

*Douglas B. Sterrett*

Water-Supply and Irrigation Paper No. 98

Series P, Hydrographic Progress Reports, 25

DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

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REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1903

---

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

JOHN C. HOYT

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PART II.—Southern Atlantic, Eastern Gulf of Mexico, and Eastern Mississippi River Drainage



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1904

## PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of the United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists may be had on application.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Waterstorage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

The following Water-Supply Papers are out of stock, and can no longer be supplied: Nos. 1-16, 19, 20, 22, 23-34, 36, 39-40, 43, 46, 57-65, 75. Complete lists of papers relating to water supply and allied subjects follow. (PP—Professional Paper; B—Bulletin; WS—Water-Supply Paper.)

### SERIES I—IrrIGATION.

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- WS 5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 11 pls.
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- WS 32. Water resources of Porto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. and maps.
- WS 43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls.
- WS 70. Geology and water resources of the Patrick and Goshen Hole quadrangles, Wyoming, by G. I. Adams. 1902. 50 pp., 11 pls.
- WS 71. Irrigation systems of Texas, by T. U. Taylor. 1902. 137 pp., 9 pls.
- WS 74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls.
- WS 87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls.
- WS 93. Proceedings of first conference of engineers of the reclamation service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp.

The following papers also relate especially to irrigation: Irrigation in India, by H. M. Wilson, in Twelfth Annual, Pt. II; two papers on irrigation engineering, by H. M. Wilson, in Thirteenth Annual, Pt. III.

### SERIES J—WATER STORAGE.

- WS 33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls.
- WS 40. The Austin dam, by Thomas U. Taylor. 1900. 51 pp., 16 pls.
- WS 45. Water storage on Cache Creek, California, by A. E. Chandler. 1901. 48 pp., 10 pls.
- WS 46. Physical characteristics of Kern River, California, by F. H. Olmsted, and Reconnaissance of Yuba River, California, by Marsden Manson. 1901. 57 pp., 8 pls.
- WS 58. Storage of water on Kings River, California, by J. B. Lippincott. 1902. 100 pp., 32 pls.
- WS 68. Water storage in Truckee Basin, California-Nevada, by L. H. Taylor. 1902. 90 pp., 8 pls.
- WS 73. Water storage on Salt River, Arizona, by A. P. Davis. 1902. 54 pp., 25 pls.
- WS 86. Storage reservoirs on Stony Creek, California, by Burt Cole. 1903. 62 pp., 16 pls.
- WS 89. Water resources of Salinas Valley, California, by Homer Hamlin. 1904. 91 pp., 12 pls.
- WS 93. Proceedings of first conference of engineers of the reclamation service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp.

The following paper also should be noted under this heading: Reservoirs for irrigation, by J. D. Schuyler, in Eighteenth Annual, Pt. IV.

[Continued on third page of cover.]

DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

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WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1904





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## LETTER OF TRANSMITTAL.

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DEPARTMENT OF THE INTERIOR,  
UNITED STATES GEOLOGICAL SURVEY,  
HYDROGRAPHIC BRANCH,

*Washington, D. C., March 23, 1904.*

SIR: I have the honor to transmit herewith Water-Supply Paper No. 98, which is Part II of a series of four papers numbered 97 to 100, inclusive. These papers compose the Report of Progress of Stream Measurements for the calendar year 1903. Parts I and II of this report contain the results of the data collected from the territory east of the Mississippi River. Parts III and IV are devoted to the data collected in the territory west of the Mississippi River.

The work of assembling the data on which this report is based and also the preparation of the same for publication has been under the immediate direction of John C. Hoyt, who has been assisted by Frank H. Brundage, L. R. Stockman, R. H. Bolster, H. J. Saunders, and W. A. Brothers. Special acknowledgment is due Maxey R. Hull, district hydrographer for the Southern States, under whose supervision the larger part of the data given were collected, for suggestions and help in their preparation.

Very respectfully,

F. H. NEWELL,  
*Chief Engineer.*

Hon. CHARLES D. WALCOTT,  
*Director United States Geological Survey.*



# PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1903.

## PART II.

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By JOHN C. HOYT.

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### INTRODUCTION.

During the calendar year 1903 the work of measuring the flow of streams has been continued on the same general lines as in previous years. During 1903 special efforts have been made to collect such other information as will be of use in general hydrographic studies. Reconnaissances have been made on many of the important rivers in different portions of the United States, and much valuable data collected in regard to floods, water powers, river profiles, etc.

During 1903 the number of regular stations at which stream measurements are being made has been steadily increased, so that at the close of the year systematic measurements were being carried on at approximately five hundred points. The stations are distributed so as to best cover the needs of the various States and Territories. The location of principal gaging stations is shown on Plate I. This expansion of the work is the result of the constantly increasing demand from engineers and the general public for the stream data collected by the Survey. The requests for information have been so numerous that the supply of publications containing the results has in many cases become exhausted.

The Survey has continued to receive the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the publication of many valuable records which could not otherwise have been obtained.

The Report of Progress of Stream Measurements for the calendar year 1903, of which this is Part II, is published in a series of four Water-Supply Papers, Nos. 97-100, inclusive, under the following subtitles:

Part I. Northern Atlantic and Great Lakes Drainage.

Part II. Southern Atlantic, Eastern Gulf of Mexico, and Eastern Mississippi River Drainage.

Part III. Western Mississippi River and Western Gulf of Mexico Drainage.

Part IV. Interior Basin, Pacific, and Hudson Bay Drainage.

The territory covered by each paper is given in the subtitle and the larger drainages are, for convenience in arrangement, subdivided into smaller ones under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon these observations and other information that may be of use in hydrographic studies, including, as far as available, a description of the drainage area.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

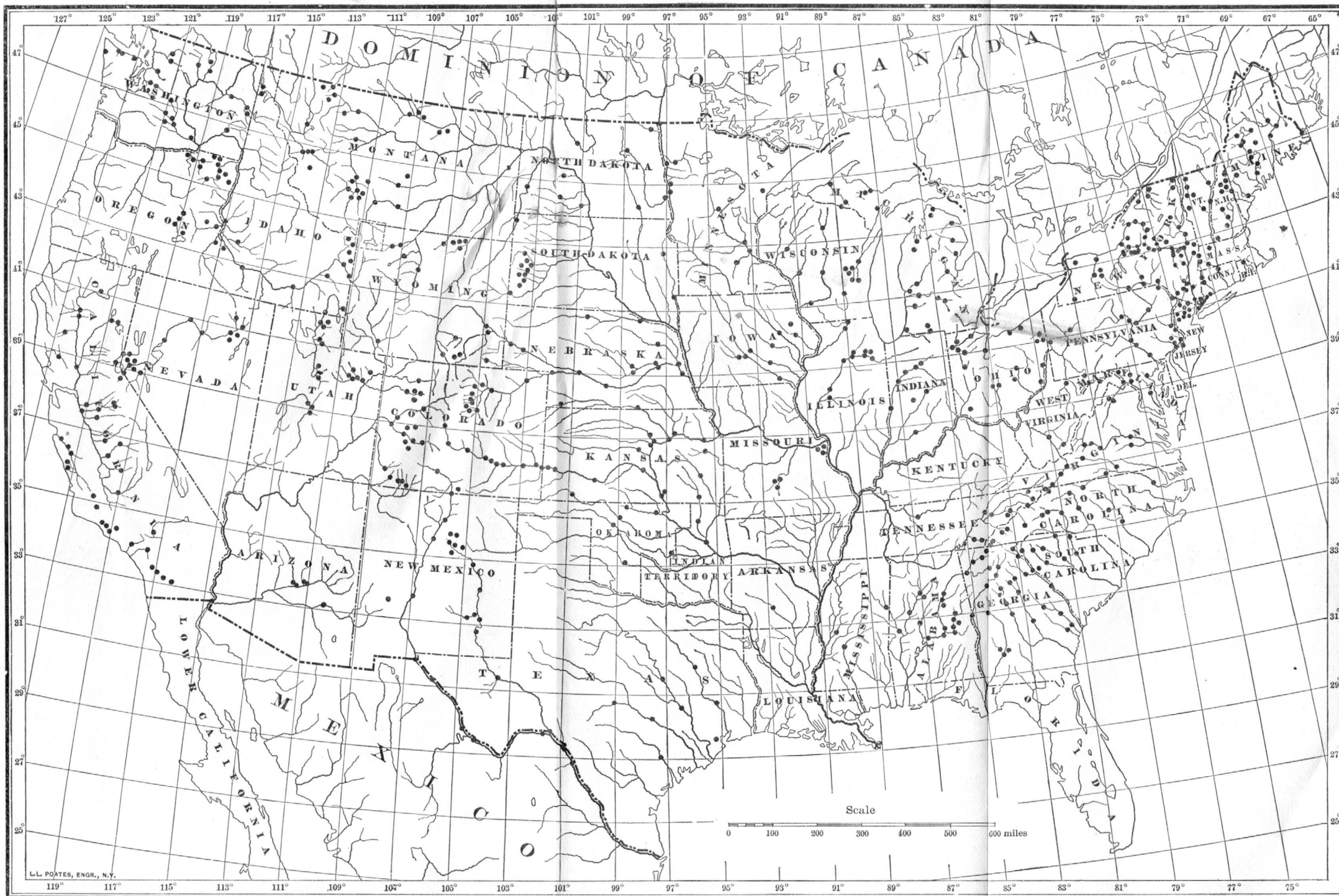
The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and make use of the equipment. The report also contains, as far as possible, a complete history of all the changes which have occurred since the establishment of the station and which affect the use of the data collected.

The discharge-measurement tables give the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the fluctuations of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and evening.

The rating table gives discharges in second-feet corresponding to each stage of the river, as given by the gage heights. It depends upon the general law that for streams of practically constant cross section the discharge is a function of the gage height, and that like gage heights will have the same discharge. In its preparation the discharge measurements are plotted on cross-section paper to some convenient scale, using gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which is the basis for the table. From this curve are tabulated, on forms prepared for the purpose, the discharges corresponding to each tenth of a foot on the gage. The first and second differences between the successive discharges are then taken. These are adjusted on the assumption that there is a gradual increase in the discharge as the gage height increases, and the discharge values in the table are then





MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1903

adjusted according to these revised differences. In preparing the rating table all available data are brought into use, including special conditions which might affect the discharge. For high waters above the stage covered by discharge measurements the general rule is to extend the curve by a tangent line. In case the river overflows its banks a percentage of the discharge is added, depending on the depth and velocity of the overflowed portion. For stages below that portion of the curve which is fixed by discharge measurements the curve has been extended, following the general form of the determined lower portion. Notes under each rating table indicate those portions that are based on actual observation and those that are estimated.

From the rating table and daily gage heights a table giving the daily discharge of the streams is prepared. From this the table of estimated monthly and yearly discharges and run-off is computed. This latter table gives in condensed form a summary of the results obtained from the observations made during the year at the station. In order to explain this table, the following definitions are given:

The term "second-feet" is an abbreviation for "cubic feet per second." It is the number of cubic feet of water flowing by the gaging station every second. The column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, as given in the rating table for that mean gage height. As the gage height is the mean for the day there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the two remaining columns in the table are based.

The expression "second-feet per square mile" means the number of cubic feet of water flowing from every square mile of drainage area for each second.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall.

It should be noticed that "depth in inches" represents the actual quantity of water produced during the period in question, while "second-feet" is merely a rate of flow into which the element of time does not enter.

The results of the stream measurements and other hydrographic work performed during previous years by the United States Geological Survey can be found in the following Survey publications:

- 1888. Tenth Annual Report, Part II.
- 1889. Eleventh Annual Report, Part II.
- 1890. Twelfth Annual Report, Part II.
- 1891. Thirteenth Annual Report, Part III.

- 1892. Fourteenth Annual Report, Part II.
- 1893. Bulletin No. 131.
- 1894. Bulletin No. 131, and Sixteenth Annual Report, Part II.
- 1895. Bulletin No. 140.
- 1896. Water-Supply Paper No. 11, Eighteenth Annual Report, Part IV.
- 1897. Water-Supply Papers Nos. 15 and 16, Nineteenth Annual Report, Part IV.
- 1898. Water-Supply Papers Nos. 27 and 28, Twentieth Annual Report, Part IV.
- 1899. Water-Supply Papers Nos. 35 to 39, inclusive, Twenty-first Annual Report, Part IV.
- 1900. Water-Supply Papers Nos. 47 to 52, inclusive, Twenty-second Annual Report, Part IV.
- 1901. Water-Supply Papers Nos. 65, 66, and 75.
- 1902. Water-Supply Papers Nos. 82 to 85, inclusive.
- 1903. Water-Supply Papers Nos. 97 to 100, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director United States Geological Survey. Aside from these, other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at a nominal price. Copies of Government publications are, as a rule, furnished to public libraries in the large cities, where they may be consulted.

### ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Alabama: District hydrographer, M. R. Hall, assisted by J. M. Giles. Dr. E. A. Smith, State geologist, has paid the salaries of the river observers at Riverside, Nottingham, Jenifer, Sturdevant, Alexander, and Centerville. Gage heights were furnished by R. C. McCalla, United States engineer, for the stations at Tuscaloosa, Cordova, and Palos, and by the United States Weather Bureau official, F. P. Chaffee, for Selma.

Georgia: District hydrographer, M. R. Hall, assisted by J. M. Giles, O. P. Hall, F. A. Murray, and W. E. Hall. Prof. W. S. Yeates, State geologist, has paid the salaries of the river observers at Millen, Groveland, Davisboro, Reidsville, Milledgeville, Greensboro, Buckhead, Flovilla, Lithonia, Covington, Norcross, Gainesville, Albany (Muckalee Creek), Albany (Kinchafoone Creek), Rome (Etowah), Canton, Carters, and Blue Ridge. J. M. Youngblood has furnished, without cost, gage heights for Augusta. The following Weather Bureau officials have furnished gage heights for the Weather Bureau stations, as noted in the

descriptions of stations: D. Fisher, Augusta, Ga.; J. B. Marbury, Atlanta, Ga.; J. R. Weeks, Macon, Ga., and F. P. Chaffee, Montgomery, Ala. Transportation has been furnished by J. S. B. Thompson, general agent of the Southern Railway; by E. Berkley, superintendent of the third division of the Seaboard Air Line Railway; by Thomas K. Scott, general manager of the Georgia Railroad; by James T. Wright, vice-president and general manager of the Macon, Dublin and Savannah Railroad; by John M. Eagan, president of the Central of Georgia Railway; by J. H. Ellis, vice-president and general manager of the Atlanta, Knoxville and Northern Railway; by C. A. Wickersham, president and general manager Atlanta and West Point Railroad and Western Railway of Alabama. The above transportation was not confined to the State of Georgia, but was furnished also for the States of South Carolina, Alabama, Mississippi, and Tennessee.

Illinois: District hydrographer, E. Johnson, jr., assisted by E. H. Heilbron, assistant engineer sanitary district of Chicago.

Indiana: District hydrographer, E. Johnson, jr., assisted by F. W. Hanna, assistant engineer; H. C. Lootz, assistant engineer; George E. Waesche, of the engineering department of Purdue University. Acknowledgment should also be made to Joseph M. Steiner and O. H. Griest, who have assisted the Survey in establishing and supplying voluntary reading at Cataract and Shoals, Ind., respectively.

Minnesota: District hydrographer, E. Johnson, jr., assisted by L. R. Stockman, assistant engineer, and W. R. Hoag, of the engineering department of the University of Minnesota.

North Carolina: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by B. S. Drane and O. P. Hall.

South Carolina: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by B. S. Drane, J. M. Giles, F. A. Murray, and W. E. Hall.

Ohio: District hydrographer, E. Johnson, jr., assisted by Benjamin H. Flinn, C. L. Bushey, and R. W. Pratt, engineer State board of health. Acknowledgment should also be made to Dr. C. O. Probst, secretary State board of health, Ohio, for assistance rendered, and to the Baltimore and Ohio Railroad for passes issued to E. Johnson, jr., and R. W. Pratt.

Tennessee: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by J. M. Giles, O. P. Hall, and B. S. Drane. Gage heights for stations at Chattanooga, Knoxville, and Nashville were furnished by the United States Weather Bureau officials, L. M. Pindell, Chattanooga, and H. C. Bate, Nashville.

Wisconsin: District hydrographer, E. Johnson, jr., assisted by L. R. Stockman, assistant engineer. Acknowledgment should also be made to Prof. L. S. Smith, of the engineering department of the University of Wisconsin, for material assistance rendered.

## SOUTHERN ATLANTIC COAST DRAINAGE.

Systematic measurements of discharge of many of the larger rivers of the southern Atlantic States have been made during the year. The drainage areas of the rivers in that region are in general similar. Most of the streams rise in the southern Appalachian Mountains or their foothills. In the upper part of their courses they are rapid, with considerable fall. Across the Piedmont Plain their valleys are wide and

their flow in general is sluggish, with occasional falls over rocky beds. Many of them have falls that could be utilized for water power, and it is largely to that end that data of the flow are being collected. In the study of water power it is important to know the flow and the fall. The fall can readily be determined by an engineer, but the variations in flow often require long and careful study. Gaging stations, to determine the latter, have been established on nearly all the larger streams in the region, and it is hoped that in the near future our information of their fall will be extended.

In this report the drainage areas in this section from which data have been received during 1903 have been grouped as follows, and arranged geographically from north to south:

Roanoke, Cape Fear, Pedee or Yadkin, Santee, Savannah, Ogeechee, and Altamaha river basins.

### ROANOKE RIVER DRAINAGE BASIN.

Roanoke River drains a total area of about 9,200 square miles and empties into Albemarle Sound a short distance below Plymouth, N. C. It is navigable at all stages for 120 miles to Weldon, N. C., where the river crosses the fall line.

The Roanoke proper is formed by the confluence of the Dan and Staunton rivers, at Clarksville, Mecklenburg County, Va., 185 miles above the mouth of the stream, though the name "Roanoke" is also applied to the upper waters of Staunton River. These streams drain, respectively, 3,798 and 3,546 square miles. The United States Weather Bureau maintains a gage at Clarksville, and gaging stations on both streams were also maintained here by the Geological Survey for some years.

Of these streams the Staunton is the more northerly, its drainage basin lying entirely in Virginia. It rises among the eastern foothills of the Blue Ridge southwest of Roanoke and Salem, being known in this part of its course as the Roanoke, and flows at first northeast, then southeast through Montgomery, Roanoke, Bedford, Campbell, Halifax, and Mecklenburg counties to the junction with the Dan.

A large part of the area drained by the Dan lies in North Carolina. The stream rises in Surry County, N. C., and in Patrick County, Va., and flows at first southeast, through Stokes County, N. C., then northeast through Rockingham and Caswell counties, N. C., and through Pittsylvania, Halifax, and Mecklenburg counties, Va., to the junction with the Staunton.

The average rainfall on the basin of the Roanoke above the fall line is about 48 inches per annum. The average amount probably increases slightly as the stream is ascended, though the records of rainfall over the basin are too incomplete to decide this matter. The amount of rainfall is evenly distributed throughout the year. This results in a

variable flow, since it is probable that the evaporation is comparatively large.

The freshets on the river are violent, and the fluctuations of height occur with great rapidity. Rises of 50 feet and over have been noted at Weldon, and freshets in which the rate of rise is 10 feet a day or more are frequent.

Gaging stations were maintained by the United States Geological Survey during 1903 on the Roanoke River proper at Neal, near Kelford, N. C.; on the Roanoke (upper portion of the Staunton) at Roanoke, Va.; on the Dan at South Boston, Va., and at Madison, N. C., and on the Staunton at Randolph, Va.

#### ROANOKE RIVER AT NEAL, N. C.

This station was established on July 27, 1896. It is located at the Norfolk and Carolina Railroad bridge at Neal, near Kelford, N. C.

The zero of the gage rod is over the center of the fourth floor beam of the second span from the north end of the bridge. The distance from the zero of the rod to the outer rim of the pulley is 2.47 feet, and the distance from the end of the weight to the pointer on the wire is 44.66 feet.

The section is a fairly good one, the course of the river being straight for some distance above and below the station and the bottom smooth. Being muddy, however, the bed is apt to cut out in seasons of high water, and both banks are subject to overflow. The observer was the bridge watchman, W. M. Adams, of Neal, N. C. The station was discontinued May 31, 1903.

The observations at this station during 1903 have been made under the direction of E. W. Myers, district hydrographer.

