0.06 foot. Current meter measurements prior to August 24, 1914, referred to a vertical staff at the upper site.

DISCHARGE MEASUREMENTS.—Made from a footbridge about 85 feet above gage.

CHANNEL AND CONTROL.—Bed consists of clay and limestone deposit, with some sand and vegetal growth. One channel at all stages but banks are overflowed during excessive floods. Control is a limestone reef about 20 feet below the present gage. Stage of zero flow approximately −2.0 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.02 feet at 1:30 a. m. July 25 (discharge 69 second-feet); maximum discharge, 70 second-feet from 2 to 7 p. m. November 6, stage 2.97 feet (2.82 feet, referred to datum used after December 14). Stage-discharge relation affected by moss. Minimum stage recorded, 1.74 feet from 3 to 10 p. m. July 12 (discharge 36 second-feet).

1914–1916: Maximum stage, 3.21 feet at 4 a. m. February 11, 1915 (discharge 86 second-feet); minimum stage, 1.74 feet from 3 to 10 p. m. July 12, 1916 (discharge 36 second-feet).

ICE.—Stage-discharge relation not affected by ice. Except for sudden freshets flow is very uniform as stream is fed by springs.

DIVERSIONS.—One small diversion and some seepage and return flow between this station and the one 2 miles above at the Home ranch.

REGULATION.—Flow affected somewhat by the diversions at the Home ranch.

ACCURACY.—Stage-discharge relation affected by moss. Rating curves fairly well defined from 40 to 50 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table gage height obtained by inspecting gage-height graph; discharge November 6, January 27, 28, July 24, 25, 27, 28, and August 3, and 4 determined by averaging hourly discharge. Records good.

Discharge measurements of Muddy River above Moapa River Indian reservation near Moapa, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 18	Leonard Tanner	2.16	49.4	June 29	Leonard Tanner	1.88	40.1
Jan. 6	do	[a] 1.99	51.4	July 26	do	2.05	43.7
Apr. 6 [b]	L. W. Jordan	1.87	44.8	28	do	2.28	49.7
May 4	Leonard Tanner	1.92	45.7	Sept. 18	do	2.16	45.7
27	do	2.16	47.9				

[a] Gage at old site read 2.14 feet.
[b] Stage of zero flow determined to be approximately −2.0 feet.

Daily discharge, in second-feet, of Muddy River above Moapa River Indian reservation near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	47	49	51	52	48	46	45	46	44	48	45
2	44	48	49	51	52	48	46	44	44	45	48	44
3	44	48	50	51	52	48	46	46	45	43	52	44
4	44	48	50	51	52	49	46	48	44	42	52	44
5	47	48	50	51	51	49	47	47	44	42	48	43
6	47	58	50	51	51	50	46	46	44	40	48	44
7	46	52	50	51	51	49	46	48	44	38	48	43
8	47	50	50	51	51	49	46	47	43	38	48	42
9	44	49	50	51	51	49	48	47	41	44	48	43
10	44	49	50	51	51	49	46	46	41	40	48	43
11	44	49	49	51	51	48	46	46	40	38	48	44
12	45	49	50	51	51	48	47	48	41	38	46	44
13	46	49	50	51	51	49	47	47	42	39	44	45
14	47	50	50	51	51	49	48	47	42	42	43	46
15	47	50	50	51	51	48	48	48	42	44	43	46
16	47	50	50	51	50	48	49	47	43	46	42	46
17	47	49	50	53	50	48	48	46	43	43	42	46
18	47	49	50	54	50	49	48	46	46	44	42	46
19	47	49	50	52	50	50	48	46	46	46	41	46
20	47	49	50	52	50	50	48	45	44	46	42	46
21	47	49	50	51	55	50	49	45	42	46	42	45
22	47	49	50	51	55	50	49	44	46	46	42	45
23	47	49	50	51	51	49	48	45	46	46	42	46
24	47	49	50	51	51	48	48	46	46	48	42	43
25	47	49	50	51	50	47	47	47	46	54	46	42
26	47	49	50	51	49	46	46	47	46	46	45	42
27	47	49	50	54	49	46	45	47	46	50	46	42
28	47	49	50	59	49	46	44	47	45	52	46	41
29	47	49	50	52	49	46	44	47	42	53	46	41
30	47	49	50	52	.....	47	46	47	43	48	45	42
31	47	.....	50	52	.....	46	.....	47	.....	48	45	.....

Monthly discharge of Muddy River above Moapa River Indian reservation near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	47	42	46.1	2,830
November	58	47	49.3	2,930
December	50	49	49.9	3,070
January	59	51	51.7	3,180
February	55	49	50.9	2,930
March	50	46	48.3	2,970
April	49	44	46.9	2,790
May	48	44	46.4	2,850
June	46	40	43.8	2,610
July	54	38	44.5	2,740
August	52	41	45.4	2,790
September	46	41	44.0	2,620
The year	59	38	47.3	34,300

MUDDY RIVER AT RAILROAD PUMPING PLANT NEAR MOAPA, NEV.

LOCATION.—In sec. 5, T. 15 S., R. 66 E., at railroad bridge on main-line track of Salt Lake Route, about a mile below the Indian Reservation and 1¼ miles south of Moapa, Clark County. Above confluence of Meadow Valley Wash.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 8, 1914, to September 30, 1916.

GAGE.—Vertical staff on right bank attached to pile of railroad bridge; read by James Borbridge.

DISCHARGE MEASUREMENTS.—Made from footplank about 150 feet below gage.

CHANNEL AND CONTROL.—Bed composed of clay. Banks comparatively low; overflowed during freshets; one channel at all stages. There is a well defined riffle 200 feet below gage, but stage-discharge relation is evidently affected by changes in channel between gage and riffle.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.3 feet at 5 p. m. January 18 (discharge estimated by prolonging rating curve, 63 second-feet); minimum stage recorded, 0.28 foot at 6 p. m. July 12 (discharge, 33 second-feet).

1914–1916: Maximum stage recorded, 2.4 feet at 3 p. m. February 11, 1915 (discharge about 145 second-feet); minimum discharge, 29 second-feet at 6.30 p. m. June 20, 1915.

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

DIVERSIONS.—Water to irrigate about 200 acres is diverted at the Indian Reservation and also for a ranch between the reservation and the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Range of stage small; direction of rating curves not accurately determined. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table; shifting-control method used October 1–4 and April 1–30. Records fair.

Discharge measurements of Muddy River at railroad pumping plant near Moapa, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	Leonard Tanner	0.78	49.3	May 27	Leonard Tanner	0.78	45.8
Apr. 6	L. W. Jordan	.54	42.1	Sept. 18	do	0.72	42.6
May 4	Leonard Tanner	.56	39.9				

Daily discharge, in second-feet, of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	48	49	49	49	46	46	41	43	44	43	43
2	42	48	49	50	49	46	43	38	39	44	43	43
3	44	47	49	50	49	46	42	38	40	38	44	41
4	43	47	50	50	49	46	42	40	40	38	44	41
5	48	47	50	49	49	48	44	38	39	36	43	41
6	48	54	50	48	50	47	41	38	38	37	43	43
7	48	54	49	48	49	45	40	41	38	35	42	43
8	48	50	49	48	49	46	43	41	38	38	42	42
9	48	49	49	48	48	47	41	40	36	40	42	42
10	46	49	49	48	48	47	43	39	36	42	42	41
11	46	49	49	48	48	46	40	39	36	36	44	42
12	45	49	50	48	48	46	44	39	36	34	44	42
13	45	49	50	48	48	47	40	40	36	35	42	41
14	48	49	50	48	48	48	42	41	38	41	42	43
15	48	50	50	48	48	45	40	42	37	40	42	44
16	48	50	50	49	48	46	42	41	38	41	41	44
17	48	50	50	51	48	44	42	40	38	41	39	44
18	48	50	50	57	48	45	42	39	42	42	39	44
19	48	48	50	52	48	46	43	39	42	42	38	44
20	48	49	49	50	48	46	42	40	41	41	37	45
21	46	49	49	49	50	46	43	41	39	42	37	44
22	46	49	49	49	53	46	44	40	41	42	38	42
23	46	49	50	49	49	45	42	40	43	42	37	43
24	46	49	50	49	48	45	42	42	42	42	38	42
25	47	49	49	49	48	44	42	43	40	44	42	40
26	46	49	49	48	47	46	40	44	40	44	39	41
27	47	49	48	51	47	44	41	46	39	43	40	40
28	47	49	49	54	46	44	38	46	39	46	43	40
29	48	49	48	51	46	42	38	44	39	45	42	39
30	47	49	48	51	.....	42	38	42	42	44	43	39
31	48	.....	50	50	.....	44	.....	42	.....	43	43	.....

Monthly discharge of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	48	40	46.5	2,860
November	54	47	49.2	2,930
December	50	48	49.4	3,040
January	57	48	49.6	3,050
February	53	46	48.4	2,780
March	48	42	45.5	2,800
April	46	38	41.7	2,480
May	46	38	40.8	2,510
June	43	36	39.2	2,330
July	46	34	40.7	2,500
August	44	37	41.2	2,530
September	45	39	42.1	2,510
The year	57	34	44.4	32,300

MUDDY RIVER AT WEISER RANCH, NEAR MOAPA, NEV.

LOCATION.—In the NE. ¼ sec. 2, T. 15 S., R. 66 E., 250 feet below intake of Weiser canal, a quarter of a mile above mouth of Meadow Valley Wash, 1 mile above Weiser ranch house, and 3 miles southeast of Moapa, Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 17, 1915, to September 30, 1916.

GAGE.—Stevens water-stage recorder on left bank. Datum lowered 1 foot February 17; published gage heights refer to present datum.

DISCHARGE MEASUREMENTS.—Made by wading about 150 feet above gage.

CHANNEL AND CONTROL.—Bed composed of clay; clean but subject to scouring and filling; one channel at all stages. Control at remains of an old dam; loose rock and firm clay but shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 3.12 feet at 7 a. m. August 4 (discharge 69 second-feet); minimum discharge 21 second-feet at 1 p. m. July 13.

ICE.—Stage-discharge relation not affected by ice; flow very uniform except for sudden freshets, usually of short duration, due to storms.

DIVERSIONS.—The Weiser canal diverts about 250 feet above gage and there are numerous diversions farther upstream.

ACCURACY.—Stage-discharge relation not permanent; channel much cut at times. Rating curve fairly well defined between 25 and 50 second-feet. Water-stage recorder out of commission January 12 to February 16. Daily discharge ascertained by applying gage height to rating table; shifting-control method used December 4 to January 11 and August 4 to September 30.

Discharge measurements of Muddy River at Weiser ranch, near Moapa, Nev., during the year ending Sept. 30, 1916.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 3	1.72	50.0	Mar. 16	1.62	46.3	June 27	1.20	29.0
Jan. 3	1.48	49.7	Apr. 6	1.50	41.4	July 13	1.11	25.0

Daily discharge, in second-feet, of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	51	50	.....	47	41	36	39	33	36	36
2	.....	51	51	.....	46	39	35	35	35	36	37
3	.....	50	50	.....	47	41	35	35	34	36	35
4	.....	51	49	.....	47	41	34	35	32	49	36
5	.....	51	49	.....	48	42	34	36	31	53	36
6	.....	51	47	.....	48	41	34	35	31	44	36
7	.....	52	48	.....	46	40	35	35	31	41	35
8	.....	52	48	.....	46	41	37	35	31	41	38
9	.....	52	46	.....	46	40	37	33	31	37	36
10	.....	51	48	.....	47	40	37	32	33	37	36
11	.....	51	47	.....	46	38	35	30	31	42	34
12	.....	51	.....	.....	46	40	35	29	31	40	35
13	.....	50	.....	.....	48	39	36	31	28	42	36
14	.....	50	.....	.....	48	40	36	31	28	38	36
15	.....	49	.....	.....	46	39	38	31	30	38	36
16	.....	48	.....	.....	46	38	38	31	30	38	34
17	51	50	.....	50	45	38	38	30	31	38	35
18	51	50	.....	50	44	38	35	30	31	38	36
19	50	49	.....	50	45	41	35	36	31	34	38
20	50	49	.....	49	45	39	37	37	31	31	37
21	50	49	.....	50	43	39	38	36	31	32	36
22	50	50	.....	52	44	39	37	34	33	36	37
23	50	50	.....	53	42	42	37	35	34	37	38
24	51	49	.....	52	42	39	39	34	33	37	38
25	51	50	.....	50	42	38	41	34	35	38	41
26	50	50	.....	49	44	37	41	33	35	38	39
27	50	49	.....	49	43	37	43	31	36	38	35
28	50	47	.....	49	42	36	42	29	44	39	34
29	50	47	.....	47	41	36	40	30	47	39	34
30	51	47	.....	.....	41	34	39	32	42	38	33
31	.....	48	50	.....	40	.....	40	.....	37	37	.....

NOTE.—Discharge estimated by comparison with records of flow for station at the pumping plant as follows: Jan. 12–30 and Feb. 1–16, 49 second-feet.

Monthly discharge of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 17–30	51	50	50.4	1,400
December	52	47	49.8	3,060
January	.....	.....	48.8	3,000
February	.....	.....	49.6	2,850
March	48	40	44.9	2,760
April	42	34	39.1	2,330
May	43	34	37.2	2,290
June	39	29	33.1	1,970
July	47	28	33.3	2,050
August	53	31	38.6	2,370
September	41	33	36.1	2,150
The period	.....	.....	.....	26,200

MUDDY RIVER NEAR ST. THOMAS, NEV.

LOCATION.—In sec. 13, T. 17 S., R. 68 E., about a quarter of a mile above the confluence of Muddy River with the Virgin, and 1½ miles below St. Thomas, Clark County.

DRAINAGE AREA.—3,980 square miles.

RECORDS AVAILABLE.—May 23, 1913, to September 30, 1916.

GAGE.—Vertical staff on right bank about a quarter of a mile above the mouth of the stream; read by J. H. Foxley. Installed March 15, 1914, to replace the gage washed out on February 22, 1914. The gage used May 23, 1913, to February 22, 1914, was a vertical staff half a mile upstream from the present site.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed of clay and mud; shifting; channel materially changed by floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.7 feet at 5 p. m. January 20 (discharge estimated very roughly at 1,700 second-feet); minimum discharge practically zero in September.

1913–1916: Maximum discharge occurred about 6 a. m. February 22, 1914, estimated later by Leonard Tanner, Water Commissioner, using Kutter's formula, to have been about 6,500 second-feet; water standing in pools June 1 and 2, and August 11, 12, 19, 21, and 30, 1913.

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

DIVERSIONS.—Station is below all diversions. At times a small amount of seepage water from the St. Thomas district is returned to the river below the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curves poorly defined. Gage read to hundredths once daily. Discharge determined by shifting-control method. Records poor.

Discharge measurements of Muddy River near St. Thomas, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 16	Leonard Tanner	5.55	34.9
Apr. 5	L. W. Jordan	4.20	1.39
Sept. 3	Leonard Tanner	4.96	5.03

Monthly discharge of Muddy River near St. Thomas, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 16-31	35	32	34.1	1,080
January	350	27	77.2	4,750
February	94	3.1	61.6	3,540
March	256	4.1	20.5	1,260
April	7.3	.9	2.44	145
May	7.9	.5	2.74	168
June	2.2	.6	.933	55.5
July	74	.5	9.58	589
August	80	.2	12.7	781
September	10	.1	2.48	148
The period				12,500

GILA RIVER BASIN.

GILA RIVER AT GUTHRIE, ARIZ.

LOCATION.—In sec. 3, T. 6 S., R. 30 E., about 1,500 feet above Arizona & New Mexico Railroad bridge at Guthrie, Greenlee County, and about 8 miles above junction of Gila and San Francisco rivers.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 6, 1910, to September 30, 1916.

GAGE.—Stevens water-stage recorder on left bank about 1,500 feet above railroad bridge, installed May 16, 1914, at datum different from that of inclined staff gage on right bank about 500 feet above railroad bridge, which was used prior to that date.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet below gage, or by wading.

CHANNEL AND CONTROL.—Sand and gravel; shifting at high stages. Semipermanent control at low stages.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 10.2 feet at 9 p. m. January 18 (discharge determined from extension of rating curve 7,600 second-feet); minimum discharge 36 [1] second-feet June 28 to July 7.

1910–1916: Maximum stage from water-stage recorder 11.4 feet at 7 p. m. December 20, 1914 (discharge determined from extension of rating curve 16,500 second-feet); minimum discharge 18 second-feet May 21, 1914.

DIVERSIONS.—Sufficient water to irrigate about 7,000 acres of land is diverted from stream above station.

ACCURACY.—Stage-discharge relation not permanent because of shifting control. Nineteen discharge measurements made during the year, together with several made before October 1, 1915, and after September 30, 1916, were used to construct rating curves applicable as follows: October 1 to November 6, fairly well defined; November 7–14, poorly defined; December 11 to February 2, fairly well defined below 2,300 second-feet; February 2 to March 24, fairly well defined; March 25 to April 7, fairly well defined; April 8 to July 10 and July 19 to August 11, well defined; August 12 to September 30, fairly well defined between 500 and 900 second-feet. Operation of the water-stage recorder was satisfactory throughout the year except for short periods as indicated in the footnote to the daily-discharge table. Daily discharge ascertained by applying to the rating table daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage heights except for period of shifting control, when the shifting-control method was used. Records obtained by use of rating tables, fair; others roughly approximate.

Discharge measurements of Gila River at Guthrie, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	J. B. Spiegel	1.95	74	Apr. 8	J. B. Spiegel	3.54	508
19	do	1.95	78	8	do	3.54	528
Nov. 15	do	2.10	111	June 11	do	1.80	54
15	do	2.10	121	11	do	1.80	61
Dec. 10	do	2.15	113	July 13	do	1.82	82
10	do	2.15	110	13	do	1.82	76
Feb. 3	do	4.47	1,200	19	Ellsworth and Spiegel	2.98	313
3	do	4.44	1,190	19	do	2.90	274
Mar. 7	do	4.28	1,120	Sept. 7	J. B. Spiegel	3.74	523
9	do	4.28	1,080	7	do	3.75	546

[1] No gage record July 8–12. Discharge may have been slightly less for a day or two during that period.

Daily discharge, in second-feet, of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	110	73	118		1,500	1,240	987	399	98	36	146	830
2	105	72	118			1,240	888	544	93	36	157	715
3	102	72	117	100	1,200	1,170	798	590	89	36	250	563
4	98	72	117		1,070	1,170	742	567	85	36	222	475
5	95	75	118		973	1,200	665	487	79	36	236	392
6	93	77	118	105	884	1,170	642	438	74	36	214	355
7	91	157	118		856	1,170	573	423	71	36	184	540
8	91	130	118		828	1,170	522	408	67		177	950
9	85	140	114		884	1,070	487	392	64		170	1,150
10	83	144	113		1,000	1,040	479	377	60	100	172	830
11	77	142	113		1,100	1,040	458	362	57		344	563
12	77	136	113	120	1,100	1,140	434	337	52		1,180	455
13	77	134	113		1,200	1,170	418	327	50	78	518	412
14	77	126	113		1,280	1,140	410	304	47	77	563	366
15	77	120	112		1,240	1,140	403	298	46	74	374	341
16	77	126	112		1,170	1,070	399	285	46	76	366	297
17	79	126	113		1,100	1,000	388	279	46	100	359	272
18	81	126	115	3,650	1,040	912	351	256	44		352	284
19	77	125	115	5,380	1,000	884	327	236	44	355	343	281
20	77	120	113	6,310	973	856	310	222	44	236	337	260
21	81	120	113	4,120	912	828	301	214	43	201	330	237
22	83	113	110	2,550	912	828	310	204	44	172	327	215
23	87	115	108	1,790	1,000	856	320	191	44	159	323	199
24	83	114	107	1,540	1,040	1,070	320	172	44	150	496	187
25	81	113	105	1,460	973	1,350	317	148	42	121	496	182
26	81	110		1,620	942	1,270	327	134	40	104	416	176
27	79	113		1,200	912	1,310	317	125	39	96	715	160
28	75	117	100	1,560	973	1,270	317	117	36	99	610	152
29	75	119		2,870	1,170	1,240	327	112	36	90	586	138
30	75	119		3,770	.....	1,160	334	107	36	168	1,260	128
31	75	.....		2,250	.....	1,060	.....	102	.....	196	1,080	.....

NOTE.—Gage height not recorded Dec. 26 to Jan. 5, Jan. 7–17, Feb. 1, 2, discharge estimated; May 7–10, discharge interpolated. Discharge July 8–12, 17, 18, estimated by comparison with records of flow at other stations. Gage heights used to determine discharge Aug. 15–23 corrected because of silt in well; possibly somewhat in error.

