DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 432

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART II. SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

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SURFACE WATER SUPPLY OF THE SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS, 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 12.

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. 7).

"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	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

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	9.09	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 momth.
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.
1¼ 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.

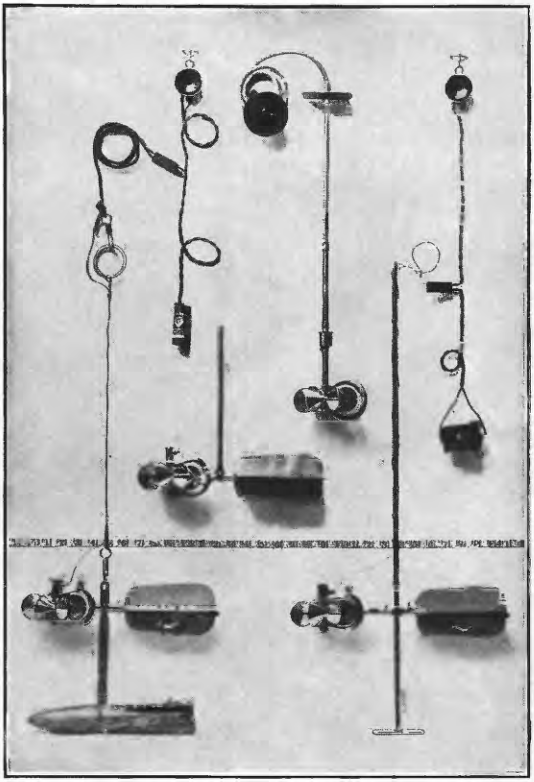
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

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

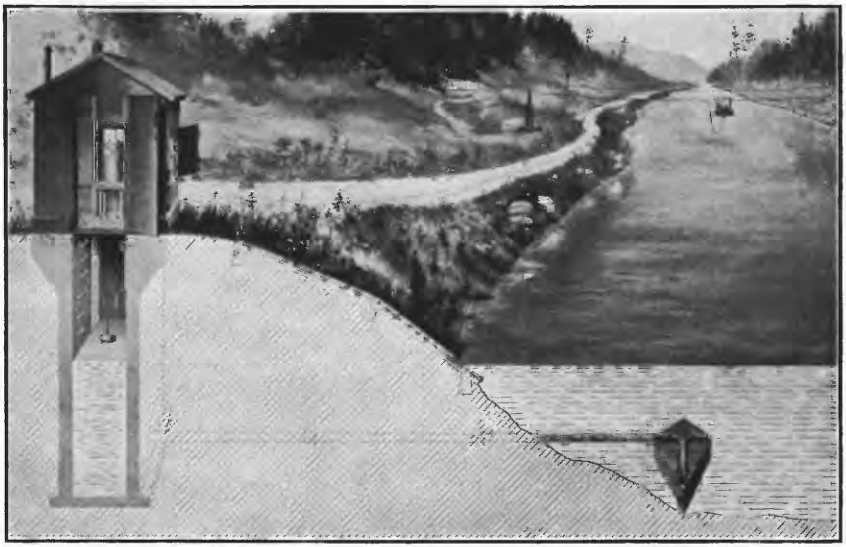
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of 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.

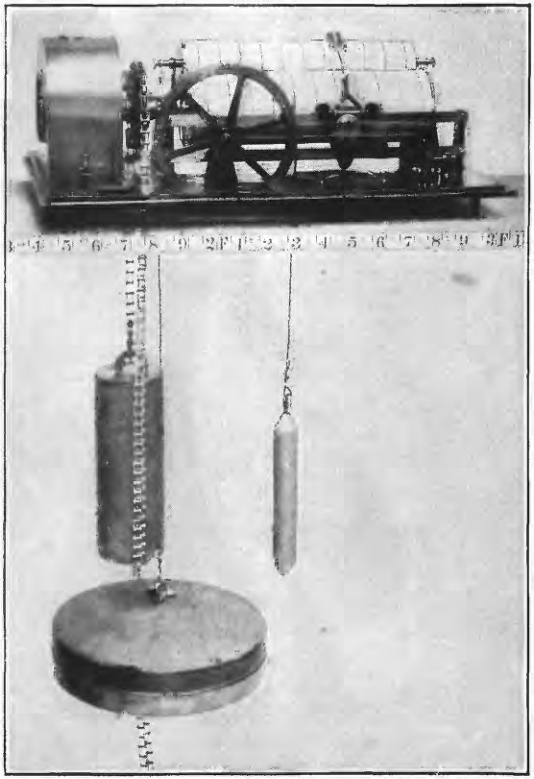
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently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



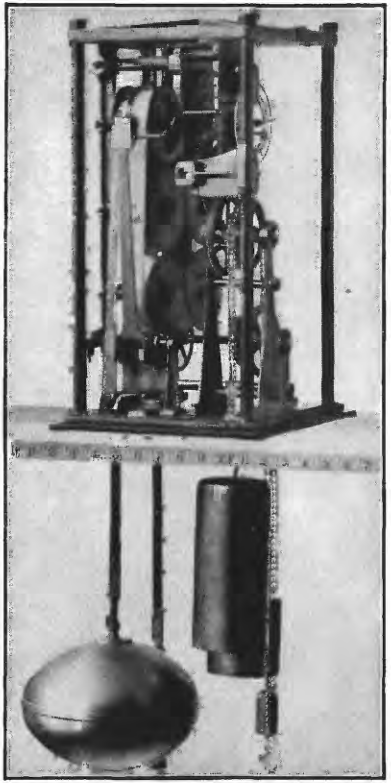
A. PRICE CURRENT METERS.



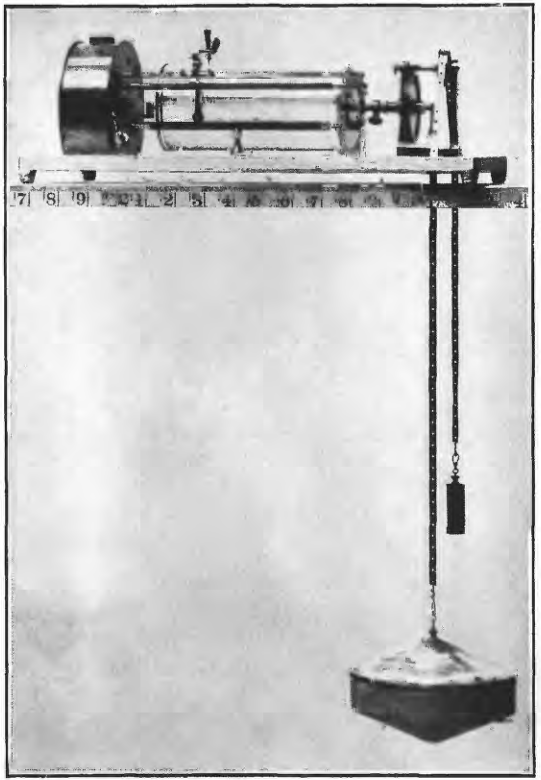
B. TYPICAL GAGING STATION.



A. STEVENS.



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

[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.

errors appear probable. The computations are also omitted for 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.

Special acknowledgments are due for financial assistance rendered by the following corporations and individuals: Virginia Railway & Power Co., Alabama Geological Survey, Division of Drainage Investigations of the United States Department of Agriculture, Tallassee Power Co., Central Georgia Power Co., Columbus Power Co., Georgia Railway & Power Co., Juliette Milling Co., and J. M. Middlebrooks, sr.

DIVISION OF WORK.

The data for the stations in the James and Roanoke drainage basins were collected and prepared for publication under the direction of G. C. Stevens, district engineer, assisted by H. J. Dean, H. W. Fear, Lasley Lee, and B. L. Hopkins.

The data for all drainage basins south of Roanoke River were collected and prepared for publication under the direction of Warren E. Hall, district engineer, assisted by B. J. Peterson, M. R. Hall, B. M. Hall, jr., E. L. Williams, B. L. Hopkins, and Miss E. M. Tiller.

The manuscript was assembled and reviewed by B. J. Peterson and E. L. Williams.

GAGING-STATION RECORDS.

JAMES RIVER BASIN.

JAMES RIVER AT BUCHANAN, VA.

LOCATION.—At highway bridge near Chesapeake & Ohio Railway station at Buchanan, Botetourt County.

DRAINAGE AREA.—2,060 square miles.

RECORDS AVAILABLE.—August 18, 1895, to September 30, 1916.

GAGE.—Chain gage attached to highway bridge, installed November 21, 1903, to replace original wire gage read from August 18, 1895, to that date; read once daily by D. D. Booze for United States Weather Bureau. Datum of gage lowered 2 feet April 3, 1897, to avoid negative readings. A span of the bridge and the gage were destroyed by flood on the night of March 27, 1913. A temporary gage was used from April 22 to September 15, 1913, when a new chain gage was installed.

DISCHARGE MEASUREMENTS.—Made from downstream side of two-span highway bridge.

CHANNEL AND CONTROL.—Bed under bridge is composed of rock overlain with a thick deposit of mud. Banks high; not overflowed except in extreme floods. Control of boulders and gravel several hundred feet below station. Stage-discharge relation not permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.0 feet October 1 and December 30 (discharge, 28,800 second-feet); minimum stage, 2.2 feet September 12–28 (discharge, 450 second-feet).

1895–1916: Maximum stage recorded, 31.0 feet during the night of March 27, 1913 (determined by levels from flood marks Oct. 2, 1914; discharge not determined); minimum stage, 1.2 feet (present gage datum), April 17 and May 2, 1896 (discharge, 260 second-feet).

ICE.—Stage-discharge relation occasionally affected by ice for short periods

ACCURACY.—Stage-discharge relation practically permanent during year; not affected by ice. Rating curve well defined below and fairly well defined above 4,000 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records fair.

COOPERATION.—Since July 15, 1906, gage-height records have been furnished by United States Weather Bureau.

The following discharge measurement was made by Dean and Fear:
June 20, 1916: Gage height, 3.80 feet; discharge, 2,150 second-feet.

Daily discharge, in second-feet, of James River at Buchanan, Va., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	28,800	650	580	7,100	5,040	3,450	2,500	1,860	1,110	1,460	1,460	650
2	12,700	650	580	5,040	7,100	3,050	2,330	1,860	1,110	1,340	1,460	650
3	7,640	650	580	4,100	5,290	3,250	2,330	1,720	1,110	1,340	1,460	580
4	5,290	650	580	3,250	4,800	3,450	2,170	1,720	1,110	1,220	1,340	580
5	4,560	650	580	2,860	4,560	3,250	2,170	1,720	1,010	1,220	1,340	580
6	5,290	650	580	2,680	4,560	3,050	2,860	1,590	1,010	1,110	2,330	580
7	4,560	650	580	2,680	4,330	4,100	2,500	1,590	1,010	1,110	2,330	580
8	3,450	580	580	3,450	4,100	5,040	2,500	1,460	1,110	1,010	2,330	510
9	2,500	580	580	3,050	3,880	3,660	3,250	1,460	1,340	1,010	2,170	510
10	2,170	580	580	2,170	3,660	3,450	4,330	1,340	1,590	1,110	2,010	510
11	1,720	580	580	2,330	3,450	3,250	8,480	1,340	2,500	1,110	2,010	510
12	1,460	580	580	11,700	3,250	3,050	6,840	1,220	2,170	1,220	1,860	450
13	1,340	580	580	7,100	3,050	2,860	5,540	1,220	1,340	1,220	2,010	450
14	1,220	580	580	4,560	2,860	2,680	4,800	1,110	1,110	1,220	1,460	450
15	1,110	580	580	4,100	2,680	2,500	4,330	1,110	1,220	1,460	1,460	450
16	1,110	580	580	2,860	2,680	2,330	3,660	1,010	1,460	2,170	1,460	450
17	1,110	580	580	2,500	2,500	2,170	3,050	1,010	3,880	5,800	2,170	450
18	1,010	580	820	2,170	2,500	2,170	2,680	910	2,500	4,560	1,590	450
19	1,010	580	9,320	2,010	2,330	2,010	2,330	910	2,170	4,330	1,460	450
20	1,010	580	5,540	2,010	2,330	2,010	2,010	820	1,860	4,100	1,340	450
21	910	580	3,880	1,860	2,170	1,860	1,860	820	1,720	3,880	1,220	450
22	910	580	2,860	1,860	2,170	1,860	1,860	730	1,590	3,880	1,220	450
23	910	580	2,170	1,720	2,010	1,720	1,720	730	1,460	6,060	1,110	450
24	820	580	1,860	1,720	2,010	1,720	1,590	1,460	1,340	4,330	1,110	450
25	820	580	1,590	1,590	3,660	1,720	2,010	1,460	1,340	4,330	1,110	450
26	820	580	1,590	1,590	8,480	1,720	2,500	1,340	1,340	3,660	1,010	450
27	820	580	2,170	1,460	6,060	1,720	2,330	1,340	1,220	2,860	910	450
28	730	580	2,500	1,460	4,800	2,330	2,170	1,220	1,220	2,170	820	450
29	730	580	5,290	1,460	4,100	5,800	2,170	1,220	1,220	1,860	820	910
30	730	580	28,800	7,100	.....	4,560	2,010	1,220	1,110	1,590	730	820
31	730	.....	7,370	5,290	.....	3,050	.....	1,110	.....	1,460	730	.....

Monthly discharge of James River at Buchanan, Va., for the year ending Sept. 30, 1916.

[Drainage area, 2,060 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	28,800	730	3,160	1.53	1.76
November	650	580	596	.289	.32
December	28,800	580	2,760	1.34	1.54
January	11,700	1,460	3,380	1.64	1.89
February	8,480	2,010	3,810	1.85	2.00
March	5,800	1,720	2,870	1.39	1.60
April	8,480	1,590	3,030	1.47	1.64
May	1,860	730	1,280	.621	.72
June	3,880	1,010	1,510	.733	.82
July	6,060	1,010	2,430	1.18	1.36
August	2,330	730	1,480	.718	.83
September	910	450	521	.253	.28
The year	28,800	450	2,240	1.09	14.76

JAMES RIVER AT CARTERSVILLE, VA.

LOCATION.—At highway bridge between Pemberton and Cartersville, Cumberland County, about 50 miles above Richmond. Willis River enters from the south about a mile above station, and Rivanna River from the north about 7 miles above.

DRAINAGE AREA.—6,230 square miles.

RECORDS AVAILABLE.—January 1, 1899, to September 30, 1916.

GAGE.—Chain on downstream side and near Cartersville end of bridge; read by B. W. Palmore. Wire gage used previous to July 24, 1903.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of rocks and sand; shifts somewhat during floods. Banks high; left bank is overflowed at a stage of about 20 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.4 feet at 6 p. m. October 2 (discharge, 59,000 second-feet); minimum stage, 0.98 foot at 10 a. m. September 23 and 29 (discharge, 1,260 second-feet.)

1899–1916: Maximum stage recorded, 26.7 feet at 6 p. m. December 30, 1901 (discharge approximately 106,000 second-feet); minimum stage, 0.5 foot October 3, 1914 (discharge, 800 second-feet). A discharge of 603 second-feet (gage height 0.42 foot) was measured September 8, 1897, but gage-height record corresponding to this measurement is probably subject to error.

ICE.—Ice forms only during severe winters, but stage-discharge relation is seldom affected thereby.

ACCURACY.—Discharge measurements made subsequent to September 30 indicate that stage-discharge relation changed after June, 1915. This change probably occurred during the high water of October 2, 1915. Rating curve based on measurements made subsequent to September 30, and also in previous years, was used for the current year; it is well defined between 1,300 and 40,000 second-feet and is extended for high stages. Stage-discharge relation not affected by ice during year. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Owing to lack of reliable discharge measurements during year, records are fair.

The following discharge measurement was made by Dean and Fear:

June 19, 1916: Gage height, 6.52 feet; discharge, 12,600 second-feet. A study of area and mean velocity curves for the station indicates that the discharge obtained is probably in error and no weight has been given this measurement in the computation of daily discharge.

Daily discharge, in second-feet, of James River at Cartersville, Va., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,390	2,300	2,650	21,600	6,390	8,650	12,200	5,460	2,830	5,630	6,150	1,860
2	57,200	2,130	2,830	13,700	11,700	7,870	10,300	5,020	2,470	6,870	5,460	1,820
3	47,400	2,300	2,470	10,600	18,600	7,870	8,390	4,810	2,470	5,920	4,810	1,890
4	20,900	2,300	2,470	10,000	20,600	8,390	8,130	5,020	2,470	4,810	4,810	1,860
5	18,300	2,130	2,300	7,870	17,100	8,390	7,360	5,460	2,130	5,020	4,810	1,760
6	12,800	2,040	2,300	6,870	15,500	9,460	7,360	6,390	1,880	3,020	5,020	1,390
7	11,400	2,300	2,130	6,150	11,700	8,920	7,110	7,360	3,990	3,020	10,600	1,600
8	11,400	2,040	2,300	5,690	10,600	8,650	8,390	6,390	4,810	2,650	9,460	1,890
9	7,870	2,040	2,300	5,460	9,730	8,390	12,000	5,690	7,870	2,830	8,650	1,760
10	6,870	2,040	2,130	5,920	10,600	9,190	12,000	4,190	9,460	2,830	7,610	1,650
11	5,460	2,040	1,880	6,390	9,460	8,920	11,100	3,790	7,610	5,020	7,360	1,530
12	4,810	2,040	1,880	8,920	8,390	8,390	11,100	3,590	5,020	8,650	7,110	1,410
13	4,600	1,880	1,960	9,730	7,870	6,630	12,200	3,400	4,600	4,390	7,870	1,500
14	4,190	1,960	1,960	17,400	7,110	6,150	11,700	3,210	4,390	4,190	6,630	1,410
15	3,790	1,880	2,040	13,400	7,110	5,690	10,600	3,020	3,990	3,790	5,020	1,500
16	3,590	1,880	2,130	10,600	6,630	5,460	10,000	2,650	35,200	3,590	4,600	2,470
17	3,400	1,880	2,130	8,390	6,630	5,240	9,190	3,210	30,300	3,400	4,190	1,990
18	3,210	1,880	2,300	7,360	6,630	5,020	7,360	3,210	22,000	15,500	4,600	1,600
19	3,020	2,470	2,830	5,920	6,390	4,810	6,390	2,650	14,600	19,300	4,190	1,810
20	3,400	6,870	4,390	5,460	5,920	4,600	5,920	2,470	10,000	12,200	4,190	1,980
21	3,790	8,920	11,100	5,240	5,460	4,190	5,460	2,470	7,870	10,600	4,190	1,790
22	4,190	7,110	7,610	5,020	5,240	4,390	5,240	2,130	8,390	9,460	3,400	1,600
23	4,190	5,690	5,460	4,810	4,810	4,600	5,020	2,300	6,390	9,730	3,790	1,290
24	3,790	4,810	5,020	4,600	4,810	4,390	5,020	3,210	4,810	12,200	3,210	1,490
25	3,400	4,390	4,810	4,390	12,500	4,390	5,020	3,590	7,610	30,300	3,210	1,410
26	2,830	3,590	5,020	4,190	13,700	4,600	5,240	3,210	6,390	29,600	3,790	1,450
27	3,210	3,400	5,240	4,190	16,400	5,460	5,020	3,020	4,810	22,000	2,830	1,440
28	2,830	3,210	5,920	3,990	13,400	21,300	5,240	2,650	5,020	13,100	2,830	1,340
29	2,650	3,020	7,610	3,790	10,600	17,100	5,690	3,210	7,110	10,600	2,830	1,290
30	2,650	2,650	24,000	3,990	.....	17,700	5,690	3,990	4,390	10,000	2,470	1,440
31	2,650	.....	33,700	5,690	.....	18,300	.....	3,440	.....	7,610	2,300	.....

Monthly discharge of James River at Cartersville, Va., for the year ending Sept. 30, 1916.

[Drainage area, 6,230 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	57,200	2,650	8,840	1.42	1.64
November	8,920	1,880	3,110	.499	.56
December	33,700	1,880	5,250	.843	.97
January	21,600	3,790	7,660	1.23	1.42
February	20,600	4,810	10,100	1.62	1.75
March	21,300	4,190	8,160	1.31	1.51
April	12,200	5,020	8,050	1.29	1.44
May	7,360	2,130	3,880	.623	.72
June	35,200	1,880	8,030	1.29	1.44
July	30,300	2,650	9,280	1.49	1.72
August	10,600	2,300	5,100	.819	.94
September	2,470	1,290	1,640	.263	.29
The year	57,200	1,290	6,580	1.06	14.40

ROANOKE RIVER BASIN.

ROANOKE RIVER AT ROANOKE, VA.

LOCATION.—At Walnut Street highway bridge in Roanoke, Roanoke County.

DRAINAGE AREA.—388 square miles.

RECORDS AVAILABLE.—July 10, 1896, to July 15, 1906; May 7, 1907, to September 30, 1916.

GAGE.—Chain on downstream side of Walnut Street Bridge; read by employees of Roanoke Railway & Electric Co. Wire gage used previous to November 28, 1903.

DISCHARGE MEASUREMENTS.—Made from downstream side of Walnut Street Bridge or from Jefferson Street Bridge, about one-third mile above. Measurement of overflow from Crystal Spring, which enters river between the two bridges, is added when discharge measurements are made at Jefferson Street Bridge.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Banks may be overflowed at extreme flood stages. Control, loose boulders; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.9 feet at 8.30 a. m. October 1 (discharge, 6,820 second-feet); minimum stage recorded, 0.58 foot January 15 (discharge, 61 second-feet).

1896–1916: Maximum stage recorded, 14.34 feet August 6, 1901 (discharge, 16,900 second-feet); minimum stage recorded, zero on morning of December 23; 1909, when flow was retarded by freezing (practically no water fowing).

ICE.—Ice seldom forms at station, but flow is sometimes retarded by freezing of headwaters.

ACCURACY—Stage-discharge relation changed during high water July 16. Rating curves used October 1 to July 16 and July 17 to September 30 are each fairly well defined below 2,000 second-feet, but definition is doubtful at high stages owing to lack of discharge measurements. Stage-discharge relation apparently not affected by ice during year. Abnormally low discharge on December 15 and January 18 probably due to retardation of flow by freezing ir the headwaters. Gage read to half-tenths or quarter-tenths once daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

COOPERATION.—Gage-height records furnished by Roanoke Railway & Electric Co., J. W. Hancock, general manager.

The following discharge measurement as made by Dean and Fear:
June 21, 1916: Gage height, 1.15 feet: discharge, 221 second-feet.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6,820	204	171	719	481	578	256	226	137	177	270	151
2	1,930	187	171	756	1,300	545	256	218	123	162	618	151
3	870	171	171	647	2,540	545	265	211	137	282	488	142
4	647	171	171	512	1,420	512	256	211	211	162	366	142
5	756	171	171	421	1,000	545	256	226	146	146	850	142
6	793	171	171	450	870	512	290	226	137	132	770	132
7	756	171	155	512	793	512	324	211	184	117	690	125
8	719	171	155	870	683	512	360	201	201	112	618	125
9	578	171	155	683	612	450	450	184	248	117	430	125
10	450	171	155	612	578	421	481	177	237	1,810	376	125
11	381	171	155	719	512	392	756	177	191	870	550	120
12	354	171	140	832	481	392	719	168	184	578	1,130	103
13	328	171	155	756	450	381	647	168	152	349	376	103
14	282	155	171	647	421	365	545	158	137	282	366	120
15	282	171	61	545	421	349	450	168	152	481	288	132
16	261	171	187	545	421	338	392	152	450	4,660	317	158
17	421	171	481	512	365	300	376	152	376	3,980	895	125
18	450	171	2,410	269	365	314	338	152	256	1,540	430	98
19	304	512	4,660	365	338	290	309	146	218	1,030	351	93
20	481	481	1,050	392	338	282	290	146	191	654	288	86
21	381	354	719	365	314	269	277	137	218	488	257	98
22	328	282	578	365	290	300	290	137	545	770	244	103
23	282	241	545	392	290	282	277	191	162	770	235	98
24	282	241	481	338	338	269	265	290	146	459	227	98
25	282	222	381	290	4,120	256	265	218	381	430	227	98
26	241	204	950	290	1,470	256	265	191	450	351	519	98
27	241	187	647	290	1,050	300	265	237	300	770	257	93
28	241	171	578	290	719	365	256	146	230	770	235	93
29	204	171	870	314	578	314	248	146	392	430	215	235
30	204	171	2,050	481	.....	290	237	146	177	351	376	235
31	204	.....	1,200	450	.....	282	.....	146	.....	302	158	.....