*Mean daily gage height, in feet, of Roanoke River at Neal, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1 .....	9.20	17.30	18.40	24.80	20.90	17 .....	12.30	19.90	17.00	24.65	9.00
2 .....	9.30	16.40	22.40	25.25	18.80	18 .....	11.25	23.50	15.70	24.10	8.75
3 .....	9.30	14.60	23.50	25.35	17.00	19 .....	11.25	29.20	14.60	22.60	8.50
4 .....	21.25	13.30	23.70	24.45	15.50	20 .....	10.65	25.60	13.70	20.70	8.30
5 .....	23.55	12.10	22.20	23.50	14.30	21 .....	9.95	29.30	13.00	19.00	8.05
6 .....	25.00	21.90	20.10	22.80	13.80	22 .....	9.70	27.80	15.10	18.70	7.90
7 .....	26.55	23.15	18.10	21.90	13.20	23 .....	13.10	25.90	23.05	18.70	7.70
8 .....	26.60	23.20	16.70	20.40	12.50	24 .....	17.40	23.60	25.15	21.10	7.50
9 .....	24.80	22.50	16.50	21.30	11.80	25 .....	16.50	21.20	29.30	21.20	7.55
10 .....	22.50	22.20	16.40	23.05	11.35	26 .....	14.90	19.00	30.35	20.40	7.85
11 .....	19.90	21.80	17.20	24.00	10.80	27 .....	13.30	17.20	30.20	20.70	8.00
12 .....	17.60	21.10	17.90	24.25	10.30	28 .....	12.10	15.70	29.05	22.10	8.50
13 .....	17.50	21.90	18.22	23.30	9.95	29 .....	11.60	.....	26.60	22.45	9.70
14 .....	16.80	23.70	18.65	21.60	9.60	30 .....	17.40	.....	24.80	22.30	10.80
15 .....	15.40	21.80	18.65	23.45	9.40	31 .....	20.00	.....	24.40	.....	.....
16 .....	13.50	20.60	18.20	24.35	9.20						

*Rating table for Roanoke River at Neal, N. C., from January 1 to May 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
7.5	6,705	11.5	10,955	15.5	16,180	23.0	35,500
8.0	7,200	12.0	11,530	16.0	16,930	24.0	41,000
8.5	7,700	12.5	12,130	17.0	18,530	25.0	46,500
9.0	8,200	13.0	12,730	18.0	20,280	26.0	52,195
9.5	8,730	13.5	13,380	19.0	22,130	27.0	59,000
10.0	9,280	14.0	14,030	20.0	24,230	28.0	66,500
10.5	9,830	14.5	14,730	21.0	26,630	29.0	74,000
11.0	10,380	15.0	15,430	22.0	30,000	30.0	82,000

Rating table for 1903 same as that for 1902.

*Estimated monthly discharge of Roanoke River at Neal, N. C., for 1903.*

[Drainage area, 8,717 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	56,277	8,412	20,798	2.39	2.76
February .....	76,400	11,650	33,081	3.79	3.95
March .....	84,800	12,730	32,985	3.78	4.36
April .....	48,493	21,575	33,880	3.89	4.34
May 1-30 .....	26,390	6,705	10,676	1.22	1.36

#### DAN RIVER AT MADISON, N. C.

This station was established May 14, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at the Southern Railway bridge about one-fourth mile from Madison and one-half mile above the mouth of Mayo River. The standard chain gage with inclosed scale is located on the upstream side of the bridge in the sixth panel of the first span from the left end. The length of the chain from the weight to the marker is 35.24 feet. During 1903 the gage was read once each day by J. W. Ward. Discharge measurements are made from the upstream side of the covered wooden two-span railway bridge and its wooden approaches. The initial point for soundings is the end of the guard rail of the trestle over the left bank. Distances are measured along the upstream guard rail and are marked with white paint. Above the station the channel is straight for about 600 feet and the current velocity is good. About 300 feet below the station the channel makes an abrupt turn. The right bank is low and overflows. There is a long trestle approach to the bridge on this side, and all water

passes beneath the bridge and approaches. The left bank is low and overflows. There is a small stream entering from this side. The bed of the stream is sandy and probably permanent. There is but one channel at all stages. Bench mark No. 1 is the edge of the top of a large wire nail driven flush into the top corner of the wooden floor beam, which is beneath gage datum on the upstream side of the bridge. The point is indicated by the letters "B. M." in white paint. When the gage reads zero, the water surface is 34.10 feet below this bench mark. Bench mark No. 2 is a standard iron bench-mark post set in cleared level ground on the left or south side of the railway track. It is 77 feet west of the initial point for soundings, and 9 feet south of the south rail of the track. Its elevation above the water surface when the gage reads zero is 36.21 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Dan River at Madison, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 14 .....	E. W. Myers .....	2.05	950
Do .....	do .....	2.07	1,002
June 18 .....	do .....	2.05	731
Do .....	do .....	2.05	742
July 18 .....	B. S. Drane .....	1.17	683
Do .....	do .....	1.14	626
August 26 .....	do .....	1.16	527
October 1 .....	do .....	.86	367
Do .....	do .....	.86	396
November 18 .....	do .....	2.31	817
December 21 .....	do .....	2.07	748

*Mean daily gage height, in feet, of Dan River at Madison, N. C., for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....		3.95	2.00	8.35	1.30	0.95	0.85	0.70
2 .....		2.70	1.85	2.35	1.15	.85	.85	1.00
3 .....		2.55	1.75	1.85	1.10	.85	.90	.70
4 .....		2.20	1.70	1.80	1.05	.85	.85	.85
5 .....		4.00	2.50	1.70	1.00	.85	2.80	1.05
6 .....		3.60	3.15	3.35	1.00	.90	1.50	.90
7 .....	17.25	17.00	2.75	1.70	.90	.85	1.00	.70
8 .....	4.80	4.80	1.80	1.35	.90	2.00	.95	.90
9 .....	4.20	4.20	1.65	1.30	4.65	2.30	.90	.95
10 .....	5.65	5.65	1.60	1.30	1.30	1.10	.95	.90
11 .....	3.45	3.45	1.65	1.70	1.10	.95	.90	.75
12 .....	3.00	3.00	1.75	1.75	1.10	.90	.95	1.00
13 .....	2.55	2.55	6.10	1.10	1.00	.90	.90	1.15



*Mean daily gage height, in feet, of Dan River, etc.—Continued.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14.....		2.40	3.75	1.30	0.90	0.85	0.90	1.10
15.....	2.00	2.35	2.25	6.60	.90	.85	.85	1.00
16.....	1.95	2.20	1.80	2.35	.90	.95	.85	.70
17.....	1.95	2.10	1.70	1.80	5.70	1.10	1.30	.85
18.....	1.90	2.05	1.65	8.60	2.65	2.05	2.50	.55
19.....	1.90	2.00	1.60	2.50	1.50	1.25	1.50	.75
20.....	1.80	3.65	1.60	1.85	1.20	1.00	1.10	1.00
21.....	1.90	2.35	1.40	1.75	1.15	1.00	1.00	2.25
22.....	1.75	2.00	1.35	1.70	1.10	.90	1.05	1.35
23.....	1.70	3.90	2.00	1.60	1.05	.90	.95	1.15
24.....	1.60	2.10	1.40	1.30	1.05	.95	1.00	1.10
25.....	1.80	2.00	1.25	1.25	1.00	.85	.95	1.15
26.....	2.00	3.85	1.25	1.15	.95	.80	.95	1.45
27.....	1.90	7.05	1.20	1.20	.95	.80	.80	1.20
28.....	3.00	2.80	1.10	1.10	1.00	.80	.75	1.10
29.....	4.10	2.75	2.50	1.05	.95	.85	.90	1.00
30.....	2.75	2.20	2.15	2.00	.90	.85	.90	.85
31.....	2.65		2.00	1.30		.80		.75

#### DAN RIVER AT SOUTH BOSTON, VA.

This station, which was established on August 27, 1900, by E. W. Myers, is in the town of South Boston, Va., on the railroad bridge of the Norfolk and Western Railroad, which crosses the river at that place. On May 18, 1903, B. S. Drane replaced the wire gage with a standard chain gage. The datum was not changed. The gage is located on the downstream guard rail near the center of the first span from the left bank. The length of the chain from the end of the weight to the marker is 35.02 feet. The observer is J. Mercer East. Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is the left end of the downstream guard rail. This is a very good station for the gaging of all except the very highest stages of flow. At extreme heights the river spreads out over a flood plain of considerable width. The trestle connecting the bridge with the embankment on the south side of the river is a curve of rather high degree. The bed of the stream is of coarse sand and probably shifts only slightly.

Bench mark No. 1 is the sharp inner corner toward the left bank of the plate attached to the inner surface of the struts at the center of the left span and to the bearing of the wooden floor beam and tie. The elevation of the top of the plate is 32.86 feet above gage datum.

Bench mark No. 2 is the top of a standard copper bolt set in the capstone of the abutment of the viaduct by means of which the Southern Railway crosses the highway a short distance upstream from the Norfolk and Western and Southern Railway crossing. Its elevation is 30.65 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

*Discharge measurements of Dan River at South Boston, Va., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 18	B. S. Drane	22.45	43,036
March 27	E. C. Murphy	8.10	7,393
May 18	E. W. Myers	3.01	2,959
May 19	do	2.94	2,801
June 23	do	3.59	3,044
Do	do	3.67	3,136
August 8	B. S. Drane	2.62	2,378
August 27	do	1.39	1,401
Do	do	1.44	1,389
September 18	do	8.78	9,411
September 25	Paul and Sawyer	1.40	1,519
December 2	W. C. Sawyer	1.51	1,258

*Mean daily gage height, in feet, of Dan River at South Boston, Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	3.90	8.20	11.65	5.20	7.40	6.65	1.90	(a)	1.32	1.35	1.65
2	4.25	3.90	7.75	7.95	5.15	6.20	5.00	2.30	2.00	1.22	1.42	1.60
3	12.05	3.90	6.35	7.15	4.80	4.30	3.50	2.60	(a)	1.20	1.40	1.62
4	18.80	5.45	5.65	7.75	4.50	3.90	3.10	2.90	(a)	1.10	1.60	1.65
5	15.55	15.95	5.15	8.10	4.50	3.90	7.25	4.45	(a)	1.20	2.90	1.67
6	9.10	11.70	4.95	6.90	4.50	4.85	12.45	4.30	(a)	1.22	3.40	1.62
7	6.90	8.85	4.90	6.10	4.50	8.30	14.00	4.50	(a)	1.30	2.75	1.62
8	5.90	8.25	4.90	12.45	4.30	14.55	9.35	2.60	(a)	1.65	1.90	1.48
9	5.25	7.25	5.15	16.80	4.30	7.20	3.75	2.40	(a)	3.15	1.72	1.38
10	4.95	6.75	5.35	13.95	4.30	5.75	2.50	2.30	(a)	3.85	1.70	1.45
11	4.70	6.85	6.05	9.05	4.15	11.30	2.40	2.20	(a)	1.90	1.65	1.58
12	5.10	14.20	8.05	6.90	3.88	12.55	2.40	2.80	(a)	1.45	1.55	1.65
13	5.00	10.40	8.50	6.55	3.85	5.75	6.30	2.50	(a)	1.40	1.48	1.67
14	4.80	6.90	7.35	6.90	3.80	4.05	12.40	2.50	1.50	1.35	1.45	1.70
15	4.70	6.10	6.60	7.10	3.80	3.50	8.90	2.95	(a)	1.32	1.57	1.67
16	4.50	5.55	5.90	7.10	3.80	3.35	4.75	3.20	(a)	1.28	1.55	1.67
17	4.40	18.35	5.20	6.90	3.80	3.15	2.85	3.40	(a)	1.42	1.42	1.67
18	4.40	22.00	4.70	6.50	3.80	2.85	2.70	4.30	8.40	1.70	3.60	1.67
19	4.40	19.20	4.30	6.50	3.35	6.00	2.60	7.05	4.10	2.42	4.47	1.65
20	4.40	12.30	4.20	6.40	2.95	9.17	2.55	(a)	2.35	2.15	2.30	1.70
21	4.50	6.55	4.65	6.30	2.90	9.05	2.50	(a)	1.85	1.65	1.72	1.67
22	4.85	5.55	15.45	6.30	2.90	5.95	2.25	(a)	1.70	1.18	1.72	1.57
23	4.65	5.25	21.05	6.30	2.80	4.30	1.95	(a)	1.60	1.50	1.72	1.52
24	4.45	4.85	23.15	6.30	2.75	3.70	1.90	(a)	1.45	1.40	1.55	1.55
25	4.20	4.70	21.70	6.30	2.95	3.20	1.80	(a)	1.38	1.35	1.58	1.40
26	4.20	4.45	11.70	6.30	3.10	2.85	1.70	(a)	1.35	1.48	1.57	1.40
27	4.20	4.30	7.85	9.80	3.30	2.70	1.60	1.40	1.35	1.52	1.58	1.55
28	4.10	4.65	6.40	8.70	4.70	2.60	1.60	(a)	1.35	1.45	1.58	6.95
29	4.10		5.80	7.15	8.20	5.67	1.50	(a)	1.35	1.42	1.62	5.00
30	4.00		11.00	5.45	9.25	7.75	1.55	(a)	1.35	1.30	1.72	2.00
31	4.00		12.05		9.30		1.90	(a)		1.48		1.62

a No record.

b Highest record, 16.2 at 10 a. m.

c Highest record, 17.7 at 4 p. m.

d Highest record, 22.5 at 4 p. m.

*Rating table for Dan River at South Boston, Va., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.1	1,185	3.6	3,240	8.2	8,110	13.2	15,260
1.2	1,250	3.7	3,330	8.4	8,350	13.4	15,610
1.3	1,320	3.8	3,420	8.6	8,610	13.6	15,970
1.4	1,390	3.9	3,510	8.8	8,870	13.8	16,330
1.5	1,465	4.0	3,600	9.0	9,130	14.0	16,700
1.6	1,540	4.2	3,800	9.2	9,390	14.2	17,080
1.7	1,620	4.4	4,000	9.4	9,650	14.4	17,460
1.8	1,700	4.6	4,200	9.6	9,910	14.6	17,850
1.9	1,780	4.8	4,400	9.8	10,170	14.8	18,250
2.0	1,860	5.0	4,600	10.0	10,430	15.0	18,650
2.1	1,940	5.2	4,800	10.2	10,690	15.2	19,060
2.2	2,020	5.4	5,000	10.4	10,960	15.4	19,480
2.3	2,100	5.6	5,200	10.6	11,240	15.6	19,910
2.4	2,180	5.8	5,400	10.8	11,520	15.8	20,350
2.5	2,265	6.0	5,600	11.0	11,800	16.0	20,790
2.6	2,350	6.2	5,810	11.2	12,100	16.5	21,950
2.7	2,435	6.4	6,030	11.4	12,400	17.0	23,170
2.8	2,520	6.6	6,250	11.6	12,700	17.5	24,450
2.9	2,610	6.8	6,470	11.8	13,000	18.0	25,840
3.0	2,700	7.0	6,690	12.0	13,300	18.5	27,320
3.1	2,790	7.2	6,910	12.2	13,620	19.0	28,860
3.2	2,880	7.4	7,150	12.4	13,940	19.5	30,460
3.3	2,970	7.6	7,390	12.6	14,260	20.0	32,130
3.4	3,060	7.8	7,630	12.8	14,580	20.5	33,890
3.5	3,150	8.0	7,870	13.0	14,920	21.0	35,800

Tangent above 21 feet gage height. Differences above this point, 400 per tenth.  
Table well determined to 10 feet gage height. Above this point it is approximate.

*Estimated monthly discharge of Dan River at South Boston, Va., for 1903.*

[Drainage area, 2,750 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	28,240	2,700	5,934	2.16	2.49
February .....	39,800	3,510	9,953	3.62	3.78
March .....	44,400	3,800	10,084	3.67	4.23
April .....	22,670	5,050	8,065	2.93	3.27
May .....	9,520	2,475	4,050	1.47	1.69
June .....	17,750	2,350	5,785	2.10	2.34
July .....	16,700	1,465	4,389	1.60	1.84
August (1-19 and 27) <sup>a</sup> .....			2,861	1.04	.77
September (15 days) <sup>a</sup> .....			2,133	.78	.44
October .....	3,465	1,185	1,551	.56	.65
November .....	4,070	1,355	1,811	.66	.74
December .....	6,635	1,376	1,811	.66	.76

<sup>a</sup>No record for missing days.

#### STAUNTON RIVER AT RANDOLPH, VA.

This station was originally established August 27, 1900, by E. W. Myers. It is located on the railroad bridge about five-eighths of a mile southwest of the Southern Railway station at Randolph, Va. The present gage was installed by B. S. Drane May 20, 1903. It is a standard chain gage and occupies practically the same position as the wire gage which it replaced. It is attached to the upstream guard rail in the middle of the second span from the left bank. The datum is the same as that of the original gage. The length of the chain from the end of the weight to the marker is 43.13 feet. The observer is J. E. Figg, the station agent. Discharge measurements are made from the bridge to which the gage is attached. The current is moderately rapid and has a well-distributed velocity. The channel is straight for a considerable distance above and below the station and has a width at ordinary stages of about 400 feet, broken by one bridge pier. The bed is composed mainly of firm material and is permanent. The bridge makes a small angle with the normal to the direction of the current. Bench mark No. 1 is the top of the floor beam nearest the zero of the gage scale at a point 0.2 foot downstream from the adjacent tie. Its elevation is 42.01 feet above the gage datum. Bench mark No. 2 is a copper bolt set in the capstone on the downstream side of the left abutment about 3 feet from the end of the ties. Its elevation is 36.99 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

*Discharge measurements of Staunton River at Randolph, Va., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 25	B. S. Drane	24.20	24,730
March 27	E. C. Murphy	10.45	7,877
May 20	E. W. Myers	5.19	3,095
June 24	do	5.32	2,520
Do	do	5.29	2,490
August 8	B. S. Drane	4.59	2,220
August 28	do	3.62	1,451
Do	do	3.61	1,468
September 25	Paul and Sawyer	4.20	1,877
December 3	W. C. Sawyer	3.82	1,466

*Mean daily gage height, in feet, of Staunton River at Randolph, Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.10	7.70	18.80	15.70	7.40	6.60	7.90	4.40	10.60	4.10	4.10	3.80
2	5.60	6.90	12.30	11.30	7.00	6.40	6.80	4.70	9.10	3.90	4.30	3.90
3	19.90	6.55	9.20	9.70	7.00	6.10	6.30	5.10	5.70	3.80	4.20	3.80
4	18.00	10.70	8.60	10.90	7.00	5.90	5.90	5.30	4.50	3.70	4.50	3.90
5	16.00	13.60	7.80	10.20	6.90	6.40	5.70	5.10	4.30	3.90	4.80	4.10
6	11.20	11.10	7.50	8.90	6.70	6.80	5.50	4.90	4.40	4.20	5.00	4.00
7	9.10	8.30	7.80	8.40	6.50	8.90	5.60	4.70	4.60	4.80	4.90	4.20
8	8.20	8.10	7.90	13.00	6.40	11.10	5.30	4.50	4.50	6.60	4.60	4.10
9	7.20	8.10	9.40	13.40	6.10	7.60	5.00	4.30	4.40	7.30	4.40	4.40
10	6.60	7.50	10.20	11.50	6.10	8.40	4.70	4.40	4.20	6.40	4.10	4.20
11	7.80	7.70	9.00	9.10	6.00	9.40	4.40	4.20	4.30	5.60	3.90	4.00
12	7.60	13.00	9.40	8.30	6.00	6.90	4.60	4.30	3.80	5.30	3.80	4.10
13	6.70	11.00	9.70	9.60	5.90	5.60	4.70	4.40	4.30	4.90	3.70	3.90
14	6.00	8.80	9.40	13.20	5.90	5.80	5.20	4.30	4.60	4.70	3.90	4.20
15	5.70	8.00	8.60	12.80	5.80	5.70	5.40	4.20	5.40	4.90	4.10	4.10
16	5.80	8.40	8.00	11.90	5.60	5.40	5.30	4.60	7.80	5.10	4.20	3.80
17	5.80	22.60	7.60	9.80	5.50	5.50	5.00	5.00	8.50	4.80	4.00	4.20
18	5.80	26.20	7.20	8.90	5.40	5.40	5.10	5.50	15.30	4.70	3.90	4.40
19	5.55	16.80	6.90	7.40	5.30	5.10	4.70	6.30	7.90	4.60	3.80	4.60
20	5.20	10.10	6.75	7.50	5.20	4.90	4.20	5.90	6.80	4.40	3.90	4.80
21	7.10	8.90	9.40	7.35	5.10	5.00	4.30	5.60	6.30	4.30	4.00	4.60
22	10.70	8.40	21.80	7.20	5.20	5.20	4.50	5.20	6.10	4.20	4.10	4.50
23	9.00	7.80	24.60	7.40	5.30	5.00	4.40	4.90	5.40	4.00	4.20	4.60
24	7.50	7.40	26.30	7.50	5.50	5.10	4.20	4.80	4.90	3.90	4.40	4.80
25	6.70	7.10	22.80	7.70	5.80	5.20	4.00	4.50	4.20	4.10	4.20	4.90
26	6.30	6.80	12.90	7.90	5.70	6.40	3.90	4.10	4.60	4.20	4.10	4.70
27	6.00	6.50	10.20	9.00	5.90	8.10	3.70	3.80	4.50	4.10	4.20	4.60
28	10.30	11.00	9.40	11.45	6.20	11.90	3.80	3.40	4.60	4.20	3.90	4.40
29	13.40	-----	8.60	9.80	6.40	10.50	3.90	3.70	4.30	4.00	3.80	4.50
30	10.00	-----	13.40	8.60	6.50	9.60	4.00	12.30	4.00	3.90	3.70	4.30
31	8.60	-----	19.30	-----	6.80	-----	4.20	11.40	-----	3.80	-----	4.40

*Rating table for Staunton River at Randolph, Va., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.4	1,310	5.4	2,830	7.8	4,860	11.8	9,080
3.5	1,370	5.5	2,910	8.0	5,040	12.0	9,320
3.6	1,435	5.6	2,990	8.2	5,240	12.2	9,560
3.7	1,500	5.7	3,070	8.4	5,440	12.4	9,800
3.8	1,570	5.8	3,150	8.6	5,640	12.6	10,040
3.9	1,640	5.9	3,230	8.8	5,840	12.8	10,280
4.0	1,715	6.0	3,310	9.0	6,040	13.0	10,520
4.1	1,790	6.1	3,390	9.2	6,240	13.2	10,760
4.2	1,870	6.2	3,470	9.4	6,440	13.4	11,000
4.3	1,950	6.3	3,550	9.6	6,640	13.6	11,240
4.4	2,030	6.4	3,630	9.8	6,840	13.8	11,480
4.5	2,110	6.5	3,710	10.0	7,060	14.0	11,720
4.6	2,190	6.6	3,790	10.2	7,280	14.2	11,960
4.7	2,270	6.7	3,870	10.4	7,500	14.4	12,200
4.8	2,350	6.8	3,960	10.6	7,720	14.6	12,460
4.9	2,430	6.9	4,050	10.8	7,940	14.8	12,720
5.0	2,510	7.0	4,140	11.0	8,160	15.0	12,980
5.1	2,590	7.2	4,320	11.2	8,380	15.5	13,680
5.2	2,670	7.4	4,500	11.4	8,600	16.0	14,400
5.3	2,750	7.6	4,680	11.6	8,840		

Tangent above 15.8 feet, gage height; differences above this point, 150 per tenth.  
Table above 12 feet gage height is a rough approximation.