Monthly discharge of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	110	75	84.0	5,160
November	157	72	115	6,840
December	118	.....	111	6,820
January	6,310	.....	1,350	83,000
February	.....	828	1,060	61,000
March	1,350	828	1,100	67,600
April	987	301	462	27,500
May	590	102	295	18,100
June	98	36	55.3	3,290
July	355	.....	110	6,760
August	1,260	146	429	26,400
September	1,150	128	404	24,000
The year	6,310	.....	464	336,000

NOTE.—See footnote to daily-discharge table.

GILA RIVER NEAR SOLOMONVILLE, ARIZ.

LOCATION.—In sec. 31, T. 6 S., R. 28 E., about a mile below intake of Brown canal and about 10 miles above Solomonville, Graham County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 21, 1914, to September 30, 1916.

GAGE.—Stevens water-stage recorder on left bank, directly opposite J. W. Earven's ranch. Gurley water-stage recorder at same site and datum used from February 29 to August 4, 1916.

DISCHARGE MEASUREMENTS.—Made from table just below gage or by wading near gage.

CHANNEL AND CONTROL.—Sand and fine silt. Control at low stages formed by rapids below the gage; shifts somewhat at all stages.

EXTREMES OF DISCHARGE.—Maximum stage during the year, from flood marks on gage well, 14 feet about 5 p. m. January 19 (discharge, determined from extension of rating curve, 100,000 second); minimum stage, zero on gage June 21–28 (discharge 110 second-feet).

1914–1916: Maximum stage and discharge January 19, 1916; minimum stage, from water-stage recorder, 0.56 foot on June 29, 1914 (discharge 64 second-feet).

DIVERSIONS.—Brown canal, which heads about a mile above station, is used to irrigate a few hundred acres on the north side of the river. About 7,000 acres are irrigated from this stream above the station at Guthrie.

ACCURACY.—Stage-discharge relation not permanent; numerous discharge measurements are necessary to define rating curves. Twenty-seven measurements were made during the year. These measurements, together with several made before October 1, 1915, and after September 30, 1916, were used to construct rating curves applicable as follows: October 1 to January 16, fairly well defined below 500 second-feet; January 17 to February 1 and May 18 to August 11, fairly well defined below 10,000 second-feet (extension of rating curve above 10,000 second-feet based largely on area-slope method and is roughly approximate); during the remainder of year the discharge was ascertained either from poorly defined rating curves or by indirect method for shifting control. The operation of the water-stage recorder was satisfactory throughout the year except for periods as indicated in the footnote to the daily-discharge table. Daily discharge for periods during which rating tables were applicable was ascertained by applying to the rating table daily gage heights determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage heights. Records fair October 1 to February 1 and May 18 to August 11 for discharge below 10,000 second-feet, except for days of missing gage heights as indicated in footnote to daily-discharge table; other records poor.

Discharge measurements of Gila River near Solomonville, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	J. B. Spiegel	0.70	170	Mar. 31	J. B. Spiegel	1.77	2,760
12	do	.70	173	Apr. 14	do	.95	1,290
Nov. 22	do	.84	199	May 3	do	.97	1,400
22	do	.84	208	3	do	.95	1,300
Dec. 12	Jacob and Spiegel	.83	211	18	do	.58	460
Jan. 21	J. B. Spiegel	4.00	a 17,400	18	do	.58	455
22	do	3.15	9,170	July 11	do	.35	287
24	do	2.28	5,840	21	Ellsworth and Spiegel	.50	399
Feb. 7	do	1.50	1,860	21	do	.50	401
7	do	1.50	1,940	Aug. 5	J. B. Spiegel	.42	323
Mar. 7	do	1.90	2,700	5	do	.42	344
7	do	1.90	2,690	Sept. 11	do	1.06	1,460
15	do	1.95	2,980	11	do	1.02	1,430
15	do	1.93	2,940				

a Surface velocity observed for about one-half the discharge and coefficient of 0.90 used to reduce to mean velocity. Depths uncertain because of high velocities.

Daily discharge, in second-feet, of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	257	170	209	291	6,580	.....	2,320	1,130	266	129	570	1,900
2	243	170	209	280	4,300	.....	1,900	1,490	260	136	511	1,440
3	227	165	209	257	3,600	.....	1,840	1,400	255	142	452	1,080
4	212	165	212	234	2,940	.....	1,570	1,230	249	149	393	804
5	202	176	230	230	2,420	.....	1,470	1,110	244	155	334	866
6	190	190	234	230	2,260	.....	1,300	940	238	155	376	866
7	181	262	230	252	1,960	2,780	1,280	910	232	155	308	1,060
8	176	257	227	280	2,320	2,620	1,130	883	232	165	296	1,360
9	176	248	223	297	3,000	2,460	1,180	856	227	180	244	2,460
10	176	234	220	319	3,480	2,460	1,160	760	222	260	205	2,740
11	173	227	216	700	3,600	2,940	1,140	760	216	290	432	1,620
12	170	223	209	532	4,100	3,260	1,140	690	214	290	2,230	1,060
13	165	223	212	405	4,700	3,260	1,260	650	212	355	2,060	916
14	165	216	216	370	4,600	3,260	1,300	610	210	308	2,000	775
15	168	216	223	336	4,250	2,940	1,230	517	195	260	1,740	674
16	160	216	234	1,120	3,700	2,620	1,190	496	180	249	1,770	660
17	158	216	248	22,100	3,320	2,160	1,190	486	165	232	1,740	610
18	165	216	243	40,800	3,320	1,800	1,180	458	150	320	1,670	560
19	181	216	234	73,600	3,270	1,580	1,180	441	137	416	1,620	600
20	181	212	230	46,800	3,000	1,460	1,170	424	124	407	1,550	550
21	181	212	227	16,400	2,880	1,460	1,170	407	110	390	1,530	470
22	181	212	227	9,300	3,500	1,580	1,160	398	110	376	1,530	440
23	184	212	223	5,650	3,650	2,940	1,160	390	110	348	1,550	430
24	184	212	216	4,640	3,270	4,750	1,150	376	110	341	1,510	360
25	184	220	216	5,030	2,840	4,900	1,150	320	110	341	1,400	320
26	184	220	223	11,700	2,560	4,600	1,040	320	110	334	1,300	306
27	178	220	234	11,400	2,940	4,250	1,040	308	110	334	2,000	292
28	170	216	223	12,300	3,600	4,250	1,100	296	110	334	1,760	278
29	173	212	223	22,100	3,760	3,760	1,040	290	116	334	1,530	264
30	170	212	243	16,100	.....	3,270	1,130	278	123	496	3,720	250
31	170	.....	248	9,600	.....	2,780	.....	266	.....	739	2,370	.....

NOTE.—Mean daily gage heights Jan. 18–20 estimated from high-water marks observed by persons residing in the locality and from comparison with records obtained at other stations; gage heights Jan. 28 to Feb. 6 from daily reading of staff gage. Gage heights not recorded Mar. 1–6; discharge estimated, from study of records obtained at other stations on the Gila, at 3,000 second-feet. Gage heights either missing or unreliable, discharge interpolated, for the following days: Mar. 29, Apr. 8, 17–24, May 8, 9, June 2, 3, 12, 13, 29, 30, July 1–4, Aug. 2–4, 28, Sept. 26–30.

Monthly discharge of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	257	158	183	11,300
November	262	165	212	12,600
December	248	209	225	13,800
January	73,600	230	10,100	621,000
February	6,580	1,960	3,440	198,000
March	4,900	1,460	2,970	183,000
April	2,320	1,040	1,280	76,200
May	1,490	266	642	39,500
June	266	110	178	10,600
July	739	129	294	18,100
August	3,720	205	1,310	80,600
September	2,740	250	867	51,600
The year	73,600	110	1,810	1,320,000

NOTE.—See footnote to daily-discharge table.

GILA RIVER NEAR SAN CARLOS, ARIZ.

LOCATION.—One mile above dam site in box canyon on San Carlos Indian Reservation, and about 6 miles below San Carlos Indian Agency, Gila County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 29, 1914, to September 30, 1916, at present site; 1899 to 1905 at a point half a mile south of the Indian Agency at San Carlos and below San Carlos Creek; August 17, 1910, to February 5, 1911, at a point just below the Arizona Eastern Railroad bridge and half a mile above San Carlos Creek.

GAGE.—Stevens water-stage recorder bolted to ledge on left bank. Gage was overtopped by flood of January 20, 1916, and put in operation again March 4, 1916.

DISCHARGE MEASUREMENTS.—Made from cable about half a mile above gage or by wading near gage. Cable destroyed by flood of January 20, 1916, and not replaced during the year.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and boulders. A semipermanent control is formed by rapids over heavy boulders just below gage. Control shifts somewhat because of sand filling in and washing out from crevices between the boulders.

EXTREMES OF DISCHARGE.—Maximum stage during year from highwater marks 25.5 feet, January 20, 1916 (discharge from extension of rating curve 92,000 second-feet); minimum stage, from water-stage recorder, 0.45 feet July 7 and 8 (discharge, 12 second-feet).

1914–1916: Maximum stage and discharge January 20, 1916; minimum stage, 0.15 foot July 1, 1914 (discharge, 1 second-foot).

DIVERSIONS.—Water to irrigate about 30,000 acres is diverted from river in the valley just above station. At times this diversion reduces flow at station practically to zero.

ACCURACY.—Stage-discharge relation not permanent. Twenty-one measurements made during the year, together with a few made before October 1, 1915, and after September 30, 1916, were used to construct a rating curve fairly well defined below 15,000 second-feet, applicable November 20 to May 25 and August 1–24; other rating curves poorly defined. Daily discharge ascertained by shifting-control method or by applying to rating table daily gage height obtained from recorder graph or, during period January 16 to March 3, from one reading on staff gage to tenths on each of the following days: January 31, February 2, 4, 6, 8, 13, 21, and 24. Records fair except those for days on which discharge exceeded 15,000 second-feet or those obtained by shifting-control method or poorly defined rating curves. Interpolated determinations (see note to daily-discharge table) probably nearly as accurate as those based on gage readings, as study of weather records and records of flow obtained at other stations indicates that changes in flow were fairly uniform.

Discharge measurements of Gila River near San Carlos, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	J. B. Spiegel	1.15	62	July 22	Ellsworth and Spiegel	1.64	169
16	do	1.15	65	22	do	1.64	175
Nov. 19	do	.92	63	Aug. 2	J. B. Spiegel	2.08	321
19	do	.92	66	2	do	2.08	319
Dec. 13	Jacob and Spiegel	1.49	153	22	do	2.23	361
13	do	1.49	156	22	do	2.23	351
May 8	J. B. Spiegel	2.65	526	Sept. 13	do	3.89	1,060
8	do	2.65	504	13	do	3.87	958
25	do	1.50	163	28	do	1.60	133
25	do	1.50	160	28	do	1.60	139
July 7	do	.45	11.5				

Daily discharge, in second-feet, of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	164	26	130	417	9,010	.....	2,410	656	121	16	359	1,480
2	142	27	130	424	5,420	.....	2,270	770	118	15	313	1,120
3	120	27	130	436	4,420	.....	2,140	968	109	14	267	913
4	114	27	.....	406	3,430	3,140	2,000	916	101	14	255	747
5	108	28	.....	406	2,990	2,830	1,860	794	87	13	272	656
6	102	32	.....	387	2,550	2,660	1,720	700	83	12	287	656
7	96	75	.....	463	2,340	2,600	1,580	598	80	12	212	747
8	90	82	.....	424	2,140	2,600	1,450	525	80	12	195	1,060
9	84	82	.....	413	2,400	2,500	1,310	521	77	14	175	1,410
10	78	82	.....	891	2,660	2,330	1,170	475	74	190	144	2,670
11	72	82	.....	1,050	2,910	2,330	1,050	444	72	87	156	1,950
12	65	75	.....	866	3,170	2,440	995	432	70	127	475	1,410
13	65	69	146	916	3,430	2,600	916	506	68	110	1,770	1,040
14	65	69	156	770	3,360	2,660	942	387	66	93	1,730	794
15	66	69	181	723	3,300	2,440	942	376	50	93	1,730	679
16	66	65	186	.....	3,230	2,330	916	356	50	82	1,450	565
17	61	65	204	.....	3,160	2,180	794	349	48	67	1,110	.....
18	57	65	230	.....	3,090	2,050	723	319	43	59	842	.....
19	53	65	250	.....	3,020	1,970	700	293	40	50	731	.....
20	49	69	270	.....	2,960	.....	664	270	35	67	620	.....
21	45	82	278	.....	2,890	.....	624	247	34	97	509	.....
22	41	85	281	.....	2,970	.....	589	222	31	173	398	.....
23	37	85	281	.....	3,060	.....	568	202	30	163	376	.....
24	33	85	258	.....	3,140	.....	589	181	31	150	380	.....
25	29	83	258	.....	.....	5,210	589	160	23	150	656	.....
26	29	82	225	.....	.....	4,600	580	154	23	165	2,430	.....
27	29	82	250	.....	.....	4,070	589	148	20	144	1,270	.....
28	28	112	264	.....	.....	3,720	568	142	20	133	1,440	139
29	27	134	287	.....	.....	3,430	533	136	19	142	1,150	133
30	27	134	319	.....	.....	2,890	538	132	17	135	1,010	128
31	26	.....	387	12,600	.....	2,550	.....	127	.....	118	1,730	.....

NOTE.—Gage heights missing or unreliable, discharge interpolated for the following days: Oct. 1, 2, 4–11, 13–15, 17–24; Feb. 1, 3, 5, 7, 9–12, 14–20, 22, and 23; April 1–9 and Aug. 19–21. Discharge estimated from study of records of flow at other stations and weather records, as follows: Dec. 4–12, 200 second-feet; Jan. 16–30, 25,000 second-feet; Feb. 25–29, 2,900 second-feet; Mar. 1–3, 3,700 second-feet; Mar. 20–24, 2,500 second-feet; Sept. 17–27, 300 second-feet. See "Accuracy" in station description.

Monthly discharge of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	164	26	66.7	4,100
November	134	26	71.5	4,250
December	387	130	222	13,600
January	.....	387	12,800	787,000
February	.....	.....	3,290	189,000
March	.....	.....	2,890	178,000
April	2,410	533	1,080	64,300
May	968	127	403	24,800
June	121	17	57.3	3,410
July	190	12	87.6	5,390
August	1,770	144	788	48,500
September	2,670	128	720	42,800
The year	.....	12	1,890	1,370,000

NOTE.—See footnote to daily-discharge table.

GILA RIVER AT KELVIN, ARIZ.

LOCATION.—In sec. 12, T. 4 S., R. 13 E., about half a mile below the mouth of Mineral Creek, 1 mile below Kelvin,[1] Pinal County, and 25 miles above Florence, Ariz.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 26, 1911 to September 30, 1916.

[1] Ray Junction on Arizona Eastern Railroad.

GAGE.—Stevens water-stage recorder installed June 15, 1914, on left bank about half a mile above the original gage and referred to new datum. The original gage, an inclined staff fastened to basalt ledge on right bank opposite observer's house, was destroyed by the flood of March 8, 1911, and replaced by painting the graduations on the ledge a few feet downstream. November 23, 1911, an inclined staff for low water was fastened to the rock at the same location as first gage and on September 20, 1912, an auxiliary vertical staff for low water was installed on left bank opposite the inclined section. All gages previous to that now used referred to same datum.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge about 1½ miles above gage, or by wading near gage.

CHANNEL AND CONTROL.—Shifting sand. Semi-permanent control at new site.

EXTREMES OF DISCHARGE.—Maximum stage during year, from flood marks on gage well 19.5 feet about noon January 20 (discharge, determined from extension of rating curve, 93,000 second-feet); minimum stage, from water-stage recorder, 1.76 feet, July 7 (discharge 29 second-feet).

1911–1916: Maximum discharge January 20, 1916; no flow June 29 to July 11, 1913.

DIVERSIONS.—About 30,000 acres are irrigated from Gila River between this station and Guthrie and about 7,000 acres above Guthrie.

ACCURACY.—Stage-discharge relation not permanent. From the 42 discharge measurements made during the year, together with several measurements made before October 1, 1915, and after September 30, 1916, rating curves have been constructed applicable as follows: October 1 to January 15, well defined; January 16 to April 20, fairly well defined below 30,000 second-feet; May 1–14 and August 5 to September 7, well defined; September 12–30, fairly well defined. Operation of water-stage recorder satisfactory throughout year except for short periods indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph, or for days of considerable fluctuation, by averaging hourly gage heights, except for periods for which shifting control method was used. Records obtained by use of rating tables good except those for high water of January, which are roughly approximate; other records fair.

Discharge measurements of Gila River at Kelvin, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	Jacob and Horton	2.02	185	Mar. 27	M. D. Anderson	4.30	3,450
12	Jacob, Jackson and Hall	1.83	97	27	do	4.30	3,410
29	J. B. Spiegel	1.80	68	Apr. 20[a]	J. B. Spiegel	2.90	877
29	do	1.80	72	20[a]	do	2.88	826
Nov. 27	do	1.89	119	May 1	M. D. Anderson	2.78	599
27	do	1.89	116	14	W. Adams	2.63	425
Jan. 12	do	2.60	810	14	do	2.65	446
12	do	2.65	932	14	M. D. Anderson	2.63	442
25	Anderson and Adams	5.87	7,500	14	do	2.65	400
Feb. 1	M. D. Anderson	6.05	7,220	June 27	do	1.86	58
2	do	5.42	5,460	27	do	1.86	57
2	do	5.35	5,390	July 14	Ellsworth and Anderson	2.31	220
3	do	4.85	4,100	Aug. 4	do	2.48	268
3	do	4.82	4,020	5	do	2.50	307
3	do	4.72	3,770	Sept. 7	C. E. Ellsworth	3.00	973
4	do	4.47	3,290	7	do	3.01	820
4	do	4.45	3,250	8	do	2.83	632
5	do	4.17	2,900	8[b]	do	3.25	1,180
5	do	4.15	2,830	8[c]	do	[d]6.00	[e]7,960
24	do	4.08	2,860	9[f]	do	4.05	3,210
24	do	4.07	2,770	25[f]	M. D. Anderson	2.15	261

NOTE.—Measurements Jan. 25 to Mar. 27 made from railroad bridge 2 miles below gage.

[a] Measured above Mineral Creek; discharge of Mineral Creek, 25.2 second-feet, measured and added.
[b] Measured above Mineral Creek; discharge of Mineral Creek, 25 second-feet, estimated and added.
[c] Measured above Mineral Creek; discharge of Mineral Creek, 100 second-feet, estimated and added.
[d] Mean gage height doubtful because of rapidly changing stage.
[e] Surface velocity observed; coefficient of 0.90 used to reduce to mean velocity.
[f] Measured above Mineral Creek; discharge of Mineral Creek, 40 second-feet, estimated and added.

Daily discharge, in second-feet, of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	381	74	206	980	8,200	3,760	1,960	605	180	47	442	1,340
2	318	74	178	830	5,820	5,120	1,870	725	170	39	463	1,150
3	283	74	185	637	4,480	3,540	1,650	876	165	34	463	850
4	258	74	214	761	3,540	2,920	1,530	915	160	34	344	689
5	221	74	292	699	2,920	2,460	1,400	915	155	34	297	653
6	178	127	352	637	2,620	2,320	1,370	788	150	32	725	641
7	178	172	372	562	2,320	2,320	1,300	689	145	29	390	750
8	178	172	326	562	2,230	2,320	1,300	629	140	34	344	2,310
9	165	178	309	506	2,230	2,320	1,220	550	135	53	289	3,020
10	153	191	300	1,060	2,520	2,320	1,120	550	130	182	258	3,230
11	122	172	309	1,290	2,720	2,140	1,150	494	125	318	265	1,840
12	90	159	401	830	2,720	2,230	1,220	494	120	228	484	1,580
13	90	146	401	761	2,920	2,320	1,120	442	115	360	1,660	1,100
14	95	127	401	692	3,230	2,420	1,110	411	110	259	1,750	890
15	106	111	421	1,210	3,320	2,420	1,150	390	105	200	1,660	778
16	111	111	411	4,000	3,120	2,230	1,120	390	100	207	1,940	688
17	106	122	411	17,300	2,720	2,140	1,020	362	95	194	1,120	662
18	95	122	401	25,800	2,620	2,050	950	362	90	169	928	650
19	90	127	440	42,200	2,520	1,820	854	334	85	244	629	579
20	90	127	401	76,200	2,420	1,780	878	316	80	259	572	510
21	85	146	381	.....	2,520	1,780	860	316	75	510	442	456
22	74	159	381	.....	2,420	1,960	850	297	70	345	344	402
23	71	172	381	.....	2,520	2,720	850	258	70	375	297	354
24	71	159	372	.....	2,820	4,440	820	250	65	325	463	307
25	67	133	352	7,030	2,720	4,230	835	245	65	273	850	264
26	68	133	352	8,200	2,520	3,880	770	240	60	421	1,750	255
27	65	127	372	13,100	2,320	3,220	795	230	59	390	1,410	229
28	74	127	381	18,100	2,420	2,920	780	220	59	494	1,260	213
29	74	206	391	23,900	2,920	2,820	760	210	56	442	1,120	178
30	74	236	401	16,800	.....	2,520	635	190	53	381	915	157
31	74	.....	472	12,300	.....	2,140	.....	180	.....	316	1,490	.....