Monthly discharge of Roanoke River at Roanoke, Va., for the year ending Sept. 30, 1916.

[Drainage area, 388 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	6,820	204	669	1.72	1.98
November	512	155	212	.546	.61
December	4,660	a61	649	1.67	1.92
January	870	a269	504	1.30	1.50
February	4,120	290	812	2.09	2.25
March	578	256	378	.974	1.12
April	756	237	355	.915	1.02
May	290	137	183	.472	.54
June	545	123	236	.608	.68
July	4,660	112	759	1.96	2.26
August	1,130	158	433	1.12	1.29
September	235	86	125	.322	.36
The year	6,820	61	443	1.14	15.53

a Low minimum discharge probably due to retardation of flow by freezing in headwaters.

ROANOKE RIVER AT OLD GASTON, N. C.

LOCATION.—At bridge of Roanoke Railway Co. at Old Gaston, Northamptor County, about three-fourths mile below mouth of Indian Creek, 1¼ miles north of Thelma, and 2½ miles above mouth of Deep Creek.

DRAINAGE AREA.—8,350 square miles.

RECORDS AVAILABLE.—December 7, 1911, to September 30, 1916.

GAGE.—Chain gage attached to outside of guard timber on downstream side of second span from right end of deck-plate girder railroad bridge of Roanoke Railway Co.; read by R. A. Howell.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge to which gage is attached. Measuring section broken by 11 bridge piers.

CHANNEL AND CONTROL.—Channel fairly permanent; point of control, about a mile below gage, is of rock and probably permanent. Left bank subject to overflow in extreme floods, but a fair determination can be made of the overflow discharge around the bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.4 feet February 5 (discharge, 68,000 second-feet;) minimum stage, 1.0 foot September 11 (discharge, 900 second-feet).

1911–1916: Maximum stage recorded, 16.6 feet at 7 a. m. March 18, 1912 (discharge, 210,000 second-feet); minimum stage, 0.95 foot at 6 a. m. October 1, 1914 (discharge, 790 second-feet).

Flood of 1877 highest known in this locality. No definite marks preserved at Old Gaston, but from authentic information regarding the crest height as observed in 1877 the approximate height has been determined as about 19 feet referred to present gage datum. The corresponding discharge is about 275,000 second-feet.

ICE.—Ice sometimes forms to considerable thickness at this station, but the stage-discharge relation is seldom affected thereby.

REGULATION.—During periods of low water variations in flow, probably due to the weekly (Sunday) shutdown of large power plants farther upstream, are observable at power plants at Roanoke Rapids and Weldon on the following Tuesday or Wednesday.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 33,300 second-feet, and fairly well defined to 180,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent.

The following discharge measurement was made by H. W. Fear:
June 22, 1916: Gage height, 2.91 feet; discharge, 6,730 second-feet.

Daily discharge, in second-feet, of Roanoke River at Old Gaston, N. C., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,160	3,310	3,310	38,800	6,470	6,870	6,870	4,290	11,400	4.980	7,280	3,470
2	5,160	2,690	4,120	14,200	9,020	8,130	4,980	3,630	9,020	4,980	6,470	3,470
3	40,600	3,160	3,630	10,900	50,300	9,020	4,120	4,290	6,470	9,490	5,340	3,310
4	35,100	3,000	3,470	9,490	63,100	9,960	3,960	4,800	3,160	8.130	10,400	2,840
5	11,900	2,390	3,630	9,020	68,000	7,700	3,160	4,980	3,310	7,280	11,400	3,470
6	10,900	1,850	3,470	8,130	26,600	9,020	5,340	3,630	3,960	5,700	11,900	3,000
7	17,900	3,310	3,630	8,130	16,600	7,700	9,960	3,310	6,470	4.460	15,900	2,840
8	23,600	3,470	3,310	8,130	10,900	6,870	10,900	8,570	16,600	4.290	14,200	2,540
9	17,200	3,160	3,470	10,400	9,960	6,470	14,700	7,700	21,400	1.850	7,280	2,840
10	13,000	3,310	3,310	9,960	8,130	5,700	14,200	6,470	19,900	2,690	8,130	1,360
11	9,960	2,690	3,310	9,020	6,470	4,630	12,500	5,160	9,960	2,840	7,280	900
12	7,280	1,980	2,690	8,130	8,130	6,470	11,400	3,630	6,870	2,690	7,280	1,480
13	8,130	1,480	2,840	9,020	6,470	6,080	10,900	3,160	4,980	9,960	9,490	2,690
14	7,280	2,540	1,600	9,960	9,020	4,290	8,130	3,310	4,980	7,700	9,020	1,850
15	5,700	3,000	1,850	9,020	9,020	5,340	8,570	3,000	6,470	7,280	8,130	1,360
16	8,130	3,160	3,470	8,130	6,470	5,700	6,470	6,470	10,900	3 960	6,470	2,840
17	4,800	4,120	4,290	9,020	7,280	5,340	5,700	5,160	53,300	4.120	6,470	2,690
18	4,290	3,800	4,800	8,130	7,700	4,630	4,800	3,310	36,900	14.200	9,490	2,840
19	4,120	4,120	16,600	7,280	7,280	5,340	3,800	3,160	13,000	18 500	8,570	2,690
20	3,310	4,460	36,900	6,470	6,870	4,630	3,310	3,310	11,400	24.300	7,280	2,110
21	3,000	14,700	19,200	6,470	6,470	4,290	3,630	2,840	8,570	9 020	8,130	2,840
22	5,340	9,490	14,200	5,340	6,080	4,630	3,960	2,110	9,490	8 130	4,630	2,390
23	8,130	7,280	8,630	5,700	5,340	5,340	4,800	3,310	6,470	8 130	3,800	2,250
24	6,470	6,470	3,470	5,700	6,470	5,340	4,460	3,000	8,130	10,900	3,630	2,540
25	6,080	3,470	3,310	3,470	6,870	5,700	4,800	27,400	9,020	11.900	7,280	2,390
26	5,700	3,000	5,700	6,870	11,900	4,290	4,460	41,600	7,280	28 200	7,700	2,250
27	5,160	2,390	6,080	6,470	19,900	3,310	4,800	22,800	6,080	36 900	4,290	2,540
28	4,460	1,850	6,470	5,700	13,000	3,160	3,630	9,020	4,460	35,100	3,800	2,110
29	4,120	1,240	7,700	5,700	10,400	6,470	3,960	5,700	4,980	21.400	3,310	1,600
30	4,120	3,470	15,300	6,470	.....	9,020	4,460	7,700	5,340	15,300	3,310	1,720
31	3,630	.....	40,600	6,470	.....	7,700	.....	12,500	.....	10,900	3,800	.....

Monthly discharge of Roanoke River at Old Gaston, N. C., for the year ending Sept. 30, 1916.

[Drainage area, 8,350 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	40,600	3,000	9,600	1.15	1.33
November	14,700	1,240	3,810	.456	.51
December	40,600	1,600	7,880	.944	1.09
January	38,800	3,470	8,890	1.06	1.22
February	68,000	5,340	14,800	1.77	1.91
March	9,960	3,160	6,100	.731	.84
April	14,700	3,160	6,560	.786	.88
May	41,600	2,110	7,400	.886	1.02
June	53,300	3,160	11,000	1.32	1.47
July	36,900	1,850	11,100	1.33	1.53
August	15,900	3,310	7,470	.895	1.03
September	3,470	900	2,440	.292	.33
The year	68,000	900	8,080	.968	13.16

PEEDEE RIVER BASIN.

YADKIN RIVER AT DONNAHA, N. C.

LOCATION.—At toll bridge in Donnaha, Forsyth County, on road between Donnaha and East Bend, about a quarter of a mile west of Donnaha railroad station and 6 miles downstream from mouth of Ararat River, which enters from the left; about 60 miles upstream from gaging station at Salisbury, N. C.

DRAINAGE AREA.—1,600 square miles.

RECORDS AVAILABLE.—April 11, 1913, to September 30, 1916.

GAGE.—Vertical gage in four sections on left bank 150 feet downstream from left end of toll bridge; read by J. F. Goolsby.

DISCHARGE MEASUREMENTS.—Made from three-span toll bridge with two piers in stream and two on banks. Bridge has steel trestle approaches at both ends. Flood water confined under bridge except during floods above a stage of about 28 feet.

CHANNEL AND CONTROL.—Bed composed of sand and bedrock; probably permanent. Current slightly obstructed by two old steel trusses lying about 150 and 400 feet, respectively, below bridge; obstruction probably permanent. Control, a rock ledge extending across river and forming a shoal about 450 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage during year, 40.0 feet at 8 a.m. July 16, estimated by observer who measured from flood marks down to water surface at a lower stage (discharge not determined); minimum stage, 5.3 feet at 8 a.m. and 6 p.m. October 25 to 31 (discharge not determined).

1913–1916: Maximum stage recorded July 16, 1916; minimum stage, 4.65 feet at 4 p.m. September 30, 1914 (discharge, 678 second-feet).

ICE.—Never enough to affect stage-discharge relation.

DIVERSIONS.—None.

REGULATION.—None except for a few small milldams on tributaries.

ACCURACY.—Stage-discharge relation probably permanent, but as no current-meter measurements have been made since 1914, it is not considered safe to use the developed rating curve. Gage read twice daily to tenths; readings not always accurate. Daily discharge not determined.

Daily gage height, in feet, of Yadkin River at Donnaha, N. C., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10.6	5.4	5.5	6.7	8.6	5.9	5.8	5.4	5.5	6.2	9.4	6.1
2	7.9	5.4	5.5	6.5	11.6	5.9	5.8	5.4	5.6	7.7	8.2	5.9
3	6.3	5.4	5.5	6.4	7.8	6.0	5.8	5.4	5.8	6.2	7.2	5.9
4	5.7	5.4	5.4	6.4	6.8	6.0	5.7	5.4	5.8	5.8	7.2	5.9
5	6.8	5.4	5.4	6.2	6.6	5.9	5.7	5.5	5.8	5.6	9.2	5.9
6	8.8	5.4	5.4	6.2	6.6	5.9	5.7	5.6	5.6	5.6	7.9	5.8
7	7.0	5.4	5.4	6.4	6.5	5.9	5.7	5.5	5.6	5.4	7.4	5.8
8	6.0	5.4	5.4	6.5	6.5	5.9	5.7	5.4	5.6	5.6	7.0	5.8
9	5.6	5.4	5.4	6.4	6.5	5.9	5.6	5.4	5.6	5.6	6.8	5.8
10	5.6	5.4	5.4	6.4	6.4	5.9	5.6	5.4	5.9	12.6	6.6	5.8
11	5.5	5.4	5.4	6.3	6.4	5.9	5.6	5.4	5.8	8.8	6.4	5.8
12	5.5	5.4	5.4	6.3	6.4	5.9	5.6	5.4	5.8	7.4	6.3	5.7
13	5.5	5.4	5.4	6.2	6.4	5.8	5.6	5.6	5.7	6.7	6.3	5.8
14	5.4	5.4	5.4	6.2	6.5	5.8	5.6	7.2	6.2	7.1	6.2	6.0
15	5.4	5.4	5.4	6.2	6.9	5.8	5.6	5.8	8.4	12.4	6.0	7.2
16	5.4	5.4	6.6	6.2	6.8	5.8	5.7	5.4	7.6	40.0	5.8	6.6
17	5.4	5.4	12.8	6.1	6.8	5.8	5.8	5.4	6.2	17.5	5.8	6.4
18	5.6	5.5	7.8	6.1	6.8	5.8	5.8	5.4	6.0	14.5	6.4	6.1
19	5.6	7.5	7.0	6.0	6.6	5.8	5.7	5.4	5.9	9.5	6.5	5.9
20	5.6	6.6	6.1	6.0	6.5	5.7	5.6	5.4	5.6	6.8	6.4	5.9
21	5.4	6.1	5.8	5.9	6.4	5.7	5.6	5.4	5.5	7.6	6.4	5.8
22	5.4	6.0	5.6	5.9	6.4	5.7	5.6	5.4	5.6	7.6	6.3	5.8
23	5.4	5.8	5.6	6.0	6.3	5.7	5.6	8.9	6.1	7.2	6.3	5.8
24	5.4	5.8	5.5	6.3	6.3	5.7	5.5	8.6	5.8	6.9	6.3	5.8
25	5.3	5.7	5.5	6.8	6.0	5.7	5.5	6.4	5.6	6.6	6.3	5.8
26	5.3	5.7	5.4	7.2	5.9	5.7	5.5	6.0	5.6	6.3	6.3	5.8
27	5.3	5.7	5.6	10.2	6.0	5.8	5.5	5.9	5.5	6.2	6.2	5.9
28	5.3	5.6	6.8	7.5	6.0	6.4	5.5	5.8	5.6	7.2	6.2	6.2
29	5.3	5.6	13.0	7.1	5.9	6.0	5.5	5.7	5.5	8.5	6.2	6.8
30	5.3	5.6	10.8	6.8	.....	5.8	5.5	5.6	5.5	7.8	6.2	6.0
31	5.3	.....	6.4	7.2	.....	5.8	.....	5.6	.....	7.4	6 2	.....

YADKIN RIVER NEAR SALISBURY, N. C.

LOCATION.—At highway bridge known as Piedmont toll bridge, 1,000 feet upstream from Southern Railway bridge 4 miles east of Spencer, 5 miles downstream from mouth of South Yadkin River, 6 miles east of Salisbury, Rowan County, and 26 miles upstream from American Aluminum Co.'s hydroelectric plant near Whitney, N. C.

DRAINAGE AREA.—3,400 square miles.

RECORDS AVAILABLE.—September 24, 1895, to December 31, 1909; September 1, 1911, to September 30, 1916.

GAGE.—Standard chain gage attached to highway bridge; read by J. T. Yarbrough. From the date of establishment to May 31, 1899, the gage was at the Southern Railway bridge, and from the latter date it was at the highway bridge until moved back to the railroad bridge early in 1903, where it remained until the end of 1905. Since January 1, 1906, the gage has been at the highway bridge at the datum originally established there in 1899. The last gage at the railroad bridge read the same as the gage at the highway bridge at gage height 3.2 feet, but not for higher and lower stages. Datum of the original gage at the railroad bridge somewhat uncertain.

DISCHARGE MEASUREMENTS.—Made from highway bridge. While the gage was at railroad bridge most of the measurements were made from that bridge. During flood of July, 1916, water rose over floor of highway bridge, making it necessary to use railroad bridge.

CHANNEL AND CONTROL.—Channel wide and rather rough. Control, a rock ledge about 500 feet below bridge, extending entirely across river.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 23.8 feet at 1 a. m., July 18 (discharge, 121,000 second-feet); minimum stage, 2.15 feet at 7 a. m. May 19, 20, and 21 (discharge, 2,060 second-feet).

1895–1916: Maximum stage recorded, July 18, 1916; minimum stage, 1.2 feet September 20, October 5, November 22 and 26, 1897 (discharge, 900 second-feet).

ICE.—Never enough to affect stage-discharge relation.

DIVERSIONS.—None.

REGULATION.—Flow during low stages may be slightly affected by operation of power plants on the river and tributaries above.

ACCURACY.—Stage-discharge relation practically permanent up to 20,000 second-feet. A recent flood measurement indicates a change in flood control, due probably to new masonry on railroad bridge 1,000 feet downstream. Rating curve well defined below 20,000 second-feet and fairly well defined between 20,000 and 121,000 second-feet. Gage read to half-tenths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

Discharge measurements of Yadkin River near Salisbury, N. C., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 18	Peterson and Hall	19.43	91,500
Aug. 5	B. M. Hall, jr	4.37	9,570

Daily discharge, in second-feet, of Yadkin River near Salisbury, N. C., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,720	2,800	2,930	9,200	6,840	5,050	3,210	2,800	4,090	4,400	6,100	3,790
2	18,000	2,540	2,930	7,220	33,800	5,390	3,210	2,800	2,930	7,600	6,840	3,500
3	9,600	2,540	2,800	6,100	54,200	5,740	3,500	2,660	2,660	12,400	8,000	3,500
4	6,840	2,540	2,660	5,050	29,600	5,050	4,090	2,660	2,540	11,200	6,460	4,090
5	7,600	2,410	2,660	4,720	10,400	4,400	4,090	2,660	2,660	4,090	6,840	3,500
6	24,600	2,410	2,800	4,400	8,000	4,400	4,720	2,930	2,410	2,800	11,200	3,360
7	22,500	2,660	2,660	5,050	6,840	4,400	4,720	2,660	28,400	2,540	7,600	3,210
8	10,400	2,660	2,660	6,100	5,740	4,400	6,840	2,930	23,000	2,660	6,840	3,210
9	6,100	2,410	2,660	5,390	5,740	4,240	8,000	2,540	8,000	2,410	5,740	3,210
10	4,400	2,410	2,660	4,720	5,050	4,090	6,100	2,410	4,400	11,600	8,000	3,500
11	3,940	2,410	2,410	4,400	5,050	3,790	4,720	2,290	3,500	25,700	5,740	3,210
12	3,640	2,410	2,540	4,400	4,720	3,640	4,090	2,290	4,400	15,600	10,400	3,210
13	3,500	2,410	3,070	4,400	4,400	3,790	3,940	2,170	5,050	7,600	6,840	2,930
14	3,210	2,660	3,360	4,400	4,720	3,790	3,790	2,170	4,400	6,460	5,500	2,930
15	4,090	2,930	3,070	4,090	4,400	3,790	3,500	3,940	5,390	12,000	4,720	3,210
16	3,940	3,210	2,800	3,640	4,090	3,790	3,500	2,930	13,800	44,600	8,000	5,390
17	3,360	2,930	3,210	4,090	4,090	3,500	3,500	2,660	11,200	107,000	6,840	4,090
18	3,500	2,660	10,800	3,790	4,240	3,500	3,210	2,410	7,600	103,000	5,050	3,210
19	3,210	12,000	33,800	3,500	4,090	3,360	3,210	2,170	4,400	69,200	4,720	3,070
20	3,790	18,500	16,500	3,500	3,790	3,500	3,070	2,170	4,090	25,700	4,400	3,360
21	5,740	8,000	7,600	3,500	3,790	3,500	3,210	2,060	5,740	15,200	4,090	2,930
22	4,720	4,720	5,740	3,790	3,790	3,640	3,070	2,170	4,090	16,000	3,940	2,930
23	4,090	3,940	4,720	4,090	3,790	3,500	3,210	5,390	3,210	23,000	4,400	2,930
24	3,500	3,500	4,400	4,720	5,050	3,360	3,210	29,000	3,210	18,500	5,050	3,500
25	3,500	3,210	3,940	4,090	12,900	3,210	3,070	15,200	4,720	18,500	4,400	3,210
26	3,210	3,360	4,400	3,790	10,800	3,210	3,070	6,100	4,240	12,400	3,790	2,800
27	2,930	3,070	5,050	4,400	6,460	3,500	3,070	4,400	4,090	17,500	3,500	2,660
28	2,930	3,210	4,400	10,000	5,050	3,640	3,070	3,070	3,210	11,200	3,500	2,660
29	2,930	3,500	12,400	6,460	4,720	4,090	2,930	3,210	2,540	14,200	6,100	3,790
30	2,930	3,210	38,600	6,460	.....	3,640	2,930	4,400	3,500	9,600	7,600	8,000
31	2,660	.....	25,200	5,740	.....	3,500	.....	5,050	.....	6,840	4,400	.....

Monthly discharge of Yadkin River near Salisbury, N. C., for the year ending Sept. 30, 1916.

[Drainage area, 3,400 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	24,600	2,660	6,130	1.80	2.08
November	18,500	2,410	3,910	1.15	1.28
December	38,600	2,410	7,270	2.14	2.47
January	10,000	3,500	5,010	1.47	1.70
February	54,200	3,790	9,180	2.70	2.91
March	5,740	3,210	3,950	1.16	1.34
April	8,000	2,930	3,860	1.14	1.27
May	29,000	2,060	4,270	1.26	1.45
June	28,400	2,410	6,120	1.80	2.01
July	107,000	2,410	20,700	6.09	7.02
August	11,200	3,500	6,000	1.76	2.03
September	8,000	2,660	3,500	1.03	1.15
The year	107,000	2,060	6,670	1.96	26.71

EDISTO RIVER BASIN.

FOUR HOLE CREEK NEAR RIDGEVILLE, S. C.

LOCATION.—At Horseford's bridge, 3½ miles west of Ridgeville, Dorchester County, 5 miles upstream from Harley's bridge and 5¼ miles upstream from junction of creek with Edisto River.

DRAINAGE AREA.—600 square miles.

RECORDS AVAILABLE.—November 16, 1914, to September 30, 1916.

GAGE.—Gage No. 1, called upper gage, on left bank of creek, 200 feet downstream from Horseford's bridge, is a Gurley seven-day graph water-stage recorder, installed December 9, 1915; October 6 to December 8, 1915, reference staff gage was read occasionally; November 18, 1914, to December 8, 1915, Gurley printing gage; November 16 and 17, 1914, vertical staff; all gages at same site and datum.

Gage No. 2 is a Stevens water-stage recorder, installed January 9, 1915, on right bank, 150 feet downstream from Harley's bridge, and 5 miles downstream from gage No. 1; datum same as gage No. 1.

DISCHARGE MEASUREMENTS.—Made from Horseford's bridge or by wading. At extremely high stages overflow channels are measured by wading or from a boat and the main channel is measured from the bridge.

CHANNEL AND CONTROL.—Bottom hard; both banks low and flat, overgrown with brush and trees. Below a stage of 13 feet flow is in one channel; between 13 17 feet flow is through three channels, and at stages above 17 feet stream spreads and over wide swamps. Gage height of zero flow about 9.6 feet. Stage-discharge relation permanent below gage height 16 feet, although there is no defined control; above 16 feet stage-discharge relation is affected by backwater from Edisto River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, from water-stage recorder No. 1, 24.75 feet at 6 p. m. July 29 (discharge, 13,400 second-feet); minimum stage, from water-stage recorder No. 1, 9.65 feet June 14 (discharge, 1 second-foot).

1914–1916: Maximum and minimum stages occurred in 1916.

ICE.—None.

DIVERSIONS.—None.

ACCURACY.—Rating curve well defined below 540 second-feet (16-foot stage). Above this point a well defined "normal curve" (see below) extends to 16,000 second-feet. Operation of water-stage recorder No. 1 satisfactory since installation of a new instrument December 8, 1815. The first recorder installed did not operate during the period October 7 to December 8, 1915. Operation of water-stage recorder No. 2 satisfactory throughout the year except for the period December 27 to January 26, when the supply of record paper was exhausted.

Discharge for stages below 16 feet determined by applying mean daily gage heights, obtained by inspecting gage-height graph from gage No. 1, to the rating table. Discharge for stages above 16 feet affected by varying slope of stream surface due to backwater from Edisto River; discharge at such stages determined by "slope method."[1] Records for most of the year are good.