*Estimated monthly discharge of Staunton River at Randolph, Va., for 1903.*

[Drainage area, 3,076 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	20,250	2,590	5,964	1.94	2.24
February .....	29,700	3,710	7,768	2.53	2.63
March .....	29,850	3,915	9,579	3.11	3.58
April .....	13,960	4,320	7,038	2.29	2.55
May .....	4,500	2,590	3,370	1.10	1.27
June .....	9,200	2,430	4,147	1.35	1.51
July .....	4,950	1,500	2,445	.79	.91
August .....	9,680	1,310	2,712	.88	1.01
September .....	13,400	1,570	3,272	1.06	1.18
October .....	4,410	1,500	2,191	.71	.82
November .....	2,510	1,500	1,841	.60	.67
December .....	2,430	1,570	1,940	.63	.73
The year .....	29,850	1,310	4,356	1.42	19.10

## ROANOKE RIVER AT ROANOKE, VA.

This station was established July 10, 1896, by D. C. Humphreys. The original gage, of the old wire type, was replaced November 28, 1903, by a standard chain gage installed by W. C. Sawyer. The datum is the same as that of the gage which it replaced. The length of the chain from the end of the weight to the marker is 27.50 feet. Discharge measurements were made from the Walnut Street Bridge, at which the gage is located, up to July 21, 1903. Since that time they have been made from the Jefferson Street Bridge, at which the section is more suitable. The initial point for soundings is the left end of the downstream handrail. The channel is nearly straight and has a width of 160 feet between abutments, broken by one pier. The current is rapid. The bed of the stream is composed of coarse gravel and small boulders. The right bank is above high water, but the left is liable to overflow at extreme flood stages. Bench mark No. 1 is the downstream upper edge of the second floor beam from the left abutment. Its elevation is 21.98 feet above gage datum. Bench mark No. 2 is a standard copper bolt set in the face of the lower wing wall of the left abutment about 4 feet above the ground. Its elevation is 19.71 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

*Discharge measurements of Roanoke River at Roanoke, Va., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 23.....	E. C. Murphy.....	6.92	6,846
May 1.....	do.....	2.01	701
May 13.....	E. W. Myers.....	1.40	349
Do.....	do.....	1.40	350
July 21.....	B. S. Drane.....	1.03	146
September 22.....	Paul and Sawyer.....	1.35	316
November 26.....	W. C. Sawyer.....	.90	120

*Mean daily gage height, in feet, of Roanoke River at Roanoke, Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.20	(a)	3.10	3.20	2.10	1.50	1.60	1.60	2.05	1.00	1.00	0.65
2.....	1.25	(a)	2.60	2.90	1.93	1.30	1.45	1.40	1.20	1.00	1.00	.90
3.....	4.10	1.60	2.30	2.60	1.85	1.25	1.40	1.20	1.08	.98	1.00	.90
4.....	2.70	2.10	2.10	2.90	1.90	1.10	1.30	2.60	1.00	1.00	1.00	.80
5.....	2.50	2.10	2.00	2.60	1.80	1.20	1.28	1.80	.95	.98	1.15	.95
6.....	2.20	2.25	1.95	2.40	1.70	1.25	1.35	1.35	.90	1.00	1.25	.85
7.....	1.95	2.00	2.00	2.35	1.65	2.10	1.45	1.20	.90	1.00	1.20	.90
8.....	1.85	1.90	2.00	2.40	1.63	1.65	1.35	1.10	.90	2.10	1.10	.80
9.....	1.40	1.75	2.90	2.45	1.55	1.45	1.20	1.08	2.10	1.50	1.10	.80
10.....	1.50	1.70	2.70	2.65	1.53	2.10	1.18	1.00	1.80	1.25	1.05	.80
11.....	1.50	1.80	2.40	2.40	1.50	1.90	1.50	1.05	1.10	1.15	1.00	.70
12.....	1.60	2.75	2.85	2.30	1.50	1.45	1.85	1.05	1.05	1.10	1.00	.75
13.....	1.35	2.40	2.85	2.20	1.48	1.50	2.35	1.00	1.00	1.05	1.00	.95
14.....	1.50	2.20	2.60	3.55	1.45	1.40	2.00	1.00	.95	1.05	1.00	.90
15.....	1.45	2.00	2.40	3.00	1.42	1.30	1.60	1.30	.95	1.03	1.00	.85
16.....	1.40	2.10	2.10	2.70	1.38	1.25	1.30	1.15	.90	1.00	1.00	.65
17.....	1.40	8.50	2.10	2.50	1.38	1.20	1.30	1.15	6.75	1.15	1.00	.65
18.....	1.35	3.50	2.00	2.30	1.38	1.20	1.25	1.18	2.60	1.45	1.10	.95
19.....	1.25	2.60	1.90	2.15	1.35	1.20	1.20	1.15	2.40	1.20	1.10	.55
20.....	1.25	2.35	1.80	2.05	1.30	1.10	1.10	1.20	1.60	1.15	1.00	.95
21.....	1.30	2.25	2.05	2.10	1.30	1.15	1.10	1.10	1.45	1.10	1.00	1.20
22.....	1.95	2.10	2.15	1.95	1.25	1.10	1.10	.95	1.35	1.05	1.00	1.05
23.....	1.70	2.00	6.70	1.90	1.25	1.80	1.10	.95	1.30	1.05	.98	1.00
24.....	1.60	1.95	4.85	1.80	1.23	1.30	1.05	.95	1.25	1.05	1.00	.95
25.....	1.50	1.85	3.80	1.80	1.25	1.20	1.00	.90	1.20	1.05	1.00	1.00
26.....	1.50	1.75	2.80	2.45	1.33	1.20	1.05	.85	1.15	1.05	1.05	1.20
27.....	1.45	1.70	2.55	4.05	1.30	2.10	1.00	.88	1.15	1.00	1.00	1.00
28.....	2.35	2.40	2.30	2.90	1.20	1.80	.95	.90	1.13	1.00	.80	1.10
29.....	2.40	-----	2.20	2.50	1.20	2.90	1.00	.90	1.13	1.00	.85	1.10
30.....	(a)	-----	4.80	2.30	1.30	2.00	.98	.90	1.08	1.00	.90	.85
31.....	(a)	-----	4.75	-----	1.25	-----	1.00	1.50	-----	1.00	-----	.65

a Gage broken.



*Rating table for Roanoke River at Roanoke, Va., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.6	76	1.6	463	2.6	1,230	3.6	2,390
.7	85	1.7	521	2.7	1,330	3.7	2,515
.8	99	1.8	580	2.8	1,435	3.8	2,645
.9	121	1.9	641	2.9	1,545	3.9	2,775
1.0	151	2.0	707	3.0	1,660	4.0	2,905
1.1	189	2.1	785	3.1	1,780	4.1	3,040
1.2	237	2.2	865	3.2	1,900	4.2	3,175
1.3	290	2.3	955	3.3	2,020	4.3	3,310
1.4	347	2.4	1,045	3.4	2,140	4.4	3,445
1.5	405	2.5	1,135	3.5	2,265	4.5	3,580

Table tangent above 4 feet gage height. Differences above this point 135 per tenth. Table well determined to 2.20 feet gage height. Above 2.2 feet table is determined by two flood measurements.

*Estimated monthly discharge of Roanoke River at Roanoke, Va., for 1903.*

[Drainage area, 388 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 1-29 <sup>a</sup>	3,040	237	606	1.56	1.68
February 3-28 <sup>a</sup>	8,980	463	1,154	2.97	2.87
March	6,550	580	1,528	3.94	4.54
April	2,972	580	1,190	3.07	3.43
May	785	237	391	1.01	1.16
June	1,545	189	422	1.09	1.22
July	1,000	135	306	.79	.91
August	1,230	109	247	.64	.74
September	6,617	121	531	1.37	1.53
October	785	145	206	.53	.61
November	263	99	162	.42	.47
December	237	73	127	.33	.38

<sup>a</sup>Gage broken on days not included.

### CAPE FEAR RIVER DRAINAGE BASIN.

Cape Fear River is formed by the junction, near Moncure, Chatham County, N. C., of Haw and Deep rivers. It is usual to consider the Haw, the Deep, and the Cape Fear as separate streams, and to a certain extent in a consideration of the physical features of the entire

drainage basin this method of treatment is desirable. All of these streams, however, form a single river system, and it is more convenient to treat of the basin as a whole in parts of what follows.

Viewed from this standpoint, Cape Fear River rises among the red clay hills of Guilford and Rockingham counties, N. C., the sources of Haw and Deep rivers being but a short distance apart. Haw River is the more northerly of the two branches, and flows at first northeast, but turning soon to the southeast drains the southern portion of Rockingham County and the greater part of Guilford, and passes thence through Alamance, a corner of Orange, and Chatham County to its junction with Deep River in the lower part of Chatham. Deep River at first flows south, but soon turns to the southeast and flows practically parallel with Haw River for many miles through Guilford and Randolph counties, and into Moore County, where it turns abruptly toward the east, flowing in this direction through Moore and Chatham counties to the junction with the Haw.

The area drained by the entire river system above the town of Fayetteville, N. C., the head of navigation on the river, is 4,493 square miles, of which Haw River drains 1,800, Deep River 1,400, and Cape Fear River below the junction 1,293 square miles.

The elevations of the divides between the drainage basin of the Cape Fear system and those of the adjacent streams are not very great, and the minor tributaries can not, therefore, furnish much power except in places where considerable storage may be obtained by the construction of suitable dams.

From January 1 to May 31, 1903, stations were maintained by the Geological Survey on the Cape Fear River at Fayetteville, N. C., and on Rockfish Creek, near Brunt, N. C.

#### CAPE FEAR RIVER NEAR FAYETTEVILLE, N. C.

This gaging station is at the bridge of the Atlantic Coast Line, about a mile east of Fayetteville, N. C. The Weather Bureau has a gage fastened on the lower side of the east abutment of the covered highway bridge, this being about 400 feet above the railroad bridge, from which discharge measurements are made. The lower 29 feet of this gage consists of a rod divided into feet and tenths and firmly fastened to the abutment. Above the 29-foot mark the scale is painted on the rock. The observer is Frank Glover, who has charge of the steamboat landing just below the railroad bridge. For his convenience he has placed a subsidiary gage at the steamboat landing reading about the same as the official gage, and from this observations are taken. The channel is straight and the current moderately swift and not influenced by dams or other obstructions. The banks are high and the total flow of the river is in one channel, even during the highest floods. The bed is fairly constant. There is a difference in elevation of 50 feet between high and low water at this point. The station was abandoned May 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Mean daily gage height, in feet, of Cape Fear River near Fayetteville, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1 .....	5.80	7.60	26.20	38.80	14.70	17 .....	6.50	18.00	10.00	21.90	4.70
2 .....	5.60	7.00	29.30	33.20	10.80	18 .....	6.40	33.50	9.40	17.80	4.50
3 .....	8.50	6.80	26.20	25.20	9.20	19 .....	6.10	33.00	8.70	13.20	4.20
4 .....	24.00	6.60	19.40	18.00	8.00	20 .....	5.70	26.80	7.80	10.80	4.00
5 .....	24.60	13.00	14.40	18.00	7.50	21 .....	7.80	21.70	7.20	9.30	4.00
6 .....	20.00	23.40	12.00	17.60	7.00	22 .....	10.00	14.00	9.80	14.30	4.00
7 .....	14.80	18.80	10.20	14.00	6.80	23 .....	14.00	12.00	35.00	14.00	3.90
8 .....	11.20	21.00	9.40	11.80	6.20	24 .....	12.00	9.60	49.80	18.20	3.70
9 .....	8.50	31.90	8.60	17.60	6.00	25 .....	9.50	9.00	50.50	16.00	4.00
10 .....	7.80	31.00	12.80	22.40	5.80	26 .....	8.00	8.60	45.00	14.40	4.80
11 .....	7.80	26.40	12.90	19.20	5.80	27 .....	7.50	8.00	35.00	24.30	4.30
12 .....	7.90	28.90	11.40	14.00	5.70	28 .....	7.00	10.00	24.20	28.60	4.00
13 .....	12.00	32.40	20.00	11.80	5.50	29 .....	7.00	-----	18.60	24.00	4.00
14 .....	12.30	28.40	22.40	12.00	5.40	30 .....	8.50	-----	17.00	19.40	3.90
15 .....	9.80	21.00	15.60	25.60	5.20	31 .....	8.50	-----	37.70	-----	-----
16 .....	7.00	17.80	12.70	28.20	5.00						

*Rating table for Cape Fear River near Fayetteville, N. C., from January 1 to May 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.5	1,400	6.0	2,400	13.0	5,800	26.0	14,250
3.6	1,440	6.2	2,480	13.5	6,075	27.0	15,150
3.7	1,480	6.4	2,560	14.0	6,350	28.0	16,300
3.8	1,520	6.6	2,640	14.5	6,625	29.0	17,450
3.9	1,560	6.8	2,720	15.0	6,900	30.0	18,600
4.0	1,600	7.0	2,800	15.5	7,175	31.0	20,050
4.1	1,640	7.2	2,880	16.0	7,450	32.0	21,500
4.2	1,680	7.4	2,960	16.5	7,725	33.0	22,950
4.3	1,720	7.6	3,050	17.0	8,000	34.0	24,650
4.4	1,760	7.8	3,150	17.5	8,275	35.0	26,350
4.5	1,800	8.0	3,250	18.0	8,550	36.0	28,050
4.6	1,840	8.5	3,500	18.5	8,875	37.0	29,800
4.7	1,880	9.0	3,750	19.0	9,200	38.0	31,550
4.8	1,920	9.5	4,000	19.5	9,525	39.0	33,300
4.9	1,960	10.0	4,250	20.0	9,850	40.0	35,050
5.0	2,000	10.5	4,500	21.0	10,500	41.0	36,800
5.2	2,080	11.0	4,750	22.0	11,150	42.0	38,550
5.4	2,160	11.5	5,000	23.0	11,800		
5.6	2,240	12.0	5,250	24.0	12,450		
5.8	2,320	12.5	5,525	25.0	13,350		

Rating table for 1903 same as those for 1901 and 1902.

*Estimated monthly discharge of Cape Fear River near Fayetteville, N. C., for 1903.*

[Drainage area, 4,493 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	12,990	2,240	4,430	0.99	1.14
February .....	23,800	2,640	10,409	2.32	2.42
March .....	54,525	2,880	13,453	2.99	3.45
April .....	32,950	3,900	10,137	2.26	2.52
May 1-30 .....	6,735	1,480	2,348	.52	.58

#### ROCKFISH CREEK NEAR BRUNT, N. C.

This station was established on October 29, 1902, by B. S. Drane. The gage rod is of pine, 12 feet long, well painted, and graduated to tenths and half-tenths of a foot. It is firmly nailed on the outside of the downstream hand rail, between the two large posts, approximately over the center of the bridge. The distance from the zero of the gage to the outer rim of the pulley is 1 foot. The length of the wire from the end of the weight to the pointer is 51.80 feet. The gage reads zero when the weight touches the bottom. The observer was C. L. Nunalee, a farmer and storekeeper; his post-office address is Brunt, N. C. The course of the creek is straight here for about 500 yards, Lower Rockfish Bridge crossing the creek near the middle of this straight stretch. The left side of the stream is shallow, most of the current flowing along the right bank. The banks of the creek, of sand, rise steeply on either side to a height of about 50 feet.

The station is reached by driving from Fayetteville, N. C., a distance of 7 miles. It was discontinued May 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer. The following discharge measurement was made by E. W. Myers in 1903:

May 27: Gage height, 4.15 feet; discharge, 563 second-feet.

*Mean daily gage height, in feet, of Rockfish Creek near Brunt, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	3.83	4.07	19.17	31.28	8.90	4.20	17.....	4.22	12.70	5.00	16.50	4.17	.....
2.....	4.05	4.02	22.17	28.97	5.80	4.40	18.....	4.15	24.75	4.40	11.25	3.95	.....
3.....	5.87	4.25	17.42	18.87	4.55	4.00	19.....	3.57	23.10	4.40	8.90	4.25	.....
4.....	18.70	4.35	12.55	13.15	4.30	3.85	20.....	4.17	20.25	4.40	5.20	4.17	.....
5.....	18.32	8.35	8.57	11.25	4.45	4.20	21.....	4.97	16.95	4.65	5.55	3.90	.....
6.....	17.05	16.60	5.98	10.75	4.45	4.50	22.....	5.40	10.00	8.10	6.85	4.65	.....
7.....	12.70	12.20	5.40	8.10	4.40	.....	23.....	7.72	6.05	25.85	7.95	4.02	.....
8.....	8.47	13.30	4.50	6.55	4.25	.....	24.....	6.30	5.45	41.50	10.80	3.95	.....
9.....	5.27	26.35	4.50	5.00	4.25	.....	25.....	4.60	4.62	42.45	9.70	4.25	.....
10.....	4.27	26.72	6.55	15.00	4.45	.....	26.....	3.82	4.60	37.65	8.60	4.45	.....
11.....	4.10	17.22	6.75	12.40	4.25	.....	27.....	4.26	4.62	27.80	17.55	4.15	.....
12.....	4.50	19.20	5.95	8.65	4.35	.....	28.....	4.22	6.30	18.45	21.55	4.55	.....
13.....	6.00	25.55	12.75	6.00	4.40	.....	29.....	4.17	.....	11.92	18.05	4.10	.....
14.....	5.82	21.42	12.90	8.75	4.40	.....	30.....	4.40	.....	14.60	13.25	4.30	.....
15.....	4.72	16.80	9.50	20.00	4.35	.....	31.....	4.40	.....	30.02	.....	4.75	.....
16.....	3.95	11.45	6.65	16.80	4.35	.....							

#### MISCELLANEOUS MEASUREMENTS MADE IN CAPE FEAR RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in 1903:

*Miscellaneous measurements in Cape Fear drainage basin.*

Date.	Streams.	Locality.	Discharge.
			<i>Second-feet.</i>
May 27.....	Little Rockfish Creek.....	McNeils, N. C.....	143
May 27.....	Big Rockfish Creek.....	do.....	361
May 27.....	do.....	do.....	346
May 27.....	do.....	do.....	345

#### PEDEE, OR YADKIN, RIVER DRAINAGE BASIN.

The Yadkin River, or, as it is called below the junction of the Uharie, the Pedee, rises on the eastern slope of the Blue Ridge, in Caldwell and Watauga counties, N. C., and flows at first southeast, then turns abruptly northeast and flows in this direction for about 60 miles, then bends again abruptly and flows south and southeast across North Carolina and South Carolina, emptying into Winyah Bay at Georgetown, S. C. The total length of the stream, from source to mouth, following its general direction, is from 275 to 300 miles, while it is probably 400 miles or more if all the windings be followed.

The Pedee drains a total area of about 17,000 square miles, of which about 9,700 square miles are in North Carolina and 7,300 in South Carolina. The stream crosses the fall line near Cheraw, S. C.,

in a series of rapids extending over a number of miles, with no very great fall at any one place or in any short distance.

Small amounts of power may be developed on some of the tributaries of this stream in South Carolina, but the power possibilities of the basin in this State are unimportant. In North Carolina the stream can be made to furnish power in large quantities at a number of places, and large amounts may be secured on many of the tributaries. This stream and its tributaries are among the most important power streams in the southern States.

Below the great bend, where the river turns to the south, the valley of the stream averages about 50 miles in width. At many points the river is bordered by wide expanses of bottom lands, which are at times subject to overflow, and which are fertile and very productive. At other places the river is confined between bold and abrupt banks, and in one case it flows for several miles in a very narrow channel, only 60 feet wide in places, in a deep ravine between the flanking hills, forming the noted "Narrows." Above the great bend the valley is only from 15 to 20 miles wide, and the elevations of the divides which separate the basin of the Yadkin from those adjacent are much higher, so that the tributary streams have a large fall.