NOTE.—Gage not working properly Dec. 23–30, discharge estimated by comparison with discharge of other stations; Jan. 5 and 13 discharge interpolated. Gage clock stopped Jan. 12 and started again in about 2 days. Jan. 20 crest of flood reached a maximum stage of about 19.5 feet and put the gage out of commission at a stage of 18.5 feet; gage heights Jan. 14–20 subject to slight error on account of uncertainty as to the exact time the gage clock was stopped. No gage-height record Jan 21–24; discharge for the period estimated at 24,000 second-feet, by comparison with record obtained near Solomonville. Gage heights, July 30 to Aug. 3 and Sept. 22–24 corrected on account of silt in well; may be slightly in error.

Monthly discharge of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	381	65	132	8,120
November	236	74	138	8,210
December	472	178	354	21,800
January	76,200	506	12,000	738,000
February	8,200	2,230	3,050	175,000
March	5,120	1,780	2,700	166,000
April	1,960	635	1,110	66,000
May	915	180	448	27,500
June	180	53	106	6,310
July	510	29	233	14,300
August	1,940	258	818	50,300
September	3,230	157	891	53,000
The year	76,200	29	1,840	1,330,000

NOTE.—See footnote to daily discharge table.

GILA RIVER NEAR SENTINEL, ARIZ.

LOCATION.—In sec. 10, T. 5 S., R. 9 W., 1 mile below old diversion dam of the Southwestern Arizona Fruit & Irrigation Co., about 10 miles north of Sentinel, Maricopa County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 1, 1913, to September 30, 1916.

GAGE.—Vertical staff on left bank; read by J. T. Lee.

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

CHANNEL AND CONTROL.—Shifting sand.

EXTREMES OF DISCHARGE.—River dry part of each year at this point. The maximum stage on record occurred at 5 p. m. January 20, 1916, gage height 24.75 feet (discharge not determined).

ACCURACY.—Stage-discharge relation not permanent because of constantly shifting control. Rating curve not developed. Gage read twice daily to hundredths from December 6 to January 19, and to half-tenths twice daily from March 5 to September 30. Daily discharge not determined.

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

Daily gage height, in feet, of Gila River near Sentinel, Ariz., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	11.90	12.3	10.7	9.7	8.0	5.8	4.65	5.95	6.75
2	.....	10.15	11.3	10.5	9.7	7.9	5.8	4.6	5.95	6.8
3	.....	9.80	10.85	.....	9.6	7.7	5.7	4.6	6.0	6.65
4	.....	9.65	.....	.....	9.35	7.8	5.6	4.55	6.35	6.95
5	.....	9.50	.....	9.1	9.1	7.7	5.6	4.55	6.2	6.85
6	7.00	9.45	.....	8.8	8.9	7.6	5.55	4.5	6.0	6.8
7	7.08	9.50	.....	9.3	8.75	7.5	5.5	4.5	5.85	6.65
8	7.19	9.50	.....	9.75	8.6	7.5	5.5	4.45	5.65	8.15
9	7.26	9.45	.....	9.4	8.6	7.45	5.45	4.4	5.45	8.5
10	7.40	9.45	.....	9.25	8.85	7.3	5.4	.....	5.25	11.1
11	7.45	9.45	.....	9.4	8.55	7.15	5.3	.....	5.05	9.5
12	7.43	9.55	.....	9.5	8.4	7.05	5.25	4.6	5.5	8.55
13	7.41	9.85	.....	9.6	8.3	6.9	5.25	4.65	5.15	8.35
14	7.40	9.80	.....	9.6	8.3	6.9	5.2	4.55	4.95	8.15
15	7.46	9.60	.....	9.65	8.5	6.8	5.2	4.5	4.9	8.05
16	7.53	9.75	.....	9.75	8.6	6.65	5.1	4.4	4.8	7.9
17	7.60	10.9	.....	9.6	8.8	6.6	5.05	.....	4.8	7.85
18	7.71	15.55	.....	9.5	8.75	6.65	5.0	.....	6.75	7.6
19	7.75	17.0	.....	9.3	8.45	6.5	5.0	.....	6.9	7.35
20	7.76	24.75	.....	9.25	8.3	6.4	4.9	.....	6.8	7.2
21	7.78	22.3	.....	9.1	8.3	6.3	4.8	.....	6.7	7.1
22	7.80	.....	.....	9.0	8.1	6.4	4.75	.....	6.6	7.1
23	7.82	.....	11.2	10.7	8.1	6.25	4.9	.....	6.4	6.9
24	7.84	.....	10.95	11.4	8.15	6.1	5.0	.....	6.4	6.75
25	7.84	.....	.....	11.8	8.15	6.1	4.85	.....	6.35	6.6
26	7.84	.....	10.4	11.2	8.15	6.1	4.8	.....	6.3	6.5
27	7.84	.....	.....	11.1	7.95	6.05	4.75	.....	6.25	6.35
28	7.86	.....	.....	10.85	8.2	6.0	4.7	.....	6.25	6.3
29	7.90	21.05	10.3	10.5	8.05	5.95	4.7	.....	6.2	6.2
30	8.30	18.3	.....	10.35	7.95	5.9	4.7	.....	6.2	6.2
31	8.93	14.7	.....	9.95	.....	5.85	.....	5.7	6.9	.....

NOTE.—Gage and cable washed out by flood Jan. 20; gage replaced at about same datum Mar. 6; records from Jan. 20 to Mar. 5 obtained from temporary gages set by observer. Gage heights Mar. 20 and 29 maximum for the day. No readings on days for which gage heights are missing, except July 10, 11, and 17–30, when stream was dry.

SAN FRANCISCO RIVER AT CLIFTON, ARIZ.

LOCATION.—In sec. 30 T. 4 S., R. 30 E., between highway bridge and railroad bridge at Clifton, Greenlee County, 1½ miles below diversion dam of the Arizona Copper Co. and about 5 miles above junction with Gila River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 24, 1910, to January 14, 1911; January 24 to March 31, 1912; and August 5, 1912, to September 30, 1916.

GAGE.—Stevens water-stage recorder with inclined well on right bank about 1,000 feet below highway bridge, installed June 11, 1916, at datum different from that of gages previously used. Original gage, read from October 24, 1910, to September 30, 1912, was a vertical staff attached to highway bridge; replaced October 1, 1912, by a chain gage set at the same datum and read until August 5, 1913. From August 6, 1913, to May 14, 1914, a vertical staff on railroad bridge was used. On May 15, 1914, this was replaced by a Stevens water-gage recorder, which was set at the same datum and was used until January 19, 1916, when it was destroyed by flood. From January 20 to April 7, 1916, the staff gage on railroad bridge was read. From April 8 to June 10, 1916, the staff gage now used in connection with the present water-stage recorder was read. The gages on the railroad bridge were referred to a datum different from that of the gages on the highway bridge.

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

CHANNEL AND CONTROL.—Banks high and steep and not likely to be overflowed except at extreme floods. Bed composed of sand and gravel. Control at old station constantly shifting; at new station fairly permanent except during high water, when it shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year, from flood marks at gage, 16.8 feet, about 2 p. m. January 19 (discharge not determined); minimum stage, from water-stage recorder, 3.10 feet June 20 to July 8 (discharge 40 second-feet).

1910–1916: Maximum stage same as for 1916 (see above); minimum stage recorded, 2.6 feet, July 3, 6, and 7, 1913 (discharge 5.0 second-feet).

DIVERSIONS.—Small amount of water is used for irrigation above station.

ACCURACY.—Stage-discharge relation not permanent. Numerous discharge measurements necessary to define rating curves. By means of the 19 measurements made during the year, together with several measurements made before October1, 1915, and after September 30, 1916, rating curves have been constructed applicable as follows: November 14 to December 10, fairly well defined; March 9–22, fairly well defined; March 23 to April 7, poorly defined; April 8 to September 30, well defined between 70 and 400 second-feet and fairly well defined above 400 second-feet. Staff gage read to tenths twice daily. Mean daily gage height obtained by inspecting water-stage recorder graph, except during periods of rapidly-changing stage, when hourly gage heights were averaged. Daily discharge ascertained by applying daily gage height to rating tables except for short periods, as indicated in footnotes to daily-discharge table. Records good since installation of new gage, April 8, except for short periods when silt in well prevented gage from working properly. Records from old gage fair for periods covered by rating tables; other records poor.

Discharge measurements of San Francisco River at Clifton, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	J. B. Spiegel	5.50	101	Apr. 7	J. B. Spiegel	[a] 4.70	724
19	do	5.50	99	June 13	do	3.25	70
Nov. 13	do	5.60	103	13	do	3.25	76
13	do	5.60	112	July 14	do	3.61	141
Dec. 9	Jacob and Spiegel	5.55	96	14	do	3.61	159
Feb. 4	J. B. Spiegel	5.90	1,040	19	Ellsworth and Spiegel	3.62	143
4	do	5.90	1,010	19	do	3.62	140
Mar. 10	do	6.10	1,440	Sept. 6	J. B. Spiegel	4.08	359
10	do	6.10	1,430	6	do	4.06	349
Apr. 7	do	[a] 4.70	728				

[a] New gage; gage on railroad bridge read 5.80.

NOTE.—Stage of measurements Oct. 19 to Mar. 10 read on gage on railroad bridge.

Daily discharge, in second-feet, of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	100	55	65	.....	.....	1,400	635	112	40	179	355
2	100	55	65	.....	.....	1,180	595	100	40	179	355
3	100	55	65	.....	.....	1,090	525	88	40	179	355
4	100	65	65	1,030	.....	900	525	75	40	179	355
5	95	65	90	.....	.....	660	525	88	40	179	355
6	70	65	90	.....	.....	810	595	75	40	179	330
7	95	120	90	.....	.....	600	525	75	40	179	380
8	95	120	90	.....	.....	595	525	75	40	179	340
9	95	120	90	.....	1,350	595	492	75	48	179	546
10	120	90	90	.....	1,750	560	492	75	80	179	1,120
11	75	90	.....	.....	2,050	635	492	75	179	189	704
12	75	90	.....	.....	1,900	635	460	67	245	432	621
13	75	90	.....	.....	1,750	675	355	63	225	1,410	535
14	75	120	.....	.....	1,750	595	305	59	161	990	453
15	75	90	.....	.....	1,900	560	305	55	152	355	369
16	100	90	.....	.....	1,600	595	355	55	134	432	285
17	100	90	.....	.....	1,350	560	355	55	164	285	265
18	100	90	.....	.....	1,250	560	305	55	245	277	265
19	100	90	.....	.....	1,250	595	355	48	167	265	237
20	100	90	.....	.....	1,350	525	305	40	189	265	219
21	100	65	.....	.....	1,350	595	305	40	189	265	201
22	100	90	.....	.....	1,470	525	305	40	176	265	183
23	100	65	.....	.....	2,850	595	355	40	170	265	165
24	100	65	.....	.....	2,450	525	305	40	161	265	148
25	100	65	.....	.....	2,100	595	245	40	158	265	131
26	80	65	.....	.....	1,650	560	205	40	158	405	120
27	80	65	.....	.....	1,530	595	185	40	179	405	125
28	80	65	.....	.....	1,950	525	155	40	197	355	125
29	80	65	.....	.....	1,530	595	140	40	185	405	125
30	80	65	.....	.....	1,400	675	125	40	182	990	125
31	80	65	.....	.....	1,300	.....	125	.....	182	380	.....

NOTE.—Discharge Oct. 1 to Nov. 13 computed by shifting-control method. Gage not working July 6–8; discharge estimated; Aug. 14–18 and Aug. 20 to Sept. 1 gage heights corrected because of silt in well and may be slightly in error. Sept. 12–15 and 20–24, silt in well; discharge interpolated, believed to be fairly accurate.

Monthly discharge of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	120	70	91.1	5,600
November	120	55	80.5	4,790
December 1–10	90	65	80.0	1,590
March 9–31	2,850	1,250	1,690	77,100
April	1,400	525	670	39,900
May	635	125	370	22,800
June	112	40	60.3	3,590
July	245	40	137	8,420
August	1,410	179	353	21,700
September	1,120	120	330	19,600

NOTE.—See footnote to daily-discharge table.

SAN PEDRO RIVER NEAR FAIRBANK, ARIZ.

LOCATION.—Opposite Boguillas Land & Cattle Co.'s ranch house, 1½ miles south of Fairbank, Cochise County, and 3 miles below old Charleston mill.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 28, 1912, to September 30, 1916. January 27, 1904, to August 31, 1906, and October 18, 1910, to November 15, 1911, for station at Charleston. November 16, 1911, to September 28, 1912, for station at diversion dam of Boguillas Land & Cattle Co.

GAGE.—Vertical and inclined staff on right bank; read by J. M. Barnes. Original gage, which was a vertical staff on right bank about 800 feet below present site, was installed September 28, 1912, destroyed by flood August 17, 1914, and replaced at same datum August 24, 1914; the second gage was washed out December 23, 1914, and replaced by present gage at independent datum January 21, 1915.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from cable 600 feet below gage.

CHANNEL AND CONTROL.—Sand, gravel, and clay; likely to shift slightly at low stages and considerably at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet at 9 p. m., August 16 (discharge, determined from extension of rating curve, 4,200 second-feet); minimum discharge, 2 second-feet, on several days during October, November, April, June, July, and September.

1912–1916: Maximum stage recorded, 16 feet at 5 p. m., December 22, 1915 (discharge not determined); minimum discharge, 1.7 second-feet June 26 to July 8, 1913.

DIVERSIONS.—The Boguillas Land & Cattle Co. diverts water at various points above station for irrigation. Total area irrigated not known.

ACCURACY.—Stage-discharge relation not permanent. The 19 measurements made during the year, together with several high-water measurements made after September 30, 1916, were used to construct a standard rating curve fairly well defined for all stages and applicable January 21 to July 9 and August 9 to September 30. Gage read to half-tenths twice daily. Daily discharge ascertained by applying gage height to rating table or by shifting-control method. Records fair for periods covered by rating curve; other records roughly approximate.

Discharge measurements of San Pedro River near Fairbank, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. B. Spiegel	0.60	[a]3.0	Apr. 24	J. B. Spiegel	0.40	7.2
Nov. 12	do	.78	10.6	24	do	.40	7.3
12	do	.78	10.0	July 25	Ellsworth and Spiegel	.71	18.9
Dec. 8	Jacob and Spiegel	.81	20.4	25	do	.71	19.3
8	do	.81	21.6	Aug. 9	J. B. Spiegel	.50	10.0
Jan. 1	J. B. Spiegel	.78	21.4	9	do	1.40	241
1	do	.78	19.5	9	do	1.50	291
Feb. 19	do	.65	17.8	10	do	1.01	99
19	do	.65	20.9	10	do	.99	83
Mar. 22	do	.55	[a]10.0				

[a] Estimated.

Daily discnarge, in second-feet, of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	35	3	21	19	60	10	12	16	3	2	34	22
2	35	2	21	17	50	10	11	16	3	2	28	25
3	35	3	17	17	32	10	10	13	3	2	28	16
4	28	4	17	17	25	10	10	10	3	2	28	25
5	28	5	21	17	25	10	9	10	3	2	88	16
6	28	6	17	17	25	10	8	8	3	2	60	16
7	28	35	17	17	25	10	7	6	3	2	60	1,070
8	21	35	17	17	25	10	7	6	3	3	10	340
9	21	21	21	17	20	10	6	6	3	3	60	60
10	21	21	21	17	20	10	6	4	3	595	120	60
11	21	12	21	17	20	10	6	4	3	980	1,200	16
12	12	12	21	17	20	10	6	4	3	340	138	8
13	12	12	21	17	16	10	6	10	3	97	315	6
14	12	12	21	13	16	10	6	10	3	82	60	4
15	12	12	21	13	16	10	6	4	3	97	400	3
16	12	12	21	13	20	10	6	10	3	44	1,760	3
17	12	12	21	13	20	10	6	4	3	630	290	3
18	12	12	21	13	20	10	6	4	3	230	120	3
19	9	19	21	17	20	10	6	4	3	97	40	3
20	6	25	21	340	20	10	6	3	3	400	40	3
21	4	25	17	400	20	10	6	3	3	67	40	3
22	3	25	17	340	20	10	6	8	2	29	32	3
23	2	25	17	240	10	25	6	8	2	44	40	3
24	2	25	17	195	10	16	6	4	2	44	32	3
25	2	37	17	130	10	16	6	3	2	260	88	2
26	2	37	17	138	10	16	6	3	2	44	40	2
27	2	37	17	195	10	15	6	3	2	36	60	2
28	2	37	13	138	10	14	6	3	2	29	155	2
29	2	37	13	88	10	14	2	3	2	30	120	2
30	2	23	13	74	.....	13	2	3	2	31	88	2
31	2	.....	17	74	.....	12	.....	3	.....	32	32	.....

NOTE.—Gage heights missing, discharge interpolated, Nov. 4, 5, and 14; Jan. 4–6; Mar. 17, Mar. 27 to Apr. 8; May 28; June 17–19 and 27–29; July 27 and 29–31.

Monthly discharge of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	35	2	13.7	842
November	37	2	19.4	1,150
December	21	13	18.5	1,140
January	400	13	85.4	5,250
February	60	10	20.9	1,200
March	25	10	11.6	713
April	.....	2	6.6	393
May	16	3	6.3	387
June	3	2	2.7	161
July	980	2	137	8,420
August	1,760	10	181	11,100
September	1,070	2	57.9	3,450
The year	1,760	2	47.2	34,200

QUEEN CREEK NEAR SUPERIOR, ARIZ.

LOCATION.—Below dam site near Whitlow's ranch and about 12 miles below Superior, Pinal County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 14, 1915, to September 30, 1916.

GAGE.—Inclined staff on left bank 1 mile below dam site; installed September 15, 1916; read by W. C. Mullins. Original gage was installed February 14, 1915, was a vertical staff painted on rock ledge on right bank at lower end of box canyon

about 500 hundred feet above Whitlow's ranch house; gage was read until October 17, 1915, when it was replaced by an inclined staff on left bank about 700 feet upstream, at a different datum. On March 30, 1916, a vertical staff was installed at practically the same site as the original gage but at a datum 1.65 feet higher. August 6, 1916, this gage was replaced by an inclined and vertical staff, at the same site and datum, which was read until September 15, 1916, when present gage was installed 1 mile below at a different datum.

DISCHARGE MEASUREMENTS.—Made from cable at dam site, or by wading.

CHANNEL AND CONTROL.—At dam site the channel is confined between high rocky banks about 300 feet apart. At the present site of gage the left bank is likely to be overflowed at extremely high stages. Bed of stream composed of constantly shifting sand and gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.0 feet at 12 noon January 28 (discharge not determined); stream channel dry during part of each year at present site of gage; at dam site the flow is probably never less than about 1 second-foot.

DIVERSIONS.—Water is diverted above gage to irrigate a few acres; amount not known.

ACCURACY.—Stage-discharge relation not permanent. One poorly defined rating curve used October 1 to March 23; shifting-control method used during rest of year. Gage read to hundredths twice daily. Records roughly approximate. Determinations of daily discharge not sufficiently accurate to warrant publication.

Discharge measurements of Queen Creek near Superior, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	Anderson and Guthrie.	1.00	1.7	Aug. 4	Ellsworth and Anderson.	0.72	2.8
Jan. 19	C. C. Jacob	3.90	533				
20	do	3.00	261	6	C. E. Ellsworth	.74	2.7
21	do	3.20	334	6	do	.78	2.5
Mar. 30	M. D. Anderson	.82	25.0	Sept. 15	do	[a] 1.68	2.3
Aug. 4	Ellsworth and Anderson.	.72	2.8	29	W. C. Mullins	[a] 1.66	1.2

[a] Referred to gage about 1 mile below dam site installed Sept. 15, 1916.

Monthly discharge of Queen Creek near Superior, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3	2	2.2	135
November	2	2	2.0	119
December	500	2	19	1,170
January	960	26	239	14,700
February	220	22	47	2,700
March	255	10	40	2,460
April	20	3	8.8	524
May	4	2	2.9	178
June			2.5	149
July	24		4.6	283
August	340	3	26	1,600
The period	960		36.0	24,000

NOTE.—See "Accuracy" in station description. No gage record Mar. 24–29; discharge estimated at 75 second-feet. Discharge Apr. 27 and 28 and May 23–26 interpolated. Discharge June 1 to July 26 estimated at 2.5 second-feet; rating table not applied because of constantly shifting control and insufficient discharge measurements. During this period there was practically no rainfall in the basin and the stream remained at a uniformly low stage. Discharge Sept. 1–5 estimated at 3.5 second-feet; Sept. 15–30, 1.3 second-feet. No gage-height record Sept. 6–14; considerable flood during this period and no data available to estimate the flow.

SANTA CRUZ RIVER NEAR NOGALES, ARIZ.