Discharge measurements of Four Hole Creek near Ridgeville, S. C., 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. 9	Hall and Eason	12.12	101	Jan. 27	Hall and Eason	13.34	187
10	Warren E. Hall	11.98	86	July 31	do	24.22	12,000
27	F. G. Eason	14.49	290	Aug. 28	F. G. Eason	13.14	94

Daily discharge, in second-feet, of Four Hole Creek near Ridgeville, S. C., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	154	55	230	194	190	122	28	1	21	10,400	235
2	46	146	56	220	194	215	112	26	1	37	8,890	210
3	88	142	60	215	210	370	126	20	1	34	7,440	220
4	70	130	70	210	225	727	260	17	1	29	6,020	250
5	50	122	82	202	225	766	280	15	1	28	5,380	270
6	47	115	94	194	220	635	260	13	1	62	5,220	250
7	46	101	101	186	220	539	225	10	1	104	4,780	198
8	42	88	108	178	215	588	215	8	1	68	3,940	150
9	38	76	98	166	225	720	215	7	1	47	3,190	108
10	34	65	88	158	260	843	225	6	1	38	2,550	84
11	30	55	83	150	290	927	260	5	1	58	2,090	66
12	26	46	122	142	300	1,040	300	4	1	112	1,890	56
13	30	41	138	134	300	1,070	340	3	1	154	1,900	58
14	60	82	138	134	310	993	355	3	1	230	1,920	59
15	88	30	134	130	310	849	340	2	2	4,870	1,790	63
16	101	26	130	130	310	772	310	1	8	6,120	1,600	60
17	101	25	126	158	300	682	290	1	14	4,670	1,250	52
18	88	22	134	178	280	606	270	1	33	7,020	996	45
19	82	22	154	178	260	520	225	1	39	7,390	781	39
20	80	26	178	174	230	445	190	1	34	6,100	651	34
21	88	30	198	162	206	400	166	1	46	8,360	460	31
22	94	34	225	158	194	370	142	1	104	3,750	340	32
23	108	38	260	166	190	325	122	1	62	3,620	260	45
24	122	42	290	178	186	290	101	2	38	4,970	202	59
25	138	46	310	182	182	260	86	1	25	6,120	166	62
26	162	55	310	186	174	230	69	1	18	6,650	130	54
27	170	60	300	190	162	202	58	1	15	7,970	98	50
28	178	65	340	198	150	182	48	1	33	10,700	101	52
29	178	65	325	202	166	162	41	1	34	13,300	138	55
30	170	60	250	202	.....	146	35	1	28	13,100	230	60
31	162	.....	240	198	.....	134	.....	1	.....	12,000	250	.....

NOTE.—Discharge determined as follows: For stages below 540 second-feet from a well-defined rating curve; Mar. 4–18 and July 15 to Aug. 20, by applying slope corrections to a fairly well defined normal rating curve, the slope corrections being accurately determined from continuous gage-height record at both gages. Gage No. 1 was not in operation Oct. 7–12, 14–19, 21–26, Oct. 28 to Nov. 2, Nov. 4–12, 14–16, 18–25, Nov. 27 to Dec. 1, and Dec. 3–8; gage heights estimated by comparison with record of gage No. 2; determinations of discharge for these days subject to error and should be used with caution.

[1] Hall, M. R., Hall, W. E., and Pierce, C. H., A method of determining the daily discharge of rivers of variable slope: U. S. Geol. Survey Water-Supply-Paper 345, p. 53, 1915.

Monthly discharge of Four Hole Creek near Ridgeville, S. C., for the year ending Sept. 30, 1916.

[Drainage area, 600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	178	26	88.9	0.148	0.17
November	154	22	67.0	.112	.12
December	340	55	168	.280	.32
January	230	130	177	.295	.34
February	310	150	231	.385	.42
March	1,070	134	523	.872	1.01
April	355	35	193	.322	.36
May	28	1	6.0	.010	.01
June	104	1	18.2	.030	.03
July	13,300	21	4,120	6.87	7.92
August	10,400	98	2,420	4.03	4.65
September	270	31	100	.167	.19
The year	13,300	1	685	1.14	15.54

SAVANNAH RIVER BASIN.

TALLULAH RIVER NEAR SEED, GA.

LOCATION.—One-fourth mile upstream from head of Rabun Lake, 1 mile downstream from Bridge Creek, 5 miles north of Seed, Rabun County, 6 miles due west of Lakemont, Ga., railroad station, and 10 miles upstream from Rabun (or Mathis) dam.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 6, 1916, to September 30, 1916.

GAGE.—A staff gage in two sections on right bank; read by employees of Georgia Railway & Power Co.

DISCHARGE MEASUREMENTS.—At low and medium stages made from cable about 200 feet above gage; flood measurements made from suspension footbridge a mile downstream from gage.

CHANNEL AND CONTROL.—Bed composed of rock, sand, and gravel; rough but permanent. Control is a ledge which extends across river and over which water drops sharply, about 250 feet downstream from gage; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.2 feet at 6 p. m. July 9 (discharge, 8,010 second-feet); minimum stage recorded, 1.08 feet at 6 p. m. May 20 and 6 a. m. and p. m. May 21 (discharge, 200 second-feet.)

ICE.—Never enough to affect stage-discharge relation.

ACCURACY.—Stage-discharge relation permanent; not affected by ice. Rating curve well defined below 5,500 second-feet. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

Discharge measurements of Tallulah River near Seed, Ga., 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	H. L. Wills	.....	248	Apr. 20	Warren E. Hall	1.24	298
Jan. 7	Warren E. Hall and H. L. Wills	1.88	704	July 10	.....do	5.80	4,900
				21	.....do	2.88	1,580
Feb. 12	H. L. Wills	1.85	661				
22	.....do	1.60	513				

Daily discharge, in second-feet, of Tallulah River near Seed, Ga., for the year ending Sept. 30, 1916.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1,700	548	355	277	301	355	832	424
2	.....	2,260	720	355	271	289	361	950	430
3	.....	1,400	685	450	265	283	313	995	444
4	.....	1,130	615	450	265	265	355	910	418
5	.....	995	548	373	260	254	325	1,130	392
6	720	910	548	404	254	1,180	265	950	385
7	685	795	615	482	243	548	444	1,310	379
8	685	758	580	515	248	373	3,350	910	379
9	650	832	548	482	238	331	6,840	995	379
10	650	832	515	430	232	313	4,910	870	482
11	685	758	482	424	232	361	3,470	795	385
12	720	720	482	385	226	424	2,360	720	367
13	1,600	685	450	373	221	343	1,810	720	367
14	910	685	444	373	265	349	1,500	720	430
15	758	615	450	361	226	515	1,400	685	379
16	720	615	437	385	216	685	3,590	650	355
17	720	580	424	482	210	515	2,250	650	325
18	650	580	411	367	210	430	1,920	685	319
19	615	548	398	355	216	379	2,030	615	313
20	580	548	385	343	205	373	1,700	580	301
21	615	515	411	343	200	650	1,600	548	295
22	1,400	515	392	331	650	307	1,700	515	289
23	995	515	373	319	2,140	337	1,500	548	289
24	795	580	367	319	870	580	1,500	515	277
25	758	548	367	319	580	450	1,310	515	265
26	758	515	418	301	450	385	1,220	482	265
27	832	482	515	301	398	349	1,220	482	265
28	795	515	418	289	411	307	1,040	450	271
29	758	580	411	289	482	301	1,220	450	411
30	685	.....	373	283	398	301	995	450	271
31	995	.....	361	.....	331	.....	910	437	.....

Monthly discharge of Tallulah River near Seed, Ga., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.		Maximum.	Minimum.	Mean.
January 6–31	1,600	580	797	June	1,180	254	416
February	2,360	482	787	July	6,840	265	1,760
March	720	361	474	August	1,310	437	712
April	515	283	375	September	482	265	352
May	2,140	200	377				

TALLULAH RIVER NEAR LAKEMONT, GA.

LOCATION.—One-fourth mile downstream from Rabun dam (originally called Mathis dam), a mile upstream from mouth of Tiger Creek, a mile upstream from Mathis gaging station, and 1¼ miles from Lakemont, Rabun County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 13 to September 30, 1916.

GAGE.—A Barrett & Lawrence water-stage recorder, with 5-foot range of stage, at rock-filled log crib, originally a bridge abutment, on left bank of river; referred to vertical staff gage 20 feet upstream. Staff was put in October 8 1915, but operation of recorder did not begin until January 13, 1916. A number of current-meter measurements made prior to January 13, 1916, are referred to staff gage.

DISCHARGE MEASUREMENTS.—Made from cable 5 feet downstream from gage.

CHANNEL AND CONTROL.—Bed rough and rocky, necessitating careful work in making discharge measurements. Control is a rock shoal 50 feet downstream from gage. Part of shoal is loose rock and high water in last part of 1915 changed stage-discharge relation by changing the position of these rocks.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.4 feet at 8.30 p.m. July 9 (discharge, 10,900 second-feet); practically no flow at certain times when sluice gates at storage dam one-fourth mile upstream were shut and no water passed over crest of dam.

ICE.—Never enough to affect stage-discharge relation.

DIVERSIONS.—None.

REGULATION.—The Rabun dam, one-fourth mile upstream, makes a very large reservoir which is used solely for storage in operating the great hydroelectric plant 7 miles downstream. Water is impounded or let loose at will of operators; consequently fluctuations are great, sudden, and frequent.

ACCURACY.—Stage-discharge relation practically permanent since flood of December, 1915. Rating curve well defined between zero and 4,000 second-feet. Operation of water-stage recorder not entirely satisfactory on account of poor attention by observer. Daily discharge ascertained by use of discharge integrator. Records fair except July 8 and 19, when stage was above the maximum that could be shown by water-stage recorder. High stages read by observer from staff gage.

Discharge measurements of Tallulah River near Lakemont, Ga., during the period Sept. 8, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 8	Warren E. Hall	2.44	579	Jan. 19	H. L. Wills	2.90	853
Oct. 9	H. L. Wills	.47	17.8	22	do	3.27	1,090
18	do	2.55	598	22	do	4.45	1,960
19	do	4.18	1,820	27	do	2.85	794
20	do	3.35	1,050	Feb. 1	do	5.22	2,600
25	do	2.10	398	3	Warren E. Hall and H. L. Wills	3.86	1,480
Nov. 1	do	3.65	1,240	21	H. L. Wills	2.42	577
1	do	2.52	606	July 11	Warren E. Hall	6.10	3,690
2	do	3.87	1,400				
4	do	3.82	1,370				

Daily discharge, in second-feet, of Tallulah River near Lakemont, Ga., for the year ending Sept. 30, 1916.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2,400	565	181	540	350	224	837	806
2	.....	2,180	728	105	524	588	71	1,090	624
3	.....	1,580	1,050	493	586	366	198	1,050	69
4	.....	1,190	503	587	628	86	297	952	540
5	.....	1,090	376	500	500	693	382	900	904
6	.....	952	562	478	288	241	551	1,070	754
7	.....	932	740	502	110	451	670	1,330	392
8	.....	726	525	241	526	263	4,140	908	298
9	.....	815	525	522	488	324	.....	1,070	192
10	.....	822	534	424	476	138	.....	838	2
11	.....	718	500	438	548	57	.....	774	370
12	.....	698	487	423	647	341	.....	744	282
13	1,600	723	481	414	310	310	.....	718	452
14	986	700	472	447	141	278	.....	732	499
15	571	674	537	315	665	210	.....	652	326
16	751	670	612	417	670	161	.....	427	194
17	690	606	689	390	731	68	.....	643	80
18	672	581	268	540	654	396	.....	652	314
19	680	578	52	582	689	294	2,160	613	346
20	571	580	445	735	378	313	2,020	557	565
21	700	574	550	806	106	292	1,700	536	538
22	1,360	554	484	284	608	290	1,770	535	582
23	1,030	582	392	90	212	321	1,690	550	252
24	810	578	542	412	44	555	1,610	519	154
25	758	570	144	620	216	460	1,420	476	368
26	854	525	412	636	188	364	1,320	500	418
27	837	504	503	678	93	298	1,300	446	395
28	835	510	392	720	47	411	1,030	424	450
29	809	637	476	245	224	682	1,190	443	384
30	759	.....	519	80	194	647	990	622	352
31	984	.....	615	.....	235	.....	929	540	.....

Monthly discharge of Tallulah River near Lakemont, Ga., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.		Maximum.	Minimum.	Mean.
January 13–31	1,600	571	856	May	731	44	396
February	2,400	504	836	June	693	57	342
March	1,050	52	506	August	1,330	424	716
April	806	80	444	September	904	2	397

TALLULAH RIVER AT MATHIS, GA.

LOCATION.—900 feet downstream from mouth of Tiger Creek, 1,000 feet from old Mathis post office (now discontinued), half a mile from railroad station at Lakemont, Rabun County, 1 mile downstream from Rabun dam (first called Mathis dam), and 5 miles upstream from Tallulah Falls.

DRAINAGE AREA.—186 square miles.

RECORDS AVAILABLE.—October 31, 1912, to September 30, 1916.

GAGE.—Vertical staff in eight sections on left bank 900 feet below mouth of Tiger Creek, installed March 27, 1913, to replace original gage, 400 feet upstream, washed out March 16, 1913; read 6 times daily (6 and 7 a. m., noon, 6 and 7 p. m., and midnight) to half-tenths, by Miles Phillips, from October 1, 1915, to January 12, 1916; after that date read four times daily (6 a. m., noon, 6 p. m., and midnight) to half-tenths by Georgia Railway & Power Co. Low-water stages hard to read because of silt which collects around lower sections of gage.

DISCHARGE MEASUREMENTS.—Originally made from a rough railroad trestle 400 feet upstream. In October, 1916, the Georgia Railway & Power Co. erected a gaging cable 800 feet upstream from gage, which was used until July, 1916, when it was carried away by flood.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and boulders. A good control, which has remained permanent, is formed by a gravel and boulder shoal 150 feet downstream from gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.0 feet at 9 p. m. July 9, determined by wye levels from flood mark (discharge, determined from extension of rating curve, 19,300 second-feet); minimum stage, 0.15 foot at 6 p. m. October 9 to 6 p. m. October 10 (discharge, 79 second-feet). This low stage caused by shutting off water at Rabun dam.

1913–1916: Maximum stage recorded that of July 9, 1916; minimum stage, 0.1 foot at several times during July, August, September, and October, 1915 (discharge, 73 second-feet). This low stage caused by shutting off water at Rabun storage dam.

ICE.—Never enough to affect stage-discharge relation.

REGULATION.—The operation of Rabun storage dam causes frequent and great fluctuations. It is doubtful whether the four daily gage readings give an accurate mean for the day.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice during year. Rating curve well defined below 5,000 second-feet. Above that point curve is an extension. Diurnal fluctuations are so frequent that it is doubtful whether an accurate mean for the day is obtained. Daily discharge ascertained by applying daily mean gage heights to rating table, except for days of considerable fluctuation, for which it was ascertained by averaging discharge for the individual gage readings. Records subject to considerable error.

Discharge measurements of Tallulah River at Mathis, Ga., 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	H. L. Wills	2.10	605	Oct. 30	H. L. Wills	1.10	254
21	do	2.40	833	Nov. 3	do	3.40	1,430
25	do	1.70	490	Jan. 8	Warren E. Hall	2.32	860
28	do	3.98	1,780	July 11	do	6.28	4,200

Daily discharge, in second-feet, of Tallulah River at Mathis, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	355	627	678	1,200	2,400	678	396	587	385	307	980	896
2	110	868	760	1,090	2,350	870	248	648	656	184	1,140	570
3	132	820	712	925	1,560	1,140	688	606	561	328	1,140	206
4	479	895	324	650	1,260	464	709	824	202	450	1,040	573
5	164	883	224	925	1,140	508	608	682	682	425	1,080	1,040
6	261	616	558	898	1,040	650	601	413	352	554	1,280	815
7	331	184	604	870	1,040	815	626	233	337	658	1,380	394
8	403	550	753	742	870	623	413	646	393	5,760	1,040	310
9	172	1,300	626	815	925	623	581	740	449	.....	1,140	337
10	134	868	701	732	898	623	502	588	215	8,530	980	233
11	455	870	367	705	815	596	543	655	182	4,420	898	438
12	448	1,090	256	788	788	596	530	776	447	2,270	870	435
13	381	494	701	1,690	815	570	458	428	456	1,970	742	514
14	394	143	670	1,040	760	570	541	248	398	1,620	742	518
15	855	503	806	622	760	627	410	822	330	1,690	689	423
16	354	670	816	898	760	727	518	796	238	3,820	596	287
17	493	570	1,150	732	678	781	415	686	182	2,110	705	184
18	619	553	390	760	678	326	576	566	493	2,070	705	439
19	1,250	196	548	760	678	199	724	693	364	2,240	678	392
20	1,130	257	1,140	650	678	488	686	433	426	2,110	623	668
21	815	85	980	788	650	641	762	206	384	1,760	596	586
22	650	373	870	1,410	650	552	451	584	384	1,990	596	686
23	650	394	760	944	705	544	206	474	605	1,830	596	331
24	543	404	705	925	705	667	527	170	639	1,620	570	220
25	493	404	760	898	678	328	689	314	518	1,500	543	422
26	493	327	760	898	623	517	720	319	426	1,440	543	494
27	412	257	732	925	623	529	803	228	384	1,380	493	434
28	994	220	1,070	870	623	425	774	172	385	1,200	493	505
29	873	530	9,400	870	732	480	421	337	618	1,320	493	458
30	443	521	1,620	788	.....	532	206	310	795	1,090	766	446
31	152	.....	768	1,270	.....	714	.....	330	.....	1,040	576	.....

Monthly discharge of Tallulah River at Mathis, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 186 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	1,250	110	498	2.68	3.09
November	1,300	85	549	2.95	3.29
December	9,400	224	1,010	5.43	6.26
January	1,690	622	906	4.87	5.62
February	2,400	623	927	4.98	5.37
March	1,140	199	594	3.19	3.68
April	803	206	544	2.92	3.26
May	824	170	500	2.69	3.10
June	795	182	430	2.31	2.58
August	1,380	493	798	4.29	4.95
September	1,040	184	475	2.55	2.84

TIGER CREEK AT LAKEMONT, GA.

LOCATION.—100 feet from old Mathis post office, 100 feet upstream from Tallulah Falls Railway bridge, 600 feet downstream from Phillips's grist-mill dam, 800 feet upstream from junction of creek with Tallulah River, and one-fourth mile downstream from Lakemont post office, Rabun County.

DRAINAGE AREA.—31 square miles (measured by Georgia Railway & Power Co.).

RECORDS AVAILABLE.—January 11 to September 30, 1916.

GAGE.—Staff gage in three sections, enamel faced, on right bank; installed by Georgia Railway & Power Co.; read by an employee of the power company.

DISCHARGE MEASUREMENTS.—Made from cable one-fourth mile upstream from gage, in front of Lakemont railroad station.

CHANNEL AND CONTROL.—Bed rocky and rough at gage. Under gaging cable bed of channel is sandy and shifting, making it necessary to obtain soundings for every discharge measurement. Control, solid rock shoal just below gage; permanent. Backwater from very high floods on Tallulah River probably affects stage-discharge relation; this condition arises very infrequently, however.

EXTREMES OF DISCHARGE.—Maximum stage during year, approximately 7.0 feet (over top of gage) at 9 p. m. July 9 (discharge not determined); minimum stage, 1.3 feet May 10–21, June 29–30, and July 3–5 (discharge, 42 second-feet).

ICE.—Never enough to affect stage-discharge relation.

DIVERSIONS.—None.

REGULATION.—Phillips's mill, which is infrequently operated, can cause considerable variation in stage. However, the gage is read only when mill is not running. As the pond above dam has practically no storage, the gage heights are accurate.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 600 second-feet; above this point it is an extension. Gage read to half-tenths four times daily—6 a. m., noon, 6 p. m., and midnight. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

Discharge measurements of Tiger Creek at Lakemont, Ga., 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. 25	H. L. Wills	.....	59	July 12	Warren E. Hall	2.44	337
June 20	Warren E. Hall	1.40	55	19	....do	1.98	193
July 11	....do	3.00	514				

Daily discharge, in second-feet, of Tiger Creek at Lakemont, Ga., for the year ending Sept. 30, 1916.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	291	98	63	56	50	50	122	70
2	.....	352	139	63	56	42	64	122	70
3	.....	179	120	84	56	49	49	122	70
4	.....	120	109	70	56	49	42	122	64
5	.....	109	98	70	56	49	42	131	57
6	.....	109	89	70	56	109	42	131	56
7	.....	109	98	77	56	59	45	136	56
8	.....	109	89	73	56	56	979	125	56
9	.....	109	87	70	56	50	.....	189	57
10	.....	109	87	70	45	48	1,030	192	70
11	87	91	87	70	42	50	483	109	63
12	91	87	87	64	42	62	339	109	62
13	107	87	87	63	42	56	253	109	57
14	89	87	87	63	42	59	192	109	69
15	87	87	87	63	42	67	158	109	67
16	98	87	87	64	42	78	329	109	57
17	87	87	73	64	42	64	182	109	56
18	87	87	70	63	42	56	163	107	56
19	87	87	70	63	42	56	208	98	56
20	87	87	70	63	42	56	230	98	56
21	87	87	70	63	42	57	192	89	56
22	109	87	70	63	125	50	352	91	56
23	98	87	64	63	323	55	240	89	56
24	87	91	63	63	98	64	201	87	56
25	89	87	63	63	72	56	163	85	56
26	89	87	72	63	73	56	163	78	56
27	96	87	87	63	78	50	158	78	59
28	87	89	78	56	78	49	136	72	57
29	87	105	64	56	84	43	141	70	57
30	87	.....	63	56	63	42	136	70	56
31	150	.....	63	.....	57	.....	122	70	.....

Monthly discharge of Tiger Creek at Lakemont, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 31 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January 11–31	150	87	94.0	3.03	2.37
February	352	87	113	3.65	3.94
March	139	63	83.1	2.68	3.09
April	84	56	65.3	2.11	2.35
May	323	42	66.5	2.15	2.48
June	109	42	56.2	1.81	2.02
July		42			
August	192	70	108	3.48	4.01
September	70	56	59.7	1.93	2.15

ALTAMAHA RIVER BASIN.

OCMULGEE RIVER AT JULIETTE, GA.

LOCATION.—1 mile below Juliette railroad station, 1 mile below Juliette Cotton Mills, which are on left side of river opposite Juliette, 2½ miles below mouth of Towaliga River, and 20 miles upstream from Macon, Ga. Ocmulgee River forms boundary between Jones and Monroe counties.

DRAINAGE AREA.—2,100 square miles (measured on Post Route map of Georgia).

RECORDS AVAILABLE.—June 3 to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on left bank of river, referred to staff gage inside of concrete well.

DISCHARGE MEASUREMENTS.—Made from a cable about 150 feet upstream from gage.

CHANNEL AND CONTROL.—Bed composed of sand and solid rock at section. Banks high; subject to overflow at about 15 feet gage height. A rock shoal half a mile downstream forms a control which will probably keep stage-discharge relation permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 26.4 feet at 3 p. m. July 10 (discharge, 42,400 second-feet); minimum stage, from water-stage recorder, 3.07 feet at 2 p. m. June 19 (discharge, 435 second-feet); minimum stage due to regulation by Jackson dam.

Maximum stage of which there is any record, 32.0 feet during flood of 1886 (approximate discharge, determined from extension of rating curve, 55,800 second-feet). This stage was determined with wye level from marks pointed out by local residents and is not reliable.

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

REGULATION.—There is a great diurnal fluctuation from three separate sources. Greatest changes are caused by operation of the hydroelectric plant about 30 miles upstream, near Jackson, Ga. Minor fluctuations are caused by operation of Juliette mills, a mile upstream, and the hydroelectric plant on Towaliga River at High Falls, about 15 miles away.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 45,000 second-feet. Operation of water-stage recorder satisfactory except June 19–25, when the time may be slightly in error, and August 4–7, when clock stopped. Daily discharge determined by use of discharge integrator, except June 19–25 and July 8 to August 3, for which it was ascertained by applying to rating table mean daily gage heights. Records excellent.