The upper part of the drainage basin is rough and mountainous and largely forest covered, and throughout this part of its course the flow of the stream is more constant than would be expected.

The average rainfall over the part of the basin in North Carolina is probably between 48 and 51 inches, approximating the lower figure over the lower portions, and possibly exceeding 51 inches over the higher and more mountainous portions, the precipitation increasing as the stream is ascended. This total amount is rather evenly distributed among the seasons.

The highest flood ever known at Wilkesboro, it is stated, occurred in March, 1899, the stream at this place rising 28 feet above low water. The greatest flood recorded at the gaging station at Salisbury, N. C., occurred in December, 1901, the stream reaching an extreme height on the gage of 19.7 feet and having a probable discharge of about 130,000 second-feet, or about 38 second-feet per square mile. The flood of March, 1899, produced a rise of about 1 foot less than this flood of December. The most destructive flood ever experienced on the stream occurred in May, 1901, but the recorded gage height at the Salisbury station was less for this flood than for either of the others mentioned, and the general testimony of those living along the banks is to the same effect.

The minimum recorded flow at the Salisbury station occurred in September, October, and November, 1897, when the basin of the stream experienced the most severe drought in its history. The flow fell to 900 second-feet several times during this period, or the basin above the station was discharging at an average rate of 0.26 second-

foot per square mile. The maximum flow is thus about 144 times the minimum.

As stated, there are a number of localities where power may be developed.

During 1903 the United States Geological Survey received data from M. R. Hall, district hydrographer, for stations on Yadkin River near Salisbury, N. C., and at North Wilkesboro, N. C.

#### YADKIN RIVER NEAR SALISBURY, N. C.

This station was established by C. C. Babb, September 24, 1895, at the Southern Railway bridge about 6 miles east of Salisbury, N. C. Measurements were made from the decked railroad bridge, from which the original wire gage was also suspended. During the year 1899 the location of the measuring station and wire gage was changed to a new iron highway bridge about 300 yards above, the gage being set to read the same as the original one. Early in 1903 it was decided that the original location at the railroad bridge was better, so the station was again changed to it. This time, however, the gage was located on a plank walk way supported by the lower members of the bridge, and from this walk way the discharge measurements are also made. The bridge is a four-span iron bridge of the decked type, having a total length of about 650 feet between stone abutments, the left bank abutment being at the edge of the high rocky bluff, while that at right bank is connected with the hill by a short earth embankment. The river is confined by the abutments at all stages, and occupies practically the whole width at low water.

The channel is straight for long distance below, but curves considerably above. The bed of the river is rocky, and the depth of water is fairly uniform. Current is good, even at lowest stages. The initial point for soundings is the end of the bridge at right bank. The new gage is a standard, inclosed-scale, boxed-chain gage, and is fastened to lower member of the bridge along the plank walk way, near the middle of the first span from right bank. The length of the gage chain from the end of the weight to the marker is 28.66 feet. The observer is J. T. Yarbrough, the bridge keeper.

Bench mark No. 1 is the top of the inside eye bar of the lower chord on the downstream side, in the fourth panel from the right end of the bridge opposite a point 80 feet from the initial point for soundings. It is marked with white paint and has an elevation of 27.28 feet above gage datum. Bench mark No. 2 is the top of the anchor-bolt head at the right downstream corner of the foot plate on the right abutment downstream side. Its elevation is 26.82 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Yadkin River near Salisbury, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 14 .....	E. W. Myers .....	4. 20	9,992
February 17 .....	do .....	10. 52	47,960
March 24 .....	E. C. Murphy .....	15. 60	70,362
March 26 .....	B. S. Drane .....	5. 56	15,094
April 15 .....	E. C. Murphy .....	7. 35	24,419
April 16 .....	E. W. Myers .....	5. 20	15,151
Do .....	E. C. Murphy .....	5. 22	12,287
Do .....	do .....	4. 95	11,787
June 20 .....	E. W. Myers .....	2. 60	4,286
August 22 .....	B. S. Drane .....	2. 35	4,490
Do .....	do .....	2. 35	3,453
October 27 .....	do .....	1. 95	2,197
November 14 .....	do .....	1. 89	2,416
December 17 .....	do .....	1. 75	2,053

*Mean daily gage height, in feet, of Yadkin River near Salisbury, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	2.55	3.00	7.55	6.35	3.20	3.30	2.70	2.55	2.75	1.80	1.82	1.80
2 .....	2.40	2.85	5.90	4.70	3.15	2.88	2.40	5.00	1.85	1.80	1.90	1.75
3 .....	10.40	2.80	4.30	4.25	3.05	2.80	2.40	3.10	2.19	1.90	1.75	1.80
4 .....	10.05	4.40	3.70	4.10	3.15	2.80	2.45	2.40	2.08	1.85	1.76	1.74
5 .....	6.07	8.67	3.50	4.95	3.15	2.84	2.50	3.40	1.94	1.95	2.38	1.75
6 .....	4.47	6.60	3.38	4.10	3.10	3.80	2.60	3.00	1.88	1.79	2.85	1.88
7 .....	3.79	4.05	3.45	3.80	3.05	8.30	3.60	2.90	2.20	1.86	2.30	1.90
8 .....	3.45	5.50	3.50	7.25	3.00	9.40	2.90	2.30	2.10	1.83	1.96	1.75
9 .....	3.15	6.50	5.66	10.65	2.95	4.60	2.50	2.10	3.80	3.81	2.00	1.65
10 .....	2.90	5.00	4.72	7.50	2.70	3.50	2.50	2.05	3.85	2.96	1.80	1.68
11 .....	2.80	4.45	5.20	5.10	2.95	3.85	2.20	1.85	2.19	2.22	1.80	1.80
12 .....	3.35	6.45	5.59	4.35	2.85	3.75	2.35	2.40	1.95	2.09	1.75	1.62
13 .....	3.40	5.65	5.15	4.55	2.80	3.25	2.55	3.15	1.90	1.86	1.72	1.88
14 .....	2.90	4.25	4.45	6.95	2.90	2.88	3.70	2.75	1.92	1.65	1.75	2.02
15 .....	2.80	3.70	4.00	7.15	2.90	2.80	2.80	2.80	1.80	1.84	1.85	1.90
16 .....	2.80	3.50	3.70	5.50	2.90	2.65	2.50	4.20	1.80	1.81	1.90	1.80
17 .....	2.75	9.25	3.50	4.35	2.80	2.55	2.20	3.15	6.25	1.89	1.78	1.70
18 .....	2.78	10.50	3.40	3.95	2.70	2.85	2.15	3.70	7.00	2.06	2.78	1.70
19 .....	2.60	5.65	3.55	3.70	2.70	2.85	2.10	4.05	4.02	2.53	2.90	1.70
20 .....	2.55	4.12	3.25	3.65	2.65	2.55	3.30	3.05	2.80	2.02	2.30	1.75
21 .....	2.60	3.75	4.05	3.80	2.65	2.60	2.25	2.85	2.25	1.91	1.90	2.35
22 .....	3.70	3.55	8.30	3.88	2.65	2.60	2.05	2.40	2.02	1.96	2.00	2.60
23 .....	3.50	3.45	10.30	3.60	2.60	2.80	1.95	2.20	1.82	1.86	2.04	2.20
24 .....	3.10	3.25	15.40	3.55	2.55	2.45	2.20	2.12	1.85	1.85	1.70	2.05
25 .....	3.00	3.20	10.60	3.44	2.55	2.80	1.85	1.90	1.87	1.85	1.80	2.05
26 .....	2.90	3.15	6.00	3.50	2.55	2.80	1.90	2.00	1.87	1.94	1.80	2.15
27 .....	2.75	3.05	4.50	3.65	2.68	3.65	1.95	1.75	1.96	1.74	1.80	2.15
28 .....	3.65	4.15	4.15	3.58	2.65	3.70	1.75	1.79	1.95	1.75	1.75	1.98
29 .....	4.10	-----	3.95	3.32	4.40	3.30	1.85	1.80	1.75	1.64	1.82	1.75
30 .....	3.45	-----	5.50	3.25	3.10	3.15	2.55	1.85	1.85	1.70	1.90	1.88
31 .....	3.10	-----	8.80	-----	3.18	-----	2.55	2.84	-----	1.72	-----	1.80



*Rating table for Yadkin River near Salisbury, N. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.6	1,500	2.9	5,350	4.2	9,670	6.0	16,750
1.7	1,740	3.0	5,670	4.3	10,020	6.2	17,610
1.8	1,990	3.1	5,990	4.4	10,370	6.4	18,470
1.9	2,260	3.2	6,310	4.5	10,720	6.6	19,340
2.0	2,540	3.3	6,640	4.6	11,080	6.8	20,220
2.1	2,830	3.4	6,970	4.7	11,450	7.0	21,100
2.2	3,130	3.5	7,300	4.8	11,830	7.5	23,350
2.3	3,440	3.6	7,630	4.9	12,210	8.0	25,650
2.4	3,750	3.7	7,960	5.0	12,600	9.0	30,400
2.5	4,070	3.8	8,300	5.2	13,410	10.0	35,750
2.6	4,390	3.9	8,640	5.4	14,230	11.0	41,700
2.7	4,710	4.0	8,980	5.6	15,070		
2.8	5,030	4.1	9,320	5.8	15,910		

Table well determined to 6 feet gage height. Above 5.6 feet table same as 1901 and 1902.

*Estimated monthly discharge of Yadkin River near Salisbury, N. C., for 1903.*

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	38,070	3,750	8,421	2.48	2.86
February .....	38,650	5,030	12,677	3.73	3.88
March .....	76,200	6,475	15,798	4.65	5.36
April .....	39,565	6,475	12,174	3.58	3.99
May .....	10,370	4,230	5,393	1.59	1.83
June .....	32,480	3,910	7,446	2.19	2.44
July .....	7,960	1,865	3,872	1.14	1.31
August .....	12,600	1,865	4,744	1.40	1.61
September .....	21,100	1,865	4,343	1.28	1.43
October .....	8,300	1,620	2,536	.75	.86
November .....	5,350	1,740	2,542	.75	.84
December .....	4,390	1,500	2,260	.66	.76
The year .....	76,200	1,500	6,850	2.02	27.17

## YADKIN RIVER AT NORTH WILKESBORO, N. C.

This station was established April 10, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at the lower highway bridge between Wilkesboro and North Wilkesboro, about one-half mile below North Wilkesboro railroad station and about three-fourths of a mile below the mouth of Reddies River. The scale of the standard chain gage is fastened to the downstream guard rail with its zero 7.63 feet east of the center of the second strut from the west end of the span. The distance from the end of the weight to the marker is 33.38 feet. The gage was read once each day during 1903 by J. V. Wallace. He was succeeded December 20, 1903, by U. H. Wyatt. Discharge measurements are made from the downstream side of the steel highway bridge to which the gage is attached. The bridge consists of a single steel span about 125 feet long, under which the river flows at ordinary stages, and three wooden spans about 50 feet each on the right bank. There are also wooden trestle approaches about 170 feet long on the right bank and about 40 feet on the left bank. The initial point for soundings is the end of the downstream guard rail at the left end of the bridge. Distances are measured along this guard rail and are marked in white paint. The channel is straight above the station, but makes a very slight curve beneath the bridge. Below the station the channel is straight for about 600 feet. The water is swift both above and below. The right bank is low and is subject to overflow, but all water must pass beneath the bridge and its approaches. The left bank is high and rocky and does not overflow at the bridge. Above the bridge the river is subject to overflow. The bed of the stream is rocky, with sand in places. There is a single channel at all stages.

Bench mark No. 1 is the top surface of the outer eyebar of the lower chord opposite a point 100 feet from the initial point for soundings. When the gage reads zero the water surface is 30.75 feet below this bench mark. Bench mark No. 2 is the top corner of the pulley frame above the hole in the box which incloses the chain. When the gage reads zero the water surface is 31.88 feet below this bench mark.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Yadkin River at North Wilkesboro, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 10 .....	E. W. Myers .....	4.00	2,969
April 11 .....	do .....	3.67	2,797
June 16 .....	do .....	1.56	977
Do .....	do .....	1.56	1,005
June 17 .....	do .....	1.46	965
July 16 .....	B. S. Drane .....	1.15	865
Do .....	do .....	1.17	830
August 24 .....	do .....	.76	675
Do .....	do .....	.73	659
August 25 .....	do .....	.71	630
October 2 .....	do .....	.41	509
Do .....	do .....	.40	479
October 3 .....	do .....	.37	491
November 6 .....	do .....	.71	691
Do .....	do .....	.71	693

*Mean daily gage height, in feet, of Yadkin River at North Wilkesboro, N. C., for 1903.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....		2.25	1.75	1.35	2.25	1.85	0.40	0.40	0.30
2 .....		2.20	1.85	1.25	1.10	.85	.40	.40	.40
3 .....		2.20	2.15	1.40	1.40	.80	.40	.40	.40
4 .....		2.30	1.70	1.25	1.90	.70	.55	.50	.40
5 .....		2.20	2.45	3.15	1.50	.70	.35	1.80	.40
6 .....		2.10	6.75	2.25	1.20	.60	.35	.75	.30
7 .....		2.10	4.45	2.15	1.00	.60	.70	.55	.35
8 .....		2.05	3.05	1.55	.85	.60	7.20	.50	.35
9 .....		2.00	2.45	1.40	.85	.55	1.35	.50	.30
10 .....	3.95	1.95	3.20	1.30	.80	.90	.80	.50	.35
11 .....	3.65	1.95	2.35	1.20	1.35	.65	.60	.45	.30
12 .....	3.35	1.90	2.25	1.50	.90	.55	.55	.45	.30
13 .....	4.25	1.90	1.95	2.05	.80	.50	.50	.45	.45
14 .....	3.85	2.15	1.85	1.60	.95	.50	.50	.40	.35
15 .....	3.80	1.90	1.80	1.30	1.80	.45	.45	.35	.30
16 .....	3.40	1.85	1.65	1.20	1.25	.60	.60	.40	.15
17 .....	3.15	1.75	1.45	1.35	1.75	2.45	1.55	.90	.25
18 .....	3.00	1.75	1.45	1.20	1.65	.95	1.20	1.15	.15
19 .....	2.95	1.65	1.40	1.05	1.25	.75	.80	.60	.05
20 .....	2.85	1.65	1.40	1.05	1.15	.65	.65	.50	.90
21 .....	2.80	1.65	1.35	.95	1.00	.60	.55	.50	.95
22 .....	2.70	1.60	1.30	.95	.90	.55	.50	.45	.55
23 .....	2.65	1.55	1.30	.90	.80	.55	.55	.45	.40
24 .....	2.50	1.50	1.45	.85	.80	.55	.50	.45	.40
25 .....	2.60	2.00	1.75	.85	.75	.50	.45	.40	.45

Mean daily gage height, in feet, of Yadkin River, etc.—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26.....	2.60	1.60	1.65	0.80	0.70	0.50	0.45	0.40	0.55
27.....	2.45	1.65	1.80	.75	.60	.50	.40	.30	.10
28.....	2.35	1.70	1.95	.75	.60	.50	.25	.25	.55
29.....	2.30	1.70	1.95	1.10	.55	.40	.40	.40	.35
30.....	2.30	2.00	1.45	.90	1.10	.40	.40	.40	.30
31.....		1.85		1.50	.80		.40		.30

Rating table for Yadkin River at North Wilkesboro, N. C., from April 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.05	365	0.8	680	1.6	1,018	2.4	1,490
.1	386	.9	722	1.7	1,065	2.5	1,570
.2	428	1.0	764	1.8	1,115	2.6	1,650
.3	470	1.1	806	1.9	1,165	2.7	1,730
.4	512	1.2	848	2.0	1,220	2.8	1,820
.5	554	1.3	890	2.1	1,280	2.9	1,920
.6	596	1.4	932	2.2	1,345		
.7	638	1.5	974	2.3	1,415		

Table uncertain above 1.6 feet gage height; the curve is a tangent above gage height 2.8 feet; differences 100 per tenth.

Estimated monthly discharge of Yadkin River at North Wilkesboro, N. C., for 1903.

[Drainage area, 498 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April 10-30.....	3,270	1,415	2,064	4.15	3.24
May.....	1,415	974	1,169	2.35	2.71
June.....	5,770	890	1,417	2.85	3.18
July.....	2,170	659	916	1.84	2.12
August.....	1,380	575	815	1.64	1.89
September.....	1,530	512	647	1.30	1.45
October.....	6,220	491	770	1.55	1.79
November.....	1,115	449	568	1.14	1.27
December.....	743	365	502	1.01	1.16

## MISCELLANEOUS MEASUREMENTS IN PEDEE RIVER DRAINAGE BASIN.

The following discharge measurements were made in Pedee River drainage basin in 1903:

*Miscellaneous measurements in Pedee River drainage basin in 1903.*

Date.	Stream.	Locality.	Discharge.
			<i>Second-feet.</i>
Nov. 7	Mulberry Creek .....	Near North Wilkesboro, N. C. ....	47
Nov. 10	Stewarts Creek .....	Mount Airy, N. C. ....	87
Nov. 10	Lovells Creek .....	.....do .....	44
Nov. 10	Ararat River <sup>a</sup> .....	.....do .....	200
Nov. 11	.....do. <sup>b</sup> .....	.....do .....	71

<sup>a</sup> Below Lovells and Stewarts creeks.

<sup>b</sup> Above Lovells and Stewarts creeks.

## SANTEE RIVER DRAINAGE BASIN.

Santee River is formed by the junction of Congaree and Wateree rivers in the central part of South Carolina. It flows southeast and enters the Atlantic Ocean about 10 miles north of Cape Romain. It has a total length of about 180 miles (following the course of the river) and drains an area of about 15,000 square miles. It is a navigable stream for its entire length, and of course offers no opportunities for the development of power.

Wateree River, the more northerly of the two parent streams, rises on the eastern slope of the Blue Ridge, in McDowell County, N. C., and flows first northeast and then east, then bends abruptly southeast and flows in this general direction across the south-central portion of North Carolina and across the north-central part of South Carolina to its junction with the Congaree, practically paralleling the course of Yadkin and Pedee rivers. This stream, throughout its course in North Carolina, and also through that part of its course in South Carolina above the mouth of Wateree Creek, is known as Catawba River. The total length of the stream is about 270 miles in a straight line, and about 450 miles when all the windings are followed.

The Wateree is navigable as far as Camden, but above this point the fall becomes too great and navigation is impracticable. In 1826 and following years the State of South Carolina spent large sums in the attempt to render the river navigable by means of locks and dams. Some large and important works were constructed at great expense, but the undertaking was abandoned before their completion.

The drainage basin resembles that of the Yadkin in many respects, the upper portion of the stream flowing between parallel ranges of mountains from which it receives many tributaries affording much power. The average width of the valley of the main stream in North

Carolina is only from 15 to 20 miles, and the fall in the main stream is considerable. The greater part of the drainage basin is hilly, and the upper portions are mountainous. A number of the tributary streams rise and flow for almost their entire length in high mountains. About 65 per cent of the upper part of the basin is in forest. Linville River and John River, the principal tributaries in North Carolina, flow in country of this character, and their basins are almost entirely forested.

Wateree River crosses the fall line about 5 miles above Camden, S. C., in rapids about 5 miles in length, with a total fall of about 52 feet. The Great Falls of the Catawba are some distance above. This is the largest power in South Carolina, and one of the largest in the Southern States, the available fall being 173 feet.

The average rainfall on the basin is about 50 inches, the annual total increasing as the stream is ascended. The greatest flood ever experienced on the river was in May, 1901, the gage reading at the Rockhill station being 24.15 feet and the measured discharge nearly 151,000 second-feet, or nearly 50 second-feet per square mile from the drainage basin above the station. The greatest flood previously experienced on the stream was in 1865. This was only about 2 feet lower than the flood of May on the lower part of the river, but the May rise exceeded all previous records on the upper portion of the river by from 8 to 15 feet.

The minimum flow recorded for the Rockhill station is 1,300 second-feet, or about 0.43 second-foot per square mile. The maximum flow is about 116 times the minimum.

The Congaree, the second and more southerly of the two streams which by their union form the Santee, is formed by the junction of Broad and Saluda rivers between Lexington and Richland counties, S. C., whence it flows in a general southeasterly direction, but in a very tortuous channel, for about 60 miles to its junction with the Wateree. The stream is navigable to Columbia, the capital of the State. There it crosses the fall line, giving rise to a very fine water power, the only one on the stream, which is being extensively used in the manufacturing enterprises of Columbia.

Broad River rises on the eastern slope of the Blue Ridge near Hickory Nut Gap, in the southwestern part of McDowell County and the northeastern part of Henderson County, N. C., and flows in a general southeasterly direction across a portion of south-central North Carolina and north-central South Carolina to its junction with the Saluda at Columbia. The length of the river in a straight line is about 128 miles, but it is much greater if the course of the river is followed.

In general character the drainage basin closely resembles those of the Yadkin and the Catawba. It lies entirely above the fall line, is without lakes, and is well wooded, especially in the upper portion, and the soil is generally loose and porous.