LOCATION.—Just below proposed dam site on Yerba Buena ranch, half a mile above city pumping plant and about 7 miles northeast of Nogales, Pima County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 22 to November 30, 1907; April 1, 1909, to September 30, 1916 (incomplete).

GAGE.—Richard Frères water-stage recorder on left bank about half a mile above city pumping plant; installed January 3, 1916. Original gage, a vertical staff on right bank about 500 feet below the intake of a small irrigation ditch and about one-fourth mile above the present gage, was used until January 18, 1912, when a Richard Frères water-stage recorder was installed at the same site as present gage. This gage was used until December 18, 1914, when it was replaced by a Stevens water-stage recorder that was used until March 13, 1915, A vertical staff on right bank at pumping plant was read from March 13 to December 4, 1915. During the interval December 4, 1915, to January 3, 1916, all readings were made on the staff gage attached to the present gage well. Gage elevations have been as follows: original gage and gage at pumping plant at different elevations and no relation to other gages; Stevens recorder and present Richard Frères recorder at approximately the same datum, which is 1.3 feet higher than that of the first Richard Frères recorder installed January 18, 1912.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Shifting sand. Banks fairly clean; subject to overflow during high stages.

EXTREMES OF DISCHARGE.—Stream is dry during a part of each year. No dependable records of extreme floods available.

DIVERSIONS.—Water is diverted above the station for the irrigation of about 140 acres.

ACCURACY.—Stage-discharge relation not permanent. Rating curves have been constructed applicable as follows: October 1 to December 4, based on two measurements made prior to September 30, 1915, poorly defined; January 4 to February 20 and July 26 to September 30 fairly well defined below 50 second-feet. Staff gage read twice daily to half-tenths. Daily discharge, which is not considered sufficiently accurate to warrant publication, was ascertained by applying daily gage height to rating table or by shifting-control method. Operation of water-stage recorder not satisfactory because of lack of sensitiveness at low stage and excessive deposits of sand and silt on float well. Records liable to considerable error, particularly for periods during which shifting-control method was used.

Discharge measurements of Santa Cruz River near Nogales, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	J. B. Spiegel	.....	0.0	Mar. 23	J. B. Spiegal	1.73	26.8
Dec. 7	Jacob and Spiegel	1.15	9.0	23	do	1.73	27.0
7	J. B. Spiegel	1.15	10.0	Apr. 23	do	1.63	6.5
Jan. 3	do	1.49	20.6	23	do	1.63	6.6
3	do	1.49	20.0	July 26	Ellsworth and Spiegel	1.47	12.4
Feb. 20	do	1.75	48.5	26	do	1.47	14.1
20	do	1.75	46.3	Aug. 11	J. B. Spiegel	1.55	24.0

NOTE.—All gage heights refer to datum of Richard Frères recorder installed Jan. 3, 1916.

Monthly discharge of Santa Cruz River near Nogales, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8	0	0.26	16
November	27	0	16.2	964
December	60	.....	26.4	1,620
January	100	14	44.3	2,720
February	55	29	40.2	2,310
March	.....	.....	29.2	1,800
April	.....	.....	13.5	803
May	12	2	4.9	301
June	7	1	2.7	161
August	55	10	23.5	1,440
September	29	4	7.6	452

NOTE.—See "Accuracy" in station description. Stream dry Oct. 2 to Nov. 6. No gage-height record Dec. 5, 6, 17–19, 21–26, Dec. 28 to Jan. 2, Jan. 4 and 5; discharge interpolated. No gage-height record Dec. 8–15 and Mar. 24 to Apr. 22; discharge estimated. Several small floods occurred during July, but gage height available are insufficient to determine discharge.

SANTA CRUZ RIVER AT TUCSON, ARIZ.

LOCATION.—In sec. 13, T. 14 S., R. 13 E., at Congress Street Bridge in Tucson, Pima County.

RECORDS AVAILABLE.—October 15, 1905, to September 31, 1916; incomplete.

DRAINAGE AREA.—Not measured.

GAGE.—Staff on bridge pier installed September 7, 1916; read by J. O. Kenny. Original gage was painted on bridge pier on left bank. During 1911 and up to September 30, 1912, gage heights were observed from temporary staff or by measuring to the water surface from a reference point on the bridge. October 1, 1912, to July 7, 1913, a chain gage installed on the bridge was used. Original datum was maintained until November 22, 1913, when it was lowered 2 feet. From December 12, 1914, to September 7, 1916, gage heights were obtained from a reference point whose elevation, until the flood of January, 1916, was 19.28 feet above new datum. During the flood in January the bridge settled, lowering the reference point to 16.73 feet above datum. During the summer of 1916 a new bridge was constructed and the present gage was installed September 7 on one of the piers at a different datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand; shifting.

EXTREMES OF DISCHARGE.—Stream dry part of each year at this point. On December 24, 1914, the maximum gage height was 9.8 feet, indicating a discharge of about 9,000 second-feet, which was probably the maximum ever recorded at the station.

ACCURACY.—Cooperating party states that the records are good.

COOPERATION.—Records furnished by University of Arizona through G. E. P. Smith, irrigation engineer.

Discharge measurements of Santa Cruz River at Tucson, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	J. B. Spiegel		0	July 31	Wilson and Atchley	1.05	290
Nov. 10	do		0	Aug. 1	C. P. Wilson	.70	25
Jan. 20	Moots and Wilson	2.31	2,000	2	do	.50	5
22	Moots and Luis	2.40	2,110	8	do	.60	7
24	Moots and Phelps	1.00	274	11	do	1.08	184
28	Moots and Gray		217	12	do	1.28	436
29	Wilson and Steinneger	1.08	246	13	do		166
Feb. 2	Enger and Pickrell	.58	17	14	do	.88	100
July 14	C. P. Wilson	.75	16	15	Wilson and Hall	1.45	810
20	Wilson and Herndon	1.10	348	16	do	1.32	932
20	do	.87	229	16	do	1.22	760
26	C. P. Wilson	.97	187	24	C. P. Wilson	1.10	210
26	do	.45	63	Sept. 7	A. L. Enger	2.60	21
27	Wilson and Jose	1.47	600	8	do	3.90	608
27	do	1.37	620	8	do	4.00	642
28	C. P. Wilson	.82	135	11	C. P. Wilson	2.83	73
28	do	.90	159				

NOTE.—New gage installed at a different satum Sept. 7, 1916.

Monthly discharge of Santa Cruz River at Tuzson, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	4,000	0	399	24,500
February	100	0	10.2	587
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	0	0	0	0
July	256	0	43.9	2,700
August	1,380	0	113	8,180
September	308	0	22.3	1,330
The year	4,000	0	51.4	37,300

NOTE.—Monthly discharge compnted by engineers of the United States Geological Survey.

RILLITO CREEK NEAR TUCSON, ARIZ.

LOCATION.—In sec. 23, T. 13 S., R. 13 E., at highway bridge on Oracle Road, 4 miles north of Tucson, Pima County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—1909 to September 30, 1916; incomplete.

GAGE.—Richard Frères water-stage recorder on right abutment of the bridge. Staff gage readings were also made at frequent intervals during flood times.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand, wide and shallow; badly shifting at all stages.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year about 4,900 second-feet January 20; maximum mean daily discharge since station was established about 16,000 second-feet December 23, 1914. Stream dry the greater part of each year.

ACCURACY.—Cooperating party states that records are good.

COOPERATION.—Records furnished by University of Arizona through G. E. P. Smith irrigation engineer.

Discharge measurements of Rillito Creek near Tucson, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 17	Enger and Luis	4.58	227	Mar. 1	W. W. Pickrell	4.70	326
17	do	4.57	242	3	do	4.40	108
17	do	4.56	188	7	do	4.20	60
18	F. A. Luis	4.60	187	24	A. L. Enger	4.55	180
19	Smith and Wilson	6.35	6,630	26	W. W. Pickrell	4.40	117
21	Moots and Luis	5.45	1,050	29	do	4.30	43.0
23	do	5.04	384	Apr. 16	F. J. McSherry	3.90	9.9
24	Moots and Phelps	5.17	289	July 20	C. P. Wilson	4.88	153
27	Moots and Feucht	5.01	307	20	do	4.50	79
29	Moots, Jones, and Hedgpeth	5.55	1,950	28	do	4.27	142
Feb. 5	A. L. Enger	4.30	53	Aug. 10	do	3.75	14
6	Enger and Pickrell	4.20	29.5	12	do	4.23	201
11	do	4.30	63	14	do	4.40	327
14	do	4.20	35.0	15	Wilson and Meserve	4.55	419
18	Pickrell and Wikoff	4.10	10.3	16	C. P. Wilson	4.10	67
21	Spiegel and Enger	4.08	7.0	Sept. 10	Enger and Schrymer	4.25	38

Monthly discharge of Rillito Creek near Tucson, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0	0	0.0	0
November	0	0	.0	0
December	0	0	.0	0
January	4,900	0	603	37,100
February	200	5	38.3	2,200
March	330	0	58.5	3,600
April	6	0	1.0	60
May	0	0	.0	0
June	0	0	.0	0
July	206	0	14.8	910
August	798	0	126	7,750
September	175	0	11.5	684
The year	4,900	0	72.0	52,300

NOTE.—This table computed by engineers of United States Geological Survey. Stream dry Oct. 1 to Jan. 15, Mar. 15–23, Apr. 4–15, Apr. 19 to July 10, July 13–18 and 21–25, July 29 to Aug. 8, Aug. 17–22, Aug. 26 to Sept. 7, and Sept. 11–30.

BLACK RIVER NEAR FORT APACHE, ARIZ.

LOCATION.—Just above bridge on highway from Rice to Fort Apache, 1½ miles above junction with White River and 18 miles west of Fort Apache, Gila County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 24, 1912, to September 30, 1916; incomplete.

GAGE.—Original vertical staff on right bank about 400 feet above bridge used November 24, 1912, to October 16, 1913, and after May 11, 1916. A Gurley water-stage recorder on left bank about three-quarters of a mile below site of present gage and at a different datum was used from October 16, 1913, to Desember 19, 1914, when it was damaged by flood; from January 20, 1915, to January 8, 1916, the staff gage on the float well was read.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed at site of upper gage, sand and gravel; control, solid rock. Bed and control at lower gage, sand and gravel; fairly permanent at low stages but shifting at high stages.

EXTREMES OF DISCHARGE.—Maximum and minimum stages during year not determined.

1912–1915: Maximum stage, from flood marks, 15.9 feet December 20, 1915 (discharge, determined from extension of rating curve, 18,000 second-feet); minimum discharge, 61 second-feet, June 27 to July 2, 1914.

DIVERSIONS.—None above gage.

ACCURACY.—Stage-discharge relation permanent at upper gage; shifting during high stages at lower gage. Rating curve used October 1 to January 8 fairly well defined between 140 and 200 second-feet; that used May 12–29 and September 3–30 fairly well defined below 220 second-feet. Gage read to half tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Gage height subject to considerable error. Records roughly approximate. Daily discharge not sufficiently accurate to warrant publication.

Discharge measurements of Black River near Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 19	Ellsworth and Spiegel	7.21	216
22	J. B. Spiegel	7.09	163
22	....do	7.09	160

Monthly discharge of Black River near Fort Apache, Ariz., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	100	80	91.9	5,650
November	208	93	140	8,330
December	100	80	88.9	5,470
January 1–8	122	100	108	1,710
May 12–29	480	173	305	10,900
September 3–30	540	173	326	18,100

NOTE.—No gage-height record Jan. 1, Jan. 9 to May 11, and May 30 to Sept. 2. Discharge Jan. 1 interpolated. See "Accuracy" in station description.

SALT RIVER NEAR ROOSEVELT, ARIZ.

LOCATION.—At diversion dam for power canal, about 10 miles above upper end of Roosevelt reservoir and about 20 miles east of the town of Roosevelt, Gila County.

DRAINAGE AREA.—4,222 square miles (measured by United States Reclamation Service).

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1916.

GAGE.—Vertical staff on left bank bolted to concrete wall at head of canal. Temporary gages are used from time to time when channel shifts away from main gage.

DISCHARGE MEASUREMENTS.—Made from cable at or by wading near dam site. Previous to January 19, 1916, when the dam was destroyed by flood, low-water measurements were made by wading below dam; when river could not be waded discharge was computed from elevation of water surface in reservoir, known outflow, and computed inflow from other than Salt River sources.

CHANNEL AND CONTROL.—Shifting sand and gravel. Prior to its destruction by flood January 19, 1916, the dam formed a permanent control.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 79,237 second-feet January 19; minimum discharge, 286 second-feet October 14, 15.

1913–1916: Maximum discharge January 19, 1916; minimum discharge, 164 second-feet June 29, 1914.

DIVERSIONS.—None.

ACCURACY.—Previous to January 19, 1916, discharge was computed by considering dam as a weir, the coefficient of discharge having been determined by current-meter measurements; discharge after January 19, when dam was destroyed by flood, determined from current-meter measurements made nearly every day. Records reported as good by U. S. Reclamation Service.

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

Daily discharge, in second-feet, of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	412	295	339	745	10,878	6,510	5,520	3,322	988	480	630	1,170
2	360	289	339	562	9,524	7,120	5,047	3,262	983	470	645	950
3	344	289	339	515	6,198	8,165	4,606	2,884	993	450	530	849
4	330	289	339	473	3,532	8,100	5,201	2,924	900	430	517	746
5	329	289	339	421	2,573	5,733	3,572	2,317	866	430	475	677
6	312	309	390	446	2,688	5,610	4,010	1,959	900	430	435	823
7	312	375	399	770	2,680	4,995	3,968	2,131	930	430	425	780
8	312	446	399	820	2,646	5,306	3,659	2,242	967	430	465	736
9	296	472	399	834	3,536	4,483	3,651	2,157	940	420	400	849
10	296	461	390	1,110	4,586	4,697	3,585	1,814	955	500	415	3,340
11	296	498	390	3,153	4,380	6,137	3,920	2,100	945	500	360	2,835
12	296	482	370	3,591	4,493	7,906	4,162	2,043	930	500	375	1,530
13	296	482	370	1,722	4,607	7,953	5,157	1,872	950	500	415	1,775
14	286	482	370	1,050	4,689	8,351	5,052	1,578	954	500	1,000	1,560
15	286	400	378	934	4,771	8,428	4,556	1,572	950	500	1,510	1,060
16	291	389	400	1,725	4,400	7,620	4,200	1,902	806	470	1,390	950
17	291	374	400	35,825	4,400	6,691	4,092	1,673	806	470	1,200	700
18	340	358	400	66,384	4,400	6,064	3,874	1,600	806	470	860	470
19	361	358	400	79,237	4,400	5,956	4,317	1,388	806	390	700	450
20	350	358	385	40,170	5,010	5,882	5,297	1,357	806	354	674	685
21	340	357	380	18,101	4,703	6,095	4,738	1,370	806	354	780	650
22	340	357	380	14,120	5,481	6,388	4,531	1,385	806	360	530	650
23	335	356	380	13,267	6,796	9,385	4,448	1,326	806	366	490	550
24	321	359	380	6,603	4,480	28,260	4,329	1,074	806	366	465	548
25	296	359	380	3,658	5,240	21,400	4,293	758	540	463	455	520
26	336	359	380	3,797	4,100	14,059	4,357	1,295	540	460	550	500
27	306	359	380	4,323	4,235	11,350	3,878	1,127	540	458	650	475
28	296	359	370	13,192	5,570	9,036	3,738	1,270	540	608	900	455
29	296	339	370	43,429	6,400	7,550	3,706	1,208	540	510	915	432
30	295	339	370	23,648	.....	7,018	3,834	1,122	490	574	1,100	390
31	295	.....	410	17,546	.....	6,554	.....	892	.....	600	1,200	.....

Monthly discharge of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	412	286	318	19,600
November	498	289	375	22,300
December	410	339	378	23,200
January	79,200	421	13,000	799,000
February	10,900	2,570	4,880	281,000
March	28,300	4,480	8,350	513,000
April	5,520	3,570	4,310	256,000
May	3,320	758	1,770	109,000
June	993	490	820	48,800
July	610	354	459	28,200
August	1,510	400	692	42,500
September	3,340	390	940	55,900
The year	79,200	286	3,030	2,200,000

NOTE.—This table computed by engineers of the United States Geological Survey from records furnished by the United States Reclamation Service.

WHITE RIVER AT FORT APACHE, ARIZ.

LOCATION.—At highway bridge on Fort Apache military reservation, just below junction of North and East forks, at Fort Apache, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 23, 1912, to September 30, 1916.

GAGE.—Vertical staff fastened to downstream end of left abutment of bridge; read by M. Jesús Velásquez. January 27, 1915, datum of gage was raised 4.4 feet.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand and gravel; fairly permanent at low stages, but likely to shift during floods. Banks high; not subject to overflow except by highest floods.

EXTREMES OF DISCHARGE.—1912–1916: River overflowed its banks January 18 and 19, 1916; discharge not determined, but was probably greater than at any other time since the station was established; minimum discharge, 25 second-feet November 3, 4, 1915.

DIVERSIONS.—A small quantity of water (amount not known) is diverted for irrigation by the Indians several miles above the station.

ACCURACY.—Stage-discharge relation changed during flood of January 17–18. Rating curves used before January 17 fairly well defined from 80 to 600 second-feet; curve used after that date fairly well defined from 90 to 1,400 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fairly accurate, except for extremely low and high stages, for which the rating curve is poorly defined.

COOPERATION.—Gage-height record furnished by United States Army.

Discharge measurements of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 17	M. D. Anderson.....	1.76	1,400	Sept. 21	Ellsworth and Spiegel..	0.10	177
17	.....do.....	1.76	1,400	21	.....do.....	.10	183

Daily discharge, in second-feet, of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1	90	32	47	105	505	675	1,460	1,070	212	180	152	180
2	76	32	47	105	475	568	1,320	1,020	180	180	152	212
3	76	25	47	90	505	475	1,190	960	196	180	180	196
4	66	25	47	90	448	505	1,070	960	201	180	152	180
5	66	32	47	76	475	535	1,020	908	206	180	166	180
6	66	66	140	76	448	535	960	960	212	180	152	196
7	66	105	140	90	448	535	1,020	1,070	230	180	180	152
8	66	90	122	90	505	568	1,070	1,070	230	180	180	285
9	66	90	105	105	505	675	1,190	1,020	247	173	152	348
10	66	102	105	287	568	908	1,260	1,070	212	166	180	370
11	66	115	90	287	568	1,260	1,460	1,020	.....	166	166	370
12	66	128	90	184	568	1,540	1,460	1,070	.....	166	180	326
13	60	140	90	260	568	1,610	1,390	1,130	.....	166	152	266
14	55	140	76	184	535	1,680	1,260	1,070	.....	152	152	230
15	66	122	76	287	568	1,020	1,130	1,020	.....	152	166	212
16	66	122	90	1,130	638	1,460	1,260	855	.....	180	180	212
17	55	122	90	.....	600	1,390	1,320	675	.....	180	180	247
18	55	122	90	.....	718	1,460	1,610	675	.....	180	152	247
19	55	105	76	3,300	718	1,460	1,610	535	247	180	166	212
20	55	105	76	2,800	718	1,610	1,540	535	247	180	212	180
21	55	105	76	2,180	808	1,190	1,540	.....	266	166	180	180
22	55	90	76	1,130	760	2,000	1,610	.....	266	180	180	180
23	55	105	76	960	808	2,620	1,540	.....	285	180	152	166
24	47	76	90	370	808	2,000	1,540	.....	285	152	180	166
25	47	66	105	475	808	1,540	1,390	.....	266	152	180	166
26	47	66	105	420	855	1,540	1,320	.....	247	180	152	152
27	47	55	90	420	855	1,540	1,260	.....	285	180	152	152
28	47	55	90	3,830	908	1,460	1,260	.....	306	180	180	140
29	47	55	76	1,840	908	1,610	1,130	180	348	152	247	128
30	47	55	76	505	.....	1,540	1,070	212	370	166	247	116
31	39	.....	76	420	.....	1,610	.....	180	.....	180	212	.....

NOTE.—Gage not read Oct. 13, Nov. 10–12, and July 9; discharge interpolated. Gage not read; discharge estimated from weather records and by comparison with records for other stations as follows: Jan. 17 and 18, 3,800 second-feet; May 21–28, 350 second-feet; June 11–18, 230 second-feet.

Monthly discharge of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	90	39	59.2	3,640
November	140	25	84.9	5,050
December	140	47	84.7	5,210
January	.....	76	*a* 958	58,900
February	908	448	641	36,900
March	2,620	475	1,260	77,500
April	1,610	960	1,310	78,000
May	1,130	180	*a* 712	43,800
June	370	180	*a* 246	14,600
July	180	152	172	10,600
August	247	152	175	10,800
September	370	116	211	12,600
The year	.....	25	492	358,000

a Partly estimated; see footnote to table of daily discharge.