Discharge measurements of Ocmulgee River at Juliette, Ga., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Ft.	*Sec.-Ft.*			*Ft.*	*Sec.-Ft.*
May 15	Warren E. Hall	3.54	671	July 12	B. M. Hall, jr	17.42	21,800
16	do	4.14	1,110	14	Warren E. Hall	9.51	7,300
June 10	do	4.61	1,620	16	B. M. Hall, jr	7.28	3,840
July 10	B. M. Hall, jr	26.12	[a]41,500	Sept. 7	Warren E. Hall	4.22	1,160

[a] Computed from measurement made at bridge at Macon, 20 miles downstream from Juliette, 3 hours after crest of flood, by assuming an equal run-off per square mile at the two places. See miscellaneous measurements, p. 55.

Daily discharge, in second-feet, of Ocmulgee River at Juliette, Ga., for the year ending Sept. 30, 1916.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	1,290	3,790	1,670	16	1,490	4,560	2,600	1,540
2	.....	846	10,100	1,565	17	1,260	9,640	2,190	1,040
3	.....	950	15,800	1,040	18	756	14,500	1,920	1,190
4	969	1,050	.....	1,090	19	926	11,800	1,470	1,700
5	1,080	1,150	.....	1,530	20	1,370	11,600	1,000	1,740
6	1,470	2,040	.....	1,580	21	1,360	10,900	1,220	1,740
7	1,500	6,090	.....	1,640	22	1,650	10,400	1,480	1,740
8	1,540	9,490	3 060	1,640	23	3,240	10,400	1,450	1,540
9	1,480	23,200	3,050	1,510	24	1,380	9,480	1,450	1,030
10	1,370	40,400	2,940	1,410	25	777	8,840	1,470	1,140
11	839	34,900	2,740	1,440	26	1,130	7,720	1,400	1,550
12	1,140	22,000	2,380	1,660	27	1,550	7,160	944	1,580
13	1,520	12,800	2,050	1,650	28	1,520	5,170	1,180	1,660
14	1,540	7,800	2,760	1,780	29	1,560	5,380	1,940	1,660
15	1,520	5,040	3,320	1,870	30	1,520	6,360	3,810	1,410
					31	.....	4,740	2,060	.....

Monthly discharge of Ocmulgee River at Juliette, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 2,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
June 4–30	3,240	839	1,390	0.662	0.66
July	40,400	846	9,920	4.72	5.44
September	1,740	1,040	1,510	.719	.80

OCONEE RIVER NEAR GREENSBORO, GA.

LOCATION.—At highway bridge, 1½ miles downstream from Town Creek, 4 miles upstream from mouth of Apalachee River, and 5 miles west of Greensboro, Greene County, on road to Madison.

DRAINAGE AREA.—1,100 square miles.

RECORDS AVAILABLE.—July 25, 1903, to September 30, 1916.

GAGE.—Standard chain gage attached to bridge; read by F. M. Chambers.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed chiefly of sand; slightly shifting. Control section not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 19.8 feet at 4 p. m. December 20 (discharge, 16,000 second-feet); minimum stage, 1.2 feet at 8 a. m. and 5 p. m. May 21, 5 p. m. August 31, and 5 p. m. September 27 (discharge, 256 second-feet).

1903–1916: Maximum stage recorded, 35.4 feet August 26, 1908 (discharge not determined). Discharge for this stage published in Water-Supply Papers 382 and 402, and determinations of discharge for stages above 13 feet prior to 1913, as published in previous water-supply papers, are too small, the error increasing with the stage; minimum stage, 0.35 foot September 18 and October 8, 1911 (discharge, 172 second-feet).

REGULATION.—Considerable diurnal fluctuation upstream caused by operation of power plants.

ACCURACY.—Stage-discharge relation changed during spring of 1914; probably permanent after the change. Rating curve fairly well defined below 1,500 second-feet; above 1,500 second-feet curve is extended parallel to old curve. Gage read to tenths twice daily. Regulation by power plants upstream makes the mean of two daily readings subject to error. Daily discharge ascertained by applying mean daily gage heights to rating table. Records poor.

Discharge measurements of Oconee River near Greensboro, Ga., during the year ending Sept. 30, 1916.

[Made by M. R. Hall.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 5	2.16	540
5	2.12	513

Daily discharge, in second-feet, of Oconee River near Greensboro, Ga., for the period May 10, 1914, to Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1914.						1914.					
1	.....	582	487	425	395	16	716	647	518	901	456
2	.....	647	518	582	395	17	647	614	487	825	518
3	.....	647	518	1,020	550	18	550	518	788	716	518
4	.....	788	582	716	788	19	550	582	863	716	518
5	.....	716	1,300	614	647	20	518	518	940	716	825
6	.....	1,660	863	487	582	21	647	550	863	681	980
7	.....	1,510	901	487	456	22	550	550	681	716	681
8	.....	1,100	716	456	425	23	582	518	487	980	518
9	.....	788	716	487	395	24	582	518	487	863	456
10	788	752	681	518	395	25	456	487	456	752	582
11	716	788	681	863	395	26	518	518	338	681	487
12	825	863	647	1,180	456	27	681	518	310	582	456
13	825	752	582	1,260	425	28	716	518	395	518	456
14	716	716	518	2,210	456	29	550	716	582	582	487
15	614	647	487	2,010	395	30	582	647	456	647	518
						31	487	.....	366	395	.....

Daily discharge, in second-feet, of Oconee River near Greensboro, Ga., for the period May 10, 1914, to Sept. 30, 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	456	614	7,660	4,070	2,210	1,810	1,060	647	1,560	1.380	230	487
2	518	647	8,460	3,330	4,850	1,660	1,060	647	1,860	1.140	180	425
3	2,910	582	6,090	2,160	4,260	1,460	1,060	681	1,760	825	395	366
4	4,070	518	4,660	1,260	2,730	1,560	1,060	681	1,460	825	752	425
5	3,510	518	9,830	1,560	2,210	2,850	1,060	681	1,020	1.960	518	366
6	2,110	518	11,100	3,090	2,160	4,590	1,020	681	901	2 260	456	366
7	1,340	518	10,900	4,330	1,910	4,070	1,060	1,140	825	1.460	366	425
8	1,020	582	5,600	3,810	1,860	3,330	980	4,850	980	1.060	310	425
9	825	940	2,670	2,790	1,660	2,210	901	3,450	1,860	901	310	425
10	681	1,180	1,860	2,060	1,560	1,960	901	2,060	1,220	1.220	550	425
11	582	1,060	1,380	1,860	1,420	1,660	901	1,560	980	1.180	980	395
12	518	940	1,220	3,270	1,300	1,460	901	3,090	901	980	1,380	366
13	487	752	1,300	2,730	1,300	1,420	901	4,720	825	716	901	366
14	582	863	1,560	2,260	1,300	1,380	901	6,360	752	582	614	425
15	1,810	2,970	1,560	1,660	1,380	1,340	825	5,110	681	614	1,300	716
16	9,180	5,600	1,340	1,460	1,300	1,300	825	2,490	752	980	2,160	425
17	15,600	4,850	1,140	1,860	1,300	1,260	825	1,860	901	716	2,550	395
18	10,900	2,910	1,100	4,780	1,220	1,220	825	1,380	681	518	1,660	366
19	3,150	2,210	1,060	8,220	1,260	1,260	788	1,220	681	425	1,180	366
20	1,510	1,910	980	6,090	1,220	1,220	788	1,020	681	395	980	395
21	1,180	1,660	1,140	3,270	1,300	1,180	788	940	614	425	1,560	425
22	940	1,260	1,300	1,960	1,300	1,140	752	863	614	366	1,220	425
23	825	1,060	1,300	1,760	1,340	1,060	752	825	614	425	825	366
24	788	901	1,140	2,060	2,210	1,060	752	901	550	487	614	395
25	788	752	1,560	3,450	3,630	1,060	716	1,220	487	425	518	366
26	716	716	3,090	3,570	2,910	1,060	716	1,140	518	425	425	338
27	647	752	4,070	2,970	2,110	1,020	716	901	487	487	425	338
28	582	788	3,450	2,210	1,960	1,060	681	863	487	487	456	310
29	582	1,460	3,450	1,710	.....	1,060	681	863	550	456	425	366
30	582	5,920	4,780	1,460	.....	1,020	647	901	681	425	681	425
31	582	.....	4,330	1,300	.....	1,060	.....	1,220	.....	310	518	.....
1915-16.												
1	550	716	681	11,300	1,300	1,460	825	550	550	550	1,060	283
2	1,220	614	614	5,920	5,040	3,030	752	550	487	487	5,840	310
3	863	614	582	2,850	6,450	3,510	752	487	395	647	5,840	395
4	614	614	550	1,510	3,570	2,370	752	487	487	1,140	2,370	550
5	1,660	550	582	1,300	2,310	1,380	716	487	647	901	1,760	425
6	3,940	550	550	1,340	1,760	1,260	681	487	550	614	1,260	366
7	2,970	550	550	1,300	1,380	1,140	825	456	1,300	1,560	2,010	366
8	1,300	647	550	1,220	1,220	3,450	980	456	863	1,510	1,960	338
9	716	614	550	1,140	1,060	3,330	901	456	614	2,730	1,960	366
10	681	550	487	1,100	1,220	1,660	825	456	456	4,720	1,860	425
11	614	518	582	1,140	1,060	1,340	681	425	338	5,840	1,610	456
12	614	614	1,220	1,140	1,020	1,220	752	366	395	7,230	980	425
13	582	614	1,300	1,460	1,100	1,140	716	425	647	6,450	863	456
14	614	681	1,100	1,660	1,140	1,100	681	425	518	3,450	1,220	366
15	2,850	752	681	1,760	1,060	1,020	647	425	681	2,490	980	825
16	4,140	681	647	1,380	980	980	647	425	681	3,690	863	1,220
17	1,380	614	681	1,300	901	901	901	425	901	4,460	647	716
18	901	681	4,330	1,180	901	901	901	425	681	5,530	614	582
19	1,060	901	8,460	1,020	825	863	863	395	518	6,540	582	425
20	1,960	1,420	15,700	901	825	825	752	338	366	5,180	614	366
21	3,750	1,220	12,600	901	825	825	681	256	425	3,810	550	395
22	6,730	825	5,920	980	681	825	681	310	425	3,030	518	310
23	8,700	614	1,710	1,140	788	788	647	980	425	3,810	487	310
24	9,700	614	1,300	1,660	1,510	788	614	1,300	487	5,840	487	310
25	3,450	582	1,260	901	1,610	752	614	1,660	366	5,560	456	310
26	1,610	825	1,220	901	1,260	825	614	1,060	582	4,070	425	283
27	1,060	1,300	1,140	1,260	1,020	980	550	681	614	1,760	425	256
28	1,020	1,180	980	980	901	940	550	550	425	1,460	425	338
29	863	1,060	5,110	901	2,310	901	550	518	338	1,380	425	901
30	825	752	10,700	940	.....	901	550	614	338	3,030	338	788
31	752	.....	13,300	901	.....	825	.....	614	.....	1,220	256	.....

Monthly discharge of Oconee River near Greensboro, Ga., for the period May 10, 1914, to Sept. 30, 1916.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1914.					
May 10-31	825	456	628	0.571	0.47
June	1,660	487	712	.647	.72
July	1,300	310	620	.564	.65
August	2,210	395	793	.721	.83
September	980	395	520	.473	.53
1914-15.					
October	15,600	456	2,260	2.05	2.36
November	5,920	518	1,530	1.39	1.55
December	11,100	980	3,580	3.25	3.75
January	8,220	1,260	2,850	2.59	2.99
February	4,860	1,220	1,970	1.79	1.86
March	4,590	1,020	1,640	1.49	1.72
April	1,060	647	861	.783	.87
May	6,360	647	1,770	1.61	1.86
June	1,860	487	896	.815	.91
July	2,260	310	802	.729	.84
August	2,550	180	821	.746	.86
September	716	310	403	.366	.41
The year	15,600	180	1,620	1.47	19.98
1915-16.					
October	9,700	550	2,180	1.98	2.28
November	1,420	518	749	.681	.76
December	15,700	487	3,090	2.81	3.24
January	11,300	901	1,720	1.56	1.80
February	6,450	681	1,590	1.45	1.56
March	3,510	752	1,360	1.24	1.43
April	980	550	720	.655	.73
May	1,660	256	564	.513	.59
June	1,300	338	550	.500	.56
July	7,230	487	3,250	2.95	3.40
August	5,840	256	1,280	1.16	1.34
September	1,220	256	462	.420	.47
The year	15,700	256	1,470	1.34	18.16

OCONEE RIVER AT FRALEYS FERRY, NEAR MILLEDGEVILLE, GA.

LOCATION.—At Fraleys Ferry, 4 miles downstream from mouth of Little River and 6 miles upstream from Milledgeville, Baldwin County.

DRAINAGE AREA.—2,840 square miles.

RECORDS AVAILABLE.—May 23, 1906, to December 31, 1908; October 6, 1909, to September 30, 1916.

GAGE.—A combination sloping and vertical rod gage on left bank just upstream from ferry landing; read by H. A. Taylor.

DISCHARGE MEASUREMENTS.—Made from ferryboat.

CHANNEL AND CONTROL.—Bed sandy and shifting at measuring section. Control formed by a rock ledge extending across river 200 feet downstream; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.1 feet at 6 p. m. July 23 (discharge, determined from extension of rating curve, about 17,500 second-feet); minimum stage recorded, 4.7 feet at 6 p. m. September 28 (discharge, 760 second-feet).

1906–1916 (except January 1 to October 5, 1909): Maximum stage recorded approximately 24.6 feet March 17, 1913 (discharge, determined from extension of rating curve, about 49,700 second-feet); minimum stage recorded, 4.1 feet at 6 a. m. September 17, 1914 (discharge, 410 second-feet).

REGULATION.—The operation of power plants a great distance upstream can cause only slight fluctuations.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 5,600 second-feet; above that point curve is an extension. No discharge measurements have been made since November 14, 1913, but it is believed that no change in control could have occurred. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good up to 5,600 second-feet; above that point subject to error.

Daily discharge, in second-feet, of Oconee River at Fraleys Ferry, near Milledgeville, Ga., for year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,490	1,870	1,870	13,200	4,500	8,280	2,150	1,380	1,380	1,610	3,250	1,610
2	1,610	1,870	1,610	10,400	15,000	6,450	2,010	1,320	1,270	1,270	8,070	1,380
3	1,610	1,610	1,610	5,260	14,500	7,650	2,010	1,270	1,170	1,380	15,600	1,380
4	1,610	1,610	1,490	4,310	9,340	6,450	2,150	1,270	1,080	2,300	8,070	1,440
5	4,130	1,610	1,610	3,770	5,850	4,310	2,150	1,220	1,380	2,010	4,310	1,490
6	4,880	1,380	1,740	3,080	4,500	3,770	2,150	1,220	1,490	1,870	3,420	1,380
7	6,450	1,380	1,740	3,080	4,130	3,420	2,150	1,170	1,870	4,130	5,850	1,270
8	4,880	1,270	1,610	2,920	3,590	5,070	2,920	1,170	2,760	6,850	5,850	1,120
9	4,310	1,320	1,490	2,760	3,420	5,850	2,920	1,120	1,870	8,280	4,880	1,040
10	2,150	1,440	1,490	2,600	3,420	4,880	2,450	1,080	1,440	12,500	4,130	1,080
11	1,610	1,380	1,610	2,300	3,420	4,310	2,150	1,080	1,220	12,800	3,250	1,380
12	1,380	1,380	2,760	2,450	3,080	3,590	1,870	1,040	950	9,560	2,150	1,270
13	1,320	1,380	3,080	4,130	2,760	3,080	1,870	990	990	9,340	1,870	1,080
14	1,380	1,380	2,760	5,070	3,080	2,920	1,870	990	1,270	7,250	1,870	990
15	1,610	1,440	2,450	4,130	3,250	2,760	1,740	910	1,320	5,450	3,080	2,450
16	3,950	1,740	1,870	3,590	2,760	2,450	1,740	990	1,610	4,880	2,150	2,600
17	6,850	1,610	1,870	3,590	2,600	2,450	2,010	910	1,440	6,850	2,010	2,600
18	3,080	1,870	5,650	2,760	2,600	2,150	2,450	910	1,270	11,600	1,870	1,870
19	2,450	3,080	9,780	3,080	2,450	2,150	2,150	910	1,320	10,000	1,740	1,440
20	3,770	3,420	11,800	2,600	2,150	2,150	1,870	950	1,440	9,340	1,610	1,220
21	4,310	3,080	14,500	2,450	2,150	2,300	1,870	910	1,270	7,050	1,490	1,080
22	9,340	1,610	11,300	2,760	2,300	2,450	1,870	910	1,380	6,450	1,380	990
23	11,300	1,870	4,500	3,080	2,150	2,300	1,740	1,440	1,870	12,800	1,380	990
24	13,800	1,740	3,590	3,080	4,130	2,300	1,610	2,300	2,010	11,600	1,270	910
25	11,800	1,610	3,080	2,760	4,500	2,150	1,610	2,760	1,740	10,900	1,170	830
26	4,130	1,610	2,760	2,450	3,770	2,150	1,490	2,600	990	8,910	1,170	870
27	2,760	1,440	2,600	2,600	3,080	2,450	1,440	2,150	1,870	6,050	1,080	910
28	2,450	2,920	3,080	2,760	2,450	2,600	1,440	1,610	3,080	4,880	1,120	795
29	2,150	3,250	9,340	2,760	8,910	2,450	1,380	1,320	1,870	5,260	1,080	990
30	2,150	1,610	11,600	2,450	.....	2,300	1,440	1,380	990	6,850	1,870	2,150
31	1,870	.....	14,600	2,450	.....	2,150	.....	1,610	.....	5,650	1,270	.....

Monthly discharge of Oconee River at Fraleys Ferry, near Milledgeville, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 2,840 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	13,800	1,320	4,080	1.44	1.66
November	3,420	1,270	1,830	.644	.72
December	14,500	1,490	4,520	1.59	1.83
January	13,200	2,300	3,700	1.30	1.50
February	15,000	2,150	4,480	1.58	1.70
March	8,280	2,150	3,540	1.25	1.44
April	2,920	1,380	1,960	.690	.77
May	2,760	910	1,320	.465	.54
June	3,080	950	1,520	.535	.60
July	12,800	1,270	6,960	2.45	2.82
August	15,600	1,080	3,200	1.13	1.30
September	2,600	795	1,350	.475	.53
The year	15,600	795	3,210	1.13	15.41

APALACHICOLA RIVER BASIN.

CHATTAHOOCHEE RIVER NEAR NORCROSS, GA.

LOCATION.—At Medlock's bridge, 1½ miles upstream from mouth of John Creek, 4½ miles north of Norcross, Gwinnett County, and about 5 miles above Suwanee Creek. The river forms the boundary between Gwinnett and Milton counties.

DRAINAGE AREA.—1,170 square miles.

RECORDS AVAILABLE.—January 9, 1903, to September 30, 1916.

GAGE.—Standard chain gage on toll bridge used until December 31, 1915; on January 1, 1916, a Dexter water-stage recorder was installed on right bank, just above bridge, and referred to chain gage without change in datum; stages above 7 feet measured by the chain gage, which is also read twice daily throughout the year by W. O. Medlock.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed sandy; shifts. Low-water control is a rock shoal about 2½ miles downstream; at higher stages shifting clay banks and other conditions may cause changes in the stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 21.4 feet at 2.30 p. m. December 30 (discharge, 36,200 second-feet); minimum stage 1.63 feet at 1 a. m. May 8 (discharge, 858 second-feet).

1903–1916: Maximum stage recorded December 30, 1915; minimum stage, 1.02 feet October 21, 1911 (discharge, 294 second-feet).

ICE.—Never enough to affect stage-discharge relation.

REGULATION.—Diurnal fluctuation is caused by operation of hydroelectric plants on Chattahoochee and Chestatee rivers near Gainesville, Ga. Discharge January 1 to September 30, 1916, determined from records of water-stage recorder, agree very closely with that obtained by using mean daily gage heights from two readings of chain gage per day. Errors in mean monthly discharge obtained by using records from chain gage varied from —1.6 per cent for February and May to +1.4 per cent for June. This study indicates that for medium and high stages estimates of discharge for former years as computed from records of the chain gage are probably not seriously in error owing to diurnal fluctuation in stage. The effect on the accuracy of records for low stage has not been determined.

ACCURACY.—Stage-discharge relation changed during high water in December, 1915. Rating curve used before December 18 well defined below 15,000 second-feet and poorly defined above; curve used after that date well defined between 1,000 and 36,000 second-feet. Stage-discharge relation never affected by ice. Chain gage read twice daily to hundredths throughout year; mean daily gage heights January 1 to September 30 obtained by averaging hourly stage shown by recorder; operation of recorder satisfactory except for short periods indicated by footnotes. Daily discharge ascertained by applying mean gage heights to rating table. See note to table. Records prior to January 1, 1916, good; since that date excellent.

Discharge measurements of Chattahoochee River near Norcross, Ga., 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. 29	Warren E. Hall and B. M. Hall, jr.	15.94	23,300	Feb. 12	Warren E. Hall	3.64	2,370
				May 20	do	2.07	1,140
30	do	21.22	35,700	24	do	9.83	9,890
31	do	12.70	13,000	June 16	B. M. Hall, jr	3.47	2,340
Jan. 1	do	6.13	4,550				
25	do	3.54	2,130				

Daily discharge, in second-feet, of Chattahoochee River near Norcross, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,640	1,260	1,330	4,520	3,280	2,880	1,720	1,390	1,530	1,280	2,560	1,530
2	3,680	1,400	1,260	3,780	9,100	3,040	1,720	1,420	1,390	1,560	2,880	1,530
3	1,700	1,330	1,330	3,390	9,850	3,210	1,720	1,390	1,360	1,560	3,580	1,460
4	1,540	1,330	1,330	3,040	4,760	2,800	1,840	1,390	1,560	1,360	3,880	1,530
5	6,780	1,260	1,330	2,800	3,580	2,480	1,760	1,390	1,280	1,110	2,800	1,530
6	6,360	1,260	1,120	2,720	3,120	2,320	1,680	1,360	1,500	1,320	3,780	1,460
7	2,640	1,260	1,260	2,720	2,880	2,800	1,760	1,320	1,920	1,680	5,250	1,530
8	2,100	1,190	1,260	2,640	2,640	3,040	1,960	1,180	2,080	5,740	3,980	1,420
9	1,700	1,260	1,190	2,480	2,560	2,560	2,040	1,280	1,560	17,100	3,040	1,500
10	1,400	1,260	1,260	2,400	2,640	2,320	1,840	1,250	1,320	27,900	2,800	1,560
11	1,260	1,190	1,330	2,400	2,480	2,200	1,800	1,250	1,320	28,900	2,560	1,530
12	1,400	1,190	1,700	2,480	2,320	2,120	1,720	1,180	1,760	16,200	2,400	1,460
13	1,260	1,260	1,620	4,280	2,320	2,080	1,680	1,220	1,840	7,750	2,320	1,390
14	1,780	1,470	1,470	4,080	2,400	2,000	1,680	1,180	2,040	6,900	2,480	1,600
15	6,080	1,540	1,400	2,960	2,200	2,000	1,600	1,180	1,960	6,340	2,240	2,040
16	3,130	1,620	1,400	2,640	2,160	1,960	1,600	1,180	2,160	5,000	2,120	1,560
17	1,860	1,540	1,620	2,640	2,120	1,880	1,800	1,460	2,160	9,100	2,040	1,460
18	1,540	1,400	14,900	2,480	2,080	1,880	1,880	1,180	1,720	8,350	2,720	1,390
19	4,260	2,100	25,000	2,320	2,040	1,880	1,680	1,250	1,530	11,100	2,240	1,390
20	10,200	2,640	7,320	2,240	1,960	1,840	1,600	1,180	1,460	11,900	2,200	1,390
21	4,500	1,860	3,580	2,200	1,960	1,840	1,680	1,140	1,460	6,480	1,960	1,390
22	4,380	1,700	2,960	2,320	1,920	1,840	1,640	1,220	1,360	7,600	1,800	1,390
23	2,930	1,470	2,560	2,480	1,920	1,960	1,560	2,880	1,320	7,600	1,760	1,320
24	2,020	1,400	2,480	2,400	2,200	1,800	1,460	8,290	1,320	4,760	1,760	1,250
25	1,780	1,470	2,320	2,240	2,320	1,600	1,530	4,070	1,460	4,520	1,680	1,220
26	1,620	1,400	2,320	2,200	2,080	1,760	1,530	2,480	1,320	4,300	1,760	1,180
27	1,540	1,330	2,320	2,240	1,960	2,200	1,460	2,040	1,500	4,410	1,600	1,180
28	1,540	1,540	2,160	2,240	1,920	2,160	1,460	1,800	1,390	3,480	1,600	1,180
29	1,540	1,400	19,300	2,200	2,480	1,920	1,460	1,800	1,280	2,800	1,720	1,390
30	1,470	1,400	35,100	2,160	.....	1,840	1,420	1,840	1,220	2,960	1,640	1,530
31	1,400	.....	12,100	2,120	.....	1,800	.....	1,640	.....	2,720	1,600	.....