The rainfall of the basin averages about 51 inches, of which about 13 inches fall in spring, the same in summer, about 10 in autumn, and about 15 in winter. It is probable that the precipitation in the region about the headwaters is much greater than these amounts indicate.

The maximum flood recorded at the Alston station on this stream, 25 miles above Columbia, occurred in May, 1901, the estimated discharge being 131,000 second-feet, equivalent to about 28 second-feet per square mile. The minimum flow recorded at the same place is 1,660 second-feet, equivalent to 0.36 second-foot per square mile. The maximum flow is therefore about 79 times the minimum.

Saluda River is formed in western South Carolina by the junction of the north, south, and middle forks, and flows southeast to its junction with Broad River, the length of the stream being about 110 miles in a straight line. The three forks are mountain streams, and the character of the drainage basin is similar to that of Broad River.

The average rainfall over the basin of the stream is 51 inches, the amount and seasonal distribution being similar to that on the Broad. The maximum flood recorded at the Waterloo station on this stream occurred in February, 1902, the rise being 23 feet above low water, and the estimated discharge being about 18,500 second-feet, equivalent to about 18 second-feet per square mile. The minimum discharge so far recorded is 290 second-feet, or about 0.28 second-foot per square mile. The maximum discharge is therefore about 64 times the minimum.

During 1903 the United States Geological Survey has maintained the following stations in this basin, under the direction of M. R. Hall: On the Wateree, near Camden, S. C.; on the Catawba, near Catawba, S. C., near Rockhill, S. C., and near Morganton, N. C.; on the Broad (of the Carolinas), near Alston, S. C.; and on the Saluda, near Waterloo, S. C.

#### WATEREE RIVER NEAR CAMDEN, S. C.

Camden, S. C., is on the Wateree River 45 miles above its mouth, and about 5 miles below the fall line. The drainage area above the station is 2,635 square miles.

A gaging station has been maintained here by the United States Weather Bureau since 1891. The present gage is at the toll bridge about 2 miles west of Camden. Measurements are made from this bridge which is two iron spans about 180 feet each, supported by tubular iron piers, and has short wooden approaches. The bridge keeper is also river observer. The gage is in three sections; the lower section being a timber fastened to a log near the right bank and about 15 feet above the bridge, and reading from 0 to 8 feet. The second is a timber fastened to an ash tree on right bank about 25 feet above bridge, and reading up to 15 feet. The third section, 15 to 32 feet, is painted on the upstream cylindrical pier on right bank.

There is some discrepancy between the middle section and the

other two. The readings have been adjusted with the upper section of gage on the pier. A new gage will be put in and set to read the same as the gage on the pier.

Both banks are high, but will probably overflow at high floods. The current is smooth and moderate at station and above and below it. The channel is 270 feet wide at low water, and the bed is sand and silt and is probably shifting.

*Discharge measurements of Wateree River near Camden, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 26-----	Myers and Drane-----	7.35	3,929
June 23-----	B. S. Drane-----	9.75	6,222
Do-----	do-----	9.90	6,694
August 7-----	J. M. Giles-----	9.15	6,285

*Mean daily gage height, in feet, of Wateree River near Camden, S. C., for 1903.<sup>a</sup>*

Day.	Jan.	Feb.	Mar.	Apr. <sup>b</sup>	May <sup>c</sup>	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	7.00	7.60	26.20	-----	-----	8.00	8.70	7.50	7.00	5.60	6.10	6.00
2.....	7.00	6.80	27.00	-----	-----	9.30	8.50	9.00	10.70	5.60	6.30	6.00
3.....	14.00	6.70	22.00	-----	-----	13.00	7.90	8.30	8.00	5.60	6.40	6.00
4.....	27.00	6.60	16.70	-----	-----	13.30	7.70	7.80	7.70	5.20	6.20	6.00
5.....	26.00	13.60	13.00	-----	-----	14.30	7.50	8.50	7.00	5.20	6.30	6.00
6.....	21.00	22.20	12.50	-----	-----	17.50	7.30	8.00	7.00	5.20	12.00	6.00
7.....	16.80	17.70	11.00	-----	-----	27.50	9.40	9.00	6.70	5.20	10.00	6.00
8.....	11.70	27.50	12.00	-----	-----	28.30	10.60	10.00	6.40	5.20	8.50	6.00
9.....	9.00	29.40	16.00	-----	-----	23.50	8.80	9.60	6.40	5.80	8.00	6.10
10.....	8.00	26.60	18.60	-----	-----	22.70	8.50	8.60	10.00	5.60	7.00	6.60
11.....	8.00	21.00	18.50	-----	-----	17.80	8.00	8.00	9.00	8.00	6.70	6.50
12.....	8.30	27.70	19.70	-----	-----	23.60	7.70	7.40	8.00	7.60	6.70	6.40
13.....	12.50	26.90	19.40	-----	-----	18.50	7.30	7.00	7.00	7.00	6.60	6.50
14.....	9.50	22.50	17.20	-----	-----	13.00	11.00	9.70	7.00	7.00	6.60	6.40
15.....	8.50	17.40	13.40	-----	8.00	11.00	10.40	10.00	6.50	7.00	6.60	6.30
16.....	7.30	13.00	12.50	-----	7.70	9.60	9.00	15.00	6.00	7.10	6.60	6.30
17.....	7.20	21.70	11.50	-----	7.50	9.30	8.80	15.70	15.00	7.20	6.40	6.30
18.....	6.70	27.70	10.00	-----	7.30	9.10	8.20	15.00	20.00	12.00	6.40	6.30
19.....	6.50	26.00	8.70	-----	7.10	8.70	8.00	18.30	16.50	10.00	7.00	6.30
20.....	6.30	20.60	8.00	-----	7.00	8.60	7.70	17.50	11.00	8.00	9.00	6.30
21.....	6.70	14.60	7.50	-----	6.90	8.80	7.40	11.00	8.00	7.50	8.20	6.20
22.....	7.60	13.00	25.00	-----	6.80	9.00	7.10	9.00	7.00	7.00	7.00	6.00
23.....	7.30	12.00	28.20	-----	6.40	9.30	7.30	8.00	6.20	6.50	6.80	6.00
24.....	7.10	11.00	29.30	-----	6.30	11.70	8.00	7.90	6.00	6.40	6.40	6.00
25.....	7.00	10.50	30.40	-----	6.20	13.50	7.80	7.40	6.00	7.00	6.40	6.40
26.....	6.80	9.00	27.70	-----	6.10	11.00	7.60	7.00	6.00	6.50	6.40	6.50
27.....	6.60	8.50	20.70	-----	6.00	10.40	7.50	6.40	6.00	6.40	6.30	7.50
28.....	6.90	11.00	16.00	-----	5.90	10.20	7.30	6.00	6.00	6.20	6.00	7.00
29.....	9.50	-----	13.00	-----	8.30	10.50	7.00	6.00	6.00	6.20	6.00	6.50
30.....	9.20	-----	23.20	-----	8.60	9.50	6.90	6.00	5.80	6.20	6.00	6.60
31.....	7.70	-----	27.60	-----	8.70	-----	8.50	6.00	-----	6.20	-----	6.50

<sup>a</sup>Furnished by United States Weather Bureau. <sup>b</sup>No record. <sup>c</sup>No record for May 1 to 14.



## CATAWBA RIVER NEAR CATAWBA, S. C.

This station was established in order to continue the records on Catawba River after the Rockhill station had been abandoned. No very favorable section was found; but this one was selected as the most available one, and a temporary gage was put in by J. M. Giles on September 11, 1903, in order to start the gage-height records.

The station is located at the bridge of the Southern Railway, 2 miles southeast of Catawba, S. C., and about 2 miles below the crossing of the Seaboard Air Line Railway. The deck bridge, from which measurements are made, is a three-span wooden-lattice structure about 520 feet long, with 250 feet of trestle approach on right bank and 160 feet on the left bank. At ordinary stages the river is about 490 feet wide; at high stages the banks, which are rather high, will overflow to some extent, but all water will pass under the bridge and its approaches. The bed is partly rock and will probably shift little. The channel is straight above and below the bridge. The current is sluggish at low water—rather too much so for accurate work. The bridge is not quite at right angles with the current and corrections are made to the widths in computing measurements.

The measurements are made from a plank footway on the lower members of the bridge. The initial point for soundings is the river edge of the capstone on the left bank pier. The gage is a vertical 1 by 4 inch timber, reading from zero to 10 feet, and consists of two 5-foot sections fastened to a 3 by 10 inch timber, which is driven into the bed of the river and spiked to a willow tree. It is located on the left bank of the river, about 85 feet above the bridge.

Bench mark No. 1 is the top of the joint plate on the upstream bottom chord, at a point 44 feet from the initial point. Its elevation is 31 feet above the zero of the gage. Bench mark No. 2 is a standard copper plug set in a sycamore tree 10 feet from the edge of the river and about 100 feet upstream from the bridge. Its elevation is 10.86 feet above the zero of the gage.

The observer is J. Y. Brice, who is conveniently located at the railroad pump house near by. During 1903 the gage was read once a day. During 1904 it will be read twice a day.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Catawba River near Catawba, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
September 11.....	J. M. Giles .....	3.02	3,944
October 23 .....	do .....	2.30	2,253
December 11 .....	do .....	2.40	2,057
August 10.....	do .....	$\alpha$ 2.52	2,506

 $\alpha$  From bench mark.

*Mean daily gage height, in feet, of Catawba River near Catawba, S. C., for 1903.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1.....		2.30	2.30	2.30	12.....	2.60	2.40	2.40	2.40	23.....	2.50	2.30	2.40	2.70
2.....		2.20	2.30	2.30	13.....	2.50	2.40	2.40	2.30	24.....	2.40	2.70	2.50	2.60
3.....		2.20	2.30	2.30	14.....	2.30	2.30	2.40	2.30	25.....	2.50	2.60	2.50	2.50
4.....		2.20	2.30	2.30	15.....	2.30	2.30	2.40	2.30	26.....	2.30	2.30	2.40	2.90
5.....		2.20	3.00	2.30	16.....	2.30	2.20	2.40	2.40	27.....	2.30	2.30	2.40	2.70
6.....		2.20	3.60	2.30	17.....	7.20	2.30	2.40	2.30	28.....	2.30	2.30	2.40	2.50
7.....		2.20	3.10	2.30	18.....	6.90	3.10	2.60	2.30	29.....	2.20	2.30	2.30	2.50
8.....		2.30	2.70	2.30	19.....	4.00	2.60	3.40	2.30	30.....	2.30	2.30	2.30	2.40
9.....		2.60	2.40	2.40	20.....	3.00	2.60	3.20	2.30	31.....		2.30		2.40
10.....		3.40	2.40	2.40	21.....	2.60	2.50	2.80	2.50					
11.....	3.00	2.80	2.40	2.40	22.....	2.50	2.30	2.60	2.60					

#### CATAWBA RIVER NEAR ROCKHILL, S. C.

This station was established by C. C. Babb on September 3, 1895, and was discontinued May 31, 1903. It was located at the bridge of the Southern Railway, 3 miles south of Fort Mill, S. C., and about 60 miles below the Catawba station, now abandoned. A wire gage of the ordinary type is fastened to the upstream guard rail on the upper side, the 2-foot mark on the rod being over the center of the second vertical compression member of the second truss from the south end of the bridge. The distance from the zero of the rod to the outside edge of the pulley wheel is 1.3 feet, and from the end of the weight to the pointer on the wire is 52.96 feet.

The channel of the stream is curved above and below the bridge, which crosses at the head of a bend. The current flows at an angle with the bridge and is swift; the water is shallow at ordinary stages of the stream, and the bottom rough. Altogether, the station was a poor one. The observer was D. A. Morris, a farmer living near the bridge.

The station is reached from Rockhill by private conveyance.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer. The following discharge measurement was made by E. W. Myers in 1903:

March 24: Gage height, 17.75 feet; discharge, 96,981 second-feet.

*Mean daily gage height, in feet, of Catawba River near Rockhill, S. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1.....	2.20	2.40	8.87	8.00	2.80	2.80	2.40
2.....	2.10	2.30	6.50	5.35	2.75	2.80	2.20
3.....	10.00	2.20	4.20	4.40	2.70	3.20	2.20
4.....	8.50	2.40	3.50	4.10	2.70	3.20	2.15
5.....	5.70	6.15	3.20	4.20	2.70	3.00	2.15
6.....	3.90	5.20	3.10	3.90	2.70	3.30	2.70
7.....	3.20	3.50	3.00	3.50	2.70	10.45	2.95
8.....	2.90	8.37	3.50	3.20	2.60	7.20	2.40

*Mean daily gage height, in feet, of Catawba River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
9.....	2.60	7.80	3.55	10.15	2.60	4.60	2.40
10.....	2.50	5.10	5.40	7.90	2.60	3.40	2.20
11.....	2.30	4.10	4.30	5.10	2.55	5.50	2.10
12.....	3.10	7.02	4.90	4.10	2.50	4.40	2.00
13.....	3.00	5.90	4.80	5.80	2.50	3.50	2.15
14.....	2.70	4.15	4.80	9.35	2.50	3.00	2.30
15.....	2.40	3.40	3.50	8.70	2.50	2.80	2.40
16.....	2.40	3.20	3.25	5.70	2.50	2.60	2.20
17.....	2.35	10.25	3.10	4.40	2.50	2.50	2.00
18.....	2.30	9.70	2.95	3.85	2.40	2.50	2.00
19.....	2.20	5.40	2.85	3.60	2.40	2.45	2.00
20.....	2.20	3.80	2.80	3.55	2.35	2.40	2.00
21.....	2.30	3.35	2.70	3.50	2.30	2.70	2.00
22.....	2.50	3.15	6.45	3.60	2.30	2.40	1.95
23.....	2.65	2.90	13.30	3.35	2.30	2.90	1.90
24.....	2.50	2.80	18.00	3.20	2.30	4.20	1.90
25.....	2.40	2.75	11.40	3.10	2.25	3.00	1.90
26.....	2.30	2.65	5.70	3.10	2.25	2.50	1.85
27.....	2.25	2.60	4.10	3.30	2.25	2.80	1.80
28.....	2.40	3.80	3.80	3.10	2.20	2.60	1.80
29.....	2.50	-----	3.50	2.90	2.30	2.50	1.80
30.....	2.60	-----	6.85	2.80	2.20	2.40	2.70
31.....	2.50	-----	11.30	-----	2.40	-----	2.10

*Rating table for Catawba River near Rockhill, S. C., from January 1 to July 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.8	3,100	3.3	6,550	4.8	10,800	6.3	16,450
1.9	3,325	3.4	6,800	4.9	11,150	6.4	16,850
2.0	3,550	3.5	7,050	5.0	11,500	6.5	17,275
2.1	3,775	3.6	7,300	5.1	11,850	6.6	17,700
2.2	4,000	3.7	7,550	5.2	12,200	6.7	18,150
2.3	4,225	3.8	7,800	5.3	12,550	6.8	18,600
2.4	4,450	3.9	8,050	5.4	12,900	6.9	19,050
2.5	4,675	4.0	8,300	5.5	13,275	7.0	19,500
2.6	4,900	4.1	8,600	5.6	13,650	7.5	21,750
2.7	5,125	4.2	8,900	5.7	14,050	8.0	24,000
2.8	5,350	4.3	9,200	5.8	14,450	8.5	26,500
2.9	5,575	4.4	9,500	5.9	14,850	9.0	29,000
3.0	5,800	4.5	9,800	6.0	15,250	9.5	31,500
3.1	6,050	4.6	10,100	6.1	15,650	10.0	34,000
3.2	6,300	4.7	10,450	6.2	16,050	10.5	36,750

Table for 1903 same as 1902. Above 4.6 feet, gage height, 1901 and 1902 rating tables are the same.

*Estimated monthly discharge of Catawba River near Rockhill, S. C., for 1903.*

[Drainage area, 2,987 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	34,000	3,775	6,728	2.25	2.59
February .....	35,375	4,000	11,183	3.74	3.89
March .....	93,000	5,125	15,952	5.34	6.16
April .....	34,825	5,350	11,518	3.86	4.31
May .....	5,350	4,000	4,610	1.54	1.78
June .....	36,470	4,450	7,585	2.54	2.83
July .....	5,687	3,100	3,883	1.30	1.50

## CATAWBA RIVER NEAR MORGANTON, N. C.

The original station was established June 19, 1900, in connection with the hydrographic investigation of the Southern Appalachian area, at which time a wire gage was installed on the highway bridge on the road from Morganton to Hartland. In May, 1901, the river throughout this part of its course rose from 8 to 15 feet higher than ever before known, and the bridge and gage were destroyed. The present station was established May 15, 1903, by E. W. Myers, assisted by B. S. Drane, at the bridge which was built to replace the one carried away by the flood of May, 1901. The station is 1 mile north of Morganton and about 200 yards below the mouth of Upper Creek. The standard chain gage with inclosed scale is attached to the lower chord of the downstream side of the bridge. The zero of the scale is about 94 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 36.95 feet. The gage is read once each day by J. J. Edmundson. Discharge measurements are made from the downstream side of the single-span steel highway bridge to which the gage is attached. The initial point for soundings is the left end of the downstream hand rail. Distances are laid off along this rail and are marked in white paint. The channel is straight for about 200 feet above and for about 600 feet below the station. The current is swift. The right bank is low and overflows to a slight extent on account of erosion, but all water passes beneath the approach to the bridge. The left bank is high, rocky, and wooded. The bed of the stream is rocky, with sand and gravel near the right bank.

Bench mark No. 1 is the left side of the upper surface of the sixth floor beam at the downstream side of the bridge, 13 feet to the right of the zero of the gage. The point is indicated by a spot of white paint and the letters B. M. When the gage reads zero the water surface is 34.77 feet below this point. Bench mark No. 2 is a copper

plug set in cement in a rock on the left bank 24.3 feet back of the initial point for soundings, and is 3 feet downstream from the line of the downstream truss. It is about  $1\frac{1}{2}$  feet above the road and is inclosed in a circle of white paint and marked "B. M." Its elevation is 37.37 feet above datum of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Catawba River near Morganton, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 13.....	E. W. Myers.....	2.77	2,861
May 5.....	do.....	2.04	1,656
Do.....	do.....	2.05	1,698
June 25.....	do.....	1.93	1,276
Do.....	do.....	1.95	1,282
August 21.....	B. S. Drane.....	1.77	1,181
Do.....	do.....	1.76	1,193
October 28.....	do.....	1.16	528
Do.....	do.....	1.18	559
December 11.....	do.....	1.19	480
Do.....	do.....	1.22	493

*Mean daily gage height, in feet, of Catawba River near Morganton, N. C., for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3.45	1.75	1.50	1.55	1.25	1.20	1.20
2.....		3.45	1.70	1.75	1.45	1.25	1.20	1.20
3.....		3.25	1.70	1.60	1.35	1.25	1.20	1.20
4.....		2.45	1.75	2.55	1.35	1.25	1.20	1.20
5.....		3.00	2.00	2.25	1.30	1.25	2.00	1.20
6.....	2.00	10.00	2.00	1.50	1.35	1.30	1.55	1.20
7.....	2.00	5.25	2.15	1.50	1.30	1.50	1.35	1.20
8.....	1.95	3.60	1.80	1.40	1.45	3.00	1.25	1.20
9.....	1.95	2.45	1.70	1.35	1.95	1.65	1.25	1.20
10.....	1.95	6.45	1.65	1.30	1.45	1.40	1.25	1.20
11.....	1.95	4.00	1.80	1.40	1.40	1.40	1.25	1.20
12.....	1.90	3.35	2.00	1.60	1.45	1.35	1.20	1.15
13.....	1.90	2.90	2.40	1.85	1.30	1.35	1.20	1.30
14.....	2.00	2.60	2.00	1.95	1.35	1.30	1.20	1.25
15.....	1.95	2.45	1.90	1.80	1.40	1.30	1.20	1.25
16.....	1.90	2.35	1.80	2.75	1.75	1.30	1.20	1.25
17.....	1.90	2.30	1.75	2.00	2.15	1.50	1.70	1.25
18.....	1.90	2.60	1.70	2.00	2.05	1.50	2.20	1.20
19.....	1.85	2.25	1.70	1.85	1.50	1.40	1.60	1.20
20.....	1.85	2.20	1.70	1.75	1.45	1.40	1.40	1.40
21.....	1.80	2.15	1.60	1.85	1.35	1.35	1.30	1.60
22.....	1.75	2.05	1.50	1.45	1.35	1.35	1.30	1.40
23.....	1.75	2.80	1.50	1.50	1.30	1.35	1.30	1.30
24.....	1.75	2.15	1.50	1.50	1.30	1.30	1.30	1.30
25.....	1.75	2.05	1.50	1.35	1.25	1.30	1.30	1.30

*Mean daily gage height, in feet, of Catawba River, etc.—Continued.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26.....	1.75	2.00	1.45	1.35	1.30	1.30	1.25	1.30
27.....	1.80	1.95	1.45	1.30	1.30	1.30	1.25	1.30
28.....	1.70	.....	1.40	1.00	1.30	1.25	1.20	1.30
29.....	1.70	2.00	1.60	1.25	1.25	1.20	1.20	1.30
30.....	2.25	1.80	1.70	1.25	1.25	1.20	1.20	1.25
31.....	1.95	.....	1.60	1.20	.....	1.25	.....	1.25

*Estimated monthly discharge of Catawba River near Morganton, N. C., for 1903.*

[Drainage area, 758 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 6-31.....	1,925	1,026	1,283	1.69	1.63
June.....	17,040	1,156	3,476	4.59	5.12
July.....	2,220	702	1,100	1.45	1.67
August.....	2,902	367	1,028	1.36	1.57
September.....	1,735	569	770	1.02	1.14
October.....	3,390	526	735	.97	1.12
November.....	1,830	526	674	.89	.99
December.....	908	485	579	.76	.88

*Rating table for Catawba River near Morganton, N. C., from May 6 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	367	2.4	2,220	3.8	4,950	5.2	7,680
1.1	444	2.5	2,415	3.9	5,145	5.3	7,875
1.2	526	2.6	2,610	4.0	5,340	5.4	8,070
1.3	612	2.7	2,805	4.1	5,535	5.5	8,265
1.4	702	2.8	3,000	4.2	5,730	5.6	8,460
1.5	800	2.9	3,195	4.3	5,925	5.7	8,655
1.6	908	3.0	3,390	4.4	6,120	5.8	8,850
1.7	1,026	3.1	3,585	4.5	6,315	5.9	9,045
1.8	1,156	3.2	3,780	4.6	6,510	6.0	9,240
1.9	1,300	3.3	3,975	4.7	6,705	6.5	10,215
2.0	1,460	3.4	4,170	4.8	6,900	7.0	11,190
2.1	1,640	3.5	4,365	4.9	7,095		
2.2	1,830	3.6	4,560	5.0	7,290		
2.3	2,025	3.7	4,755	5.1	7,485		

Above 7 feet gage height differences are 195 per tenth.