EAST FORK OF WHITE RIVER AT FORT APACHE, ARIZ.

LOCATION.—On Fort Apache Military Reserve at Fort Apache, Navajo County, about half a mile above junction with North Fork of White River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 8, 1912, to September 30, 1916.

GAGE.—Vertical staff fastened to ash tree on left bank opposite officers' quarters. January 27, 1915, a new staff gage was installed and the datum raised 5 feet.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Boulders and gravel; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage and discharge during year not determined minimum discharge 15 second-feet November 3–5.

1912–1916: Maximum stage and discharge not determined; minimum discharge 5 second-feet February 14–16, 1914.

ACCURACY.—Stage-discharge relation changed during high water on January 17–18. Rating curve used before January 17 fairly well defined at all stages. Curve used after that date fairly well defined between 40 and 250 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fairly accurate except for high stages, for which rating curve is poorly defined.

COOPERATION.—Gage-height record furnished by United States Army.

Discharge measurements of East Fork of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 17	M. D. Anderson	1.40	216	Sept. 21	Ellsworth and Spiegel	.25	41.2
17	.....do	1.40	232	21	.....do	.25	42.2

Daily discharge, in second-feet, of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	22	16	18	27	289	212	333	249	38	38	38	52
2	22	16	18	27	262	190	318	236	42	38	30	47
3	22	15	18	24	249	180	289	236	38	38	34	42
4	20	15	18	24	275	160	236	224	35	38	30	38
5	20	15	24	22	262	170	212	236	32	38	38	38
6	20	24	27	22	236	180	201	249	30	38	34	47
7	20	24	30	24	236	180	212	224	34	38	42	47
8	18	30	30	24	224	190	224	212	34	38	38	57
9	18	30	27	27	212	224	224	201	38	38	30	57
10	18	33	27	56	224	333	212	224	34	38	38	68
11	18	36	24	61	212	382	224	212	.....	38	38	68
12	18	39	24	42	224	398	249	212	.....	30	38	57
13	18	42	22	51	236	450	236	224	.....	34	38	57
14	20	42	22	42	224	262	224	224	.....	30	34	47
15	20	38	22	67	212	333	249	212	.....	30	38	47
16	20	38	24	73	201	349	249	180	.....	38	57	38
17	18	38	24	.....	190	318	236	160	.....	42	62	47
18	18	38	24	.....	190	333	262	160	.....	38	47	47
19	18	34	22	704	180	333	262	142	47	38	52	38
20	18	34	22	581	190	349	275	125	47	38	42	38
21	18	34	22	398	224	432	262	.....	47	38	34	42
22	18	30	22	365	224	432	249	.....	42	38	38	38
23	18	34	22	303	236	562	275	.....	34	30	38	34
24	20	27	24	236	249	432	275	.....	42	30	47	38
25	16	24	27	160	249	349	249	.....	47	30	47	38
26	16	22	27	125	236	333	249	.....	52	38	47	42
27	16	20	24	102	236	333	262	.....	57	38	47	34
28	16	18	24	853	224	303	275	.....	57	38	57	30
29	16	18	24	467	224	333	262	30	68	38	47	30
30	16	18	22	382	.....	333	262	34	68	38	38	30
31	16	.....	22	224	.....	318	.....	34	.....	38	47	.....

NOTE.—Gage not read Nov. 10–12, June 4, 5 and 25; discharge interpolated. Discharge estimated because of lack of gage readings, from weather record and study of record of flow at other stations as follows: Jan. 17 and 18, 900 second-feet; May 21–28, 80 second-feet; June 11–18, 40 second-feet. See "Accuracy" in station description.

Monthly discharge of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	22	16	18.5	1,140
November	42	15	28.1	1,670
December	30	18	23.4	1,440
January	.....	22	236	14,500
February	289	180	229	13,200
March	562	160	312	19,200
April	333	201	252	15,000
May	249	.....	157	9,650
June	68	.....	42.8	2,550
July	42	30	36.4	2,240
August	62	30	41.5	2,550
September	68	30	44.4	2,640
The year	.....	15	118	85,800

TONTO CREEK NEAR ROOSEVELT, ARIZ.

LOCATION.—In sec. 14, T. 6 N., R. 10 E., 6 miles above upper end of Roosevelt reservoir and 15 miles northwest of town of Roosevelt, in Gila County.

DRAINAGE AREA.—1,004 square miles (measured by United States Reclamation Service).

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1916.

GAGE.—Vertical staff on right bank. Position of gage is changed from time to time owing to shifting control.

DISCHARGE MEASUREMENTS.—Made by wading at low stages and by slope method at high stages. Measurements are made frequently by engineer of United States Reclamation Service stationed at Roosevelt dam.

CHANNEL AND CONTROL.—Boulders and gravel; shifting at high stages. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 15,847 second-feet January 19; minimum discharge, 5 second-feet November 2–7, No, vember 24 to December 6, and December 10–14.

1913–1916: Maximum mean daily discharge January 19, 1916; minimum, 2 second-feet August 15–19, 1914.

DIVERSIONS.—No diversions in vicinity of station; entire flow is discharged into Roosevelt reservoir.

ACCURACY.—Records reported as fair by U. S. Reclamation Service.

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

Daily discharge, in second-feet, of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	6	5	750	600	150	150	100	80	20	15	70
2	8	5	5	150	400	150	150	100	80	10	100	50
3	8	5	5	75	300	150	150	94	80	10	54	45
4	8	5	5	40	240	100	120	90	80	10	50	45
5	8	5	5	25	240	100	120	90	80	10	20	43
6	8	5	5	30	200	100	120	90	80	10	20	40
7	8	5	8	38	200	80	120	90	50	10	20	17
8	8	8	8	38	200	80	100	90	50	10	20	17
9	8	8	8	38	200	80	100	90	50	10	10	565
10	8	8	5	38	300	80	100	90	50	10	10	480
11	8	8	5	100	300	100	100	90	50	10	10	395
12	8	8	5	112	300	100	100	90	50	10	10	310
13	8	8	5	112	300	100	100	90	50	10	200	225
14	8	8	5	50	300	200	100	90	40	10	200	140
15	8	8	10	50	300	200	100	90	30	10	200	60
16	8	8	10	1,000	200	200	100	90	20	10	275	50
17	8	8	10	7,165	200	180	100	88	20	10	200	50
18	6	8	10	13,276	200	180	100	82	20	10	200	50
19	6	8	10	15,547	200	180	100	82	20	10	200	50
20	6	8	10	8,036	200	180	100	80	20	10	180	50
21	6	8	10	3,620	200	180	100	80	20	10	150	50
22	6	8	10	2,824	200	180	100	80	20	10	130	50
23	6	8	10	2,653	250	200	100	80	20	12	130	40
24	6	5	10	1,320	200	400	100	80	20	12	110	40
25	6	5	10	732	200	400	100	80	20	12	195	40
26	6	5	10	759	150	400	100	80	20	12	150	30
27	6	5	10	865	150	300	100	80	20	12	100	30
28	6	5	10	2,638	200	300	100	80	20	12	100	20
29	6	5	10	8,686	200	300	100	80	20	60	70	18
30	6	5	10	4,749	.....	300	100	80	20	31	40	15
31	6	.....	800	3,509	.....	250	.....	80	.....	15	80	.....

Monthly discharge of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8	6	7.1	437
November	8	5	6.6	393
December	800	5	33.5	2,060
January	15,800	25	2,560	157,000
February	600	150	246	14,200
March	400	80	190	11,700
April	150	100	108	6,430
May	100	80	86.3	5,310
June	80	20	40.0	2,380
July	60	10	13.2	812
August	275	10	105	6,460
September	565	15	103	6,130
The year	15,800	5	294	213,000

NOTE.—This table computed by engineers of the United States Geological Survey from records furnished by the United States Reclamation Service.

VERDE RIVER NEAR CLARKDALE, ARIZ.

LOCATION.—In T. 17 N., R. 3 E., about 4 miles below the mouth of Sycamore Creek and about 5 miles above Clarkdale, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18, 1915, to September 30, 1916.

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

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

CHANNEL AND CONTROL.—Gravel and boulders; fairly permanent at low stages liable to shift at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 11.93 feet at 11 p. m., January 18 (discharge, determined from extension of rating curve, 6,860 second-feet); minimum stage, from water-stage recorder 2.12 feet at 9 p. m. June 12 (discharge, 73 second-feet).

1915–1916: maximum stage recorded January 18, 1916; minimum stage 2.10 feet on August 4, 11, and 12, 1915 (discharge 70 second-feet).

DIVERSION.—Water is diverted above and below station to irrigate a few small ranches amount not known.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve fairly well defined below 1,000 second-feet. Operation of water-stage recorder satisfactory throughout the year. Daily discharge ascertained by applying to the rating table daily gage height determined by inspecting gage-height graph. Records fair except for extremely high stages for which the rating curve is poorly defined.

COOPERATION.—Station established and maintained in cooperation with United Verde Copper Co.

Discharge measurements of Verde River near Clarkdale, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 15	Anderson and Gittings	4.95	859
Aug. 16	Ellsworth and Anderson	2.50	132

Daily discharge, in second-feet, of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	78	79	80	85	575	435	147	78	78	78	100	78
2	78	79	80	85	536	378	102	78	78	78	188	78
3	78	79	80	85	542	422	88	78	78	78	127	78
4	78	79	84	85	512	584	84	78	76	78	88	78
5	79	79	84	94	455	1,410	84	78	78	78	93	78
6	80	85	82	92	400	1,950	85	78	78	78	147	78
7	80	90	80	92	412	2,210	84	78	76	78	97	78
8	80	82	80	90	590	2,270	85	78	76	78	90	134
9	79	82	80	90	750	1,570	84	78	78	82	87	115
10	79	84	80	90	776	1,280	82	78	78	93	79	115
11	79	82	80	94	848	1,250	82	78	76	138	78	88
12	80	80	80	90	920	1,350	80	78	76	78	80	82
13	79	80	80	90	902	1,290	79	78	76	78	165	78
14	79	80	80	94	880	1,160	78	78	78	119	345	78
15	80	80	92	95	880	1,250	76	78	78	85	395	78
16	80	80	87	102	952	1,180	76	78	78	79	147	80
17	79	80	84	395	1,180	1,050	76	79	78	78	93	88
18	79	80	82	5,170	1,220	1,040	78	80	78	78	80	78
19	79	80	82	1,450	1,160	1,080	78	82	78	78	78	78
20	79	80	82	627	1,190	1,180	78	80	78	78	78	78
21	79	82	84	554	1,350	1,890	78	80	78	87	78	78
22	79	82	82	390	1,310	1,320	78	78	78	88	78	78
23	79	82	82	252	1,280	1,430	78	78	78	79	78	78
24	79	82	82	252	880	1,320	78	78	78	79	78	78
25	79	82	82	252	666	984	78	78	78	156	78	78
26	78	82	82	252	575	756	78	78	78	230	78	78
27	78	82	82	250	506	506	78	78	78	215	149	78
28	78	92	82	3,740	479	375	78	78	78	112	581	78
29	78	82	82	1,530	461	302	78	78	78	362	220	78
30	78	82	95	820	.....	245	78	78	78	408	108	78
31	78	.....	94	545	.....	215	.....	78	.....	112	79	.....

Monthly discharge of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	80	78	78.9	4,850
November	90	79	81.3	4,840
December	95	80	82.8	5,090
January	5,170	85	578	35,500
February	1,350	400	800	46,000
March	2,270	215	1,090	67,000
April	147	76	82.9	4,930
May	82	78	78.4	4,820
June	78	76	77.6	4,620
July	408	78	117	7,190
August	581	78	137	8,420
September	134	78	83.2	4,950
The year	5,170	76	273	198,000

VERDE RIVER AT CAMP VERDE, ARIZ.

LOCATION.—In sec. 30, T. 14 N., R. 5 E., at steel highway bridge just above town of Camp Verde, Yavapai County, and above mouth of Beaver Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 5, 1912, to September 30, 1916.

GAGE.—Chain gage on downstream side of bridge; installed November 12, 1915, at datum 1.80 feet above that of original gage, which was a vertical staff painted on east pier of bridge. Gage read by Nicholas A. Vyne.

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

CHANNEL AND CONTROL.—Channel straight; clay and sand bottom. Banks fairly high; not likely to be overflowed. Control shifts, especially during high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, 17.0 feet on night of January 18 (discharge not determined); minimum discharge, 40 second-feet October 5–7.

1912–1916: Maximum stage January 18, 1916; minimum discharge, 31 second-feet June 28, 29, 1914.

DIVERSIONS.—Much of the low-stage flow is diverted for irrigation at various points up the valley.

ACCURACY.—Stage-discharge relation changed considerably during high water in January and slightly at various times during low stages. Rating curves fairly well defined below 3,000 second-feet except for extremely low stages, for which discharge measurements are too few to indicate the date of slight shifts in control. Gage read once daily to half-tenths; oftener during floods. Daily discharge ascertained by applying gage height to rating table. Records fair except for extremely low and high stages, for which the rating curve is poorly defined.

Discharge measurements of Verde River at Camp Verde, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	M. D. Anderson	3.50	199	Aug. 13	Ellsworth and Anderson	1.71	448
Feb. 17	do	3.80	2,430	14	do	2.37	938
Apr. 22	do	.85	114	15	do	2.85	1,400
Aug. 13	Ellsworth and Anderson	.90	94	28	M. D. Anderson	.88	126

Daily discharge, in second-feet, of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	70	130	162	220	800	2,080	685	100	105	110	220	260
2	60	130	162	262	760	1,970	615	100	105	110	220	220
3	50	130	162	240	720	1,750	350	100	105	110	240	200
4	50	130	180	240	650	1,580	300	100	105	110	260	165
5	40	130	199	240	550	2,620	280	100	105	110	240	140
6	40	162	180	220	490	3,120	240	100	110	110	240	130
7	40	162	180	220	400	2,620	240	100	110	110	240	130
8	50	199	180	240	650	1,970	220	110	105	110	240	130
9	50	180	180	262	1,480	2,080	180	110	105	110	200	460
10	50	180	180	240	1,280	4,120	180	100	105	110	180	580
11	50	199	180	240	1,530	5,010	180	100	105	105	150	400
12	50	180	180	240	1,640	4,260	165	100	105	105	140	260
13	50	162	180	220	1,640	3,840	165	100	105	105	430	180
14	50	162	180	220	1,860	3,120	165	100	110	110	280	165
15	50	162	199	262	1,700	2,020	150	100	105	150	1,280	150
16	374	162	199	398	1,750	1,860	140	100	105	140	800	165
17	327	162	199	.....	1,750	1,640	130	100	105	130	260	200
18	305	162	199	.....	2,500	1,280	122	105	110	122	220	180
19	240	162	199	.....	2,500	1,180	122	105	110	115	180	180
20	180	162	199	.....	2,320	1,140	122	110	110	110	180	165
21	180	162	199	2,380	2,560	1,050	115	110	110	108	150	150
22	180	162	180	1,970	2,920	1,970	110	115	110	105	150	165
23	180	162	180	880	1,970	3,120	110	115	105	105	140	150
24	180	162	180	615	1,580	3,980	105	115	105	122	140	150
25	162	162	180	580	1,700	2,920	105	110	105	122	140	150
26	130	162	180	1,140	2,560	2,620	105	110	110	150	130	140
27	130	162	180	1,140	4,120	2,500	110	110	110	220	130	140
28	130	162	162	.....	2,800	2,320	100	110	115	300	130	130
29	130	162	162	.....	2,500	1,970	100	110	115	280	350	130
30	130	162	162	3,050	.....	1,580	100	105	115	260	400	130
31	130	.....	199	1,230	.....	1,050	.....	105	.....	220	300	.....

NOTE.—Discharge Oct. 1 and 2 estimated, July 21 interpolated; gage not read. Discharge estimated, because of backwater from Beaver Creek, by comparison with records for other stations on Verde River as follows: Jan. 17–20, 12,000 second-feet; Jan. 28 and 29, 15,000 second-feet.

Monthly discharge of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	374	40	124	7,620
November	199	130	161	9,580
December	199	162	182	11,200
January	.....	a220	3,060	188,000
February	4,120	400	1,710	98,400
March	5,010	1,050	2,400	148,000
April	685	100	194	11,500
May	115	100	105	6,460
June	115	105	108	6,430
July	300	105	138	8,480
August	1,280	130	270	16,600
September	580	130	196	11,700
The year	.....	40	724	524,000

a Partly estimated. See footnote to daily-discharge table

VERDE RIVER AT CHILDS, NEAR CAMP VERDE, ARIZ.

LOCATION.—Just below power plant of Arizona Power Co. at Childs, 3 miles above mouth of Fossil Creek and about 18 miles southeast of Camp Verde, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 25, 1911, to September 30, 1916.

GAGE.—Inclined staff in three sections on left bank about 300 feet below power plant of Arizona Power Co. Read to half-tenths twice daily by engineer of power plant.

DISCHARGE MEASUREMENTS.—Made by wading or from a cable a mile above gage.

CHANNEL AND CONTROL.—Boulders and bedrock; apparently fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 23 feet at 7.25 a. m. January 19; minimum stage, 4 feet at 6.55 a. m. June 21.

1911–1916: Maximum stage January 19, 1916; minimum stage, 3.2 feet April 27, 28, 1911.

DIVERSIONS.—Water is diverted above station for irrigation. See Verde River at Camp Verde, page 179.

REGULATION.—A fairly constant flow of about 48 second-feet, diverted from Fossil Creek for power development, is discharged into the river above the gage.

COOPERATION.—Gage-height record furnished by United States Reclamation Service.

Permanence of stage-discharge relation not known, as no discharge measurements have been made at this station since October 18, 1913. Daily discharge not determined.

Daily gage height, in feet, of Verde River at Childs, near Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.45	4.75	4.9	5.3	7.7	7.7	6.0	4.55	4.55	4.55	5.25	5.3
2	4.45	4.8	4.85	5.0	7.2	7.2	5.9	4.6	4.6	4.5	5.2	5.3
3	4.45	4.7	4.9	.....	6.85	7.05	5.9	4.65	4.65	4.55	5.2	5.2
4	4.45	4.7	4.9	.....	6.7	7.2	5.8	4.6	4.7	4.5	5.15	5.1
5	4.5	4.8	5.0	4.95	6.55	7.9	5.7	4.6	4.65	4.6	5.0	5.0
6	4.55	4.85	5.1	5.15	6.5	10.9	5.65	4.65	4.7	4.6	5.1	5.0
7	4.55	4.95	4.95	5.1	6.6	8.6	5.6	4.7	4.7	4.5	5.0	4.9
8	4.6	4.95	4.9	5.15	7.0	7.95	5.5	4.6	4.65	4.55	4.95	5.05
9	4.75	4.9	4.9	5.4	7.75	8.3	5.4	4.55	4.6	4.65	4.9	6.15
10	4.7	5.0	4.9	5.8	7.9	11.25	5.3	4.5	4.65	4.7	5.0	7.25
11	4.7	5.0	4.9	5.75	8.2	11.25	5.35	4.5	4.6	4.65	4.9	6.15
12	4.65	5.0	4.9	5.4	8.2	9.45	5.3	4.55	4.6	4.7	4.9	5.6
13	4.6	4.95	4.95	5.2	8.6	9.05	5.15	4.6	4.55	4.7	5.45	5.35
14	4.65	4.85	4.95	5.1	8.45	8.55	5.2	4.65	4.55	4.75	5.55	5.3
15	4.6	4.9	5.05	5.25	8.45	7.9	5.15	4.75	4.5	4.7	7.5	5.2
16	5.05	4.85	5.0	5.9	8.4	7.3	5.15	4.7	4.5	4.75	6.0	5.2
17	4.8	4.85	5.05	10.1	9.1	7.3	5.1	4.7	4.55	4.8	5.6	5.2
18	4.8	4.85	5.0	19.8	9.15	7.15	5.0	4.65	4.5	4.8	5.25	5.1
19	4.8	4.9	4.95	21.3	8.95	7.05	5.05	4.7	4.5	4.7	5.2	5.1
20	4.75	4.9	4.95	14.85	8.9	7.25	5.0	4.7	4.5	4.7	5.1	5.1
21	4.7	4.8	4.9	9.5	9.05	10.15	4.9	4.75	4.3	4.65	5.1	5.1
22	4.7	4.85	4.9	8.25	9.7	11.3	4.85	4.8	4.55	4.65	5.0	5.1
23	4.7	4.95	4.9	7.7	8.35	11.95	4.85	4.8	4.55	4.7	5.05	5.05
24	4.75	4.85	5.0	7.6	7.75	11.2	4.8	4.65	4.6	4.6	5.1	5.05
25	4.8	4.8	4.95	7.6	7.65	8.9	4.75	4.7	4.55	4.6	5.1	5.05
26	4.75	4.85	4.9	7.9	8.2	9.4	4.75	4.7	4.55	4.85	5.25	5.05
27	4.75	4.9	4.9	8.15	9.8	8.95	4.7	4.65	4.6	5.85	4.95	5.05
28	4.7	4.85	4.9	19.35	11.0	7.45	4.7	4.7	4.6	5.55	5.0	5.0
29	4.7	4.8	4.9	16.0	8.85	7.0	4.75	4.6	4.55	5.25	5.45	5.0
30	4.7	4.85	5.1	12.05	.....	6.7	4.55	4.6	4.55	5.5	5.85	5.0
31	4.7	.....	5.25	8.8	.....	6.25	.....	4.65	.....	5.65	5.4	.....