NOTE.—Readings from chain gage used in determining discharge Oct. 1 to Dec. 31, Feb. 2–3, May 16–20, July 9–23, Sept. 3–7 and 19–22. Discharge Jan. 13, Feb. 1, May 24–25, July 8, computed by averaging hourly discharge.

Monthly discharge of Chattahoochee River near Norcross, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	10,200	1,260	2,840	2.43	2.80
November	2,640	1,190	1,460	1.25	1.40
December	35,100	1,120	5,080	4.34	5.00
January	4,520	2,120	2,700	2.31	2.66
February	9,850	1,920	2,940	2.51	2.71
March	3,210	1,600	2,190	1.87	2.16
April	2,040	1,420	1,680	1.44	1.61
May	8,200	1,140	1,770	1.51	1.74
June	2,160	1,220	1,570	1.34	1.50
July	28,900	1,110	7,220	6.17	7.11
August	5,250	1,600	2,480	2.12	2.44
September	2,040	1,180	1,440	1.23	1.37
The year	35,100	1,110	2,790	2.38	32.50

NOTE.—See paragraph under "Regulation" in station description.

CHATTAHOOCHEE RIVER AT WEST POINT, GA.

LOCATION.—At West Point waterworks pumping plant just below Osellige Creek, one-fourth mile east of Alabama-Georgia State line and 1 mile upstream from West Point railroad station, Troup County. Previous to October 20, 1912, station was at Montgomery Street Bridge in West Point.

DRAINAGE AREA.—3,300 square miles.

RECORDS AVAILABLE.—July 30, 1896, to September 30, 1916.

GAGE.—Staff gage on left bank. By using a telescope the observer reads gage from pump house on right bank. Datum of this gage is 0.2 foot lower than that used prior to 1916, but new gage reads about the same as old chain gage, a mile downstream, at a stage of 3.5 feet.

DISCHARGE MEASUREMENTS.—Made from Montgomery Street Bridge, a mile downstream. No tributaries enter between gage and bridge.

CHANNEL AND CONTROL.—Bed rocky; fairly permanent; banks subject to overflow at high stages. Control a rock ledge extending across river just below gage, and is probably not affected by Langdale dam, 5 miles downstream. The old chain gage was abandoned in 1912, because of backwater from this dam.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.1 feet at 4 p. m. July 10 (discharge, 49,200 second-feet); minimum stage, 2.6 feet, mean for day, May 18 (discharge, 1,880 second-feet).

1896–1916: Maximum stage recorded (old gage), 25.0 feet December 30, 1901 (discharge, 88,600 second-feet); minimum stage (old gage), 0.8 foot September 18–21, 1896 (discharge, 780 second-feet).

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

DIVERSIONS.—None.

REGULATION.—Operation of power plants a great distance upstream causes some diurnal fluctuation, but a mean of three daily readings is probably accurate.

ACCURACY.—Stage-discharge relation practically permanent; a change in gage datum necessitated a change in rating curve for this year. Rating curve well defined between 2,500 and 35,000 second-feet. Gage read to tenths three times daily and more frequently during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

COOPERATION.—Since October 20, 1912, gage heights have been furnished by Columbus Power Co., of Columbus, Ga.

The following discharge measurement was made by W. E. Hall and B. M. Hall, jr.:
December 21, 1915: Gage height, 12.97 feet; discharge 26,400 second-feet.

Daily discharge, in second-feet, of Chattahoochee River near West Point, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,340	2,830	2,540	35,000	13,200	9,750	3,940	2,540	3,160	3,160	7,000	3,730
2	4,840	2,540	2,400	34,800	15,200	7,000	3,530	2,540	2,990	2,540	6,280	4,150
3	3,730	2,540	2,400	10,000	17,200	8,750	3,730	2,540	2,830	2,540	9,000	5,320
4	4,150	2,540	2,400	9,000	16,800	7,500	4,150	2,400	3,340	2,680	8,750	4,600
5	6,040	2,400	2,400	7,500	13,000	6,520	3,730	2,400	2,830	2,680	8,750	3,160
6	12,500	2,400	2,830	6,520	9,500	5,800	3,530	2,540	2,400	2,680	7,250	3,160
7	12,000	2,400	2,260	6,040	7,500	6,280	3,730	2,400	2,400	19,000	6,040	3,340
8	7,250	2,400	2,260	5,800	6,760	8,250	5,800	2,260	3,340	35,000	9,000	4,840
9	3,940	2,260	2,540	5,320	6,040	8,750	5,320	2,260	3,160	48,800	6,040	5,320
10	3,340	2,260	2,400	5,320	5,800	6,520	4,370	2,000	3,340	45,500	7,750	5,320
11	2,830	2,260	2,260	5,320	5,560	5,560	3,730	2,000	2,680	39,000	7,000	5,080
12	2,400	2,260	2,990	5,560	5,560	5,080	3,940	2,000	2,130	38,800	5,800	4,840
13	2,260	2,260	4,600	9,500	6,040	4,600	3,530	2,130	4,150	38,000	7,500	3,530
14	2,540	2,540	3,530	9,500	6,280	4,370	3,340	2,130	4,600	35,200	7,500	3,940
15	19,500	2,990	2,990	9,250	5,560	4,600	3,160	2,000	3,530	16,000	10,000	7,500
16	13,500	3,940	2,830	7,500	5,080	4,150	3,160	2,000	4,600	14,200	8,000	6,280
17	10,200	2,990	3,530	6,280	4,840	4,150	3,160	2,000	4,840	12,800	5,560	3,940
18	5,320	3,160	28,800	5,800	4,600	3,940	2,680	1,880	5,320	17,000	4,600	3,160
19	5,320	3,940	33,200	5,320	4,370	3,940	3,160	2,260	3,530	18,500	7,000	3,160
20	23,000	3,940	26,500	5,080	4,370	3,940	3,340	1,880	2,830	18,500	8,000	2,680
21	20,800	3,940	26,500	5,320	4,150	3,730	3,340	2,000	3,340	23,800	4,840	2,680
22	20,500	3,940	15,800	5,080	3,940	3,940	3,160	2,000	2,990	21,500	4,600	2,680
23	17,500	2,830	6,520	5,560	4,150	3,730	3,160	2,990	2,680	16,800	4,150	2,540
24	12,500	2,680	5,560	5,080	5,080	3,730	2,990	7,000	2,540	15,500	4,150	2,540
25	7,000	2,680	4,840	5,080	5,800	3,730	2,830	8,750	3,160	14,500	3,730	2,540
26	4,840	2,680	4,840	4,840	4,840	4,840	2,680	10,800	2,990	13,200	3,730	2,400
27	3,940	2,830	4,370	4,600	4,600	5,320	2,830	5,560	2,990	12,000	3,730	2,400
28	3,530	2,990	4,600	4,370	4,150	4,600	2,830	4,840	2,680	10,200	3,530	2,260
29	3,340	2,540	43,500	4,600	9,000	4,370	2,830	3,940	2,680	8,750	3,160	2,400
30	3,160	2,680	48,500	4,370	.....	4,150	2,830	3,340	2,990	7,750	3,940	4,150
31	2,990	.....	38,000	4,370	.....	2,990	.....	3,340	.....	7,250	5,080	.....

Monthly discharge of Chattahoochee River near West Point, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	23,000	2,260	8,000	2.42	2.79
November	3,940	2,260	2,820	.855	.95
December	48,500	2,260	10,900	3.30	3.80
January	35,000	4,370	7,990	2.42	2.79
February	17,200	3,940	7,210	2.18	2.35
March	9,750	2,990	5,310	1.61	1.86
April	5,800	2,680	3,480	1.05	1.17
May	10,800	1,880	3,180	.964	1.11
June	5,320	2,130	3,230	.979	1.09
July	48,800	2,540	18,200	5.52	6.36
August	10,000	3,160	6,180	1.87	2.16
September	7,500	2,260	3,790	1.15	1.28
The year	48,800	1,880	6,730	2.04	27.71

FLINT RIVER NEAR WOODBURY, GA.

LOCATION.—At the Macon & Birmingham Railroad bridge one-fourth mile downstream from mouth of Elkins Creek, one-third mile upstream from mouth of Cane Creek, and 3 miles east of Woodbury, Pike County.

DRAINAGE AREA.—1,090 square miles.

RECORDS AVAILABLE.—March 29, 1900, to September 30, 1916.

GAGE.—Vertical staff in four sections on left bank about 300 feet above railroad bridge; read to tenths twice daily by E. T. Riggins. Datum of gage, 660 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from downstream side of railroad bridge, which does not make a right angle with the current.

CHANNEL AND CONTROL.—Bottom consists chiefly of rock; rough; current irregular. Control formed by a shoal a mile downstream; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.0 feet at 6 a. m. July 10 (discharge not determined); minimum stage, 0.1 foot at 5 p. m. June 11, 6 a. m. and 5 p. m. June 12, and 6 a. m. June 13 (discharge not determined).

1900–1916: Maximum stage recorded, 16.2 feet March 15, 1913 (discharge, 35,300 second-feet); minimum stage, —0.4 foot October 8–10, 1911 (discharge, 86 second-feet).

REGULATION.—Some slight diurnal fluctuations caused by operation of small mills on tributary streams.

Stage-discharge relation not permanent. Daily discharge not determined, as no current-meter measurements have been made since June 23, 1914.

Daily gage height, in feet, of Flint River near Woodbury, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	0.6	0.6	7.9	3.0	3.5	1.0	0.4	0.35	0.45	1.65	1.15
2	.8	.55	.6	4.8	4.2	4.3	1.0	.4	.3	.3	2.5	.8
3	.8	.5	.6	2.4	5.0	3.8	1.05	.4	.3	.25	4.0	.9
4	.7	.5	.6	1.9	4.4	3.1	1.1	.4	.3	.2	3.7	.7
5	.95	.5	.65	1.6	3.7	2.0	1.1	.4	.3	.2	2.2	.65
6	2.2	.5	.8	1.5	3.2	1.85	1.1	.4	.3	1.1	1.35	.6
7	2.1	.5	.75	1.4	2.1	1.75	1.2	.4	.3	2.4	1.1	.6
8	1.85	.5	.7	1.3	1.6	2.6	1.65	.4	.3	6.4	1.1	.6
9	1.5	.5	.7	1.2	1.4	2.1	1.8	.3	.2	12.4	1.05	.55
10	1.1	.5	.7	1.1	1.2	1.85	1.7	.3	.2	12.6	.95	.5
11	.65	.5	.8	1.15	1.1	1.7	1.4	.3	.15	10.8	.9	.4
12	.5	.5	1.45	1.3	1.2	1.55	1.25	.3	.1	8.2	.95	.4
13	.4	.5	1.5	3.2	1.75	1.4	1.15	.4	.15	6.2	1.3	.4
14	.5	.5	1.25	2.9	2.3	1.3	1.0	.3	.45	3.8	1.45	.7
15	2.4	.6	1.05	2.2	2.4	1.2	1.0	.2	1.35	2.5	2.7	1.5
16	1.9	.6	.9	1.9	2.4	1.1	.9	.2	1.8	2.5	2.4	1.45
17	1.1	.7	1.15	1.75	2.1	1.1	.9	.2	2.7	3.0	1.9	1.2
18	.9	.75	7.5	1.65	2.0	1.1	.85	.2	1.25	3.2	1.05	1.1
19	.9	1.2	8.8	1.5	1.1	1.05	.8	.2	.7	4.1	1.0	1.0
20	1.25	1.15	8.6	1.4	1.1	1.0	.8	.2	.55	4.1	.85	.7
21	1.2	1.0	7.4	1.3	1.05	1.0	.85	.2	.4	5.7	.65	.65
22	5.0	.8	4.0	1.3	1.0	1.0	.9	.2	.3	7.0	.55	.5
23	4.4	.7	2.4	1.3	1.2	1.0	.8	2.8	.3	6.0	.5	.5
24	2.6	.65	1.45	1.4	2.5	1.0	.65	2.0	.35	4.4	.5	.4
25	2.2	.6	1.1	1.3	2.2	.95	.6	1.6	.4	3.4	.45	.3
26	1.75	.6	1.3	1.3	2.0	1.15	.6	1.0	.35	3.0	.4	.3
27	1.35	.75	1.3	1.3	2.0	1.55	.6	.65	.3	2.6	.4	.25
28	.95	.9	1.6	1.3	1.25	1.5	.55	.45	.25	2.6	.4	.2
29	.8	.75	7.4	1.25	2.9	1.35	.5	.4	.45	2.4	.45	.2
30	.7	.6	9.4	1.2	.....	1.3	.5	.3	.65	2.3	.8	.2
31	.6	.....	9.0	1.2	.....	1.15	.....	.35	.....	1.95	.65	.....

FLINT RIVER NEAR CULLODEN, GA.

LOCATION.—At Grays Ferry, Upson County, 1½ miles upstream from mouth of Auchumpkee Creek and 14 miles southwest of Culloden.

DRAINAGE AREA.—2,000 square miles.

RECORDS AVAILABLE.—July 1, 1911, to September 30, 1916.

GAGE.—A staff in four sections on left bank at ferry landing; read by Lonie Williams.

DISCHARGE MEASUREMENTS.—Made from ferryboat.

CHANNEL AND CONTROL.—Bed sandy; shifting at gage. Control is a permanent rock ledge half a mile downstream.

EXTREMES OF DISCHARGE.—Maximum stage during year estimated at 33.3 feet during night of July 9 (discharge not determined); minimum stage, 1.6 feet at 6 a. m. June 13 (discharge, 473 second-feet).

1911–1916: Maximum stage recorded July 9, 1916; minimum stage 1.0 foot October 8, 1911 (discharge, 165 second-feet).

REGULATION.—Practically none.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 4,400 second-feet. Above 4,400 second-feet curve is an extension. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records for low water good; determinations of discharge above 4,400 second-feet subject to error.

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

Daily discharge, in second-feet, of Flint River near Culloden, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	875	1,170	1,120	19,200	5,860	5,670	1,460	875	663	696	2,580	1,840
2	838	1,080	1,080	13,000	11,000	7,400	1,410	875	663	696	3,130	1,460
3	875	1,040	955	9,400	10,800	6,240	1,510	875	663	663	4,400	1,360
4	838	955	915	6,620	9,000	5,480	1,560	875	663	663	7,800	1,220
5	1,720	915	875	4,400	7,000	4,070	1,510	800	663	630	3,750	1,040
6	1,840	800	955	2,450	4,740	3,130	1,460	730	663	1,040	2,580	955
7	2,850	800	998	2,080	3,590	2,320	1,510	730	663	6 620	2,580	875
8	2,320	730	1,120	1,840	2,850	6,240	1,840	730	663	26 600	1,840	838
9	1,720	730	1,080	2,080	2,580	4,570	2,580	663	598	.....	1,620	800
10	1,560	663	998	1,840	2,320	3,130	2,580	663	598	.....	1,510	765
11	1,360	663	955	1,620	2,200	2,580	2,080	663	534	.....	1,510	875
12	1,080	630	1,620	1,460	2,080	2,320	1,620	663	534	28 800	955	800
13	838	598	1,720	2,850	2,080	2,080	1,510	663	504	17,800	1,720	800
14	663	598	1,840	5 480	2,850	1,840	1,460	696	598	10 400	2,200	915
15	7,400	534	1,840	4,070	2,580	1,840	1,410	663	1,170	5,860	3,750	2,580
16	3,750	598	2,080	3,130	2,320	1,620	1,310	663	2,320	4,740	4,070	2,320
17	1,960	663	2,320	2,580	2,080	1,510	1,510	598	3,590	6,430	2,850	1,620
18	1,260	765	10,000	2,450	1,840	1,510	1,360	598	2,080	8,200	1,840	1,510
19	1,170	955	22,200	2,320	1,620	1,510	1,220	598	1,080	9,000	1,410	1,460
20	1,620	1,120	21,000	2,320	1,510	1,510	1,220	598	838	7,400	1,080	1,360
21	1,720	1,120	18,200	2,080	1,510	1,460	1,220	598	730	11,600	1,220	915
22	5,480	1,080	14,600	1,840	1,510	1,410	1,310	630	663	13,800	1,170	838
23	10,000	1,040	11,000	2,080	1,510	1,410	1,220	1,560	838	20,600	998	765
24	6,620	1,040	9,200	2,080	2,710	1,410	1,120	3,280	800	20,400	955	663
25	4,400	955	8,000	1,960	3,430	1,410	1,040	2,580	730	15,000	915	663
26	3,430	955	5,480	1,960	2,990	1,510	1,040	1,840	663	8,600	838	663
27	2,320	1,220	4,740	1,840	2,200	2,320	955	1,310	663	6,620	765	663
28	1,720	1,220	4,920	1,720	1,840	2,320	955	955	663	4,400	730	663
29	1,410	1,120	13,800	1,620	3,280	2,080	955	696	663	4,400	730	663
30	1,120	1,080	22,400	1,840	.....	1,720	955	663	765	4,070	765	663
31	998	.....	23,000	1,720	.....	1,510	.....	663	.....	3,590	1,120	.....

Monthly discharge of Flint River near Culloden, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 2,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	10,000	663	2,440	1.22	1.41
November	1,220	534	895	.448	.50
December	23,000	875	6,810	3.40	3.92
January	19,200	1,460	3,610	1.80	2.08
February	11,000	1,510	3,510	1.76	1.90
March	7,400	1,410	2,750	1.38	1.59
April	2,580	955	1,430	.715	.80
May	3,280	598	935	.468	.54
June	3,590	504	898	.449	.50
August	7,800	730	2,040	1.02	1.18
September	2,580	663	1,090	.545	.61

FLINT RIVER AT ALBANY, GA.

LOCATION.—At the Dougherty County highway bridge in Albany, 700 feet below Atlantic Coast Line Railroad bridge and 2 miles downstream from mouth of Muckafoonee Creek.

DRAINAGE AREA.—5,000 square miles.

RECORDS AVAILABLE.—April 10, 1893, to September 30, 1916 (United States Weather Bureau gage heights). Discharge measurements were begun by the Geological Survey in 1901, and determinations of daily discharge have been made from January 1, 1902, to September 30, 1915.

GAGE.—Chain gage, installed at the bridge April 20, 1904; read once daily by D. W. Brosnan. Original staff gage was washed out in 1898. It was again damaged in 1902, and on June 18 of that year a new gage was installed by the United States Weather Bureau at a datum 0.75 foot lower than that of the former gage. All gage heights for 1902 published by the United States Weather Bureau and the United States Geological Survey refer to the new datum. Present gage conforms with the United States Weather Bureau gage.

DISCHARGE MEASUREMENTS.—Fairly accurate measurements can be made at the section at the Atlantic Coast Line bridge, although it is very rough and train switching in the yard interferes with the work. The section at the Georgia Northern Railway bridge, 1 mile above, at which measurements are sometimes made, is considered better, especially for medium and low stages.

CHANNEL AND CONTROL.—Bed at and below gage may shift slightly, but control is such that conditions of flow are practically permanent. The river overflows both banks, but only under the approaches to the bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.4 feet at 2 p.m. July 15 (discharge not determined); minimum stage, −0.8 foot at 7 a.m. June 13 and 16 (discharge not determined).

1902–1916: Maximum stage recorded, 30.3 feet at 7 a.m. March 21, 1913 (discharge, 53,700 second-feet); minimum stage, −1.1 feet October 9–12, 1911 (discharge, 1,110 second-feet).

REGULATION.—Power developments on Muckalee Creek, which joins Flint River about 2 miles above station, cause considerable diurnal fluctuation, especially at low stages. Flow probably affected also by operation of other power plants farther up the river.

Stage-discharge relation considered practically permanent and a well-developed curve has been constructed, but lack of recent current-meter measurements makes the use of this curve inadvisable for determination of daily discharge for 1916.

Daily gage height, in feet, of Flint River at Albany, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.4	1.7	0.7	3.7	2.1	4.1	3.0	0.3	0.0	0.1	17.0	2.1
2	− .5	.8	.6	5.2	2.5	4.0	2.5	.1	− .3	.5	13.6	1.8
3	.0	.6	.5	7.7	3.5	5.0	2.4	.0	− .4	.7	10.0	1.6
4	.6	.5	.4	10.2	5.5	5.8	2.3	.0	− .5	1.0	7.9	1.4
5	.1	.4	.3	12.4	6.6	6.6	2.2	− .1	− .6	1.4	6.6	1.8
6	1.1	.3	.3	13.5	7.9	7.0	2.6	− .2	− .6	1.2	6.1	1.5
7	1.4	.3	.3	13.3	8.5	7.0	2.6	− .2	− .6	1.0	6.0	1.6
8	2.8	.2	.2	10.8	9.2	6.6	2.4	− .2	− .6	2.5	5.8	1.2
9	3.7	.1	.0	6.0	9.4	6.2	2.4	− .3	− .6	13.2	6.7	1.4
10	4.1	.1	.1	3.3	8.5	6.0	2.4	− .3	− .7	19.9	7.2	1.2
11	3.5	.1	.3	2.9	5.8	5.9	2.6	− .4	− .3	25.0	6.4	1.0
12	2.7	.1	.5	2.7	4.0	6.0	2.7	− .5	− .3	22.8	5.0	.9
13	1.9	.2	.5	2.6	3.6	6.0	2.5	− .4	− .8	22.3	3.8	1.4
14	1.1	.5	.4	2.6	3.4	5.6	2.4	− .5	− .7	24.7	3.4	1.1
15	.9	.9	.8	2.9	3.2	4.4	2.0	− .6	− .3	27.1	3.0	1.8
16	.5	.3	2.2	3.8	3.0	3.3	1.9	− .6	− .8	27.3	2.9	2.0
17	1.5	.2	1.4	4.9	3.2	3.1	1.8	− .4	− .7	26.2	3.6	2.7
18	3.1	.2	1.2	5.4	3.3	2.8	1.6	− .5	.2	24.0	4.0	2.8
19	3.3	.8	1.5	5.0	3.2	2.6	1.5	− .5	1.2	21.4	4.7	2.8
20	3.2	2.1	2.3	4.2	2.9	2.5	1.4	− .6	1.5	18.1	4.2	2.3
21	1.6	1.7	4.0	4.0	2.5	2.5	1.4	− .6	1.8	15.4	3.1	1.8
22	1.6	1.1	5.1	3.5	2.3	2.3	.8	− .5	2.0	13.4	2.9	1.3
23	2.8	1.1	6.2	3.2	2.2	2.0	.8	− .5	1.0	12.8	2.6	1.2
24	3.2	.9	8.0	3.2	2.2	2.0	.9	− .5	.1	13.4	1.5	1.0
25	3.2	.8	9.4	3.0	2.4	2.0	.8	.0	− .3	14.0	1.7	1.1
26	4.8	.6	11.5	3.0	2.5	1.9	1.0	1.0	.2	17.5	1.4	.2
27	5.3	.5	11.9	2.8	3.0	1.9	1.0	2.1	− .1	21.5	1.1	.4
28	5.8	.5	9.9	2.6	3.4	1.9	.5	1.7	.0	22.6	1.0	.4
29	4.8	.6	4.0	2.5	4.2	2.2	.4	1.2	− .1	22.2	1.2	.3
30	2.4	.8	3.0	2.2	.....	2.8	.3	.4	.1	21.0	1.6	.3
31	1.9	.....	3.4	1.9	.....	3.4	.....	.2	.....	19.5	2.6	.....