## BROAD RIVER (OF THE CAROLINAS) AT ALSTON, S. C.

This station was established July 3, 1896, by E. W. Myers at the Southern Railroad bridge at Alston, S. C., about 27 miles above Columbia. The standard chain gage is located in the second span from the left end of the bridge. The zero of the scale is 74 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 39.22 feet. The observer is G. M. Heron, a farmer of Alston, S. C., who reads the gage once each day. Discharge measurements are made from the downstream side of the steel through 6-span railway bridge to which the gage is attached. The initial point for soundings is the end of the second span nearest the left bank over the center of the pier. At flood stages some water passes behind this point. The channel above the station is straight, but the current is interrupted by a large island and passes under the bridge at an angle. Below the bridge the channel is straight for about one-half mile. Both banks are high and all water passes beneath the bridge. The bed of the stream is of sand and silt and is slightly shifting. There is but one channel at all stages.

Bench mark No. 1 is a point on the right side of the downstream end of the fifth floor beam from the left end of the second span from the left end of the bridge. It is marked in white paint and is indicated by the letters B. M. When the gage reads zero the water surface is 36.44 feet below this point. Bench mark No. 2 is a standard copper bolt set in rock on the left bank on the hillside 50 yards from the river and 52 feet downstream from the center line of the trestle approach to the bridge and is 21.2 feet from the corner of the pump house. The rock is white and the bench mark is under a small china tree. This bench mark is 9.85 feet below the bench mark on the bridge, making its elevation 26.59 feet above the gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Broad River at Alston, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 23 .....	E. W. Myers .....	19.85	71, 138
April 17 .....	E. C. Murphy .....	7.74	15, 058
June 24 .....	B. S. Drane .....	6.20	10, 591
August 6 .....	J. M. Giles .....	5.58	8, 259
Do .....	M. R. Hall .....	5.58	7, 954
September 10 .....	J. M. Giles .....	4.86	7, 218
October 22 .....	do .....	3.45	3, 219
December 10 .....	do .....	3.75	3, 437

*Mean daily gage height, in feet, of Broad River at Alston, S. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.60	4.90	15.12	13.50	5.20	5.60	4.90	3.80	3.60	3.30	3.40	3.20
2.....	4.25	4.65	11.25	10.00	5.10	7.55	4.40	3.90	7.10	3.20	3.40	3.60
3.....	12.60	4.45	7.90	7.90	5.00	8.70	4.20	6.60	4.50	3.20	3.50	3.50
4.....	12.72	7.25	6.55	7.20	5.30	6.65	4.30	4.70	4.20	3.25	3.90	3.60
5.....	9.85	10.00	6.25	7.00	5.00	7.30	4.50	5.50	4.00	3.20	4.50	3.60
6.....	7.75	8.20	5.80	6.40	5.10	13.60	4.70	5.70	3.60	3.10	5.60	3.60
7.....	6.55	7.55	5.75	6.20	5.00	27.20	5.10	5.50	3.60	3.40	4.50	3.60
8.....	5.70	18.90	7.12	6.00	4.90	26.70	4.80	3.90	3.20	3.50	4.00	3.70
9.....	5.30	18.00	6.90	8.20	4.90	17.30	4.30	3.60	3.40	4.00	3.70	3.80
10.....	5.05	11.85	7.83	10.20	4.80	9.90	4.10	3.60	4.80	3.90	3.50	3.70
11.....	4.85	11.82	6.50	7.40	4.80	8.90	4.00	3.20	4.00	3.70	3.70	3.70
12.....	7.62	15.97	8.55	6.60	4.60	10.20	4.00	4.20	4.20	3.40	3.60	3.70
13.....	7.40	13.65	8.45	6.30	4.80	7.60	4.20	3.70	3.40	3.20	3.50	3.60
14.....	6.05	9.65	7.35	15.75	4.90	6.20	4.90	4.40	3.30	3.40	3.50	3.70
15.....	5.45	7.25	6.53	14.95	5.10	5.80	4.50	5.70	3.10	3.40	3.50	3.50
16.....	5.20	6.30	6.00	11.05	4.90	5.40	4.20	7.15	3.60	3.20	3.40	3.80
17.....	4.80	15.75	5.80	8.40	4.70	5.20	3.90	8.60	7.00	3.60	3.30	3.70
18.....	4.85	17.15	5.50	7.15	4.60	5.00	3.80	7.10	6.20	4.60	3.40	3.70
19.....	4.60	11.50	5.37	6.70	4.50	5.00	3.80	8.20	4.70	3.80	4.20	3.80
20.....	4.45	8.82	5.43	6.50	4.40	5.00	3.80	8.40	3.90	3.40	3.90	3.60
21.....	4.80	6.80	8.25	6.10	4.40	4.80	3.50	6.20	3.70	3.50	3.60	3.70
22.....	5.25	6.30	13.95	6.40	4.30	4.90	3.60	4.60	3.40	3.40	3.50	3.60
23.....	5.20	5.75	20.60	5.90	4.20	5.20	3.50	4.40	3.50	3.40	3.60	4.00
24.....	4.70	5.60	25.10	5.80	4.20	6.00	3.50	4.20	3.50	3.70	3.40	3.80
25.....	4.45	5.35	19.00	5.60	4.30	5.50	3.40	3.70	3.50	3.70	3.70	3.80
26.....	4.60	5.15	10.70	5.30	4.00	4.90	3.40	3.70	3.40	3.40	3.60	4.20
27.....	4.60	4.95	7.90	6.80	4.10	5.30	3.20	3.50	3.30	3.20	3.50	4.10
28.....	4.65	11.17	7.20	5.80	4.20	4.80	3.10	3.50	3.40	3.40	3.50	4.00
29.....	6.05	-----	7.95	5.40	7.10	5.70	3.20	3.50	3.10	3.40	3.50	3.70
30.....	5.70	-----	17.40	5.30	6.60	5.70	4.00	3.30	3.30	3.30	3.50	3.80
31.....	5.25	-----	19.05	-----	5.20	-----	4.00	3.80	-----	3.20	-----	3.70



*Rating table for Broad River at Alston, S. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.0	2,250	5.5	8,225	10.0	22,150	15.0	43,300
3.1	2,420	5.6	8,500	10.2	22,800	15.2	44,400
3.2	2,590	5.7	8,775	10.4	23,500	15.4	45,500
3.3	2,770	5.8	9,050	10.6	24,200	15.6	46,650
3.4	2,960	5.9	9,325	10.8	24,900	15.8	47,800
3.5	3,150	6.0	9,600	11.0	25,650	16.0	48,950
3.6	3,350	6.2	10,200	11.2	26,400	16.2	50,100
3.7	3,560	6.4	10,800	11.4	27,150	16.4	51,250
3.8	3,780	6.6	11,400	11.6	27,900	16.6	52,450
3.9	4,010	6.8	12,000	11.8	28,700	16.8	53,650
4.0	4,250	7.0	12,600	12.0	29,500	17.0	54,850
4.1	4,500	7.2	13,200	12.2	30,300	17.2	56,150
4.2	4,750	7.4	13,800	12.4	31,150	17.4	57,500
4.3	5,000	7.6	14,400	12.6	32,000	17.6	58,900
4.4	5,250	7.8	15,000	12.8	32,850	17.8	60,300
4.5	5,500	8.0	15,650	13.0	33,700	18.0	61,700
4.6	5,750	8.2	16,300	13.2	34,550	18.2	63,100
4.7	6,025	8.4	16,950	13.4	35,450	18.4	64,500
4.8	6,300	8.6	17,600	13.6	36,350	18.6	66,000
4.9	6,575	8.8	18,250	13.8	37,250	18.8	67,500
5.0	6,850	9.0	18,900	14.0	38,200	19.0	69,000
5.1	7,125	9.2	19,550	14.2	39,150	19.2	70,500
5.2	7,400	9.4	20,200	14.4	40,150		
5.3	7,675	9.6	20,850	14.6	41,200		
5.4	7,950	9.8	21,500	14.8	42,250		

Differences above 19 feet gage height, 750 per tenth. Table not well determined above 8 feet gage height.

*Estimated monthly discharge of Broad River at Alston, S. C., for 1903.*

[Drainage area, 4,609 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	32,425	4,875	9,882	2.14	2.47
February .....	63,800	5,375	22,647	4.91	5.11
March .....	114,750	7,812	25,601	5.55	6.40
April .....	47,512	7,675	15,578	3.38	3.77
May .....	12,900	4,250	6,474	1.40	1.61
June .....	130,500	6,300	20,836	4.52	5.04
July .....	7,125	2,420	4,407	.96	1.11
August .....	17,600	2,590	6,837	1.48	1.71
September .....	12,900	2,420	4,416	.96	1.07
October .....	5,750	2,420	3,136	.68	.78
November .....	8,500	2,770	3,656	.79	.88
December .....	4,750	2,590	3,604	.78	.90
The year .....	130,500	2,420	10,589	2.30	30.85

#### SALUDA RIVER NEAR WATERLOO, S. C.

This station was established by E. W. Myers, August 30, 1896. It is located at the Charleston and Western Carolina Railroad bridge between Coronaca and Waterloo, 3 miles from Waterloo and 9 miles from Greenwood. It is 1 mile below the mouth of Reedy River. The standard chain gage is on the downstream side of the bridge, on the span next the left bank, in the seventh panel. The zero of the gage is 5.4 feet to the right of the panel point. The length of the chain from the end of the weight to the marker is 45.65 feet. July 20, 1902, the gage was changed so as to increase the readings 1.5 feet. The 1902 gage heights were all referred to the new datum. The gage is read once each day by R. N. Cunningham, storekeeper and farmer at Waterloo, S. C. Discharge measurements are made from the railway bridge and its approaches. The bridge is a steel through bridge of two spans about 125 feet each, with wooden trestles 600 feet long on the left bank and 200 feet on the right bank. The initial point for soundings is the end of the guard rail of the trestle on the left bank. The channel is straight for about 600 feet above and below the station. Both banks are low and wooded and are subject to overflow, but all water passes beneath the bridge and its approaches. The bed of the stream is sandy and muddy and is slightly shifting.

There is but one channel at all stages. Its width at low water is 250 feet, the channel is broken by one pier, and the velocity is moderate.

Bench mark No. 1 is a point on the top surface of the outer eye bar of the lower chord of the downstream side of the bridge, at a point opposite the zero of the gage. The point is indicated by a spot of white paint and by the letters "B. M." When the gage reads zero the water surface is 43.59 feet below this bench mark. Bench mark No. 2 is a copper bolt set in a granite boulder on the right bank of the stream 470 feet from the end of the trestle (measured along the railroad track) and 50 feet upstream from the center of the track. Its elevation is 61.44 feet above gage datum. The rock is near two small persimmon trees.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Saluda River near Waterloo, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 23.....	E. W. Myers.....	17.40	12,968
April 18.....	E. C. Murphy.....	9.40	3,481
Do.....	B. S. Drane.....	9.60	3,739
April 21.....	do.....	9.20	3,747
June 25.....	do.....	6.76	1,375
Do.....	do.....	7.03	1,527
August 5.....	J. M. Giles.....	6.88	1,543
Do.....	M. R. Hall.....	6.88	1,458
September 9.....	J. M. Giles.....	6.38	1,245
October 21.....	do.....	6.28	1,176
December 9.....	do.....	5.90	883

*Mean daily gage height, in feet, of Saluda River near Waterloo, S. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.45	7.90	14.70	11.20	7.75	9.85	7.15	6.85	5.55	5.50	5.30	6.00
2.....	7.20	6.20	12.70	9.80	7.80	10.40	6.55	6.85	5.50	5.55	5.50	5.80
3.....	11.40	6.60	9.90	9.45	7.85	8.40	6.90	7.15	5.50	6.25	7.90	6.10
4.....	10.90	10.60	9.20	9.05	8.20	7.75	18.25	6.20	5.55	5.20	7.10	5.80
5.....	9.10	12.50	8.90	9.30	8.05	12.15	5.70	7.00	5.55	5.30	8.45	5.75
6.....	8.05	9.60	9.00	8.75	7.90	14.00	7.95	7.15	6.35	5.30	6.70	5.55
7.....	7.60	11.00	8.70	8.50	7.90	19.25	7.45	6.20	4.90	5.60	6.90	4.75
8.....	7.40	19.60	9.00	9.90	7.70	22.35	6.85	6.55	5.40	5.75	6.60	5.95
9.....	6.80	17.60	9.70	10.80	7.10	14.45	6.25	6.35	5.60	5.55	5.65	6.05
10.....	7.10	11.70	9.80	9.20	8.30	10.30	6.25	5.75	8.05	6.25	6.10	5.90
11.....	8.90	13.30	9.70	9.40	6.05	11.20	6.90	5.70	6.10	5.60	6.00	5.90
12.....	9.30	17.05	11.90	9.60	7.40	10.10	7.30	6.05	6.30	4.95	5.80	6.00

*Mean daily gage height, in feet, of Saluda River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13.....	8.70	15.30	12.50	11.00	7.60	9.15	7.60	6.15	5.95	5.50	5.85	5.70
14.....	7.75	10.85	9.90	17.70	7.25	8.55	8.00	5.85	5.05	5.55	6.55	4.90
15.....	7.30	9.95	9.50	16.45	7.60	8.35	7.25	6.70	5.45	5.60	5.70	6.15
16.....	7.30	8.80	9.00	11.20	7.15	8.25	6.45	7.40	6.55	5.55	5.45	6.00
17.....	7.20	15.80	8.70	9.90	7.55	8.20	6.10	7.30	5.90	6.45	6.50	6.35
18.....	7.60	16.20	8.50	9.40	5.90	7.90	6.05	9.90	6.05	5.55	6.15	5.65
19.....	6.10	13.60	8.20	9.65	6.85	7.85	7.95	11.00	6.60	5.35	5.15	5.90
20.....	6.90	9.70	8.30	-----	7.70	7.15	5.15	7.60	5.75	5.55	5.95	5.60
21.....	6.45	9.30	8.40	-----	6.65	7.55	5.65	6.55	5.60	6.35	6.10	4.90
22.....	6.60	8.85	11.00	-----	6.60	7.15	5.95	7.00	5.45	5.55	5.70	6.05
23.....	6.40	8.55	17.40	-----	6.55	8.60	5.85	6.65	5.50	6.20	5.75	6.00
24.....	6.70	8.40	16.30	-----	7.05	7.95	5.75	5.85	5.60	5.65	6.00	5.95
25.....	7.40	7.45	15.20	8.30	6.05	7.10	6.00	5.75	5.40	5.25	5.85	5.75
26.....	6.50	8.00	10.30	9.10	9.25	7.20	6.50	5.70	5.50	5.10	5.85	5.50
27.....	6.90	8.50	9.45	8.40	6.20	7.40	5.70	5.45	5.25	5.55	4.80	6.15
28.....	6.50	12.00	9.05	8.35	8.55	7.95	6.45	5.45	5.10	5.70	6.55	5.85
29.....	8.40	-----	11.90	8.15	7.95	8.10	6.25	5.60	5.40	5.70	5.85	5.95
30.....	7.40	-----	15.50	8.10	7.50	8.00	6.00	6.25	5.45	5.70	5.25	5.90
31.....	7.40	-----	14.40	-----	7.95	-----	7.05	4.85	-----	6.30	-----	5.65

*Rating table for Saluda River near Waterloo, S. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
4.7	386	6.1	1,040	7.5	1,890	8.9	2,990
4.8	423	6.2	1,095	7.6	1,960	9.0	3,085
4.9	461	6.3	1,150	7.7	2,030	9.1	3,180
5.0	500	6.4	1,205	7.8	2,100	9.2	3,280
5.1	540	6.5	1,260	7.9	2,175	9.3	3,380
5.2	582	6.6	1,320	8.0	2,250	9.4	3,485
5.3	626	6.7	1,380	8.1	2,325	9.5	3,590
5.4	672	6.8	1,440	8.2	2,400	9.6	3,700
5.5	720	6.9	1,500	8.3	2,480	9.7	3,810
5.6	770	7.0	1,560	8.4	2,560	9.8	3,920
5.7	822	7.1	1,625	8.5	2,640	9.9	4,035
5.8	875	7.2	1,690	8.6	2,725	10.0	4,150
5.9	930	7.3	1,755	8.7	2,810	10.1	4,270
6.0	985	7.4	1,820	8.8	2,900		

Above gage height 10 feet, differences 120 per tenth.

*Estimated monthly discharge of Saluda River near Waterloo, S. C., for 1903.*

[Drainage area, 1,056 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	5,830	1,040	2,074	1.96	2.26
February .....	15,670	1,095	5,858	5.55	5.78
March .....	13,030	2,400	5,273	4.99	5.75
April <sup>a</sup> .....	13,390	2,325	4,303	4.07	3.78
May .....	2,682	930	1,798	1.70	1.96
June .....	18,970	1,625	4,222	4.00	4.46
July .....	14,050	561	1,748	1.66	1.91
August .....	5,350	442	1,417	1.34	1.54
September .....	2,287	461	856	.81	.90
October .....	1,232	480	802	.76	.88
November .....	2,600	423	1,072	1.02	1.14
December .....	1,177	404	882	.84	.97

<sup>a</sup> April 23-24 missing.

#### MISCELLANEOUS MEASUREMENTS IN SANTEE RIVER DRAINAGE BASIN.

*Wateree River.*—Measurements were made at Camden, S. C. The gage heights were measured by the United States Weather Bureau gage.

*Discharge measurements of Wateree River at Camden, S. C., in 1903.*

Date.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
May 26 .....	8.35	3,929
June 23 .....	10.75	6,222
Do .....	10.90	6,694
August 7 .....	9.15	6,285

*Catawba River.*—Measurements were made on this stream at the Lancaster and Chester Railroad bridge near Fort Lawn, S. C. The bench mark is the top of first crossbeam from second pier from left bank of the railroad bridge. It has an elevation of 33 feet above gage datum.

*Discharge measurements of Catawba River near Fort Lawn, S. C., in 1903.*

Date.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 8 .....	3.98	5,070
September 12 .....	2.90	3,137
October 24 .....	2.93	3,107
December 12 .....	2.45	2,108

At Mount Holly, N. C., Catawba River was discharging 1,192 second-feet on November 13.

At Belmont, N. C., the stream was discharging 1,393 second-feet on December 3, when the water surface was 27.48 feet below the bench mark, which is the top of inside bar of lower downstream chord at first crossbeam from third pier from left bank.

*John River.*—At Morganton, N. C., this stream had a discharge of 1,192 second-feet on February 13, 1903.

*Broad River.*—At the Seaboard Air Line bridge near Carlisle, S. C., this stream was discharging 3,663 second-feet on August 11, 1903, when the water surface was 34.16 feet below the top of the first crossbeam of the second span from right bank.

*Tiger River.*—This stream was measured at the Seaboard Air Line bridge near Delta, S. C. The bench mark is the top of the downstream end of the second crossbeam from the right bank.

*Discharge measurements of Tiger River near Delta, S. C.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 12 .....	32.52	921
October 27 .....	34.25	411

*Enoree River.*—This stream was measured at the Seaboard Air Line bridge near Whitmire, S. C. The bench mark is the top of the girder under cross-ties at a point 50 feet from end of bridge at right bank downstream.

*Discharge measurements of Enoree River near Whitmire, S. C.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 13 .....	54.50	470
October 27 .....	54.40	293

A mill about one-half mile below prevents rating at this place.