NOTE.—No gage-height record Jan. 3 and 4.

VERDE RIVER NEAR McDOWELL, ARIZ.

LOCATION.—At dam site on Salt River Indian Reservation, three-fourths mile above junction with Salt River and about 5½ miles below McDowell, Maricopa County.

DRAINAGE AREA.—6,000 square miles (measured by United States Reclamation Service).

RECORDS AVAILABLE.—August 14 to September 30, 1889; April 20, 1897, to November 11, 1899; January 1, 1901, to April 19, 1902; July 23–26, 1902; January 1, 1903, to September 30, 1916.

GAGE.—Painted directly on granite rocks on right bank.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading. Since November, 1913, measurements have been made regularly three or four times a week by a man stationed at gage.

CHANNEL AND CONTROL.—Sand; shifting.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 53,350 second-feet January 19; minimum discharge, 115 second-feet July 9 and 10.

1897–1915: Maximum mean daily gage height, 17.0 feet November 27, 1905 (discharge, 61,640 second-feet); minimum discharge, 32 second-feet July 19 and 20, 1904.

DIVERSIONS.—See Verde River at Camp Verde, page 179. A small quantity of water is also diverted 5 miles above station for use on Indian Reservation.

ACCURACY.—Records reported as good by U. S. Reclamation Service.

COOPERATION.—Daily discharge record furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	158	195	265	3,050	1,800	3,000	1,700	300	170	129	580	460
2	160	195	262	1,562	1,300	1,000	1,700	260	186	129	660	423
3	160	195	255	825	980	900	1,650	260	214	129	500	405
4	157	185	252	700	1,200	1,000	1,180	260	214	129	410	372
5	152	185	258	525	890	1,000	960	260	210	129	340	345
6	148	185	275	525	800	1,150	900	255	179	129	362	302
7	148	235	312	675	800	1,900	820	255	172	125	300	280
8	146	225	300	850	820	1,900	800	255	172	120	290	252
9	135	225	288	800	820	1,400	720	237	202	115	295	1,048
10	135	255	270	900	820	1,650	700	237	190	115	275	20,700
11	132	285	288	950	750	2,400	610	225	190	150	250	4,680
12	158	285	288	1,175	800	3,000	580	240	190	170	270	1,900
13	162	350	275	1,100	800	2,800	550	224	185	170	255	968
14	168	325	262	875	800	2,400	580	224	160	200	244	655
15	160	305	262	750	800	2,400	620	220	145	190	1,060	410
16	160	275	275	1,000	760	2,000	570	220	145	160	1,710	540
17	158	262	425	12,000	700	1,800	570	220	145	160	1,950	475
18	160	255	418	28,000	800	1,700	570	230	145	160	1,300	445
19	160	250	412	53,350	900	1,400	570	230	140	170	655	450
20	220	245	400	44,865	900	1,350	600	208	130	160	496	415
21	240	238	365	2,912	900	1,300	540	218	130	150	150	405
22	232	238	330	2,062	1,000	5,500	430	220	130	160	340	395
23	230	252	288	1,800	2,200	10,200	450	262	125	160	296	385
24	225	242	288	1,740	1,300	18,500	450	227	121	160	280	380
25	225	235	282	1,450	1,000	12,000	420	227	130	150	358	372
26	210	252	282	1,100	800	4,500	365	214	132	150	495	328
27	200	275	282	1,500	900	2,450	365	205	129	154	360	320
28	200	275	275	18,000	900	3,000	310	205	129	330	310	310
29	200	262	288	22,600	5,000	2,050	300	200	129	660	272	305
30	200	270	302	9,800	.....	2,000	300	210	129	738	340	250
31	200	.....	3,150	2,250	.....	1,900	.....	170	.....	480	290	.....

Monthly discharge of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	240	132	177	10,900
November	350	185	248	14,800
December	3,150	252	393	24,200
January	53,350	525	7,090	436,000
February	5,000	800	1,110	63,800
March	18,500	900	3,210	197,000
April	1,700	300	696	41,400
May	300	170	232	14,300
June	214	121	159	9,460
July	738	115	201	12,400
August	1,950	150	506	31,100
September	20,700	250	1,300	77,400
The year	53,350	115	1,290	933,000

NOTE.—Monthly and yearly discharge computed by engineers of United States Geological Survey from daily-discharge records furnished by United States Reclamation Service.

BEAVER CREEK AT CAMP VERDE, ARIZ.

LOCATION.—In sec. 30, T. 14 N., R. 5 E., one-fourth mile above junction with Verde River and about a mile northeast of Camp Verde, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 1, 1912, to September 30, 1916.

GAGE.—Inclined and vertical staff on right bank installed August 14, 1916, at same datum and at practically same site as original gage, which was washed out January 21, 1916. From January 22 to August 13, 1916, a temporary gage at a datum 1.46 feet above the original gage was used. All readings on temporary gage reduced to datum of original gage. Observer, Nicholas A. Vyne.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Sand, clay, and solid rock; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, about 4,950 second-feet January 17; maximum stage recorded during year, 13.0 feet during night of January 18 (caused by backwater from Verde River). Minimum discharge during year, 7 second-feet July 8–10 and September 2–7.

1912–1916: Maximum discharge not determined. Minimum discharge, 1.5 second-feet April 26–30, 1913.

DIVERSIONS.—Water is diverted for irrigation at several points above the station. Quantity unknown. A small amount of water is discharged into the creek above the gage at times by an irrigation ditch which diverts from Verde River above the mouth of Beaver Creek.

ACCURACY.—Stage-discharge relation changed during high water in January; fairly permanent for remainder of year. Rating curve fairly well defined below 1,000 second-feet and poorly defined above. Gage read to half tenths once daily; oftener during high water. Daily discharge ascertained by applying daily gage height to rating table except when stage-discharge relation was affected by backwater from Verde River (see footnote to daily-discharge table). Records fair, except those for high stages.

Discharge measurements of Beaver Creek at Camp Verde, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	M. D. Anderson	4.05	11.1	Aug. 14	Ellsworth and Anderson	4.32	29.0
Feb. 2	do	5.66	[a]652				
Apr. 22	do	4.21	15.3	15	do	4.83	151
Aug. 13	Ellsworth and Anderson	4.16	8.8	28	M. D. Anderson	4.07	8.1

[a] Surface velocity determined with floats and coefficient of 0.80 used to reduce to mean velocity.

Daily discharge, in second-feet, of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	10	14	17	1,200	159	159	8	8	8	122	8
2	10	10	14	23	1,000	138	138	8	13	8	78	7
3	10	10	14	29	860	105	105	8	13	8	46	7
4	10	10	17	17	860	122	92	8	8	8	55	7
5	10	10	17	23	815	650	78	8	8	13	46	7
6	10	10	17	23	1,260	505	78	8	8	13	37	7
7	10	23	14	17	1,150	435	92	8	8	13	30	7
8	10	17	14	17	1,100	310	78	8	8	7	37	10
9	14	14	14	29	1,150	505	55	8	8	7	37	105
10	14	17	14	78	1,050	1,000	46	8	8	7	37	55
11	14	14	14	78	1,100	1,320	37	8	8	8	13	55
12	14	14	14	55	1,440	1,260	30	10	8	8	13	55
13	14	14	14	46	1,000	1,150	18	10	8	8	13	37
14	14	14	14	23	860	1,000	37	10	8	10	23	13
15	14	14	17	37	730	435	30	10	8	13	310	13
16	14	14	17	78	905	505	30	13	8	13	78	13
17	29	14	17	4,950	1,380	400	23	10	8	10	30	13
18	23	14	17	.....	815	310	13	8	8	10	13	10
19	23	14	14	.....	770	255	13	8	8	10	13	10
20	17	14	14	860	730	205	13	8	8	10	10	10
21	17	14	14	1,440	815	1,620	10	8	8	10	8	10
22	17	14	14	1,320	1,440	3,630	10	8	13	10	8	10
23	14	14	14	1,150	650	815	10	13	13	10	8	10
24	10	14	14	950	950	575	8	13	10	18	8	8
25	10	10	14	860	470	815	8	8	10	18	8	8
26	14	10	14	1,000	610	905	8	8	8	23	8	8
27	14	10	14	730	540	770	8	8	8	66	8	8
28	10	10	14	.....	1,050	770	8	8	8	55	8	8
29	10	10	14	.....	340	690	8	8	8	46	8	8
30	10	10	17	2,080	.....	505	8	8	8	46	8	8
31	10	.....	23	1,440	.....	205	.....	8	.....	37	8	.....

NOTE.—Dischargeestimated because of backwaterfrom Verde River, as follows: Jan. 18–19, 2,000 second-feet; Jan. 28–29, 1,500second-feet. Discharge, Jan. 17 and 30 and Feb. 21 and 22, estimated from extension of rating curve, and is roughly approximate.

Monthly discharge of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	29	10	13.5	830
November	23	10	12.9	768
December	23	14	15.1	928
January	4,950	17	786	48,300
February	1,440	340	932	53,600
March	3,630	105	712	43,800
April	159	8	41.7	2,480
May	13	8	88.1	542
June	13	8	8.80	524
July	66	7	17.1	1,050
August	310	8	36.4	2,240
September	105	7	17.8	1,060
The year	4,950	7	215	156,000

AGUA FRIA RIVER NEAR GLENDALE, ARIZ.

LOCATION.—In sec. 28, T. 6 N., R. 1 E., at old diversion dam of the Beardsley irrigation project, at Camp Dyer, 4 miles below mouth of Castle Creek and 22 miles northwest of Glendale, Maricopa County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 10, 1910, to September 30, 1916.

GAGE.—Stevens water-stage recorder on right bank installed October 2, 1913; destroyed by flood January 27, 1916, and replaced March 21, 1916; during the interval staff gage readings were made by R. Jones. From August 28, 1913, to October 2, 1913, a Richard Frères water-stage recorder was used. Prior to August 28, 1913, gages were vertical staffs, either painted on or attached to the masonry diversion dam, with a datum 20 feet lower than that used for the water-stage recorders.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from cable about one-third of a mile below gage.

CHANNEL AND CONTROL.—Bed of channel above and below the dam composed of shifting sand and gravel. Principal control is formed by the remains of the old diversion dam which failed during the flood of 1895, when a portion of masonry near each end was washed out. At low and medium stages the entire stream flows through the larger opening which is near the right bank. This control shifted considerably as the crevices in the dam were filled in with sand, which washed out during high stages. On October 18, 1914, an artificial control was completed across the right opening or gap in the dam, but was partly destroyed by flood January 29, 1915. It was repaired October 28, 1915, but was again partly destroyed during the floods of January, 1916.

EXTREMES OF DISCHARGE.—Maximum stage during year, from flood marks, 30 feet about 7 p. m., January 27 (discharge, determined from extension of rating curve, 105,000 second-feet); minimum discharge, 2 second-feet October 19–27 and November 20.

DIVERSIONS.—Water (amount not known) is diverted above the gage for irrigating two or three small ranches.

ACCURACY.—Stage-discharge relation not permanent (see "Channel and control." The 38 measurements made during the year, together with two high-stage measurements made during April, 1917, were used to construct rating curves applicable as follows :November 7–23, poorly defined; December 30 to March 22, fairly well defined below 13,000 second-feet; March 23 to July 10, well defined below 300 second-feet and fairly well defined for all stages; September 3–30, fairly well defined below 40 second-feet. Shifting-control method used to determine discharge for other periods. Operation of the water-stage recorder not satisfactory during much of year (see footnote to daily-discharge table). Records fair from April 1 to July 12, August 8 to September 3, and September 14–30; poor for rest of year.

Discharge measurements of Agua Fria River near Glendale, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	Jacob and Horton	2.06	2.7	Feb. 4	C. C. Jacob	4.60	587
13	Anderson and Jackson	2.07	3.9	12	do	4.00	438
13	do	2.08	3.6	Mar. 3	M. D. Anderson	3.55	301
22	Loren Guthrie	2.10	2.1	3	do	3.55	328
23	do	2.10	2.1	21	do	2.30	142
Nov. 1	Anderson and Guthrie	3.25	3.4	Apr. 1	do	4.15	279
8	J. B. Spiegel	3.64	41.4	1	do	4.15	288
8	do	3.65	42.6	29	do	2.74	58
8	M. D. Anderson	3.65	42.2	29	do	2.74	57
8	do	3.65	42.0	May 22	do	2.21	26.0
23	Anderson and Guthrie	3.30	3.4	22	do	2.21	28.2
23	do	3.30	3.2	June 28	do	1.62	4.4
Dec. 29	C. C. Jacob	3.45	7.4	July 12	Ellsworth and Anderson	2.48	27.3
Jan. 20	M. D. Anderson	7.68	2,980	Aug. 8	M. D. Anderson	1.45	24.3
20	do	7.45	2,320	Sept. 3	C. E. Ellsworth	1.41	13.3
20	do	7.45	2,250	3	do	1.40	11.7
21	do	6.30	1,530	14	do	2.00	32.6
21	do	6.35	1,360	14	do	2.00	33.6
21	do	6.20	1,200				
21	do	6.20	1,220				

Daily discharge, in second-feet, of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	3	12	.....	1,080	.....	270	48	13	4	.....	48
2	3	3	12	.....	885	.....	258	48	13	4	.....	27
3	3	3	14	.....	689	311	246	48	12	4	.....	15
4	3	3	17	.....	604	.....	234	45	10	4	.....	.....
5	3	3	28	.....	.....	.....	223	43	10	4	.....	.....
6	3	3	29	.....	.....	.....	212	40	10	4	.....	.....
7	3	800	36	.....	.....	.....	192	37	10	3	.....	.....
8	3	213	29	.....	.....	.....	183	34	9	4	24	.....
9	4	22	29	.....	.....	.....	174	32	9	4	15	.....
10	4	12	29	.....	.....	.....	165	30	8	15	14	.....
11	4	6	29	.....	.....	.....	156	28	7	99	13	.....
12	4	5	29	.....	423	.....	148	28	7	44	145	.....
13	4	5	29	.....	.....	.....	156	26	7	.....	28	.....
14	4	5	29	.....	.....	.....	202	24	7	.....	31	33
15	4	5	65	.....	.....	.....	202	23	6	.....	212	26
16	3	4	75	.....	.....	.....	174	22	6	.....	170	22
17	3	4	45	.....	.....	.....	148	22	6	.....	51	19
18	3	4	30	.....	.....	.....	140	23	6	.....	26	19
19	2	3	24	29,500	.....	.....	126	22	5	.....	16	18
20	2	2	24	2,710	.....	.....	112	23	5	.....	14	17
21	2	3	18	1,380	.....	152	105	24	5	.....	13	18
22	2	4	20	930	.....	.....	98	24	5	.....	13	17
23	2	4	18	802	.....	.....	95	22	5	.....	27	16
24	2	6	18	725	.....	.....	81	20	4	.....	177	15
25	2	6	14	1,080	.....	.....	73	18	4	.....	36	13
26	2	6	12	.....	.....	.....	67	17	4	.....	35	13
27	2	8	12	.....	.....	.....	63	16	4	.....	145	13
28	3	8	12	.....	.....	.....	57	16	4	.....	74	13
29	3	10	8	.....	.....	.....	55	15	4	.....	79	13
30	3	12	1,660	2,850	.....	.....	51	14	4	.....	300	14
31	3	.....	5,150	1,920	.....	.....	.....	13	.....	.....	92	.....

NOTE.—Daily gage heights, Oct. 29–31 and Nov. 2–7, determined from observations by nearby residents. Discharge estimated, because of missing or unreliable gage heights, from weather records and general observations by residents, as follows: Jan. 1–6, 1,400 second-feet; Jan. 7–15, 725 second-feet; Jan. 16–18, 27,000 second-feet; Jan. 26–29, 54,000 second-feet; Feb. 5–11, 480 second-feet; Feb. 13–22, 450 second-feet; Feb. 23–29, 740 second-feet; Mar. 1 and 2, 400 second-feet; Mar. 4–20, 240 second-feet; Mar. 22–31, 1,030 second-feet; July 13–31, 30 second-feet; Aug. 1–7, 25 second-feet; Sept. 4–13, 320 second-feet.

Monthly discharge of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4	2	2.94	181
November	800	2	39.2	2,330
December	5,150	8	244	15,000
January	.....	.....	11,400	701,000
February	.....	.....	577	33,200
March	.....	.....	505	31,100
April	270	51	149	8,870
May	48	13	27.3	1,680
June	13	4	6.97	415
July	99	3	24.6	1,510
August	300	13	62.1	3,820
September	.....	.....	120	7,140
The year	.....	2	1,110	806,000

NOTE.—See footnote to daily-discharge table.

HASSAYAMPA RIVER NEAR WAGONER, ARIZ.[1]

LOCATION.—In sec. 23,[2] T. 11 N., R. 3 W., at road crossing opposite Shride's ranch (Moore's ranch prior to August 20, 1916), 2½ miles above mouth of Milk Creek, 4½ miles above Wagoner, Yavapai County, 6 miles above Walnut Grove dam site, and about 25 miles northeast of Wickenburg.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 21, 1912, to September 30, 1916.

GAGE.—Vertical staff on right bank; read by Mrs. A. A. Moore from October 1 to August 19 and by E. W. Shride from August 20 to September 30. Auxiliary gage were used from time to time but all were referred to same datum.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Sand and gravel; constantly shifting.

EXTREMES OF DISCHARGE.—No reliable records of maximum discharge; channel dry at gage for periods of varying length nearly every year.

DIVERSIONS.—Nearly entire low-water flow is diverted for irrigation above station.

ACCURACY.—Stage-discharge relation constantly changing. Rating curve not developed. Gage read to half-tenths once daily. Daily discharge not determined.

Discharge measurements of Hassayampa River near Wagoner, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 10	M. D. Anderson	5.30	24.	Jan. 24	C. C. Jacob	6.04	30.1
10	do	5.30	25.	Aug. 11	Ellsworth and Anderson.	5.38	.4

Daily gage height, in feet, of Hassayampa River near Wagoner, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.3	5.3	5.3	5.5	6.2	5.6	5.4	4.7	4.3	4.5	5.5	5.8
2	5.25	5.3	5.3	5.5	6.0	5.6	5.35	4.7	4.3	4.5	5.5	5.8
3	5.3	5.3	5.3	5.5	5.9	5.5	5.4	4.7	4.2	4.5	5.7	5.8
4	5.3	5.3	5.3	5.5	5.85	5.5	5.4	4.65	4.2	4.5	5.6	5.8
5	5.3	5.3	5.3	5.5	5.85	5.5	5.4	4.65	4.2	4.5	5.6	5.8
6	5.3	5.45	5.3	5.5	5.9	5.5	5.4	4.6	4.2	4.5	5.85	5.8
7	5.3	5.5	5.3	5.5	5.9	5.4	5.4	4.6	4.15	6.15	5.85	5.8
8	5.3	5.4	5.3	5.5	5.6	5.4	5.4	4.6	4.15	6.5	5.6	5.8
9	5.3	5.4	5.3	5.5	5.5	5.4	5.4	4.6	4.15	6.05	5.5	5.9
10	5.3	5.4	5.3	5.5	5.55	5.5	5.4	4.6	4.15	5.95	5.4	5.9
11	5.3	5.35	5.3	5.5	5.55	5.5	5.4	4.6	4.15	5.8	5.4	5.8
12	5.5	5.35	5.3	5.5	5.6	5.5	5.4	4.6	4.15	5.7	5.6	5.8
13	5.5	5.35	5.3	5.4	5.65	5.4	5.3	4.6	4.15	5.7	5.4	5.8
14	5.5	5.3	5.3	5.4	5.65	5.4	5.25	4.55	4.1	5.6	5.6	5.85
15	5.5	5.3	5.3	5.4	5.7	5.4	5.1	4.55	4.1	5.6	5.6	5.85
16	5.5	5.3	5.3	5.6	5.8	5.4	5.0	4.45	4.1	5.6	5.5	5.9
17	5.4	5.3	5.3	7.4	5.9	5.4	5.0	4.45	4.1	5.55	5.5	5.8
18	5.4	5.3	5.3	7.25	5.6	5.4	5.0	4.45	4.1	5.55	5.4	5.8
19	5.4	5.3	5.4	6.0	5.5	5.45	5.0	4.4	4.1	5.55	5.4	5.8
20	5.3	5.35	5.4	6.0	5.4	5.6	4.9	4.4	4.1	5.55	5.4	5.8
21	5.3	5.3	5.4	6.0	5.8	5.6	4.8	4.4	4.1	5.55	5.4	5.8
22	5.3	5.3	5.4	5.8	5.7	6.0	4.8	4.4	4.1	5.55	5.4	5.8
23	5.3	5.3	5.4	.....	5.9	6.2	4.8	4.4	4.1	5.5	5.85	5.8
24	5.2	5.3	5.4	6.0	5.9	6.3	4.7	4.5	4.1	5.5	5.7	5.8
25	5.2	5.3	5.4	6.0	5.9	6.0	4.7	4.5	4.1	5.45	5.8	5.8
26	5.2	5.3	5.4	6.0	6.1	5.9	4.7	4.4	4.1	5.45	5.85	5.8
27	5.3	5.3	5.4	7.0	5.8	5.75	4.7	4.35	4.5	5.4	5.95	5.8
28	5.3	5.3	5.4	10.0	5.85	5.7	4.7	4.5	4.5	5.4	5.85	5.8
29	5.3	5.3	5.4	6.2	5.8	5.7	4.7	4.0	4.5	5.4	5.9	5.8
30	5.3	5.3	5.5	6.2	.....	5.6	4.7	4.0	4.5	5.35	5.85	5.8
31	5.3	.....	5.5	6.9	.....	.....	.....	3.5	.....	5.35	5.8	.....