TOBLER CREEK NEAR YATESVILLE, GA.

LOCATION.—At Tobler mills, 1 mile downstream from Macon & Birmingham Railroad bridge, 2 miles north of Yatesville, Upson County, and 15 miles upstream from junction of creek with Flint River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 4, 1914, to September 30, 1916.

GAGE.—Vertical staff on right bank just below penstock of Tobler mills; read once daily by J. K. Sanders.

DISCHARGE MEASUREMENTS.—Made from steel highway bridge across mill pond about 600 feet above gage during medium and high stages; by wading during low stages.

CHANNEL AND CONTROL.—Bed composed of boulders and solid rock. Control formed by solid rock ledge; permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 3.3 feet at 5.30 a. m. July 8; minimum stage, 0.4 foot at 6.30 a. m. November 8 to 17.

1914–1916: Maximum stage recorded July 8, 1916; minimum stage, 0.3 foot at 6 a. m. September 29, 1915.

REGULATION.—Operation of Tobler mill causes large fluctuations in stage. Gage is read in the morning before starting of mill in order to obtain readings which more nearly represent the normal stage.

Data inadequate for determination of daily discharge.

The following discharge measurement was made by B. M. Hall, jr.

February 5, 1916: Gage height, 0.82 foot; discharge; 28.5 second-feet.

Daily gage height, in feet, of Tobler Creek near Yatesville, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.45	0.6	0.6	0.7	0.9	0.6	0.7	0.6	0.6	0.6	0.6	0.6
2	.45	.6	.6	.7	1.7	.6	.7	.6	.6	.6	.9	.6
3	.45	.6	.5	.7	1.1	.6	.7	.6	.6	.6	.8	.6
4	1.0	.5	.5	.7	.8	.6	.7	.6	1.1	.5	.7	.6
5	.75	.5	.5	.65	.9	.6	.7	.6	.8	.5	.7	.6
6	.7	.5	.5	.6	.8	.6	.7	.6	.7	.5	.6	.6
7	.7	.5	.5	.6	.8	.6	.7	.6	.6	.75	.6	.6
8	.7	.4	.5	.6	.8	1.3	.7	.6	.6	3.3	.6	.6
9	.7	.4	.5	.7	.8	.7	.7	.6	.6	2.5	.6	.6
10	.6	.4	.5	.7	.8	.6	.7	.6	.6	2.4	.6	.6
11	.6	.4	.5	.7	.7	.6	.7	.6	.6	.8	.5	.6
12	.6	.4	.6	.7	.7	.6	.7	.6	.6	.8	.5	.6
13	.5	.4	.6	1.1	.7	.6	.7	.6	.6	.8	.5	.6
14	.5	.4	.6	1.0	.7	.6	.65	.6	.6	.8	.5	.7
15	1.7	.4	.6	.7	.7	.6	.65	.6	.6	.8	.5	.7
16	.6	.4	.6	.6	.7	.6	.65	.6	.6	.8	.6	.7
17	.6	.4	.6	.6	.7	.6	1.1	.6	.6	.8	.6	.6
18	.6	.45	2.2	.6	.6	.6	.8	.6	.6	.8	.6	.6
19	.6	.6	.7	.6	.6	.6	.7	.6	.6	.9	.6	.6
20	1.0	.65	.7	.6	.6	.6	.7	.6	.6	1.1	.6	.6
21	1.6	.65	.7	.7	.6	.6	.7	.4	.6	1.2	.6	.6
22	1.5	.6	.7	.7	.6	.6	.7	.4	.6	1.1	.6	.6
23	.9	.6	.6	.7	.6	.55	.6	1.3	.7	.8	.5	.6
24	.6	.6	.6	.7	.6	.6	.6	.8	.6	2.0	.5	.6
25	.7	.6	.6	.7	.7	.6	.6	.8	.6	.8	.6	.6
26	.7	.6	.6	.7	.6	.6	.6	.7	.6	1.3	.6	.6
27	.6	.6	.7	.7	.6	.7	.6	.6	.6	.8	.6	.6
28	.6	.6	.7	.7	.6	.7	.6	.6	.6	.7	.6	.6
29	.6	.6	2.2	.65	.7	.7	.6	.6	.6	.6	.6	.6
30	.5	.6	1.0	.7	.....	.7	.6	.6	.6	.6	.6	.6
31	.7	.....	1.0	.7	.....	.7	.....	.6	.....	.6	.6	.....

ESCAMBIA RIVER BASIN.

CONECUH RIVER AT BECK, ALA.

LOCATION.—At Simmons Bridge at Beck, Covington County, 8 miles west of Andalusia, a station on the Central of Georgia Railway and Louisville & Nashville Railroad, and about 12 miles downstream from mouth of Patsaliga Creek.

DRAINAGE AREA.—1,290 square miles.

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

GAGE.—Chain gage attached to upstream side of wagon bridge; read by A. W. Lambert.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Channel cut in soft bedrock; practically permanent. Banks subject to overflow at very high stages. Position of control not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 30.1 feet at 8 a. m. July 8; minimum stage, 1.4 feet at 8 a. m. June 13.

1904–1916: Maximum stage (no gage height) March 18, 1913 (discharge, 26,000 second-feet; estimated by comparison with record of flow of Pea River at Pera, Ala.); minimum stage, 0.7 foot October 4, 1904 (discharge, 187 second-feet).

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

DIVERSIONS.—None.

REGULATION.—Flow may be affected at times by logging operations.

ACCURACY.—Gage read to tenths once daily. Gage heights may be considerably in error owing to elongation of chain. Stage-discharge relation considered practically permanent, but as no current-meter measurements have been made since October, 18, 1911, no rating curve has been prepared and daily discharge has not been determined.

Daily gage height, in feet, of Conecuh River, at Beck, Ala., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.9	5.2	3.2	13.4	5.4	5.3	17.2	2.9	2.2	2.1	8.5	2.5
2	6.5	4.3	3.1	.....	6.8	5.4	.....	2.8	2.1	.....	7.3	2.5
3	.....	3.8	2.9	16.7	8.7	5.5	11.1	2.7	2.0	2.9	8.5	.....
4	5.8	3.5	2.9	15.0	8.7	5.7	8.9	3.1	.....	2.4	8.3	3.3
5	5.2	3.3	.....	12.6	8.5	.....	7.5	3.1	1.9	2.8	7.3	4.8
6	5.6	3.2	2.8	11.1	.....	5.8	6.7	3.2	1.8	3.9	.....	3.5
7	5.6	.....	2.8	8.1	10.9	5.5	6.3	.....	1.7	11.0	8.2	3.0
8	5.1	3.1	2.8	7.4	10.8	6.2	7.1	2.9	1.6	30.1	9.4	2.8
9	4.7	3.0	2.7	.....	9.2	6.3	.....	2.7	1.5	.....	10.7	2.6
10	.....	2.9	2.7	5.7	7.7	6.0	6.1	2.5	1.5	28.3	9.7	.....
11	3.5	2.9	2.7	5.4	6.6	6.3	5.8	2.4	.....	26.3	9.1	2.9
12	3.2	2.8	.....	5.4	5.9	.....	5.5	2.3	1.5	24.5	8.2	2.5
13	2.9	2.8	2.7	7.3	.....	5.7	5.1	2.2	1.4	22.8	.....	2.4
14	2.9	.....	2.7	7.5	5.7	5.1	4.7	.....	1.8	22.1	7.6	2.6
15	4.7	2.8	2.7	6.7	5.5	4.8	4.4	2.1	1.9	20.1	7.3	2.7
16	4.1	2.8	2.7	.....	5.1	4.5	.....	2.1	2.4	.....	5.3	2.8
17	.....	2.7	2.7	7.4	4.9	4.2	4.0	2.1	2.1	17.6	4.6	.....
18	2.9	2.7	5.6	7.8	4.8	4.1	3.8	2.0	.....	17.2	4.1	2.6
19	2.9	3.7	.....	7.0	4.6	.....	3.7	2.2	2.4	19.3	3.8	2.5
20	13.6	3.2	5.8	6.2	.....	3.9	3.5	2.1	2.2	15.4	.....	2.4
21	10.6	.....	5.6	5.8	4.3	3.8	5.3	.....	2.1	11.3	3.3	2.3
22	6.4	3.2	5.6	5.7	4.2	3.8	5.6	2.5	2.0	9.4	3.2	2.3
23	5.9	3.2	5.5	.....	4.2	3.7	.....	7.2	1.9	.....	3.0	2.2
24	.....	3.0	5.5	6.9	5.4	3.6	4.8	4.9	2.3	10.5	2.9	.....
25	6.1	2.9	5.5	6.2	5.5	3.6	4.3	4.3	.....	11.2	2.8	2.1
26	6.4	2.8	.....	6.0	4.7	.....	3.9	4.1	2.0	11.1	2.7	2.0
27	7.5	3.5	5.2	5.8	.....	8.4	3.6	3.5	2.2	10.7	.....	2.0
28	8.6	.....	4.8	5.5	4.3	11.3	3.3	.....	1.9	12.8	2.6	2.1
29	8.6	3.3	15.8	5.3	4.5	11.6	3.1	2.8	2.1	15.2	2.7	2.4
30	7.3	3.2	14.9	.....	.....	12.8	.....	2.5	2.2	.....	2.6	2.1
31	.....	.....	15.1	4.8	.....	15.4	.....	2.3	.....	10.9	2.5	.....

MOBILE RIVER BASIN.

OOSTANAULA RIVER AT RESACA, GA.

LOCATION.—At Western & Atlantic Railroad bridge in Resaca, Gordon County, 400 feet upstream from new highway bridge, 3 miles below the junction of Conasauga and Coosawattee rivers, which form Oostanaula River, and 1 mile above Camp Creek.

DRAINAGE AREA.—1,610 square miles.

RECORDS AVAILABLE.[1]—1891 to 1898 (gage heights by the United States Weather Bureau and discharge measurements and gage heights by the United States Geological Survey); 1899 to 1904 incomplete records of gage heights; continuous records January 1, 1905, to September 30, 1916.

GAGE.—Heavy vertical timber attached to the downstream side of midstream pier of railroad bridge.

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

CHANNEL AND CONTROL.—Bed composed of sand; somewhat shifting. Right bank a high bluff; not subject to overflow; left bank high, but is overflowed at very high stages. Though the position of control is not exactly known, the fact that station rating has shown very little change in the past indicates that the control is practically permanent.

[1] Gage-height records not obtained during following periods: May 1 to July 31, 1896; May 1 to Oct. 31, 1899; July 1 to Oct. 31, 1900; May 1 to Nov. 12, 1901; and Jan. 1, 1902, to Dec. 31, 1904.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.1 feet July 13 (discharge, 23,700 second-feet); minimum stage, 2.0 feet November 6–8 (discharge, 590 second-feet).

1896–1916: Maximum stage recorded, 31.7 feet March 15, 1909 (discharge, 39,200 second-feet); minimum stage, 0.95 foot during discharge measurement September 26, 1904 (discharge, 273 second-feet).

ICE.—None.

REGULATION.—Practically none from the few small mills upstream.

ACCURACY.—Stage-discharge relation practically permanent, such changes as have occurred being small. Rating curve well defined between 500 and 8,000 second-feet; above which curve is extended tangent . Gage read to tenths once daily. Gage heights subject to some error because of poor condition of lower part of gage. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

The following discharge measurement was made by M. R. Hall:

November 1, 1914: Gage height, 2.80 feet; discharge, 986 second-feet.

Daily discharge, in second-feet, of Oostanaula River at Resaca, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,270	830	1,540	16,600	7,540	6,970	1,890	1,410	1,540	1,110	2,490	880
2	3,680	780	1,470	12,300	12,800	7,250	1,890	1,290	1,540	1,110	2,490	880
3	1,750	780	1,410	4,540	15,600	8,110	1,890	1,290	1,350	1,110	2,490	830
4	1,470	730	1,290	4,540	14,400	6,140	1,890	1,290	1,230	1,110	2,490	830
5	7,730	680	1,110	3,510	8,310	4,450	1,890	1,290	1,230	1,110	2,340	830
6	8,310	590	1,110	3,110	4,800	3,680	1,890	1,290	1,230	1,110	2,110	830
7	2,040	590	1,110	3,680	4,370	4,110	2,040	1,290	1,540	1,410	2,110	830
8	1,890	590	1,110	3,680	3,430	5,330	1,750	1,230	1,540	5,420	2,110	830
9	1,750	680	1,110	3,680	3,600	4,540	2,110	1,230	1,350	16,100	2,110	830
10	1,540	680	1,110	3,270	4,280	3,600	2,110	1,110	1,110	20,000	3,680	2,110
11	1,470	730	1,110	3,110	3,680	3,270	1,960	1,110	1,110	22,600	3,270	830
12	1,410	730	1,750	2,720	3,270	3,110	1,750	1,110	1,750	23,600	2,490	830
13	1,410	880	2,040	4,110	2,880	2,880	1,750	990	3,270	23,700	2,490	830
14	1,290	1,110	1,750	6,970	3,430	2,490	1,750	990	1,750	22,000	2,490	830
15	2,190	2,190	1,350	7,160	2,880	2,490	1,750	935	2,490	17,600	3,270	830
16	1,750	3,680	1,470	4,110	2,800	2,490	1,750	935	5,690	9,660	2,490	830
17	1,470	3,430	1,610	4,110	2,650	2,490	1,750	830	5,690	7,250	2,490	830
18	1,610	1,110	7,350	3,110	2,650	2,490	1,750	830	2,880	9,170	2,110	830
19	2,040	2,490	17,200	2,960	2,490	2,340	1,750	830	2,490	10,200	1,750	830
20	4,110	2,110	15,400	2,650	2,340	2,260	1,750	830	2,110	8,690	1,750	830
21	4,540	1,750	12,600	2,490	2,110	2,190	1,750	830	1,750	5,870	1,750	830
22	3,270	1,290	6,780	4,110	2,110	2,110	1,750	830	1,410	5,870	1,410	830
23	3,270	1,290	3,270	8,500	1,960	1,960	1,540	4,450	1,110	9,170	1,410	830
24	2,340	1,290	2,720	8,690	6,600	1,960	1,540	5,600	1,110	8,690	1,410	830
25	1,350	1,110	2,490	8,690	5,870	1,960	1,540	3,430	1,750	8,210	1,410	830
26	1,350	1,110	3,940	4,110	3,600	1,960	1,540	2,040	1,890	5,420	1,410	830
27	1,350	2,650	3,270	3,600	2,880	2,340	1,540	1,540	1,890	4,980	1,410	830
28	1,230	2,490	2,880	3,040	2,650	2,650	1,410	1,540	1,540	3,270	1,110	830
29	1,110	2,340	13,200	2,800	4,720	2,490	1,410	1,410	1,410	3,270	1,110	830
30	1,050	1,750	18,000	2,490	.....	2,340	1,410	1,890	1,110	3,270	1,110	2,110
31	935	.....	19,600	2,490	.....	2,040	.....	2,340	.....	2,880	1,110	.....

Monthly discharge of Oostanaula River at Resaca, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 1,610 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	8,310	935	2,390	1.48	1.71
November	3,680	590	1,420	.882	.98
December	19,600	1,110	4,910	3.05	3.52
January	16,600	2,490	4,870	3.02	3.48
February	15,600	1,960	4,850	3.01	3.25
March	8,110	1,960	3,370	2.09	2.41
April	2,110	1,410	1,750	1.09	1.22
May	5,600	830	1,550	.963	1.11
June	5,690	1,110	1,930	1.20	1.34
July	23,700	1,110	8,550	5.31	6.12
August	3,680	1,110	2,050	1.27	1.46
September	2,110	830	919	.571	.64
The year	23,700	590	3,220	2.00	27.24

COOSA RIVER AT RIVERSIDE, ALA.

LOCATION.—At Southern Railway bridge at Riverside, St. Clair County, 1 mile above mouth of Blue Eye Creek, 4 miles below Lock 4, 5 miles above the uncompleted Lock 5, and 7 miles above Choccolocco Creek.

DRAINAGE AREA.—7,060 square miles.

RECORDS AVAILABLE.—September 25, 1896, to September 30, 1916.

GAGE.—Chain gage attached to right bank end of downstream side of railroad bridge. read by J. E. Whitehead. Original wire gage was on downstream side of bridge near middle of river.

DISCHARGE MEASUREMENTS.—Made from downstream side of railroad bridge.

CHANNEL AND CONTROL.—Bed of stream rocky; permanent. Control composed of rock ledges below bridge; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 21.4 feet at 12 m; July 10 (discharge, 82,600 second-feet); minimum stage, 1.7 feet November 13, May 18–20, September 27–28 (discharge, 3,660 second-feet).

1896–1916: Maximum stage recorded July 10, 1916; minimum stage, 0.35 foot October 20 to November 1, 1904 (discharge, 1,220 second-feet).

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

REGULATION.—Flow is not affected to any extent by operation of navigation locks; locks seldom operated.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 50,000 second-feet; above that point curve is an extension. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records may be subject to error, as no discharge measurements have been more since 1911.

Daily discharge, in second-feet, of Coosa River at Riverside, Ala., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5,970	5,420	7,750	53,700	20,600	13,100	8,380	4,900	13,400	4,900	11,700	5,160
2	11,000	4,900	7,140	52,400	34,500	14,200	8,380	4,900	11,700	5,970	11,000	4,640
3	13,800	4,900	6,250	51,500	44,300	16,400	8,060	4,380	8,380	6,540	11,700	4,380
4	13,400	4,380	5,970	49,000	46,000	17,500	7,440	4,380	6,840	5,970	11,700	4,380
5	14,500	4,380	5,420	46,000	44,700	19,000	7,140	4,380	5,420	6,540	11,000	4,900
6	15,300	3,890	4,900	32,400	37,500	20,200	6,540	4,380	5,420	6,840	11,700	5,160
7	19,800	3,890	4,380	21,000	29,000	18,700	7,750	4,380	9,020	23,900	10,600	4,900
8	20,600	3,890	4,380	14,500	21,800	19,000	12,400	4,380	9,340	52,400	10,300	4,380
9	17,100	3,890	4,380	19,000	18,300	20,600	12,000	4,380	7,750	68,100	14,500	4,380
10	13,100	3,890	3,890	16,400	17,500	19,400	10,300	3,890	5,970	77,900	14,200	4,640
11	7,750	3,890	3,890	15,300	17,500	17,100	9,340	3,890	5,160	77,500	13,100	5,420
12	5,420	3,890	4,640	16,400	14,500	14,900	8,380	3,890	9,340	76,200	13,100	6,540
13	4,380	3,660	5,160	20,600	13,800	12,000	7,750	3,890	14,200	77,900	14,500	6,250
14	5,970	4,640	5,420	22,700	13,400	10,600	7,140	3,890	12,000	79,200	14,900	5,420
15	10,300	5,700	6,250	23,500	11,700	9,340	6,540	3,890	10,600	80,500	13,800	4,900
16	10,300	6,540	7,140	23,100	10,300	8,700	6,840	3,890	9,970	82,200	13,800	4,380
17	14,200	6,840	8,060	21,000	9,660	7,440	6,840	3,890	9,340	80,100	13,400	4,380
18	16,000	8,380	22,300	18,300	9,660	7,140	6,840	3,660	11,300	77,100	11,300	4,380
19	13,100	9,980	39,200	16,400	9,660	7,140	7,140	3,660	13,400	72,000	10,300	4,380
20	20,600	11,000	45,100	14,500	9,660	7,140	7,140	3,660	11,000	62,600	7,440	4,380
21	29,000	10,300	46,800	12,400	9,340	6,840	6,540	4,380	9,020	58,800	7,140	3,890
22	34,500	9,660	44,300	17,100	9,020	6,540	6,540	7,750	7,140	53,200	7,140	3,890
23	34,500	8,380	42,200	27,300	9,020	6,540	6,540	14,500	5,700	45,600	7,140	3,890
24	23,900	7,140	37,500	35,800	8,700	6,250	6,540	20,600	5,420	46,800	9,660	3,890
25	18,300	6,540	32,800	34,900	8,380	5,970	5,970	22,300	5,420	46,400	9,660	3,890
26	13,800	5,700	19,000	31,500	9,020	8,060	5,970	23,100	5,970	43,400	9,020	3,890
27	10,600	6,540	13,400	27,300	10,600	9,980	5,700	17,500	6,540	35,800	7,440	3,660
28	8,060	7,140	12,700	24,800	11,300	10,300	5,420	13,400	5,970	23,100	6,250	3,660
29	7,140	7,140	35,800	20,200	12,000	10,300	5,160	9,660	5,970	18,300	5,970	6,250
30	6,250	8,060	50,700	15,300	.....	9,660	4,900	9,660	5,420	15,300	5,420	5,420
31	5,420	.....	53,700	15,300	.....	9,020	.....	12,000	.....	13,400	5,160	.....

Monthly discharge of Coosa River at Riverside, Ala., for the year ending Sept. 30, 1916.

[Drainage area, 7,060 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	34,500	4,380	14,300	2.03	2.34
November	11,000	3,660	6,150	.871	.97
December	53,700	3,890	19,000	2.69	3.10
January	53,700	12,400	26,100	3.70	4.27
February	46,000	8,380	18,000	2.55	2.75
March	20,600	5,970	11,900	1.69	1.95
April	12,400	4,900	7,390	1.05	1.17
May	23,100	3,660	7,660	1.08	1.24
June	14,200	5,160	8,400	1.19	1.33
July	82,200	4,900	46,000	6.52	7.52
August	14,900	5,160	10,500	1.49	1.72
September	6,540	3,660	4,660	.660	.74
The year	82,200	3,660	15,100	2.14	29.10

ETOWAH RIVER NEAR BALL GROUND, GA.

LOCATION.—At iron wagon bridge 3 miles southeast of Ball Ground and a quarter of a mile below mouth of Longswamp Creek.

DRAINAGE AREA.—466 square miles.

RECORDS AVAILABLE.—May 16, 1907, to December 31, 1915, when station was discontinued.

GAGE.—Chain gage attached to upstream side of bridge, installed August 18, 1908, to replace vertical staff gage 75 feet below bridge. Chain gage set so as to read same as vertical staff at low stages; readings at other stages differ only slightly. Gage read by Miss Ethel Long.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Left bank not subject to overflow, but rigl t bank is overflowed during high stages for about 500 feet beyond end of bridge approach. Control somewhat shifting.

EXTREMES OF DISCHARGE.—1907–1915: Maximum stage recorded, 20.0 feet at 5 p. m. December 29, 1915 (discharge, 16,000 second-feet); minimum stage recorded, 1.4 feet at 6 a. m. July 28, 1914 (discharge, 165 second-feet).

REGULATION.—Operation of a number of mills above may cause slight variations in flow.

ACCURACY.—Stage-discharge relation probably permanent for period for which records are given. Rating curve fairly well defined. Gage read twice daily to half-tenths. Discharge ascertained by applying mean daily gage heights to rating table. Records fair.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Etowah River near Ball Ground, Ga., for period Oct. 1 to Dec. 31, 1915.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	2,440	560	520	11	480	500	520	21	1,740	690	1,200
2	780	560	500	12	445	480	780	22	1,550	600	980
3	480	520	480	13	445	560	600	23	1,250	560	930
4	600	520	480	14	2,230	830	560	24	980	540	830
5	3,450	520	480	15	2,230	830	520	25	830	560	880
6	1,200	520	480	16	980	690	580	26	690	560	1,030
7	880	500	480	17	735	580	880	27	735	560	880
8	690	500	480	18	645	560	10,500	28	690	540	880
9	560	500	462	19	3,930	980	3,770	29	600	540	14,900
10	500	520	445	20	4,610	780	1,550	30	600	520	7,300
								31	580		2,300

Monthly discharge of Etowah River near Ball Ground, Ga., for the period Oct. 1 to Dec. 31, 1915.