**SAVANNAH RIVER DRAINAGE BASIN.**

Savannah River is formed by the junction of Tugalo and Seneca rivers, which unite about 100 miles above Augusta, Ga. It flows in a southeasterly direction, forming the boundary between Georgia and South Carolina, and empties into the Atlantic Ocean near Savannah, Ga. It is navigable up to Augusta, which is at the fall line.

Seneca River is formed by the junction of Little and Keowee rivers, about 5 miles northeast of Seneca, S. C. Both of these tributaries rise in the Blue Ridge in North Carolina and the northwestern part of South Carolina.

Tugalo River is formed by the junction of Chattooga and Tallulah rivers, which join at the western corner of Oconee County, S. C. It flows in a southeasterly direction, and is a part of the boundary between Georgia and South Carolina. Chattooga River rises in Jackson County, N. C., and flows in a southwesterly direction along the boundary between Georgia and South Carolina. Tallulah River rises in Macon County, N. C., and the northwestern part of Rabun County, Ga., and flows in a southeasterly direction. Parts of its course are cut through the solid rock for hundreds of feet, forming canyons and steep bluffs. Throughout its entire length the fall is very great, and at Tallulah Falls the stream drops more than 500 feet in a short distance.

Broad River joins the Savannah at the southeast corner of Elbert County, Ga. It rises in Habersham and Banks counties, and flows in a southeasterly direction to the southeast corner of Madison County, Ga., where the South Fork joins it. From there it flows east to Savannah River. Its drainage is from a rolling country, and there is a considerable amount of fall at various points. At Anthony Shoals the fall is more than 50 feet in a short distance. Above Augusta, Ga., there is much fall, which can be developed for water power. With exception of the large plant at Augusta, very little of this is being used.

The United States Geological Survey during 1903 maintained the following stations in this basin under the direction of M. R. Hall: On the Savannah, at Augusta and Calhoun Falls; on the Broad (of

Georgia), at Carlton, Ga.; on the Seneca, near Clemson College, S. C.; and on the Tugalo, near Fort Madison, S. C.

#### SAVANNAH RIVER AT AUGUSTA, GA.

Observations of river height have been maintained since 1875 by the city of Augusta at the city highway bridge. The results have been printed in a volume entitled "Stages of Water at River Stations," prepared by the United States Weather Bureau. Those for 1875 to 1889 are given in part 3, those for 1890 to 1892 in part 4, and those for 1893 to 1895 in part 5 of this publication. The gage consists of a vertical timber fastened to the pier and graduated to feet and inches. Readings are made four times a day by J. M. Youngblood, keeper of the city bridge, usually at 6 a. m., 12 m., 6 p. m., and 9 p. m. The 6 a. m. readings are those used by the Weather Bureau, but in the publications of the United States Geological Survey since 1900 the average of all four of the daily readings is used and is reduced to feet and tenths of feet.

Discharge measurements are made from the North Augusta highway bridge at Thirteenth street in the city of Augusta, while the city gage is located at the city bridge at Fifth street, which is about a mile below.

The North Augusta bridge consists of three iron spans, 208 feet each, with 319 feet of wooden approach on the right bank and 259 feet on the left. The channel is straight for a long distance above and below and is about 560 feet wide at low water. The banks are high, but will overflow at times under a part of the length of the approaches and, at very high stages, for a long distance on either side of the river beyond the ends of the bridge. The bed of the river is sandy and undergoes considerable change. The current is swift. Measurements are made from the downstream side of the bridge, and the initial point is the end of the iron bridge at the right bank on the downstream side.

The gage at the city bridge, 1 mile below the measuring station, is a heavy vertical timber, graduated to feet and inches, and is bolted to the first bridge pier which is in the water. It is on the side of the pier near the upstream corner, facing the right bank. The zero of the gage is the datum of all the city levels, and any city bench mark can therefore be used. A point is established on the North Augusta bridge from which to measure down with a steel tape. This is the top of the downstream end of the second iron crossbeam from the right-bank end of the bridge, and at ordinary stages it is 48.60 feet above water, less the reading of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.



*Discharge measurements of Savannah River at Augusta, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 10 .....	M. R. Hall .....	15.10	17,741
September 29 .....	do .....	7.13	3,831
December 3 .....	W. E. Hall .....	7.20	3,898

*Mean daily gage height, in feet, of Savannah River at Augusta, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	9.70	10.20	26.70	23.40	10.60	11.00	9.70	9.00	7.40	7.10	6.80	7.00
2 .....	9.40	9.60	24.00	18.70	10.50	16.30	9.40	8.90	7.20	7.00	7.20	7.20
3 .....	11.20	9.70	18.40	16.10	10.50	20.00	9.00	12.00	7.30	7.00	8.30	7.20
4 .....	13.80	10.80	14.90	15.20	10.60	15.30	9.50	13.60	7.30	6.90	9.10	7.10
5 .....	13.90	18.50	13.90	14.60	12.40	13.20	9.60	11.70	7.40	7.10	9.10	7.00
6 .....	12.20	18.20	13.70	13.90	11.30	19.90	10.60	10.60	7.20	6.90	9.40	7.00
7 .....	10.70	14.60	13.70	13.00	10.70	24.70	10.00	9.50	7.10	7.10	8.80	7.10
8 .....	9.90	30.70	13.30	13.30	10.50	25.50	10.10	8.60	7.20	7.10	8.00	7.20
9 .....	9.50	33.00	15.00	16.80	10.50	17.70	9.50	8.10	7.30	7.20	7.80	7.30
10 .....	9.20	28.70	15.10	17.50	10.40	15.60	9.20	8.10	7.20	7.50	7.60	7.40
11 .....	9.26	24.10	14.90	14.90	10.40	16.10	9.20	8.10	8.30	7.40	7.60	7.40
12 .....	11.70	28.40	18.20	13.30	10.00	16.10	9.90	10.00	7.80	7.30	7.50	7.40
13 .....	14.10	26.50	19.00	13.10	10.00	15.00	10.00	9.10	7.20	7.00	7.50	7.10
14 .....	12.20	20.40	15.30	20.40	10.40	12.10	13.20	8.30	7.40	7.00	7.50	7.20
15 .....	10.60	16.00	13.80	23.60	11.20	11.20	13.40	9.50	8.20	6.90	7.30	7.40
16 .....	9.90	14.40	13.20	17.80	12.90	10.60	11.00	9.80	9.40	6.90	7.30	7.60
17 .....	9.60	25.90	12.70	14.60	11.70	10.10	9.50	10.30	11.90	7.30	7.30	7.50
18 .....	9.30	29.10	12.20	13.60	10.50	9.80	8.90	9.90	10.80	9.20	7.50	7.30
19 .....	9.20	23.40	11.90	12.70	9.90	9.70	8.70	17.70	9.00	8.40	7.60	7.20
20 .....	9.10	18.60	11.80	12.50	9.60	9.60	8.40	14.80	8.10	8.20	7.80	7.00
21 .....	9.10	14.60	12.00	12.30	9.50	9.80	8.20	11.30	8.20	7.60	7.70	7.10
22 .....	9.20	13.10	18.20	12.30	9.40	10.40	8.20	9.90	7.60	7.40	7.30	7.40
23 .....	9.00	12.60	25.50	11.90	9.50	9.80	8.10	8.70	7.50	7.00	7.30	7.90
24 .....	9.00	12.10	29.40	11.50	9.20	9.40	8.10	8.40	7.40	7.10	7.30	7.60
25 .....	9.10	11.70	28.60	11.10	9.20	9.40	8.00	8.30	7.40	6.80	7.40	7.40
26 .....	9.90	11.50	22.50	11.40	9.00	9.30	7.60	8.00	7.40	7.00	7.30	7.70
27 .....	10.20	11.60	17.10	11.70	8.70	9.70	7.90	7.80	7.20	7.00	7.30	8.00
28 .....	10.90	16.90	15.20	11.50	8.80	10.70	8.00	7.60	7.20	6.90	7.10	8.00
29 .....	10.90	-----	14.80	11.00	9.40	12.90	7.70	7.60	7.10	6.90	7.00	7.60
30 .....	11.80	-----	25.30	10.70	9.60	11.00	8.00	7.50	7.10	7.00	7.10	7.50
31 .....	11.20	-----	27.30	-----	9.70	-----	8.70	7.50	-----	7.00	-----	7.60

*Rating table for Savannah River at Augusta, Ga., for 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
6.8	3,400	10.8	11,200	14.8	19,660	23.0	45,800
7.0	3,740	11.0	11,600	15.0	20,100	23.5	48,900
7.2	4,100	11.2	12,020	15.2	20,560	24.0	52,000
7.4	4,460	11.4	12,440	15.4	21,020	24.5	56,000
7.6	4,840	11.6	12,860	15.6	21,480	25.0	60,000
7.8	5,220	11.8	13,280	15.8	21,940	25.5	64,400
8.0	5,600	12.0	13,700	16.0	22,400	26.0	68,800
8.2	6,000	12.2	14,120	16.5	23,600	26.5	73,200
8.4	6,400	12.4	14,540	17.0	24,800	27.0	77,600
8.6	6,800	12.6	14,960	17.5	26,050	27.5	82,000
8.8	7,200	12.8	15,380	18.0	27,300	28.0	86,400
9.0	7,600	13.0	15,800	18.5	28,700	28.5	90,800
9.2	8,000	13.2	16,220	19.0	30,100	29.0	95,200
9.4	8,400	13.4	16,640	19.5	31,700	29.5	99,600
9.6	8,800	13.6	17,060	20.0	33,300	30.0	104,000
9.8	9,200	13.8	17,480	20.5	35,100	30.5	108,400
10.0	9,600	14.0	17,900	21.0	36,900	31.0	112,800
10.2	10,000	14.2	18,340	21.5	38,950	31.5	117,200
10.4	10,400	14.4	18,780	22.0	41,000	32.0	121,600
10.6	10,800	14.6	19,220	22.5	43,400	33.0	130,400

Table same as for 1902.

*Estimated monthly discharge of Savannah River at Augusta, Ga., for 1903.*

[Drainage area, 7,294 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	18,120	7,600	10,591	1.45	1.67
February .....	130,400	8,800	39,580	5.42	5.64
March .....	98,720	13,280	32,924	4.51	5.20
April .....	49,520	11,000	19,907	2.73	3.05
May .....	15,590	7,000	10,040	1.38	1.59
June .....	64,400	8,200	18,265	2.50	2.79
July .....	16,640	4,840	8,153	1.12	1.29
August .....	26,550	4,650	9,054	1.24	1.43
September .....	13,490	3,920	5,315	.73	.81
October .....	8,000	3,400	4,179	.57	.66
November .....	8,400	3,400	4,979	.68	.76
December .....	5,600	3,740	4,405	.60	.69
The year .....	130,400	3,400	13,949	1.91	25.58

## SAVANNAH RIVER NEAR CALHOUN FALLS, S. C.

Systematic measurements were begun at this point August 4, 1896, in order to determine the value of the water powers on this stream. The station is located at the Seaboard Air Line Railroad bridge, 3 miles west of Calhoun Falls, S. C., above the mouth of Beaver Dam Creek and about one-fourth mile below the mouth of Rocky River. The station is at the head of Trotters Shoal. The boxed chain gage is bolted to the downstream guard rail with the bottom resting on ties. The center of the pulley is 185 feet from the initial point for soundings. The length of the chain from the index to the end of weight is 57.10 feet. The observer is Peter J. Pfeiffer, who reads the gage once daily. The station is also used by the United States Weather Bureau, which pays the gage reader. Discharge measurements are made from the upstream side of the railroad bridge to which the gage is attached. This bridge consists of one short span, 175 feet in length, across the east channel and three spans of 155 feet each across the west, or main, channel. These two sections are connected by 875 feet of wooden trestle, from 35 to 45 feet high, which crosses the island between the two channels. The base of the rail is about 54 feet above low water. The initial point for soundings is the left-bank end of the iron bridge on the upstream side. A separate initial point has been used for each channel, the description being the same in both cases. Distances are marked with white paint on the upstream guard rail. The river is divided into two channels by a large island containing several hundred acres. Both channels are slightly curved for about 2,000 feet above the bridge and are straight for about 500 feet below. The west channel, which is the main river, is sluggish only at low water. It has a rough and rocky bed, and in places the current is irregular.

The east channel is a good section, but has a low velocity. The right bank of the west channel and the left bank of the east channel are high and wooded and are not liable to overflow. The island between the channels is nearly covered at extreme high water. At low water the east channel is 150 feet wide and from 3 to 4 feet deep. The main channel is about 400 feet wide and from 2 to 8 feet deep.

Bench mark No. 1 is the top of the iron girder under the cross-ties of the downstream side of the bridge at a point 40 feet west of the second pier from the east end of the bridge. Its elevation is 54 feet above the gage datum. Bench mark No. 2 is the top of the capstone of the east pier of the east channel bridge. The upstream side of this pier is 29.87 feet above gage datum. Bench mark No. 3 is a copper plug set in solid rock on the east bank of the east channel, 15 feet from the edge of the water and 110 feet upstream from the center of the railroad track. Its elevation is 14.38 feet above gage datum. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Savannah River near Calhoun Falls, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 20.....	J. M. Giles.....	4.15	9,769
May 7.....	do.....	3.60	7,103
June 10.....	do.....	4.75	10,904
August 13.....	do.....	2.80	3,823
September 15.....	do.....	2.52	3,209
October 28.....	do.....	2.33	2,534
December 8.....	do.....	2.12	2,098

*Mean daily gage height, in feet, of Savannah River near Calhoun Falls, S. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.00	4.20	10.40	5.20	3.80	3.60	3.50	3.10	2.90	2.60	2.30	2.00
2.....	4.00	3.80	7.10	4.50	3.70	5.50	3.50	3.00	2.80	2.50	2.20	2.10
3.....	4.40	3.90	4.90	4.00	3.70	4.40	3.60	3.00	2.80	2.50	2.20	2.10
4.....	4.40	6.30	4.40	3.90	4.00	4.60	3.90	3.10	2.80	2.40	2.30	2.20
5.....	4.20	8.10	4.20	4.00	3.90	4.80	3.70	3.20	2.70	2.40	2.60	2.20
6.....	4.10	6.40	4.10	3.90	3.70	7.00	3.80	3.40	2.70	2.40	2.50	2.20
7.....	4.10	5.90	4.10	3.90	3.60	15.30	4.80	3.20	2.60	2.50	2.30	2.20
8.....	4.00	12.70	4.00	4.00	3.50	8.00	4.00	3.10	2.00	2.50	2.20	2.20
9.....	3.90	9.40	4.30	5.90	3.50	4.90	4.10	3.00	2.50	2.70	2.20	2.20
10.....	3.90	5.30	4.20	4.50	3.50	4.00	3.50	3.00	3.00	2.60	2.20	2.30
11.....	4.10	7.30	4.00	4.10	3.40	3.50	4.00	3.10	2.90	2.60	2.10	2.20
12.....	4.40	11.20	6.50	4.00	3.40	4.00	4.10	3.20	2.80	2.50	2.10	2.20
13.....	4.30	6.40	5.90	5.10	3.30	3.80	4.00	3.30	2.60	2.50	2.20	2.30
14.....	4.10	4.60	4.60	12.90	3.30	3.70	4.20	3.40	2.70	2.40	2.20	2.20
15.....	3.90	4.40	4.40	9.50	3.40	3.60	4.00	3.20	3.40	2.40	2.10	2.20
16.....	3.80	5.30	4.40	5.00	3.50	3.50	3.80	3.10	4.20	2.50	2.10	2.10
17.....	3.70	9.50	4.50	5.40	3.40	3.50	3.70	3.50	4.00	2.60	2.10	2.10
18.....	3.60	8.40	4.20	5.00	3.30	3.40	3.50	5.50	3.50	3.00	2.20	2.20
19.....	3.60	6.60	4.20	5.00	3.40	3.20	3.30	6.90	3.20	2.80	2.20	2.20
20.....	3.60	5.40	4.30	4.90	3.40	3.60	3.20	4.50	3.00	2.60	2.70	2.30
21.....	3.60	4.90	4.50	4.90	3.30	3.20	3.10	4.00	3.00	2.50	2.40	2.40
22.....	3.70	4.50	5.90	4.80	3.30	3.10	3.00	3.70	2.90	2.40	2.30	2.30
23.....	3.60	4.30	11.10	4.70	3.20	3.00	3.00	3.30	2.90	2.40	2.20	2.20
24.....	3.50	4.10	14.50	4.50	3.20	3.10	3.10	3.10	2.80	2.30	2.20	2.20
25.....	3.30	4.00	8.70	4.30	3.10	3.00	2.90	3.10	2.80	2.20	2.10	2.20
26.....	3.20	3.70	6.90	4.00	3.00	3.00	2.90	3.00	2.80	2.20	2.10	2.10
27.....	3.10	3.80	4.70	3.90	3.00	3.20	2.90	3.00	2.70	2.10	2.00	2.20
28.....	3.30	7.00	4.40	3.90	3.10	3.50	2.80	2.90	2.70	2.20	2.00	2.20
29.....	3.40	-----	4.90	3.80	3.10	4.00	2.80	2.90	2.70	2.10	2.00	2.20
30.....	4.30	-----	9.10	3.80	3.40	3.60	2.90	3.00	2.60	2.10	2.00	2.10
31.....	3.30	-----	7.50	-----	3.50	-----	3.00	2.90	-----	2.30	-----	2.10

*Rating table for Savannah River near Calhoun Falls, S. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.0	1,870	3.0	4,640	4.0	8,470	5.0	12,600
2.1	2,050	3.1	5,010	4.1	8,860	5.5	14,775
2.2	2,250	3.2	5,390	4.2	9,260	6.0	16,950
2.3	2,470	3.3	5,770	4.3	9,660	6.5	19,125
2.4	2,710	3.4	6,150	4.4	10,060	7.0	21,300
2.5	2,980	3.5	6,530	4.5	10,470	7.5	23,475
2.6	3,280	3.6	6,910	4.6	10,890	8.0	25,650
2.7	3,600	3.7	7,300	4.7	11,310		
2.8	3,930	3.8	7,690	4.8	11,740		
2.9	4,280	3.9	8,080	4.9	12,170		

Table not well determined above 4.75 feet gage height. Above 5 feet same as 1901 and 1902. Tangent at 8 feet. Differences above 8 feet, 435 per tenth.

*Estimated monthly discharge of Savannah River near Calhoun Falls, S. C., for 1903.*

[Drainage area, 2,712 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	10,060	5,010	7,777	2.87	3.31
February .....	46,095	7,300	17,551	6.47	6.74
March .....	53,925	8,470	16,244	5.99	6.90
April .....	46,965	7,690	12,325	4.54	5.07
May .....	8,470	4,640	6,216	2.29	2.64
June .....	57,405	4,640	10,071	3.71	4.14
July .....	11,740	3,930	6,623	2.44	2.81
August .....	20,865	4,280	6,265	2.31	2.66
September .....	9,260	2,980	4,402	1.62	1.81
October .....	4,640	2,050	2,878	1.06	1.22
November .....	3,600	1,870	2,301	.85	.95
December .....	2,710	1,870	2,170	.80	.92
The year .....	57,405	1,870	7,902	2.91	39.17

## BROAD RIVER (OF GEORGIA) NEAR CARLTON, GA.

This station was established May 27, 1897, by M. R. Hall. The gage is now maintained and the observer paid by the United States Weather Bureau. The station is located at the Seaboard Air Line Railroad bridge 3 miles east of Carlton, Ga., and 2 miles above the mouth of the South Fork. The boxed chain gage is bolted to the guard rail with its bottom resting on the upstream end of the cross-ties. The center of the pulley is 39.5 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 54 feet. The observer is S. P. Powers, jr., who reads the gage once daily. Discharge measurements are made from the upstream side of the railway bridge to which the gage is attached. This is an iron deck bridge in two spans of 125 feet each, with trestle approaches 340 feet long on the left bank and 50 feet long on the right bank. The base of the rail of the track is about 51 feet above low water. The initial point for soundings is the end of the iron bridge on the right bank upstream side. The channel above and below the station is straight for 500 feet. The right bank is high and wooded and is not liable to overflow. The left bank is low for about 400 feet and is then high and rocky. It overflows at a gage height of about 16 feet. The bed of the stream is of sand and gravel and is somewhat changeable.