[1] Records published as "Hassayampa River at Walnut Grove" in Water-Supply Papers 329, 359, and 389. Walnut Grove post office was originally in sec. 2, T. 10 N., R. 3 W., as shown on the topographic map of the Congress quadrangle. Some time prior to the establishment of the gaging station the post office was moved to sec. 23, T. 11 N., R. 3 W., about one-fourth mile above site of gage. It was abandoned in March, 1914, and since then the nearest post office has been Wagoner.

[2] Incorrectly given as "sec. 33" in Water-Supply Papers 329, 359, and 389.

SEEPAGE INVESTIGATIONS ON GILA RIVER.

From April 25 to October 1, 1916, eight series of discharge measurements were made on Gila River from the head of Florence canal to the east line of Gila Indian Reservation to determine the quantity of water lost by seepage and evaporation between those points. All diversions were measured. The results of these measurements are shown in the following table:

Seepage measurements on Gila River from head of Florence canal to east line of Gila River Indian Reservation, during period Apr. 25 to Oct. 1, 1916.

First eries.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
			Sec.-ft.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
Apr. 25	Gila River	Above Florence canal	717			
25	Florence canal	Intake		70		
25	McLellan canal	do		3.7		
25	O. T. canal	do		28.9		
26	Pierson-Nicholas canal	do		13.0	131	
26	Price and Powell canal	do		1.1		
26	North Side Blackwater canal	do		5.4		
26	Aztec canal	do		9.2		
26	Gila River	Near east line of Gila River Indian Reservation.	403			183

Second series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 2	Gila River	Above Florence canal	778			
2	Florence canal	Intake		82		
2	McLellan canal	do		1.5		
2	O. T. canal	do		25.2		
2	Pierson-Nichols canal	do		13.7	147	
2	Price and Powell canal	do		1.1		
2	North Side Blackwater canal	do		13.4		
2	Aztec canal	do		10.0		
2	Gila River	Near east line of Gila River Indian Reservation.	430			201

Third series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 15	Gila River	Above Florence canal	438			
15	Florence canal	Intake		87		
15	McLellan canal	do		3.6		
15	O. T. canal	do		10.3		
15	Pierson-Nicholas canal	do		9.7	129	
15	Price and Powell canal	do		1.0		
15	North Side Blackwater canal	do		11.2		
15	Aztec canal	do		6.2		
15	Gila River	Near east line of Gila River Indian Reservation.	231			78

Fourth series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 21	Gila River	Above Florence canal	325			
21	Florence canal	Intake		80		
21	McLellan canal	do		2.7		
21	O. T. canal	do		19.7		
20	Pierson-Nicholas canal	do		6.4	114	
20	Price and Powell canal	do		1.6		
20	North Side Blackwater canal	do		1.6		
20	Aztec canal	do		2.2		
20	Gila River	Near east line of Gila River Indian Reservation.	136			75

Seepage measurements on Gila River from head of Florence canal to east line of Gila River Indian Reservation, during period Apr. 25 to Oct. 1, 1916—Continued.

Fifth series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
			Sec.-ft.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
June 1	Gila River	Above Florence canal	172			
1	Florence sanal	Intake		30.9		
1	McLellan canal	do		2.3		
2	Pierson-Nicholas canal	do		14.8	60	
2	Price and Powell canal	do		3.9		
2	North Side Blackwater canal	do		5.0		
2	Aztec canal	do		3.4		
2	Gila River	Near east line of Gila River Indian Reservation.	28.5			84

Sixth series.

June 7	Gila River	Above Florence canal	129			
7	Florence canal	Intake		61		
7	O. T. canal	do		3.4	65	
8	Aztec canal	do		.8		
8	Gila River	Near east line of Gila River Indian Reservation.	3.6			60

Seventh series.

July 18	Gila River	Above Florence canal	132			
18	Florence canal	Intake		64		
18	McLellan canal	do		1.9	91	
18	O. T. canal	do		9.9		
19	Pierson-Nicholas canal	do		15.2		
19	Gila River	Near east line of Gila River Reservation.	0			41

Eighth series.

Oct. 1	Gila River	Above Florence canal	184			
1	Florence canal	Intake		48.8		
1	McLellan canal	do		4.8		
1	O. T. canal	do		6.2	74	
1	Pierson-Nicholas canal	do		9.5		
1	Aztec canal	do		4.3		
1	Gila River	Near east line of Gila River Indian Reservation.	23.2			87

WHITEWATER DRAW BASIN.

WHITEWATER DRAW NEAR DOUGLAS, ARIZ.

LOCATION.—In sec. 10, T. 24 S., R. 27 E., opposite city pumping plant, one-quarter mile above highway bridge, about the same distance above El Paso & Southwestern Railroad bridge, 1 mile above electric railway bridge, and 1¼ miles west of Douglas, Cochise County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 24 to October 10, 1911, at electric railway bridge; July 21, 1912, to February 15, 1916, at highway bridge; and February 16 to September 30, 1916, at present location.

GAGE.—Vertical and inclined staff on right bank opposite city pumping plant; read by Mrs. L. E. King. Original gage, installed August, 1911, at electric railway bridge, was read until October 10, 1911. On July 21, 1912, the station was moved about three-quarters of a mile upstream to the highway bridge, where gage read-

ings were obtained until February 16, 1916; datum of this gage, which bears no definite relation to gage on the electric railway bridge, was raised 3.00 feet on January 20, 1915. On February 16, 1916, the station was moved one-quarter of a mile upstream to its present location and the gage was set at an independent datum.

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

CHANNEL AND CONTROL.—Sand and gravel; fairly permanent. The dumping of slag into the channel below the gage has caused backwater at various times at the gages until about July 1, 1916, when a new channel was dug around the slag.

EXTREMES OF DISCHARGE.—Maximum stage during year, from flood marks on gage, 9.5 feet during night of July 10 (discharge, determined from extension of rating curve, 1,600 second-feet).

1911–1916: Maximum stage recorded, 13.6 feet at 9 a. m. December 23, 1914 (discharge, determined from extension of rating curve, 3,000 second-feet). Stream is dry or carries less than 0.5 second-feet the greater part of each year.

DIVERSIONS.—Some flood water is diverted above station for irrigation; quantity unknown.

ACCURACY.—Stage-discharge relation prior to July 11 was affected by smelter slag that was being constantly dumped in channel below the gage. Rating curve used prior to February 17 fairly well defined below 1,000 second-feet; curve used since that date fairly well defined below 65 second-feet; above 65 second-feet its extension is based on the slope of the old curve and may be considerably in error. During periods when the discharge was greater than about one-half second-foot the gage was read to half-tenths twice a day or oftener, but on account of rapidly fluctuating stage considerable error may be introduced in assuming that the mean daily gage height was the mean of the observed gage heights. Daily discharge ascertained by applying daily gage height to rating curve. Records roughly approximate.

Discharge measurements of Whitewater Draw near Douglas, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. B. Spiegel	3.25	0.0	Aug. 18	J. B. Spiegel	4.65	63
Nov. 11	do		*a*.8	18	do	4.61	55
Dec. 9	Jacob and Spiegel		.0	18	do	4.46	38.4
Feb. 17	J. B. Spiegel	3.62	*a*.2	18	do	4.44	33.3
Mar. 21	do	3.58	*a*.1	19	do	4.24	12.4
Apr. 27	do	4.15	.0	19	do	4.24	12.3
July 24	Ellsworth and Spiegel	3.82	*a*.3	30	do	4.16	13.3
Aug. 8	J. B. Spiegel	3.70	*a*.1	30	do	4.15	13.6
18	do	4.65	60				

a Discharge estimated.

Monthly discharge of Whitewater Draw near Douglas, Ariz., for the year ending Sept. 30, 1916.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
Jan. 20–28	49.3	880	August	118	7,260
May 1–3	154	916	Sept. 1–21	28.0	1,170
July 11–31	31.6	1,320			

NOTE.—For periods of no record the stream was either dry or carried less than 0.5 second-foot except possibly for a few hours at a time immediately following showers. Discharge Sept. 5, 15, and 18–20 interpolated. Daily discharge not sufficiently accurate for publication. See "Accuracy" in station description.

MISCELLANEOUS MEASUREMENTS.

In additions to the records of flow obtained at the gaging stations and reported in the preceding pages, many measurements were made at other points, as shown by the following table:

Miscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 6	Blacks Fork	Green River	Approximately in sec. 34, T. 16 N. R. 108 W. About 3 miles above mouth, Wyo.	11.06	1,400
21	do	do	do	11.13	1,340
Aug. 11	do	do	do		87
June 5	Hams Fork	Black Fork	Above mouth near Granger, Wyo.	17.20	604
20	do	do	do	17.05	678
Aug. 15	Fraser River	Grand River	500 feet above St. Louis Creek, Fraser, Colo.		89
15	St. Louis Creek	Fraser River	Mouth, Fraser, Colo		46
Nov. 3	Brush Creek	Green River	Approximately in sec. 36, T. 3 S., R. 22 E. (Salt Lake base and meridian), at bridge on road from Vernal at Bridgeport, Utah.		a 7.0
May 8	Ferron Creek	San Rafael River	Sec. 35, T. 19 S., R. 8 E., at former gaging station known as Ferron Creek near Castledale, Utah.	6.97	128
June 30	do	do	do	6.50	49
Aug. 10	do	do	do	6.40	43
Nov. 18	East Elk Creek	Grand River	Newcastle, Colo	.93	9.7
Oct. 27	Pack Creek	do	Approximately sec. 8, T. 26 S., R. 22 E., on road to Monticello about 3 miles above Moab, Utah.		a 1.0
May 9	Muddy Creek	Fremont River	Below head of Thos. S. Johnson ditch, the only diversion above, about at location of former gaging station known as "Muddy River near Emery," Utah.		175
July 1	do	do	do		95
May 9	do	do	NE. ¼ sec. 35, T. 21 S., R. 6 E., at former gaging station known as "Muddy Creek (lower station) near Emery, Utah."		173
July 1	do	do	do		1.0
1	Thos. S. Johnson ditch.	Muddy Creek	Near head of ditch		1.0
June 17	Verdure or South Montezuma Creek.	Montezuma Creek	Sec. 25, T. 34 S., R. 23 E., State road crossing, about 2½ miles below former gaging station, known as "Verdure Creek, near Verdure, Utah."		2.0
Oct. 26	Recapture Creek	San Juan River	SE. ¼ sec. 12, T. 36 S., R. 22 E., at State road crossing and 1 mile below head of San Juan Irrigation Co.'s canal.		.0
Mar. 2	do	do	do		a 5.0
6	do	do	do		a 12.0
June 17	do	do	do		.3
17	San Juan Irrigation Co.'s canal.	Recapture Creek	do		2.6
Sept. 24	Little Colorado River	Colorado River	100 feet above head of canal, near St. Joseph, Ariz.		35.6
Aug. 26	do	do	Tolchaco, Ariz	2.10	200
Sept. 24	St. Joseph canal	Little Colorado River	30 feet below head of canal, about 4 miles east of St. Joseph, Ariz.		20.5
25	Clear Creek	do	Near mouth, about 4 miles east of Winslow, Ariz.		11.8
June 10	Burro Creek	Williams River	About half a mile west of line between Yavapai and Mohave counties, Ariz.		3.0
July 21	do	do	do	1.00	.8
22	do	do	do		.5

a Estimated.

Msscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge
				Feet.	*Sec.-ft.*
Aug. 25	Burro Creek	Williams River	About half a mile west of line between Yavapai and Mohave counties, Ariz.	1.05	3.7
28	do	do	do		12.3
July 23	Neals ditch	Burro Creek	do		.6
July 26	Ash Creek	Virgin River	About in sec. 35, T. 40 S., R. 13 W., above Toquerville Springs, Utah.		3.2
Jan. 13	do	do	SW. ¼ sec. 2, T. 41 S., R. 13 W., at the southwest corner of the town of Toquerville, Utah.	0.35	13
Mar. 31	do	do	do	.68	109
May 25	do	do	do	.30	38
July 27	do	do	do		18
26	do	do	NW. ¼ sec. 2, T. 41 S., R. 13 W., below diversions at Toquerville, Utah.		8.6
26	Toquerville Town Springs ditch.	Ash Creek	Head of ditch at Toquerville, Utah.		1.4
26	West side Toquerville fields ditch.	do	do		8.7
26	Unnamed ditch	do	do		4.7
May 25	La Verkin Creek	do	SE. ¼ sec. 14, T. 41 S., R. 13 W., at State road crossing, 2 miles south of Toquerville, Utah.		24
May 26	Savage ditch	Leeds Creek	Sec. 36, T. 40 S., R. 14 W., at head of ditch which diverts on left bank a short distance below gaging station on Leeds Creek.		2.1
26	Leeds ditch	do	Sec. 36, T. 40 S., R. 14 W., at head of ditch which diverts on left bank about a quarter of a mile below gaging station on Leeds Creek.		18
29	Cottonwood Creek	Virgin River	Above head of St. George and Cottonwood canal about 15 miles north of St. George, Washington County, Utah.		9.3
July 12	St. George and Cottonwood canal.	Cottonwood Creek	Near head of canal which diverts on right bank of Cottonwood Creek about 15 miles north of St. George, Utah.	1.32	6.8
May 27	Santa Clara Creek	Virgin River	About in sec. 29, T. 41 S., R. 17 W., above heading of Santa Clara Bench canal; short distance above old smelter at Shem and 10 miles northwest of Santa Clara, Washington County, Utah.		54
Feb. 14	do	do	Sec. 16, T. 42 S., R. 16 W., at former gaging station known as "Santa Clara Creek at Santa Clara, Utah."	0.88	80
Apr. 22	do	do	do		23
May 23	do	do	do	*a*.95	34
27	do	do	do	*a*.47	33
July 19	do	do	do	*a*.82	16
May 28	Central canal or 8-mile flat ditch.	Santa Clara Creek	Sec. 11, T. 39 S., R. 16 W., at flume about half a mile below head of canal and about 1½ miles east of Central, Washington County, Utah.	.98	16
July 19	St. George and Santa Clara south ditch.	Santa Clara Creek	Sec. 21, T. 42 S., R. 16 W., at former gaging station at Santa Clara, Utah.	1.12	9.9
Jan. 15	Gila River	Colorado River	Below mouth of San Carlos Creek near San Carlos, Ariz.		8.6
15	do	do	do		8.8
May 9	do	do	Above diversions near Florence, Ariz.		6.2
27	do	do	do		218
June 12	do	do	do		103
15	do	do	do		91
19	do	do	do		75

a Temporary gage; old gage not in main channel.

Miscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916—Continued.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 8	Gila River	Colorado River	Above diversions near Florence, Ariz.		34.5
12	do	do	do		157
25	do	do	do		194
Aug 2	do	do	do		448
9	do	do	do		240
12	do	do	do		301
Sept. 7	do	do	do		923
19	do	do	do		509
19	do	do	do		507
27	do	do	do		226
27	do	do	do		213
Apr. 20	Mineral Creek	Gila River	Mouth, Kelvin, Ariz.		[25.4
20	do	do	do		24.7
15	Florence canal	do	Head of canal near Florence, Ariz.	2.49	63
19	do	do	do		63
29	do	do	do	2.50	81
May 27	do	do	do	2.24	46.9
June 12	do	do	do	2.62	66
July 25	Florence canal	Gila River	Head of canal near Florence, Ariz.	2.94	94
May 27	McLellan canal	do	do	1.60	3.0
July 25	do	do	do	1.61	3.0
Apr. 15	O. T. canal	do	do	1.87	20.3
May 27	do	do	do	1.60	9.1
July 25	do	do	do	1.74	18.0
Apr. 22	Price and Powell canal	do	do		2.7
Mar. 30	Queen Creek	do	1 mile below dam site near Superior, Ariz.		9.8
Sept. 22	North Fork of White River.	White River	Below tailrace of power plant half a mile from Fort Apache Indian School at White River, Navajo County, Ariz.,	2.24	128
22	do	do	do	2.24	127
Aug. 11	Hassayampa River	Gila River	Dam site near Wagner, Ariz., about 5 miles below regular gaging station.	2.85	6.0

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART IX.—COLORADO RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, ground 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, monographs, 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 slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins, in three volumes:
A. Pacific slope basins in Washington and Upper Columbia River basin.
B. Snake River basin.
C. Lower Columbia River basin and Pacific slope basins in Oregon.

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 furnish lists giving prices.

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

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

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Atlanta, Ga., Post Office Building.
Chicago, Ill., 1404 Kimball Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Topeka, Kans., 25 Federal Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Austin, Tex., Capitol Building.
Portland, Oreg., 606 Post Office Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Tucson, Ariz., Univeristy of Arizona.
Honolulu, Hawaii, 14 Capitol Building.

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

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,100 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 September, 1890.
12th A, pt. 2.....	.....do.....	1884 to June 30, 1891.
13th A, pt. 3.....	Mean discharge in second-feet.....	1884 to Dec. 31, 1892.
14th A, pt. 2.....	Monthly discharge (long-time records, 1871 to 1893).....	1888 to Dec. 31, 1893.
B 131.....	Description, measurements, gage heights, and ratings.....	1893 and 1894.
16th A, pt. 2.....	Descriptive information only.....	
B 140.....	Descriptions, measurements, gage heights, ratings, 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. 2.....	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	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.

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 1916. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1916, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. Results of miscellaneous measurements are published by drainage basins.

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

In exception to this rule the records for the Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are presented in order of streams around the rim of the lake.

Number of water-supply papers containing results of stream measurements, 1899-1916.

Year.	I North Atlantic slope basins. (St. John River to York River).	II South Atlantic slope and eastern Gulf of Mexico basins. (James River to the Mississippi).	III Ohio River basin.	IV St. Lawrence River and Great Lakes basins.	V Hudson Bay and upper Mississippi River basins.	VI Missouri River basin.	VII Lower Mississippi River basin.	VIII Western Gulf of Mexico basins.	IX Colorado River basin.	X Great Basin.	XI Pacific slope basins in California.	XII North Pacific slope basins.		
												Pacific slope basins in Washington and upper Columbia River basins.	Snake River basin.	Lower Columbia River basin and Pacific slope basins in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[a]	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	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	55	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907-8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332-A	332-B	332-C
1913	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables of monthly discharge 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.

PART IX. COLORADO RIVER BASIN.

PRINCIPAL STREAMS.

The largest tributaries of the Colorado River are Green River (considered the continuation of the main stream), Grand River, Dolores, San Juan, Little Colorado, Virgin, and Gila rivers. The principal streams flowing into the Green are East Fork, Yampa River, Ashley Creek, Duchesne River, and White River. The principal tributaries of Grand River are Grand Lake, Frazier River, Williams Fork, Blue River, and Gunnison River. The streams of the Colorado basin drain wholly or in part the States of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming.

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

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1916. Period after a date indicates discontinuance.

Green River (head of Colorado River) near Kendall, Wyo., 1910–1912.
Green River near Daniel, Wyo., 1915–
Green River at Green River, Wyo., 1895–1906; 1915–
Green River at Bridgeport, Utah, 1911–1915.
Green River at Jensen, near Vernal, Utah, 1903–1906; 1914–1915.
Green River at Ouray, Utah, 1904–5.
Green River at Green River (formerly Blake), Utah, 1894–1899; 1905–1911.
Green River at Little Valley, near Green River, Utah, 1910–
Colorado River at Bulls Head, near Mohave, Ariz., 1902–3.
Colorado River at Hardyville, Ariz., 1905–1907.
Colorado River at Yuma, Ariz., 1891–
Horse Creek at Daniel, Wyo., 1915–
Cottonwood Creek near Big Piney, Wyo., 1916–
East Fork at East Fork canal, Wyo., 1916–
East Fork at Newfork, Wyo., 1905–6; 1915–
New Fork at Alexander's ranch, near Cora, Wyo., 1910–11.
New Fork at Pinedale crossing, near Cora, Wyo., 1905.
New Fork near Boulder, Wyo., 1915–
Pine Creek at Fremont Lake outlet near Pinedale, Wyo., 1905–1906; 1910–1912; 1915–
Pine Creek at Pinedale, Wyo., 1915–
Pole Creek near Fayette, Wyo., 1904–1906.
Pole Creek near Pinedale, Wyo., 1910.
Fall Creek at Fayette, Wyo., 1904–5.
Boulder Creek near Boulder (Newfork), Wyo., 1904–1906; 1915–
North Piney Creek near Marbleton, Wyo., 1915–1916.
Middle Piney Creek near Big Piney, Wyo., 1915–
Labarge Creek near Labarge, Wyo., 1915–16.