[Drainage area, 466 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	4,610	445	1,240	2.66	3.07
November	980	480	589	1.26	1.41
December	14,900	445	1,840	3.95	4.55

ETOWAH RIVER NEAR ROME, GA.

LOCATION.—At Freemans Ferry, which is a railroad stop on the Nashville, Chattanooga & St. Louis Railway branch line from Kingston to Rome, 1 mile downstream from mouth of Dikes Creek, and 5 miles upstream from Rome, Floyd County, where the Etowah and Oostanaula rivers unite to form Coosa River.

DRAINAGE AREA.—1,800 square miles.

RECORDS AVAILABLE.—August 17, 1904, to September 30, 1916.

GAGE.—Vertical staff in three sections on left bank, 250 feet downstream from ferry; read by R. M. Pattillo.

DISCHARGE MEASUREMENTS.—Made from boat held in place by ferry cable. Measurements can not be made at high water.

CHANNEL AND CONTROL.—Bed composed of rock, boulders, and gravel; practically permanent. Banks subject to overflow at extremely high stages. A shoal immediately below gage forms control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 27.0 feet at 12 p. m. July 11 (approximate discharge, obtained from extension of rating curve, 45,400 second-feet); minimum stage, 1.95 feet at 7 a. m. and 6 p. m., October 13 (discharge, 1,040 second-feet).

1904–1916: Maximum stage recorded July 11, 1916; previous to 1909 high-water rating was not defined and estimates based on an extension of the rating curve are considerably too large, as shown by later measurements; minimum stage, 1.2 feet October 10 and 24, 1904 (discharge, 360 second-feet).

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

REGULATION.—The operation of a few small mills upstream apparently has no effect on flow.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 4,000 second-feet and extended tangent above that point. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good below 4,000 second-feet; determinations above that point subject to error because of impossibility of obtaining flood discharge measurements.

The following discharge measurement was made by M. R. Hall:

November 2, 1915: Gage height, 2.45 feet; discharge, 1,590 second-feet.

Daily discharge, in second-feet, of Etowah River near Rome, Ga., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,640	1,660	1,360	13,200	7,600	2,340	2,200	1,600	2,200	2,340	2,960	2,490
2	3,640	1,600	1,360	7,240	16,600	4,540	2,060	1,600	2,200	1,790	2,800	2,340
3	2,060	1,540	1,360	4,360	13,400	4,360	1,920	1,540	2,060	1,600	3,640	2,340
4	1,600	1,540	1,300	3,640	7,600	3,640	1,790	1,540	2,060	1,360	6,520	2,340
5	4,720	1,480	1,300	3,470	5,440	3,300	1,790	1,540	2,060	1,140	4,360	2,340
6	6,520	1,480	1,300	3,300	3,640	2,800	2,490	1,540	2,060	3,300	12,100	2,200
7	2,640	1,420	1,300	3,300	3,300	3,300	3,300	1,480	1,920	6,160	8,860	2,200
8	1,540	1,420	1,250	3,130	3,130	3,130	2,640	1,480	1,790	18,800	6,880	2,060
9	1,200	1,300	1,250	2,960	2,960	2,960	2,200	1,480	1,540	31,000	4,720	1,920
10	1,090	1,300	1,250	2,880	4,180	2,640	2,060	1,420	1,540	40,000	5,260	1,790
11	1,090	1,250	1,200	2,640	3,640	2,640	2,060	1,420	2,060	44,700	4,720	1,790
12	1,090	1,200	1,200	2,490	3,300	2,640	2,060	1,360	3,640	40,000	4,180	1,660
13	1,040	1,790	1,420	4,180	3,130	2,640	1,920	1,300	2,960	29,900	3,640	1,660
14	3,640	2,060	1,300	5,260	2,960	2,640	1,920	1,300	2,800	21,300	3,300	1,600
15	12,100	2,340	1,300	3,640	2,640	2,490	1,920	1,250	2,640	17,300	2,490	1,540
16	6,160	2,200	1,540	2,800	2,640	2,490	1,920	1,200	2,960	13,900	4,180	1,540
17	2,490	2,060	2,490	2,640	2,640	2,490	1,920	1,200	2,960	13,000	4,000	1,540
18	2,200	2,060	22,400	2,490	2,490	2,490	1,920	1,200	1,920	11,600	3,640	1,540
19	5,980	2,060	26,300	2,490	2,490	2,340	1,920	1,140	1,660	10,300	3,300	1,540
20	24,700	1,920	13,400	2,340	2,340	2,340	1,790	1,140	1,600	9,040	2,800	1,480
21	14,100	1,790	4,360	2,340	2,340	2,200	1,790	1,090	1,540	6,880	2,340	1,480
22	7,060	1,660	3,470	2,960	2,340	2,200	1,790	2,340	1,540	14,300	2,340	1,420
23	6,520	1,660	2,960	2,960	2,340	2,200	1,790	7,600	1,420	10,800	2,340	1,420
24	4,360	1,540	2,800	2,800	2,640	2,060	1,790	11,600	1,420	8,680	2,340	1,420
25	2,960	1,420	2,640	2,640	2,340	2,060	1,790	7,960	2,060	6,520	2,200	1,420
26	2,340	1,420	2,640	2,640	2,340	2,340	1,790	5,800	2,340	5,080	2,200	1,360
27	2,340	1,660	2,640	2,490	2,340	2,200	1,790	3,300	2,060	4,720	2,060	1,300
28	2,200	1,540	2,640	2,490	2,340	2,060	1,660	2,060	1,790	4,360	2,060	1,300
29	2,060	1,420	29,000	2,340	2,640	2,340	1,660	3,130	1,660	4,000	1,920	5,800
30	1,790	1,420	37,800	2,340	.....	2,060	1,660	2,640	1,600	3,640	1,920	2,640
31	1,790	.....	30,300	2,200	.....	2,060	.....	2,340	.....	3,300	1,790	.....

Monthly discharge of Etowah River near Rome, Ga., for the year ending Sept. 30, 1916.

[Drainage area, 1,800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	24,700	1,040	4,380	2.43	2.80
November	2,340	1,200	1,640	.911	1.02
December	37,800	1,200	6,670	3.71	4.28
January	13,200	2,200	3,440	1.91	2.20
February	16,600	2,340	4,060	2.26	2.44
March	4,540	2,060	2,640	1.47	1.70
April	3,300	1,660	1,980	1.10	1.23
May	11,600	1,090	2,500	1.39	1.60
June	3,640	1,420	2,070	1.15	1.28
July	44,700	1,140	12,600	7.00	8.07
August	12,100	1,790	3,800	2.11	2.43
September	5,800	1,300	1,920	1.07	1.19
The year	44,700	1,040	4,000	2.22	30.24

TALLAPOOSA RIVER AT STURDEVANT, ALA.

LOCATION.—At bridge of Central of Georgia Railway, one-fourth mile west of Sturdevant, Tallapoosa County, and 5 miles below mouth of Hillabee Creek.

DRAINAGE AREA.—2,460 square miles (2,500 square miles used in computing table of monthly means, published in Water-Supply Papers 322 and 352 for years 1912 and 1913).

RECORDS AVAILABLE.—July 19, 1900, to September 30, 1916.

GAGE.—Vertical staff on right bank about 2,000 feet upstream from bridge; installed August 20, 1906; read by A. L. Stowe. Original gage, a staff attached to pier of railroad bridge, was read until July 10, 1905, when the present gage was substituted for the chain gage because it was impossible to obtain an observer for chain gage. From August 21, 1906, to September 30, 1915, readings on the present staff gage were reduced to datum of original gage by means of comparative readings; since October 1, 1915, gage heights have been obtained from readings on the present staff gage without reference to datum of old gage, which has been removed.

DISCHARGE MEASUREMENTS.—Made from a plank walk resting on lower members of deck of railroad bridge.

CHANNEL AND CONTROL.—Bed rough and rocky; permanent. At extreme high stage water overflows banks. Control is a series of rock ledges and shoals below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.5 feet at 5 p. m. December 29 (discharge, 58,200 second-feet); minimum stage, 0.88 foot at 4 p. m. June 13 (discharge, 968 second-feet).

1900–1916: Maximum stage recorded December 29, 1915; minimum stage, −0.2 foot (old datum) October 25–29, 1904 (discharge, 250 second-feet).

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

REGULATION.—Practically none.

ACCURACY.—Control permanent. Stage-discharge relation unchanged to September 30, 1915. New rating curve used for period beginning October 1, 1915, when reference of staff gage readings to the original gage was discontinued; curve well defined between 500 and 20,000 second-feet and extended above 20,000 second-feet. Gage read to hundredths twice daily.

As no current-meter measurement had been made since 1911, records of daily discharge in 1914 and 1915 were withheld from publication because of uncertainty regarding applicability of rating curve. Old curve has, however, been checked by measurement in 1916 and has been applied to the gage-height records for 1914 and 1915. Records 1914 to 1916, good.

The following discharge measurement was made by Warren E. Hall:
April 6, 1916: Gage height, 2.60 feet; discharge, 2,500 second-feet.

Daily discharge, in second-feet, of Tallapoosa River at Sturdevant, Ala., Oct. 1, 1913, to Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1913–14.												
1	6,500	1,180	1,360	3,110	3,770	2,960	10,800	2,400	985	555	1,900	1,000
2	3,770	1,100	2,810	2,670	3,270	2,810	8,330	2,400	985	480	1,460	950
3	2,140	1,060	2,810	3,110	2,530	2,670	5,120	2,140	915	1,670	1,270	1,100
4	1,560	1,060	2,810	2,810	1,900	2,400	3,770	1,900	1,020	915	1,560	1,270
5	1,180	1,020	1,900	2,670	1,780	2,140	2,960	1,900	1,560	635	1,270	1,180
6	985	985	1,780	2,400	2,670	2,020	2,670	1,780	2,670	1,180	1,560	848
7	848	1,060	2,140	2,140	6,010	1,900	2,400	1,780	2,270	782	1,060	720
8	848	985	1,900	1,900	9,440	1,900	3,770	2,140	1,780	662	880	608
9	782	1,060	1,780	1,780	6,010	1,780	4,910	1,780	1,780	580	1,100	530
10	782	1,060	1,560	1,780	4,130	1,780	4,130	1,900	1,360	880	6,010	505
11	750	1,020	1,460	1,670	3,110	1,780	3,770	1,780	1,020	690	4,130	458
12	690	985	1,360	1,560	2,530	3,770	3,110	1,560	2,140	1,100	2,670	555
13	662	985	1,270	1,460	2,400	3,770	2,670	1,460	1,180	915	7,280	848
14	635	985	1,270	1,460	2,810	3,110	11,400	1,360	1,560	720	6,500	1,560
15	608	985	1,460	1,360	2,670	2,670	18,400	1,270	1,460	530	3,950	848
16	580	985	1,460	1,360	2,400	2,400	11,700	1,270	1,360	458	2,400	608
17	580	985	1,360	1,360	2,140	2,140	7,800	1,180	1,360	985	1,780	530
18	880	1,060	1,360	1,360	1,900	1,900	4,910	1,270	1,560	6,010	1,460	555
19	2,960	1,060	1,270	1,360	2,020	1,780	4,510	1,270	3,430	3,430	1,100	720
20	3,430	1,060	1,270	1,360	2,400	2,020	6,760	1,270	1,900	2,670	950	608
21	2,530	1,060	1,270	1,360	2,810	2,400	6,760	1,180	2,020	2,140	1,060	662
22	2,020	985	1,270	1,460	2,670	2,400	4,910	1,180	1,560	1,560	950	1,560
23	2,140	985	1,270	1,360	2,400	2,400	3,770	1,100	1,180	915	1,060	1,180
24	4,320	985	1,270	1,460	2,140	2,140	3,110	1,060	950	720	1,780	985
25	3,430	915	1,560	1,360	1,900	1,900	2,810	985	782	635	1,270	815
26	2,670	915	1,780	1,780	2,140	2,020	2,670	985	635	635	1,020	750
27	2,020	915	1,780	1,780	2,400	2,020	2,400	915	530	635	2,270	750
28	1,780	985	1,560	1,670	2,810	2,020	2,140	915	530	608	1,560	662
29	1,360	1,060	3,770	1,670	.....	2,140	2,140	848	635	2,020	1,020	608
30	1,270	1,020	4,130	2,140	.....	2,140	2,400	848	662	2,670	950	608
31	1,270	.....	4,130	4,130	.....	6,500	.....	915	.....	2,810	1,360	.....
1914–15.												
1	720	690	3,770	4,710	26,100	4,130	3,600	1,780	2,400	3,950	750	1,060
2	1,780	690	2,810	3,430	30,600	3,770	3,430	1,670	2,960	21,000	720	985
3	1,900	635	2,670	2,810	18,800	3,770	3,110	1,670	2,530	15,200	985	782
4	1,270	635	5,550	2,670	14,900	3,770	2,810	1,560	2,140	7,540	1,270	782
5	985	635	10,800	2,400	8,880	11,700	2,810	1,560	1,780	15,600	815	32,500
6	915	635	5,550	5,550	6,760	10,300	2,670	1,560	1,670	26,800	750	12,400
7	985	635	3,600	14,900	5,770	7,800	2,670	1,900	1,670	6,500	750	9,160
8	985	635	2,810	10,000	4,910	6,010	2,530	15,200	2,530	4,130	690	3,770
9	880	690	2,400	6,010	4,510	4,910	2,530	19,400	1,780	6,500	690	2,140
10	782	690	1,900	4,710	4,130	4,510	2,530	10,300	1,360	13,000	690	1,670
11	750	635	1,780	4,510	3,770	4,130	2,400	4,710	1,270	11,400	4,130	1,360
12	662	635	1,670	6,760	3,600	3,950	2,270	5,330	1,270	5,120	3,110	1,180
13	848	750	2,140	5,550	3,430	3,770	2,270	4,510	1,360	3,110	2,020	1,060
14	1,780	915	2,810	4,510	3,770	3,600	2,270	3,770	1,560	2,530	1,670	1,060
15	4,710	4,510	2,810	3,600	9,720	3,430	2,140	3,110	1,780	2,140	1,360	1,180
16	5,770	8,600	2,530	3,270	9,160	3,430	2,140	2,810	1,560	2,810	1,180	985
17	3,430	6,010	2,140	10,300	7,020	3,430	2,140	2,270	1,360	2,400	1,020	1,270
18	2,400	2,400	1,900	14,900	5,120	3,270	2,140	2,140	1,780	1,900	915	1,020
19	1,560	1,780	1,780	14,300	4,510	3,110	2,140	1,900	1,360	1,560	1,560	950
20	1,270	1,460	1,780	10,000	4,130	3,110	2,020	1,780	1,270	1,360	4,130	915
21	1,060	1,270	1,780	6,500	3,770	3,270	2,020	1,780	1,060	1,360	2,810	848
22	950	1,060	1,900	4,710	3,600	3,110	1,900	1,670	985	1,180	2,270	782
23	815	950	1,900	4,910	3,950	3,110	1,900	1,670	848	1,100	1,780	750
24	782	815	1,900	15,900	8,330	2,960	1,900	1,780	782	1,100	1,780	720
25	750	750	2,960	14,300	9,720	2,810	1,780	1,670	782	1,060	2,810	635
26	750	782	6,010	10,800	7,800	2,810	2,140	1,670	815	985	2,140	580
27	720	950	6,500	8,060	5,550	2,810	1,900	2,270	950	915	1,180	530
28	635	1,270	4,710	6,010	4,510	2,810	2,140	7,280	1,060	848	1,020	530
29	690	3,430	5,550	4,710	.....	2,810	1,900	4,710	3,770	782	915	505
30	690	4,510	9,720	4,130	.....	2,810	1,780	3,600	2,670	750	1,060	1,900
31	690	.....	7,020	3,770	.....	3,430	.....	2,670	.....	750	985	.....

Daily discharge, in second-feet, of Tallapoosa River at Sturdevant, Ala., Oct. 1, 1915, to Sept. 30, 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.												
1	9,060	1,720	1,930	22,800	18,900	6,880	2,620	1,820	3,160	2,500	3,160	1,930
2	7,360	1,620	1,720	9,840	23,700	5,170	2,750	1,820	2,620	1,720	5,960	2,260
3	3,760	1,530	1,720	6,880	21,000	5,170	2,880	1,720	1,820	2,040	4,980	3,300
4	2,750	1,440	1,620	5,170	14,700	4,440	2,880	1,720	1,930	1,320	4,440	2,260
5	2,880	1,440	1,720	4,800	8,320	3,760	2,750	1,720	1,620	1,720	4,440	1,820
6	3,450	1,360	1,930	4,260	5,960	3,760	2,620	1,720	1,440	7,360	3,450	1,720
7	2,750	1,360	1,930	3,920	5,170	6,400	3,160	1,720	1,320	30,900	4,260	1,720
8	2,150	1,280	1,820	3,450	4,800	8,320	4,620	1,620	1,200	42,900	3,760	1,620
9	1,720	1,200	1,720	3,160	4,440	5,750	5,170	1,530	1,400	40,500	3,920	2,880
10	1,530	1,120	1,620	3,160	4,090	4,440	4,090	1,530	1,320	37,200	3,300	1,930
11	1,320	1,440	1,720	3,160	4,260	3,920	3,450	1,440	1,160	36,900	2,880	2,620
12	1,200	1,720	2,880	3,450	4,260	3,450	3,020	1,400	1,050	28,800	2,880	1,720
13	1,120	1,530	2,880	9,840	4,620	3,160	2,880	1,320	980	14,700	4,440	1,530
14	2,380	1,080	2,620	8,560	4,440	3,160	2,620	1,320	3,450	15,600	5,550	1,720
15	7,840	2,620	2,380	5,960	3,920	3,020	2,620	1,240	4,260	7,600	3,450	3,920
16	4,800	3,760	2,150	4,620	3,760	2,880	2,500	1,200	4,440	9,320	3,300	2,750
17	3,020	3,300	3,760	4,800	3,450	2,880	2,500	1,280	3,160	10,600	2,880	1,720
18	2,150	2,750	26,700	4,090	3,300	2,750	2,750	1,440	2,500	8,080	2,750	1,720
19	7,360	4,620	18,600	3,760	3,160	2,750	2,620	1,400	2,150	9,840	4,440	2,750
20	27,300	3,760	14,400	3,450	3,160	2,620	2,380	1,360	1,620	13,200	2,880	1,620
21	16,500	2,750	7,600	3,300	3,020	2,620	2,260	1,320	1,360	13,600	2,500	1,400
22	18,900	2,260	4,440	4,090	3,020	2,620	2,260	1,320	1,620	13,000	2,260	1,400
23	10,400	1,930	3,450	4,440	3,020	2,620	2,260	2,040	2,750	11,400	2,040	1,280
24	4,090	1,720	3,020	4,090	4,440	2,500	2,380	4,090	2,620	11,100	1,930	1,280
25	2,880	1,620	3,160	3,600	3,760	2,500	3,160	8,320	3,600	9,320	1,820	1,200
26	2,620	1,820	3,450	3,300	3,450	4,440	2,150	6,180	3,020	8,800	1,720	1,160
27	2,380	2,880	3,300	3,160	3,160	5,550	2,040	3,450	2,380	11,400	1,720	1,120
28	2,150	2,620	3,600	3,160	5,550	3,920	1,930	2,500	2,260	9,320	2,040	1,080
29	1,930	2,380	54,900	3,020	9,840	3,450	1,930	2,040	2,040	5,550	2,150	1,820
30	1,930	2,150	41,100	2,880	.....	3,160	1,930	1,720	1,930	7,600	3,300	1,400
31	1,720	.....	28,500	2,880	.....	2,880	.....	2,260	.....	4,620	2,880	.....

NOTE.—Discharge determined from a rating curve well defined from 500 second-feet to 20,000 second feet and extended tangent above 20,000 second-feet.

Monthly discharge of Tallapoosa River at Sturdevant, Ala., for the period Oct. 1, 1913, to Sept. 30, 1916.

[Drainage area, 2,460 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1913–14.					
October	6,500	580	1,810	0.736	0.85
November	1,180	915	1,020	.415	.45
December	4,130	1,270	1,880	.764	.88
January	4,130	1,360	1,900	.772	.89
February	9,440	1,780	3,040	1.24	1.29
March	6,500	1,780	2,440	.992	1.14
April	18,400	2,140	5,230	2.13	2.38
May	2,400	848	1,440	.585	.67
June	3,430	530	1,390	.565	.63
July	6,010	458	1,330	.541	.62
August	7,280	880	2,080	.846	.98
September	1,560	458	820	.333	.37
The year	18,400	458	2,020	.821	11.15
1914–15.					
October	5,770	635	1,380	.561	.65
November	8,600	635	1,670	.679	.76
December	10,800	1,670	3,650	1.48	1.71
January	15,900	2,400	7,050	2.87	3.31
February	30,600	3,430	8,100	3.29	3.43
March	11,700	2,810	4,150	1.69	1.95
April	3,600	1,780	2,330	.947	1.06
May	19,400	1,560	3,860	1.57	1.81
June	3,770	782	1,640	.667	.74
July	26,800	750	5,330	2.17	2.50
August	4,130	690	1,550	.630	.73
September	32,500	505	2,800	1.14	1.27
The year	32,500	505	3,610	1.47	19.92
1915–16.					
October	27,300	1,120	5,210	2.12	2.44
November	4,620	1,120	2,090	.850	.95
December	54,900	1,620	8,140	3.31	3.82
January	22,800	2,880	5,070	2.06	2.38
February	23,700	3,020	6,510	2.65	2.86
March	8,320	2,500	3,900	1.59	1.83
April	5,170	1,930	2,770	1.13	1.26
May	8,320	1,200	2,110	.858	.99
June	4,440	980	2,210	.898	1.00
July	42,900	1,320	14,000	5.69	6.56
August	5,960	1,720	3,270	1.33	1.53
September	3,920	1,080	1,890	.768	.86
The year	54,900	980	4,780	1.94	26.48

MISCELLANEOUS MEASUREMENTS.

Measurements of streams at points other than those at which gaging stations were maintained were made in 1916 as follows:

Miscellaneous discharge measurements in south Atlantic and eastern Gulf of Mexico drainage basins during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft*
July 11	Ocmulgee River.	Altamaha River	Former gaging station, Macon, Ga.	[a] 22.78	47,800
11	....do....	....do....	....do....	22.32	45,900
15	....do....	....do....	....do....	9.89	4,970
Sept. 29	Withlacooche River.	Suwanee River	Bridge on road from Valdosta to Quitman, Ga., about 6 miles from Valdosta.	[b]	84

[a] Crest of flood, 23.1 feet at 8 a. m. Measurement begun at 8.30 a. m.
[b] Water surface 27.98 feet below top of downstream end of cap of third bent from left end of bridge.

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART II. SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS

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, professional papers, monographs, and annual reports.

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

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

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

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

Boston, Mass., 2500, Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., Capitol Building, care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Topeka, Kans., 25 Federal Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., Federal Building.
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 Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.

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

Report.	Character of data.	Year.
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.

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

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

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1916. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 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 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.

Numbers of water-supply papers containing results of stream measurements, 1899–1916.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X		XII		
												North Pacific slope basins.		
	North Atlantic slope basins (St. John River to York River).	South Atlantic and eastern Gulf of Mexico basins (James River to the Mississippi).	Ohio River basin.	St. Lawrence River basin.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington and upper Columbia River basin.	Snake River basin.	Lower Columbia River basin and Pacific slope basins in Oregon.
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [l] 39	38, [f], 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k]98, 99, [m]100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332–A	332–B	332–C
1913	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[g] 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 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.

PRINCIPAL STREAMS.

The south Atlantic slope and eastern Gulf of Mexico drainage basins include streams flowing into the Atlantic Ocean and Gulf of Mexico from York River, Va., to Pearl River, Miss., inclusive. The principal streams in this division are James, Roanoke, Cape Fear, Yadkin, Santee, Savannah, Altamaha, Apalachicola, Chotawhatchee, Mobile, and Pearl. The streams drain wholly or in part the States of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia.