Colorado River tributaries—Continued.
- Fontenelle Creek near Fontenelle, Wyo., 1915–
- Big Sandy Creek at Leckie's ranch, near Big Sandy, Wyo., 1910–11.
- Big Sandy Creek near Eden, Wyo., 1911–12.
- Big Sandy Creek near Farson, Wyo., 1915–
  - Dutch Joe Creek at Dutch Joe ranger station, near Big Sandy, Wyo., 1911–12.
  - Squaw Creek near Eden, Wyo., 1911–12.
  - Little Sandy Creek near Eden, Wyo., 1911–12.
- Blacks Fork near Urie, Wyo., 1913–
- Blacks Fork above Hams Fork, near Granger, Wyo., 1896–97.
- Blacks Fork below Hams Fork at Granger, Wyo., 1897–1900; 1916.
- Henrys Fork near Linwood, Utah, 1916.
- Beaver Creek at Myer's ranch, near Lodore, Colo., 1910–11.
- Vermilion Creek at Bassett's ranch, near Lodore, Colo., 1910–11.
- Yampa River at Yampa, Colo., 1910–1913.
- Yampa River at Steamboat Springs, Colo., 1904–1906; 1910–1913.
- Yampa River at Craig, Colo., 1901–2; 1904–1906; 1910–1913.
- Yampa River near Maybell, Colo., 1904–5; 1910–12; 1916–
  - Terrible Creek:
    - Trout Creek at Pinnacle, Colo., 1910–11.
  - Soda Creek at Steamboat Springs, Colo., 1910–11.
  - Elk River at Hinman Park, Colo., 1912–13.
  - Elk River near Clark, Colo., 1910–1913.
  - Elk River near Trull, Colo., 1904–1906; 1910–1913.
    - Mad Creek near Steamboat Springs, Colo., 1912–13.
  - Sage Creek:
    - Fish Creek at Dunkley, Colo., 1910–11.
  - Elk Head Creek near Craig, Colo., 1906; 1910–1913.
  - Fortification Creek at Craig, Colo., 1905–6; 1910–1913.
  - Williams River near Pyramid, Colo., 1910–11.
  - Williams River at Hamilton, Colo., 1904–1906; 1910–1913.
  - Milk Creek near Axial, Colo., 1904–5.
  - Little Snake River, Middle Fork, near Battle Creek, Colo., 1912–13.
  - Little Snake River at Dixon, Wyo., 1910–1913.
  - Little Snake River near Maybell, Colo., 1904.
    - South Fork of Little Snake River near Battle Creek, Colo., 1912–13.
    - Slater Creek at Baxter ranch, near Slater, Colo., 1912–13.
    - Slater Creek near Slater, Colo., 1910–1912.
    - Savery Creek near Savery, Wyo., 1915–
    - Beaver Creek:
      - Willow Creek near Baggs, Wyo., 1912–13.
    - Muddy Creek near Baggs, Wyo., 1915–
    - Fourmile Creek near Baggs, Wyo., 1912–13.
- Ashley Creek above Dry Fork, near Vernal, Utah, 1911–
- Ashley Creek below Dry Fork, near Vernal, Utah, 1900–1904.
  - Dry Fork of Ashley Creek at Vernal, Utah, 1904.
- Duchesne River, North Fork (head of Duchesne River), above Forks, Utah, 1904.
- Duchesne River at Myton, Utah, 1899–
  - West Fork of Duchesne River above Forks, Utah, 1904.
  - Rock Creek (East Creek), 10 miles above mouth, Utah, 1904.
  - Strawberry River above mouth of Indian Creek, in Strawberry Valley, Utah, 1903–1906; 1909–10.
  - Strawberry River below mouth of Indian Creek, in Strawberry Valley, Utah, 1908–9.

[1] Flows into Gulf of California in Mexico.

REPORTS ON WATER RESOURCES OF COLORADO 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.

*2. Irrigation near Phoenix, Ariz., by A. P. Davis. 1897. 98 pp., 31 pls. 15c.

Describes physiographic features, temperature, rainfall, stream flow, soils, and projected irrigation works in Gila River basin; discusses briefly possible use of ground water for irrigation and gives data concerning wells in Pinal and Maricopa counties. Chiefly of historic interest, as indicated by the date of publication.

*33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls. 15c.

Describes conditions existing in 1896-99, available water supply, silt, and reservoir sites (Buttes, Riverside, San Carlos, and Queen Creek); contains section on cement, and treats of irrigable land, distribution canals, and organization of irrigation. Interest chiefly historic.

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

Describes various types of canals for irrigation.

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

Gives elevations and distances along Colorado, Little Colorado, San Juan, Mancos, La Plata, Animas, Los Pinos, Grand, Gunnison, Dolores, Uncompahgre, Lake Fork, Roaring Fork, and Eagle rivers; also brief descriptions of several of the streams.

*57. Preliminary list of deep borings in the United States, Part I (Alabama–Montana), by N. H. Darton. 1902. 60 pp. 5c.

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

A second, revised, edition of Nos. 57 and 61 was published in 1905 as Water-Supply Paper 149 (q. v.).

*73. Water storage on Salt River, Arizona, by A. P. Davis. 1903. 54 pp., 25 pls. 20c.

Discusses Verde and Salt River basins and McDowell and Salt River reservoirs.

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

Discusses drainage and irrigation; gives records of stream flow.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. Contains:

Investigations in Arizona, by A. P. Davis. Describes the proposed storage reservoir on Salt River at the mouth of Tonto Creek.

Salt River Valley Water Users' Association, by B. A. Fowler. Contains Judge Kibbey's address presenting a plan for the organization of the owners of lands to be irrigated.

Topographic work in the Grand Canyon of the Gunnison, by I. W. McConnell. Discusses the proposed diversion of water from Gunnison River into Uncompahgre Valley.

The Colorado River, by J. B. Lippincott.

Colorado River reclamation projects, by E. T. Perkins. Describes the site of the Yuma dam and summarizes the advantages of the Yuma site.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. Superseded by 152.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

104. The underground waters of Gila Valley, Arizona, by W. T. Lee. 1904. 71 pp., 5 pls. 10c.

Presents information concerning the topographic features and surficial geology of the area between The Buttes, 12 miles east of Florence and the junction of the Gila and Salt rivers; treats of the source, amount, quality, and methods of securing the underflow.

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

Cites legislative acts relating to ground waters in Colorado, Nevada, New Mexico, Utah, and Wyoming.

136. Underground waters of Salt River valley, Arizona, by W. T. Lee. 1905. 196 pp., 23 pls. 25c.

Describes the physiography and geology of the Mesa and Pheonix regions, gives many well records, and discusses the amount and chemical character of the ground waters, duty of water, and cost of pumping.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Troxton Canyon flood, Arizona, by E. C. Murphy. Globe flood, Arizona, by O. T. Reedy. La Plata River flood, Colorado, from report of Theo. Tobish.

*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 valuable 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.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

*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.

Contains accounts of floods on Colorado, Green, Grand, Gunnison, San Juan, Little Colorado, Gila, San Francisco, Verde, San Pedro, and Salt Rivers, and of th flow of the Colorado into Salton Sink; gives index to literature on floods on American streams.

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 analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analysis of waters of Colorado, Green, Grand, Gunnison, Animas, Little Colorado, Gila, San Francisco, Salt, and Verde ri ers.

320. Geology and water resources of the Sulphur Spring Valley, Arizona, by O. E. Meinzer and F. C. Kelton, with a section on agriculture, by R. H. Forbes. 1913. 231 pp., 15 pls. 45c.

Describes the physiography and drainage of the region, geologic formations, and geologic history; discusses the seasonal and geographic distribution of rainfall, the occurrence and level of ground waters, the flowing and nonflowing wells, the quality of ground waters, the effect of alkali on plant life and on waters for irrigation, the relation of zones for vegetation to water supply and geographic controls, and the plants used for pumping water; treats also of the early history of agriculture and agricultural methods.

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 spring and well waters from Colorado and New Mexico and of mine waters from Dunton, Colo., and Tombstone, Ariz.

365. Ground water in southeastern Nevada, by Everett Carpenter. 1915. 86 pp., 5 pls. 15c.

Describes an area in Clark, Lincoln, White Pine, and Nye counties, drained in part by streams tributary to Colorado River and in part by streams discharging into the Great Basin. Discusses stream, lake, and wind topography; vegetation, crops, and industrial development; rainfall; water in bedrock and unconsolidated sediments; source and permanence of artesian waters, and character and distribution of springs; also the quality of waters for domestic use and for irrigation, and gives analyses. Contains details of water supply by areas in Las Vegas and Virgin river basins and the Great Basin. Gives information in regard to watering places on routes of travel.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c. Contains:

(*b*) Ground water in Paradise Valley, Ariz., by O. E. Meinzer and A. J. Ellis, pp. 51–75, pls. 3–5. Describes an area north of Phoenix, in Maricopa County, between Phoenix Mountains on the west and McDowell Mountains on the east, terminated on the north by a rocky upland, but on the south opening into the Salt River Valley. Discusses briefly physiography and drainage, soil and vegetation, climate, occurrence, source, and disposal of ground water, artesian prospects, quality of water, wells, and irrigation.

380. The Navajo country—a geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah, by Herbert E. Gregory. 1916. 219 pp., 29 pls. 80c.

Contains a historical sketch of the Navajo country and discusses geographic provinces, climate, soil, stream flow, the utilization of the streams, the source of the ground water, springs, wells, and artesian areas: gives a table of geographic names and a bibliography of books and pamphlets examined in connection with the study.

*395. Colorado River and its utilization, by E. C. La Rue. 1916. 231 pp., 25 pls. 50c.

Assembles the principal facts relating to the water resources and gives the result of a study of the "possibility of controlling the flow of the whole river by means of storage reservoirs in order to avoid further danger of overflow to the Salton Sink and to render available for profitable use the enormous quantity of water which now flows unused and largely unusable to the Gulf of California in the form of floods."

396. Profile surveys in the Colorado River Basin in Wyoming, Utah, Colorado, and New Mexico, prepared under the direction of W. H. Herron, acting chief geographer, 1917. 6 pp., 43 pls. 50c.

Consists chiefly of maps showing outlines of river banks, islands, position of rapids, falls, and shoals, and existing dams. The streams to which the surveys relate are fully described in Water-Supply Paper 395.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. Contains:

(*a*) Ground water in San Simon Valley, Arizona and New Mexico, by A. T. Schwennesen, with a section on agriculture, by R. H. Forbes, pp. 1–35, pls. 1–3. 1917.

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.

*Ninth Annual Report of the United States Geological Survey, 1887–88, J. W. Powell, Director. 1889. xiii, 717 pp., 88 pls. $2. Contains:

*On the geology and physiography of a portion of northwestern Colorado and adjacent parts of Utah and Wyoming, by C. A. White, pp. 677–712, pl. 88. Describes the canyons of Green, Yampa, Snake, and White rivers.

*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, field and office methods, and brief descriptions of the topography of some of the river basins.

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

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

*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, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basisns, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

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, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, pls. 35–39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, pls. 48–102. Describes the Agua Fria dam, Arizona, and reservoir projects on Rio Verde, Salt River, Queen Creek, Hassayampa River, and Little Colorado River, Arizona, and in the Tonto basin; gives tables of reservoir capacities and areas.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xix, 498 pp., 159 pls., 8 maps in separate case. $2.80. Contains:

*White River Plateau timber land reserve, by G. B. Sudworth, pp. 117–179, pls. 49–58. Battlement Mesa forest reserve, by G. B. Sudworth, pp. 181–243, pls. 59–75. Describes briefly the streams and lakes in the reserves.

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.

*56. Geography and geology of a portion of southwestern Wyoming, with special reference to coal and oil, by A. C. Veatch. 1907. 178 pp., 26 pls. 60c.

Covers the southwest corner of Wyoming and a small adjacent portion of Utah. Gives a detailed description of the geology and a brief discussion of the water-bearing formations Includes a geologic map with structure contours.

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. 106pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated record of well in Sweetwater County, Wyo.

*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 Arizona, California, Colorado, New Mexico, Utah and Wyoming and detailed record of well near Phoenix, Maricopa County, Ariz. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

*350. Geology of the Rangely oil district, Rio Blanco County, Colorado with a section on the water supply, by H. S. Gale, 1908. 61 pp., 4 pls. 20c.

Discusses White River and its tributaries as sources of water supply and the possibility of obtaining artesian flows; treats of the quality of the water of White River and gives analyses.

*352. Geologic reconnaissance of a part of western Arizona, by W. T. Lee, with notes on the igneous rocks of western Arizona, by Albert Johannsen. 1908. 99 pp. 11 pls. 25c.

Describes the geography and geology and contains a geologic sketch map of western Arizona north of longitude 33° 30′, including the valley of Colorado River and Hualpai, Big Sandy, Detrital-Sacramento, Williams, and McMullen valleys. Contains a section on water supplies, which includes well data and discussion of ground-water prospects.

*531. Contributions to economic geology, 1911, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1913. 361 pp., 24 pls. 45c.

Issued also in separate chapters. The following papers contain information on ground water: *(c) Geology and petroleum resources of the De Beque oil field, Colo., E. G. Woodruff (pp. 54–68, Pl. VI). Contains a description of the geology and a geologic map of a square area covering Tps. 7 and 8 S., Rs. 97 and 98 W., in the vicinity of De Beque in Mesa and Garfield counties. Includes a brief statement on artesian water in the area (p. 61).

*541. Contributions to economic geology, 1912, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1914. 532 pp., 29 pls. 50c.

Issued also in separate chapters. The following paper contains information on ground water (*d*) Oil and gas near Green River, Grand County, Utah, by C. T. Lupton (pp. 115–133, Pl. VI). Describes the geology and contains a geologic map of an area of about 300 square miles southeast of the town of Green River. Contains meager data in regard to wells, water supplies. and artesian conditions (pp. 117–123).

*543. Geology and geography of a portion of Lincoln County, Wyo., by A. R. Schultz. 1914. 141 pp., 11 pls. 50c.

Describes the geology and contains a geologic map of an area in the central part of Lincoln County, between Green River and the Salt River Range (Tps. 22–39 N., Rs. 113–117 W.) Includes a brief discussion of ground water and artesian prospects (pp. 134, 135).

628. Geology and coal resources of Castle Valley, in Carbon, Emery, and Sevier counties, Utah, by C. T. Lupton. 1916. 88 pp., 12 pls. 20c.

Describes the geology and contains a geologic map of an area lying between the Wasatch Plateau and the San Rafael Swell, in east-central Utah, and extending from the vicinity of Mounds, on the Denver & Rio Grande Railroad, southwestward about 80 miles. Describes the drainage and water resources, including the prospects of finding water in the Dakota sandstone and underlying McElmo formation.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United State 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 the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and 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 alleys 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.

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 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 geologic folios amounting to $5 at the retail price—that is, 20 of the 25-cent folios (or their equivalent in higher priced folios) will be sold for $3. The discount is allowed on an order for folios alone, either of one kind or in any assortment, or for folios together with topographic maps, but no discount is allowed on the damaged folios sold at 5 cents each.

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.

[1] Index maps showing areas in the Colorado 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.

An asterisk (*) indicates that the Geological Survey's stock of the folio is exhausted.

*111. Globe, Arizona.

112. Bisbee, Arizona. 25c. Reprinted in 1914.

*120. Silverton, Colorado.

*129. Clifton, Arizona.

Gives analyses of spring water from San Francisco River.

*130. Rico, Colorado.

*153. Ouray, Colorado.

Describes the river waters used for irrigation, the underground waters, and the thermal springs; gives analyses of water from Hot Spring at Ouray.

171. Engineer Mountain, Colorado. 5c.

199. Silver City, New Mexico. 25c.

"The Continental Divide passes through the quadrangle from its southwest to its north east corner. All northerly drainage reaches Gila River and ultimately the Gulf of California and the Pacific Ocean. All southerly drainage flows toward the Rio Grande," but is lost in the sands of a desert region. The underground-water resources are discussed by N. H. Darton. The discussion of the surface waters is restricted to Mimbres River, one of the southward-flowing streams.

MISCELLANEOUS REPORTS.

Other Federal bureaus and 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 Colorado River basin are the reports of the State engineers of Colorado, Nevada, New Mexico, and Wyoming, and the annual reports of the United States Reclamation Service. The following reports deserve special mention:

Canyons of the Colorado, by J. W. Powell. 1895. A popular, revised, and enlarged edition of his original journal of exploration, which appeared as part of a report entitled "Exploration of the Colorado River of the West and its tributaries, explored in 1869, 1870, 1871, and 1872," published by the Smithsonian Institution in 1875.

A canyon voyage; the narrative of the second Powell expedition down the Green-Colorado River from Wyoming, and the explorations on land, in the years 1871–72, by Frederick S. Dellenbaugh, artist and assistant topographer of the expedition. 1908.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the chief of engineers, together with a report of Capt. Chittenden. 55th Cong., 2d sess., House Doc. 141. 1898.

Irrigation pumping in Nevada, etc., by Charles A. Norcross: Nevada bureau of industry, agriculture, and irrigation Bull. 8, 1913.

Report of irrigation investigations in Utah under the direction of Elwood Mead: U. S. Dept. Agr. Office Exper. Sta., Bull. 124, 1903.

Irrigation in Utah, Utah Irrigation Commission, 1894.

Irrigation and agricultural practice in Arizona, by R. H. Forbes: Univ. Arizona Agr. Exper. Sta. Bull. 63, 1911.

Ground-water supply and irrigation in Rillito Valley, Arizona: Univ. Arizona, College of Agriculture, Exper. Sta., Bull. 64, 1910.

Oil engines for pump irrigation and the cost of pumping, by G. E. P. Smith: Univ. Arizona Agr. Exper. Sta. Bull. 74, 1915.

The lower Colorado River and the Salton Basin, by C. E. Grunsky: Am. Soc. Civil Eng. Trans., vol. 59, pp. 1–51; discussion, pp. 52–62, December, 1907.

Irrigation and River control in the Colorado River delta, by H. T. Cory: Am. Soc. Civil Eng. Trans., vol. 76, pp. 1204–1453; discussion, pp. 1454–1571, December, 1913.

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 City, Kans.; 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.

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, compares 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 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachuetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.

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

*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.

*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 ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground 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 wells; 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.

*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 effects 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 the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this report should be addressed to the U. S. Reclamation Service.]

Contains 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 H. 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 statues 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, 1094; 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.

Appproximate 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.

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., and 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, amounts, 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.

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.

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.

*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. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drill 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. [Requests for this report should be addressed to the Reclamation Service.]

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 of 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 the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

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

*150. Weir experiments, coefficients, and formula, 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.

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 laws forbidding pollution of inland waters in the United States, second edition, by E. B. Goodell. 1905. 149 pp. 10c.

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 fluctuations due to rainfall and evaporation, barometric changes, temperature changes, 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 publications relating to ground 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.

*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.

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

Discusses composition, disposal, purification and treatment of sewages and 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.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and of 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.

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.

Scope indicated by amplification of title.

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

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 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.

*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 hundreth méridan, 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.

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. Underground 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. 123 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.

*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.

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., 22 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.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

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

(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.

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 well shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914.

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

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

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

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*400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer. 1917. 108 pp., 7 pls. —c. Contains:

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.
(c) The measurement of silt-laden streams, by R. C. Pierce, pp. 39–51.
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416. The divining rod, a history of water witching, with a bibliography, by A. J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continuously being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

(c) Hydraulic conversion tables and convenient equivalents, pp. 71–94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

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. 21. 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. 363–561, pls. 107 to 146. 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, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. 111 to 146. Discusses the economic aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes 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, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of 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. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analyses 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 theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and 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 medium and through sand, 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, pl. 17. Scope indicated by title.

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; gives 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, Chattahooche, 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. 263 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.

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

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.

*319. Summary of the controlling factors of artesian flows, by M. L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground 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.

616. The data of geochemistry (third edition), by F. W. Clarke. 1916. 821 pp. 45c.

Earlier editions were published as Bulletins 330 and 491. Contains a discussion of the statement and interpretation of water analyses and a chapter of "Mineral wells and springs" (pp. 179–216). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water 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.

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