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

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1916; period after a date indicates discontinuance. Tributaries are indicated by indention.

JAMES RIVER BASIN.

Jackson River (head of James) at Covington, Va., 1907–8.
James River at Buchanan, Va., 1895–
James River at Holcomb Rock, Va., 1900–1915.
James River at Cartersville, Va., 1899–
  Cowpasture River near Clifton Forge, Va., 1907–8.
  North River near Glasgow, Va., 1895–1905.
  Appomattox River at Mattoax, Va., 1900–1905.

ROANOKE RIVER BASIN.

Roanoke River at Roanoke, Va., 1896–
Roanoke River at Randolph, Va., 1900–1906.
Roanoke River above Dan River, at Clarksville, Va., 1895–1898.
Roanoke River at Old Gaston, N. C., 1911–
Roanoke River near Weldon, N. C., 1912.
Roanoke River at Neal, N. C., 1896–1903.
  Tinker Creek at Roanoke, Va., 1907–8.
  Back Creek near Roanoke, Va., 1907–8.
  Dan River at Madison, N. C., 1903–1908.
  Dan River at South Boston, Va., 1900–1907.
  Dan River at Clarksville, Va., 1895–1898.
    Banister River at Houston, Va., 1904–5.

TAR RIVER BASIN.

Tar River near Tarboro, N. C., 1896–1900.

NEUSE RIVER BASIN.

Neuse River near Selma, N. C., 1896–1900.

CAPE FEAR RIVER BASIN.

Haw River (head of Cape Fear River) near Moncure, N. C., 1898–9.
Cape Fear River near Fayetteville, N. C., 1889–1903.
Deep River near Cumnock, N. C., 1900–1902.
Deep River near Moncure, N. C., 1898–9.
Rockfish Creek near Brunt, N. C., 1902–3.

YADKIN (OR PEEDEE) RIVER BASIN.

Yadkin River (head of Peedee River) at North Wilkesboro, N. C., 1903–1909.
Yadkin River at Siloam, N. C., 1900–1901.
Yadkin River at Donnaha, N. C., 1913–
Yadkin River near Salisbury, N. C., 1895–1909; 1911–
Yadkin River near Norwood, N. C., 1896–1899.
Yadkin River near Peedee, N. C., 1906–1912.
Peedee River at Cheraw, S. C., 1909–1912.

SANTEE RIVER BASIN.

Catawba River (head of Santee River) at Old Fort, N. C., 1907.
Catawba River near Morganton, N. C., 1900; 1903–1909.
Catawba River at Catawba, N. C., 1896–1902.
Catawba River near Catawba, S. C., 1903–1905.
Catawba River near Rock Hill, S. C., 1895–1903.
Wateree River (lower part of Catawba) near Camden, S. C., 1903–1910.
Mill Creek at Old Fort, N. C., 1907.
Linville River at Fonta Flora, N. C., 1907–8.
Linville River near Bridgewater, N. C., 1900.
John River at Collettsville, N. C., 1907.
John River near Morganton, N. C., 1900–1901.
Broad River (of the Carolinas), head of Congaree River, at Uree, N. C., 1907–1909.
Broad River (of the Carolinas) at Dellinger, S. C., 1900–1901.
Broad River (of the Carolinas) near Gaffney, S. C., 1896–1899.
Broad River (of the Carolinas) at Alston, S. C., 1896–1907.
Green River near Saluda, N. C., 1907–1909.
Second Broad River near Logans Store, N. C., 1907–8.
Saluda River near Waterloo, S. C., 1896–1905.
Saluda River near Ninety Six, S. C., 1905.

EDISTO RIVER BASIN.

Four Hole Creek near Ridgeville, S. C., 1914–

SAVANNAH RIVER BASIN.

Chattooga River (head of Savannah River) near Clayton, Ga., 1907–8.
Tugaloo River (continuation of Chattooga River) near Toccoa, Ga., 1907–8.
Tugaloo River near Madison, S. C., 1898–1901; 1903–1910.
Savannah River near Calhoun Falls, S. C., 1896–1903.
Savannah River at Woodlawn, S. C., 1905–1910.
Savannah River at Augusta, Ga., 1899–1906.
Stekoa Creek near Clayton, Ga., 1907–8.
Tallulah River near Seed, Ga., 1916–
Tallulah River near Lakemont, Ga., 1916–
Tallulah River at Mathis, Ga., 1912–
Tallulah River at Tallulah Falls, Ga., 1900–1901; 1904–1812.
Tiger Creek at Lakemont, Ga., 1916–

Savannah River tributaries—Continued.
Chauga River near Madison, S. C., 1907.
Seneca River near Clemson College, S. C., 1903–1905.
Broad River (of Georgia) near Carlton, Ga., 1897–1913.

OGEECHEE RIVER BASIN.

Ogeechee River near Millen, Ga., 1903.
Williamsons Swamp Creek near Davisboro, Ga., 1903–4.
Canoochee River near Groveland, Ga., 1903–1907.

ALTAMAHA RIVER BASIN.

South River (head of Ocmulgee River, which is head of Altamaha River) near Lithonia, Ga., 1903–4.
Ocmulgee River near Jackson, Ga., 1906–1915.
Ocmulgee River near Flovilla, Ga., 1901–1905.
Ocmulgee River at Juliette, Ga., 1916–
Ocmulgee River at Macon, Ga., 1893–1913.
Yellow River at Almon, Ga., 1897; 1899–1901.
Alcovy River near Covington, Ga., 1901–1904.
Alcovy River near Stewart, Ga., 1905–6.
Towaliga River near Juliette, Ga., 1899–1901.
Oconee River at Barnett Shoals, near Watkinsville, Ga., 1902.
Oconee River near Greensboro, Ga., 1903–
Oconee River at Carey, Ga., 1896–1898.
Oconee River at Fraleys Ferry, near Milledgeville, Ga., 1905–1908; 1909–
Oconee River at Milledgeville, Ga., 1903–1905.
Oconee River at Dublin, Ga., 1894–1913.
Middle Oconee River near Athens, Ga., 1901–2.
Apalachee River near Buckhead, Ga., 1901–1908.
Ohoopee River near Reidsville, Ga., 1903–1907.

ST. JOHNS RIVER BASIN.

Silver Spring near Silver Springs, Fla., 1906–7.

FLORIDA EVERGLADES DRAINAGE CANALS.

North New River canal near Fort Lauderdale, Fla., 1913.
North New River canal near Rita, Fla., 1913.
South New River canal near Zona, Fla., 1913.
South New River canal near Rita, Fla., 1913.
Miami canal near Miami, Fla., 1913.

SUWANNEE RIVER BASIN.

Suwannee River near White Springs, Fla., 1906–1908.

APALACHICOLA RIVER BASIN.

Chattahoochee River (head of Apalachicola River) near Ariel, Ga., 1907–1907.
Chattahoochee River near Leaf, Ga., 1907.
Chattahoochee River near Gainsville, Ga., 1901–1903.
Chattahoochee River near Buford, Ga., 1901.
Chattachoochee River near Norcross, Ga., 1903–
Chattahoochee River at Oakdale, Ga., 1895–1904.
Chattahoochee River at West Point, Ga., 1896–1910; 1912–

Chattahoochee River at Columbus, Ga., 1912.
Chattahoochee River at Alaga, Ala., 1908–1912.
Soque River near Demorest, Ga., 1904–1909.
Sweetwater Creek near Austell, Ga., 1904–5; 1913.
Flint River near Molina, Ga., 1897–98.
Flint River near Woodbury, Ga., 1900–
Flint River near Musella, Ga., 1907.
Flint River near Culloden, Ga., 1911–
Flint River near Montezuma, Ga., 1905–1909; 1911–12.
Flint River at Albany, Ga., 1902–
Flint River at Bainbridge, Ga., 1908–1913.
Tobler Creek near Yatesville, Ga., 1914–
Kinchafoonee Creek near Leesburg, Ga., 1905–1909.
Kinchafoonee Creek near Albany, Ga., 1903.
Muckalee Creek near Albany, Ga., 1903.
Ichawaynochaway Creek at Milford, Ga., 1905–1907.
Chipola River at Altha, Fla., 1912–13.

CHOCTAWHATCHEE RIVER BASIN.

Choctawhatchee River near Newton, Ala., 1906–1908; 1911–12.
Choctawhatchee River near Geneva, Ala., 1904.
Double Bridges Creek at Geneva, Ala., 1904.
Pea River at Pera, Ala., 1904–1913.
Pea River at Elba, Ala., 1906.

ESCAMBIA RIVER BASIN.

Conecuh River at Beck, Ala., 1904–

MOBILE RIVER BASIN.

Cartecay River (head of Mobile River) near Cartecay, Ga., 1904–5; 1907.
Coosawattee River (continuation of Cartecay River) at Carters, Ga., 1892–1908.
Oostanaula River (continuation of Coosawattee River) at Resaca, Ga., 1896–1901; 1905–
Coosa River (continuation of Oostanaula River) at Rome, Ga., 1897–1903.
Coosa River at Lock No. 4, above Riverside, Ala., 1890–1901.
Coosa River at Riverside, Ala., 1896–
Coosa River at Lock No. 5, near Riverside, Ala., 1892–1899.
Coosa River at Childersburg, Ala., 1914.
Coosa River at Lock No. 12, near Clanton, Ala., 1914.
Coosa River at Lock No. 18, near Wetumpka, Ala., 1914.
Coosa River near Wetumpka, Ala., 1896–1898.
Alabama River (continuation of Coosa River) at Montgomery, Ala., 1899–1903.
Alabama River at Selma, Ala., 1899–1913.
Ellijay River at Ellijay, Ga., 1907.
Conasauga River at Beaverdale, Ga., 1907–8.
Etowah River near Ball Ground, Ga., 1907–1915.
Etowah River at Canton, Ga., 1892–1905.
Etowah River near Rome, Ga., 1904–
Etowah River at Rome, Ga., 1903.
Amicalola River near Potts Mountain, Ga., 1907–8; 1910–1913.
Choccolocco Creek near Jenifer, Ala., 1903–1908.
Talladega Creek at Nottingham, Ala., 1900–1904.
Tallapoosa River at Sturdevant, Ala., 1900–
Tallapoosa River near Susanna, Ala., 1900–1901.

Alabama River tributaries—Continued.
Tallapoosa River at Cherokee Bluffs, near Tallassee, Ala., 1912–1914.
Tallapoosa River at Milstead, Ala., 1897–1903.
Little Tallapoosa River near Wedowee, Ala., 1913–14.
Hillabee Creek near Alexander City, Ala., 1900–1903.
Big Sandy Creek near Dadeville, Ala., 1900–1901.
Cahaba River at Centerville, Ala., 1901–1908.
Tombigbee River at Columbus, Miss., 1900–1912.
Tombigbee River at Epes, Ala., 1900–1901; 1905–1913.
Black Warrior River (Mulberry Fork of Black Warrior River) near Cordova, Ala., 1900–1912.
Black Warrior River near Coal, Ala., 1908–1910.
Black Warrior River at Tuscaloosa, Ala., 1889–1905.
Sipsey Fork of Black Warrior River:
Clear Creek near Elk, Ala., 1904–5.
Locust Fork of Black Warrior River at Palos, Ala., 1902–1905.
Village Creek near Mulga, Ala., 1909–10.
Camp Branch near Ensley, Ala., 1908–1910.
Venison Branch near Mulga, Ala., 1908–9.

PEARL RIVER BASIN.

Pearl River at Jackson, Miss., 1901–1913.
Bogue Chitto at Warnerton, La., 1906.

REPORTS ON WATER RESOURCES OF THE SOUTH ATLANTIC AND EASTERN GULF STATES.

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.

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

Gives elevations and distances along rivers of the United States, and brief descriptions of many of the streams, including Roanoke, Cape Fear, Peedee, Santee, Savannah, Oconee, Apalachicola, Chattahoochee, Coosa, Tallapoosa, and Black Warrior rivers.

*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.)

62. Hydrography of the southern Appalachian Mountain region, Part I, by H. A. Pressey. 1902. 95 pp., 25 pls. 15c.

63. Hydrography of the southern Appalachian Mountain region, Part II, by H. A. Pressey. 1902. pp. 96–190, pls. 26–44. 15c.

Nos. 62 and 63 describe in a general way the mountains, rivers, climate, forests, soil, vegetation, and mineral resources of the southern Appalachian Mountains, and then discuss in detail the drainage basins, giving for each an account of the physical features, rainfall, forests, minerals, transportation, discharge measurements, and water powers. Most of the streams described are tributary through Tennessee River to the Ohio, but Part II (No. 63) includes also descriptions of several streams in the south Atlantic and eastern Gulf of Mexico drainage basins.

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

Describes artesian well at Savannah, Ga.

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

Contains an account of flood on tributaries of Broad River (of the Carolinas) in Spartanburg County, S. C.

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

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

*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 Alabama, Florida, Georgia, Mississippi North Carolina, and Virginia.

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

Contains gage heights, rating tables, and estimates of monthly discharge at stations on Tallapoosa, Coosa, Alabama, Cahaba, Black Warrior, and Tombigbee rivers and their tributaries; gives estimates and short descriptions of water powers.

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

Contains reports as follows:

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie. Scope indicated by title.

Water resources of the Cowee and Pisgah quadrangles, North Carolina. by Hoyt S. Gale. Discusses drainage, springs, and mineral waters of one of the units of the geologic atlas of the United States.

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

Contains brief reports relating to south Atlantic and eastern Gulf of Mexico drainage areas, as follows:

Virginia, by N. H. Darton and M. L. Fuller.
North Carolina, by M. L. Fuller.
South Carolina, by L. C. Glenn.
Georgia, by S. W. McCallie.
Florida, by M. L. Fuller.
Alabama, by A. E. Smith.
Mississippi, by L. C. Johnson.

Each of these reports describes the geology of the area in its relation to water supplies, notes the principal mineral springs, and gives list of pertinent publications.

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

Contains results of surveys made to determine location of undeveloped power sites. Gives elevations and distances along Catawba, Tallulah, Chattooga, Tugaloo, Savannah, Broad, Ocmulgee, Yellow, South, Alcovy, Towaliga, and Chattahoochee rivers.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains "Notes on certain hot springs of the southern United States," by Walter Harvey Weed, including the "Warm springs of Georgia." Describes the location of the springs, the geologic conditions, and the composition of the waters (with analyses); estimates discharge.

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 Alabama, Georgia, Florida, Mississippi, North Carolina, and Virginia.

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

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

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

Contains brief report entitled "Peculiar mineral waters from crystalline rocks of Georgia," by Myron L. Fuller, discussing origin of certain mineral springs and wells near Austell; gives analyses.

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

Gives estimates of flood discharge and frequency on Cape Fear, Savannah, Alabama, and Black Warrior rivers.

*197. Water resources of Georgia, by B. M. and M. R. Hall. 1907. 342 pp., 1 pl. 50c.

Describes topographic and geologic features of the State; discusses by drainage basins, stream flow, river surveys, and water powers.

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

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of James, Roanoke, Dan, Neuse, Cape Fear, Peedee, Wateree, Saluda, Savannah, Ocmulgee, Oconee, Chattahoochee, Flint, Oostanaula, Alabama, Cahaba, Tombigbee, and Pearl rivers.

*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:

Saline artesian waters of the Atlantic coastal plain, by Samuel Sanford. Discusses briefly the geology of the coastal plain, the artesian waters, the occurrence and character of the salt waters, the causes of salinity, and lateral changes in salinity.

*319. Geology and ground waters of Florida, by G. C. Matson and Samuel Sanford. 1913. 445 pp., 17 pls. 60c.

Describes the characteristic upland, lowland, and coastal features of the State—the springs, lakes, caverns, sand dunes, coral reefs, bars, inlets, tidal runways, pine lands, swamps, keys, and ocean currents; discusses in detail the stratigraphic position, lithologic character, thickness, physiographic expression, structure, and areal distribution of the geologic formations; treats of the source, amount, depth, circulation, and recovery of ground waters, the artesian waters, and public water supplies; and gives details concerning source, quality, and development of the water supplies by counties. Discusses briefly the quality of the well waters.

341. Underground waters of the coastal plain of Georgia, by L. W. Stephenson and J. O. Veatch, and a discussion of the quality of the waters, by R. B. Dole. 1915. 539 pp., 21 pls. 50c.

Describes the physiographic features of the State, the geologic provinces, the areal distribution, stratigraphic position, and lithologic character of the rocks belonging to the geologic systems; discusses the source and amount of the ground waters, the uses of the springs and shallow and artesian wells, and the distribution of the ground waters in the rocks of the various formations; gives details concerning each county. The chapter on the chemical character of the waters describes standards for classification and the general requisites of waters for miscellaneous industrial uses and for domestic use; treats also of methods of purifying water and of the relation of quality to geopraphic position, to water-bearing stratum, and to depth.

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 in Virginia, North Carolina, South Carolina, and Florida, and of water from the Gulf of Mexico.

ANNUAL REPORTS.

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

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

*Tenth Annual Report of the United States Geological Survey, 1888-89, J. W. Powell, Director. 1890. 2 parts. *Pt. I. Geology, xv, 774 pp., 98 pls. $2.35. Contains:

*General account of the fresh-water morasses of the United States, with a description of the Dismal Swamp district of Virginia and North Carolina, by N. S. Shaler, pp. 235-339, pls.6-19. Scope indicated by title.

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:

*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.

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.

*37. The southern Appalachian forests, by H. B. Ayres and W. W. Ashe. 1905. 291 pp., 37 pls. 80c.

Describes the relief, drainage, climate, natural resources, scenery, and water supply of the southern Appalachian forests, the trees, shrubs, and rate of growth; gives details concerning forests by drainage basins, including New, Holston (southern tributaries of South Fork only), Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Hiwassee, Tallulah-Chattooga, Toxaway, Saluda and First and Second Broad rivers, Catawba and Yadkin rivers, describing many of the tributaries of each of the master streams.

*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, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

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.

138. Artesian-well prospects in the Atlantic Coastal Plain region, by N. H. Darton. 1896. 232 pp., 19 pls.

Describes the general geologic structure of the Atlantic Coastal Plain region and summarizes the conditions affecting subterranean water in the Coastal Plain; discusses the general geologic relations in New York, southern New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, and eastern Georgia; gives for each of the States a list of the deep wells and discusses well prospects. The notes on the wells that follow the tabulated lists contain many sections and analyses of the waters.

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

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Alabama, Florida, Georgia, Mississippi, and North Carolina, and detailed records of wells in Hancock and Jackson counties, Mississippi. These wells were selected because they give definite stratigraphic information.

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

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia; and detailed records of wells in Madison, Marengo, and Mobile counties Alabama; Duval, Escambia, Sumter, and Volusia counties, Florida; Chatham, Decatur, Fulton, Pierce, and Tattnall counties, Georgia; Lenoir, New Hanover, and Moore counties, North Carolina; Hancock, Harrison, Jackson, Jones, Marshall, Newton, and Panola counties, Mississippi; and Aiken, Barnwell, Charleston, Hampton, Lee, and Orangeburg counties, South Carolina. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute 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 valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

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 many of the folios are usable. The damaged folios are sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

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

*80. Norfolk, Virginia-North Carolina.

Describes the plains, Dismal Swamp, and the tidal marshes; discusses the reclamation of swamp lands and gives an account of the ground waters; gives sections of wells near Norfolk and at Fort Monroe, and analyses of waters from the test boring at Norfolk and the boring at Lambert Point.

[1] Index maps showing areas in the South Atlantic States 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.

90. Cranberry, North Carolina-Tennessee. 5c.
*124. Mount Mitchell, North Carolina-Tennessee.
*147. Pisgah, North Carolina-South Carolina.
175. Birmingham, Alabama.[1] 5c.
187. Ellijay, Georgia-North Carolina-Tennessee.[2] 25c.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the South Atlantic States are the reports of the State surveys of North Carolina, Georgia, Florida, and Alabama, and the Tenth Census (vol. 16).

The following reports deserve special mention:

Hydrography of Virginia, by N. C. Grover and R. H. Bolster: Virginia Geol. Survey Bull. 3, 1906.

Underground waters of the Coastal Plain province of Virginia, by Samuel Sanford: Virginia Geol. Survey Bull. 5, 1913.

Surface water supply of Virginia, by G. C. Stevens: Virginia Geol. Survey Bull. 10, 1916.

A preliminary report on the water powers of Georgia, by B. M. Hall: Georgia Geol. Survey Bull. 3–A, 1896.

A preliminary report on the artesian-well system of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 7, 1898.

A preliminary report on the underground waters of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 15, 1908.

Second report on the water powers of Georgia, by B. M. Hall and M. R. Hall: Georgia Geol. Survey Bull. 16, 1908.

A preliminary report on the mineral springs of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 20, 1913.

A preliminary report on the underground water supply of central Florida, by E. H. Sellards: Florida Geol. Survey Bull. 1, 1908.

Underground waters of Mississippi; a preliminary report by W. N. Logan and W. R. Perkins: Mississippi Agr. Exper. Sta. Bull. 89, 1905.

Report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region: 57th Congress, 1st sess., S. Doc. 84, 1902.

Underground water resources of Alabama, by E. A. Smith. Montgomery, Ala., 1907.

Preliminary report on part of the water powers of Alabama, by B. M. Hall: Alabama Geol. Survey Bull. 7, 1903.

Papers on the water power in North Carolina, a preliminary report by George F. Swain, J. A. Holmes, and E. W. Myers: North Carolina Geol. Survey Bull. 8, 1899.

The Coastal Plain of North Carolina, by W. B. Clark, B. L. Miller, L. W. Stephenson, B. L. Johnson, and H. N. Parker: North Carolina Geol. and Econ. Survey Rept., vol. 3, 1912.

Many of these reports can be obtained by applying to the several organizations, and most of them can be consulted in the public libraries of the larger cities.

[1] Octavo edition only.

[2] Octavo edition, 50c.

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., 9pls.
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. 10c. (See Water-Supply Paper 22.)
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, 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 No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage, utilization, and disposal.

*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. (73–147), 2 pls (15–16). 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.

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 irrgiation, 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 measurement (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., Superseded by No. 152, q. v.

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

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

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

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

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, amount, and temperature of waters; permeability and storage capacity of rocks, water-bearing formations; recovery of water by springs, wells, and pumps; essential conditions of artesian flows; and general conditions affecting underground waters in eastern United States.

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

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

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

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c. [Inquiries concerning 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 on stream flow, by R. E. Horton.

Sanitary regulations governing construction camps, by M. O. Leighton.

Necessity of draining irrigated land, by Thos. H. Means.

Alkali soils, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.

Equipment of a cable gaging station, by E. C. Murphy.

Silting of reservoirs, by W. M. Reed.

Farm-unit classification, by D. W. Ross.

Cost of power for pumping irrigating water, by H. A. Storrs.

Records of flow at current-meter gaging stations during the frozen season, by F. F. Tillinghast.

147. Destructive floods in 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 areas of cross section.

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

Scope indicated by title.

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

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 development, 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 underground waters, and contains the following brief reports of general interest:

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

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

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

Scope indicated by title.

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

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

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

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, * * * 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 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 amounts 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.

Scope indicated by title.

*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 Hermar Stabler and G. H. Pratt. 1909. 76 pp. 10c.

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

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

Describes collection of samples, 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 ground water, artesian conditions, and oil and gas bearing formation; 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.

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

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation.

*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., 7 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. Scope indicated by title.

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

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

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

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

*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, as follows:

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

(e) A method for 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.

*400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer. 1917. 108 pp., 7 pls. 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.

(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53–59.

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 continually 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.

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, pp. xi, 486, 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. 111 to 146. Discusses 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, pp. xx, 597, 73 pls. $2.10. Contains:

*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 analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

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

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls 6 to 16. Discusses the amount of water stored in sandstone, in soil and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

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."

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 Myron 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 water; 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.

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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.