Bench mark No. 1 is the top of the upstream iron girder under the cross-ties at a point about 40 feet from the initial point for soundings. Its elevation is 51 feet above gage datum. Bench mark No. 2 is the top of the capstone of the right bank pier at a point under the upstream side of the end of the bridge. Its elevation is 30.78 feet above the gage datum. Bench mark No. 3 is a copper plug set in solid rock in the railroad cut 1,135 feet from the west end of the iron bridge, 11 feet north of the center of the track, and at about the same elevation as the bottom of the cross-ties. Its elevation above gage datum is 57.67 feet. Gage datum is 384 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Broad River near Carlton, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 21 .....	J. M. Giles .....	4.55	2,592
May 8 .....	do .....	3.10	1,242
June 11 .....	do .....	3.65	1,766
August 14 .....	do .....	2.70	953
September 16 .....	do .....	4.52	2,435
October 29 .....	do .....	2.16	606
December 8 .....	do .....	2.20	628

*Mean daily gage height, in feet, of Broad River near Carlton, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.00	3.10	7.90	5.80	3.20	4.30	3.00	3.10	2.20	2.20	2.30	2.20
2.....	3.10	3.00	5.20	4.40	3.10	4.60	2.90	2.70	2.20	2.20	2.30	2.20
3.....	3.90	3.60	4.00	4.20	3.10	6.00	3.00	3.10	2.20	2.20	2.90	2.20
4.....	3.76	7.00	3.70	4.40	3.70	4.50	3.40	3.50	2.10	2.20	3.10	2.20
5.....	3.40	7.80	3.60	4.00	3.50	4.60	2.90	3.70	2.10	2.20	3.00	2.20
6.....	3.10	5.20	3.70	3.80	3.20	6.10	2.80	3.20	2.10	2.20	3.10	2.30
7.....	3.00	3.80	3.70	3.70	3.10	8.00	3.30	3.60	2.20	2.20	2.50	2.30
8.....	2.80	17.60	3.80	4.10	3.10	6.00	2.90	2.50	2.20	2.30	2.40	2.20
9.....	2.80	11.20	3.60	4.80	3.10	4.80	2.80	2.40	2.20	2.40	2.30	2.20
10.....	2.80	5.60	4.30	4.10	3.00	4.40	2.70	2.40	2.20	2.30	2.30	2.30
11.....	2.90	6.50	5.70	3.80	3.00	3.60	2.70	5.30	2.10	2.20	2.30	2.20
12.....	4.90	10.40	5.80	3.60	2.90	4.80	3.20	3.30	2.10	2.20	2.30	2.20
13.....	4.70	7.50	4.60	3.60	3.00	3.90	5.50	2.70	2.10	2.20	2.30	2.30
14.....	3.50	4.40	3.90	6.80	3.20	3.30	4.90	2.70	2.10	2.20	2.30	2.50
15.....	3.20	4.00	3.70	5.50	3.60	3.20	3.30	4.70	3.20	2.20	2.30	2.30
16.....	3.10	3.80	3.60	4.00	3.30	3.10	2.90	4.00	4.40	2.20	2.30	2.30
17.....	2.90	13.10	3.40	3.70	3.10	3.10	2.80	2.90	4.30	2.30	2.30	2.20
18.....	2.90	12.70	3.40	3.60	3.10	3.00	2.70	7.30	3.20	2.60	2.40	2.20
19.....	2.80	4.90	3.30	3.50	3.00	3.00	2.70	4.00	2.60	2.40	2.30	2.10
20.....	2.80	4.10	3.20	3.50	3.00	2.90	2.60	3.60	2.50	2.30	2.30	2.20
21.....	2.90	3.80	4.10	3.50	3.20	3.10	2.60	2.80	2.50	2.30	2.30	2.50
22.....	2.80	3.70	5.50	3.40	3.00	2.90	2.50	2.70	2.40	2.20	2.30	2.40
23.....	2.70	3.50	13.20	3.40	3.00	2.80	2.50	2.60	2.40	2.20	2.20	2.30
24.....	2.90	3.40	21.00	3.30	2.90	2.80	2.50	2.50	2.40	2.20	2.20	2.20
25.....	3.10	3.30	10.70	3.30	2.90	2.70	2.40	2.50	2.30	2.20	2.20	2.30
26.....	3.00	3.30	5.00	3.40	2.80	2.70	2.40	2.50	2.30	2.20	2.20	2.70
27.....	2.90	3.20	4.40	3.40	2.80	3.10	2.40	2.40	2.30	2.20	2.20	2.50
28.....	3.10	6.00	4.20	3.30	2.90	5.60	2.30	2.40	2.30	2.10	2.20	2.40
29.....	3.70	-----	5.40	3.30	2.80	3.60	2.40	2.40	2.20	2.10	2.20	2.30
30.....	4.30	-----	9.00	3.20	2.90	3.30	2.70	2.30	2.20	2.10	2.20	2.20
31.....	3.40	-----	9.00	-----	4.00	-----	2.80	2.30	-----	2.20	-----	2.20

*Rating table for Broad River near Carlton, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.1	575	3.4	1,490	5.4	3,390	9.5	8,875
2.2	630	3.5	1,570	5.6	3,640	10.0	9,550
2.3	690	3.6	1,655	5.8	3,900	10.5	10,225
2.4	755	3.7	1,740	6.0	4,160	11.0	10,900
2.5	820	3.8	1,825	6.2	4,420	11.5	11,575
2.6	890	3.9	1,910	6.4	4,690	12.0	12,250
2.7	960	4.0	2,000	6.6	4,960	12.5	12,925
2.8	1,030	4.2	2,180	6.8	5,230	13.0	13,600
2.9	1,105	4.4	2,365	7.0	5,500	14.0	14,950
3.0	1,180	4.6	2,555	7.5	6,175	15.0	16,800
3.1	1,255	4.8	2,750	8.0	6,850	16.0	17,650
3.2	1,330	5.0	2,950	8.5	7,225		
3.3	1,410	5.2	3,160	9.0	8,200		

Table well determined up to 5-foot gage height. Above this point the table depends upon measurements made previous to 1903.

*Estimated monthly discharge of Broad River near Carlton, Ga., for 1903.*

[Drainage area, 762 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	2,850	960	1,375	1.81	2.09
February .....	19,810	1,180	4,638	6.09	6.34
March .....	24,400	1,330	4,110	5.39	6.21
April .....	5,230	1,330	2,007	2.63	2.93
May .....	2,000	1,030	1,270	1.67	1.93
June .....	6,850	960	2,125	2.79	3.11
July .....	3,510	690	1,150	1.51	1.74
August .....	5,905	690	1,387	1.82	2.10
September .....	2,365	575	818	1.07	1.19
October .....	890	575	651	.85	.98
November .....	1,255	630	750	.98	1.09
December .....	960	575	683	.90	1.04
The year .....	24,400	575	1,747	2.29	30.75

#### SENECA RIVER NEAR CLEMSON COLLEGE, S. C.

This station was established by M. R. Hall as a regular station on December 8, 1903, at which time a boxed chain gage was installed and the bench marks were established. A vertical gage had been put in July 19, 1903, by F. A. Murray, and records obtained from it for a portion of the time. The station is located at the iron wagon bridge about 3 miles south of Clemson College, S. C., and about 300 feet up the river from the crossing of the Blue Ridge Railroad, which is a branch of the Southern Railway. The bridge is a single span of iron, about 157 feet long, with 40 feet of trestle approach on the right bank and 70 feet on the left bank. At ordinary stages the channel is about 150 feet wide. The right bank is high and will not overflow, but the left bank will overflow for a considerable width at a gage height of about 23 feet. The bed of the river is sandy. The current is moderate. At low stages there is a daily fluctuation of about 1 foot in the gage heights, caused by the operation of water powers above. On this account the gage is read twice each day, and a mean of the two readings is used. The observer is M. L. Sanders.

Discharge measurements are made from the downstream side of the bridge, and the initial point is the center of the tubular iron pier at the right bank downstream. The boxed chain gage is located on the



lower chord on the downstream side. The 24-inch box extends from 20 to 22 feet from the initial point. The chain is 31.82 feet long from the bottom of the weight to the marker. The vertical gage is of 2 by 4 inch timbers in 5-foot sections, fastened to a scantling which is clamped to the iron braces between the cylinders of the right bank pier. Both gages are in good condition, except that mud accumulates at the lower end of the vertical gage.

Bench mark No. 1 is the top of the upstream cylinder of the right bank pier at a point marked "B. M." by chisel cuts. Its elevation is 28.95 feet above gage datum. Bench mark No. 2 is a copper plug set in rock on the right bank under the railroad bridge and about 20 feet to the right of the center pier. Its elevation is 10.27 feet above gage datum. This rock is low and has been uncovered by erosion of the bank. Bench mark No. 3 is a bench cut on the root of a hickory tree at the fork of the roads about 100 feet from the right bank end of the bridge. Its elevation is 30.52 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Seneca River near Clemson College, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
July 10.....	F. A. Murray.....	4.54	1,388
July 28.....	do.....	3.53	959
July 29.....	do.....	3.56	1,077
August 27.....	do.....	3.14	869
September 23.....	do.....	2.51	616
October 9.....	J. M. Giles.....	3.43	1,050
December 8.....	W. E. Hall.....	2.21	539

*Mean daily gage height, in feet, of Seneca River near Clemson College, S. C., for 1903.*

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1.....	2.8	2.40	9.....	3.1	2.40	17.....	2.9	2.80	25.....	2.5	3.10
2.....	2.8	2.50	10.....	2.8	2.35	18.....	3.8	2.45	26.....	2.6	3.00
3.....	3.5	2.50	11.....	2.8	2.70	19.....	3.1	2.30	27.....	2.6	2.30
4.....	4.9	2.70	12.....	2.7	2.45	20.....	3.0	2.20	28.....	2.6	3.10
5.....	5.7	2.70	13.....	2.8	2.50	21.....	3.0	2.30	29.....	2.5	2.60
6.....	4.7	2.65	14.....	2.6	2.80	22.....	2.8	2.90	30.....	2.6	2.60
7.....	3.0	2.50	15.....	2.8	2.65	23.....	3.0	2.80	31.....		2.45
8.....	3.0	2.40	16.....	2.8	2.60	24.....	2.8	2.80			

*Rating table for Seneca River near Clemson College, S. C., from November 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.2	550	3.1	860	4.0	1,180	4.9	1,530
2.3	584	3.2	895	4.1	1,218	5.0	1,570
2.4	618	3.3	930	4.2	1,256	5.1	1,610
2.5	652	3.4	965	4.3	1,294	5.2	1,650
2.6	686	3.5	1,000	4.4	1,332	5.3	1,690
2.7	720	3.6	1,036	4.5	1,370	5.4	1,730
2.8	755	3.7	1,072	4.6	1,410	5.5	1,770
2.9	790	3.8	1,108	4.7	1,450	5.6	1,810
3.0	825	3.9	1,144	4.8	1,490	5.7	1,850

Table well determined to 4.50 feet gage height.

*Estimated monthly discharge of Seneca River near Clemson College, S. C., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
November	1,850	652	861
December	860	550	685

#### TUGALOO RIVER NEAR MADISON, S. C.

This station was originally established July 19, 1898, at Cook's ferry and was discontinued December 31, 1901, when the ferry was moved. It was reestablished July 7, 1903, by M. R. Hall. It is located at Holcomb's ferry, 1 mile west of Madison, S. C., and 900 feet below the Southern Railway bridge. This station is about  $1\frac{1}{2}$  miles above the point where the old station was located. The gage consists of a vertical timber in three sections. The first section reads from 1 to 16 feet and is attached to a sycamore tree on the left bank about 30 feet, above the ferry landing. The second section reads from 16 to 22 feet and is attached to a sycamore tree on the left bank, about 18 feet above the ferry landing. The third section reads from 21 to 31 feet and is fastened to a locust tree on the left bank at the forks of the road, about 175 feet from the ferry landing. The gage is read once daily by T. A. Spencer, a farmer. Discharge measurements are made from the ferryboat, which is held in place by a cable stretched across the river, a rope running from each end of the boat to a pulley on the

cable. A small boat is also used. The initial point for soundings is the side away from the river of the windlass used for stretching the cable; it is located on the right bank. Distances are measured along the hand line which is used to pull the boat across the river.

The bed of the river is sandy and the current is moderately swift. The channel is about 160 feet wide and is fairly uniform in width and general appearance for some distance above and below, the current being moderately swift and the channel straight for 1,000 feet or more both above and below the station. The banks are both moderately high, but will overflow for about 200 feet on right bank and 250 feet on the left. Both are open and cultivated except a few trees along the edge of the river. These conditions make it possible to obtain fairly good float measurements at time of floods.

Bench mark No. 1 is a nail in a willow tree on the right bank 20 feet below the ferry landing. It is 7 feet above the zero of the gage. Bench mark No. 2 consists of two large nails in the locust tree to which the third section of the gage is attached. They are at an elevation of 22 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock on the north side of the railroad 10½ feet from the north rail and about 400 feet east of the east end of the Southern Railway bridge. Its elevation is 44.27 feet above the zero of the gage. Bench mark No. 4 is the Geological Survey standard plate bench mark on the right bank pier of the Southern Railway bridge. Its elevation is 35.37 feet above the zero of the gage, and 665 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Tugaloo River near Madison, S. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 24 .....	J. M. Giles .....	4.00	1,927
July 7 .....	M. R. Hall .....	3.69	1,677
July 9 .....	F. A. Murray .....	3.40	1,535
July 31 .....	do .....	2.84	1,091
August 28 .....	do .....	2.18	798
September 24 .....	do .....	1.94	715
October 9 .....	J. M. Giles .....	2.23	927

*Mean daily gage height, in feet, of Tugaloo River near Madison, S. C., for 1903.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.80	2.00	1.70	1.80	1.60	17.....	3.30	4.90	3.90	1.70	1.80	1.70
2.....		5.40	1.90	1.70	1.90	1.60	18.....	3.20	3.80	3.50	2.40	2.80	1.70
3.....		4.60	1.90	1.90	2.80	1.60	19.....	3.10	2.90	2.30	2.00	2.20	1.50
4.....		4.20	1.90	1.80	2.20	1.60	20.....	3.10	2.70	2.10	1.80	1.90	1.70
5.....		3.40	1.90	1.70	3.00	1.60	21.....	3.00	3.00	2.00	1.80	1.80	2.50
6.....		2.90	1.90	1.70	2.50	1.70	22.....	2.90	2.60	2.00	1.70	1.80	2.00
7.....	3.70	2.80	1.80	1.80	2.10	1.60	23.....	2.90	2.50	1.90	1.70	1.80	1.90
8.....	3.70	2.70	1.80	2.40	1.90	1.60	24.....	2.80	2.40	1.90	1.70	1.80	1.90
9.....	3.40	2.50	1.80	2.40	1.90	1.60	25.....	2.70	2.30	1.90	1.60	1.70	1.90
10.....	3.60	2.40	1.90	1.90	1.80	1.60	26.....	2.70	2.30	1.80	1.60	1.70	2.00
11.....	3.90	3.00	1.80	1.80	1.80	1.60	27.....	2.70	2.20	1.90	1.60	1.70	1.90
12.....	4.40	2.80	1.70	1.80	1.80	1.60	28.....	2.60	2.10	1.90	1.60	1.60	1.80
13.....	4.50	2.70	1.70	1.70	1.90	1.80	29.....	3.10	2.10	1.80	1.60	1.60	1.80
14.....	4.10	2.60	1.70	1.70	1.90	2.00	30.....	2.70	2.10	1.70	1.60	1.60	1.80
15.....	3.60	2.70	4.10	1.60	1.80	1.80	31.....	2.90	2.00	-----	1.60	-----	1.80
16.....	3.20	4.30	5.60	1.60	1.90	1.80							

*Rating table for Tugaloo River near Madison, S. C., from July 7 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.5	510	2.5	980	3.5	1,560	4.5	2,320
1.6	552	2.6	1,032	3.6	1,630	4.6	2,400
1.7	596	2.7	1,086	3.7	1,700	4.7	2,480
1.8	640	2.8	1,140	3.8	1,775	4.8	2,560
1.9	686	2.9	1,195	3.9	1,850	4.9	2,640
2.0	732	3.0	1,250	4.0	1,925	5.0	2,720
2.1	780	3.1	1,310	4.1	2,000	5.4	3,040
2.2	828	3.2	1,370	4.2	2,080	5.6	3,200
2.3	878	3.3	1,430	4.3	2,160		
2.4	928	3.4	1,495	4.4	2,240		

Table well determined between gage heights 1.8 and 4 feet.

*Estimated monthly discharge of Tugaloo River near Madison, S. C., for 1903.*

[Drainage area, 593 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July 7-31.....	2,320	1,032	1,441	2.43	2.26
August.....	3,040	732	1,283	2.16	2.49
September.....	3,200	596	874	1.47	1.64
October.....	928	552	634	1.07	1.23
November.....	1,250	552	720	1.21	1.35
December.....	980	510	623	1.05	1.21

MISCELLANEOUS MEASUREMENTS IN SAVANNAH RIVER DRAINAGE  
BASIN.

*Eighteenmile Creek.*—This stream was measured  $3\frac{1}{2}$  miles southeast of Calhoun, S. C. The bench mark is the top of downstream end of cap, 35 feet from right-bank end of bridge.

*Discharge measurements of Eighteenmile Creek  $3\frac{1}{2}$  miles southeast of Calhoun, S. C.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
July 11.....	5.43	392
July 30.....	8.12	48
September 23.....	8.08	51

*Twelvemile Creek.*—This stream was measured 1 mile northwest of Calhoun, S. C. The bench mark is the top of downstream corner of left-bank pier.

*Discharge measurements of Twelvemile Creek 1 mile northwest of Calhoun, S. C.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
July 11.....	4.45	374
July 30.....	5.13	225
September 23.....	5.91	192

*Chauga Creek.*—This stream was measured at Bryan's bridge, 2 miles east of Fort Madison, S. C. The bench mark is a spike in a sycamore sapling, 100 feet above bridge on left bank.

*Discharge measurements of Chauga Creek 1 mile east of Fort Madison, S. C.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 29.....	3.00	168
September 24.....	3.25	133

*Brier Creek.*—At Ray's bridge,  $3\frac{1}{2}$  miles northeast of Waynesboro, Ga., this stream was discharging 246 second-feet on October 12, 1903, when the water surface was 9.66 feet below end of plank, 43 feet from right-bank end of bridge, downstream side.

*McIntosh Creek*.—One mile south of Waynesboro, Ga., this stream had a discharge of 3.7 second-feet on October 12, 1903.

*South Broad River*.—At Carlton, Ga., this stream had a discharge of 219 second-feet on October 12, 1903.

*Tallulah River*.—At Tallulah Falls, Ga., this stream had a discharge of 698 second-feet on June 23, 1903; gage height (old gage), 1.96 feet.

### OGEECHEE RIVER DRAINAGE BASIN.

Ogeechee River is formed by the junction of Williamsons Swamp Creek and Rocky Comfort Creek in Jefferson County, Ga., and drains a small basin in southeastern Georgia lying between the Savannah and Altamaha basins. Ogeechee River runs in a southeasterly direction and empties into the Atlantic Ocean. Its main tributary is Cannoochee River, which rises in Emanuel County, Ga., and flows southeast, joining the Ogeechee about 20 miles from the Atlantic Ocean. The streams in this basin run through a country that is mostly low. The current is generally good, but the fall available for power is probably small. The bank on one side or the other of the stream is generally low and swampy. During 1903 the United States Geological Survey maintained the following stations in this basin under the direction of M. R. Hall: Williamsons Swamp Creek at Davisboro, Ga.; Ogeechee River, near Millen, Ga.; and Cannoochee River, near Groveland, Ga.

#### CANNOOCHEE RIVER NEAR GROVELAND, GA.

This station was established June 12, 1903, by F. A. Murray. It is located at Moody's bridge, 3 miles south of Groveland, Bryan County, Ga. The vertical gage is in three sections. The first section is a 1½ by 4 inch pine board, reading from 1 to 5 feet, with brass figures for footmarks. The second section is a pine rod ¾ inch by 4 inch and 12 feet long, marked with brass tacks. These sections are nailed to the right side of the upstream post of the fourth bent from the right bank. From 17 to 20 feet the post is graduated to feet and half feet with nails and brass figures. These sections are opposite a point 61 feet from the initial point for soundings. A third section of the gage reading from 5 to 10 feet is fastened to a gum tree on the left bank 25 feet above the bridge. This gage faces the bridge and is used for the stages which it covers. The observer is J. M. Edwards, who reads the gage once each day. Discharge measurements are made from the downstream side of the 9-span wooden highway bridge. The initial point for soundings is the outer edge of the post which supports the end of the hand rail of the downstream side of the bridge on the left bank. The channel is straight for about 300 feet above and for about 400 feet below the station. The current is swift in the main channel and sluggish near the banks. Both banks are of clay

and sand and overflow at from 15 to 16 feet gage height. The bed of the stream is of silt and is shifting. There is but one channel at all stages up to the height at which the river overflows its banks.

Bench mark No. 1 is the top of the bridge floor at the fourth bent from the left end of the bridge on the upstream side opposite a point 61 feet from the initial point for soundings. The point is marked by a cross and the letters B. M. cut in the floor. It is at an elevation of 20 feet above the zero of the gage. Bench mark No. 2 is a spike in a pine tree which stands near the upstream side of the road 15 feet from the left end of the bridge and 9 feet upstream from the line of the edge of the bridge. It is at an elevation of 20.12 feet above the zero of the gage. Bench mark No. 3 consists of two large wire nails driven into the tree to which the third section of the gage is fastened at a gage height of 5.30 feet. Two more nails are also driven at the 8-foot mark.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Cannoochee River near Groveland, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 12 .....	F. A. Murray .....	12.90	3,467
June 23 .....	do .....	5.20	734
July 17 .....	do .....	9.97	2,224
Do .....	do .....	9.92	2,562
August 21 .....	do .....	15.11	4,125
October 9 .....	do .....	4.45	462
November 18 .....	do .....	5.05	734
December 29 .....	do .....	6.20	1,014

*Mean daily gage height, in feet, of Cannoochee River near Groveland, Ga., for 1903.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		9.80	2.60	5.50	5.70	3.80	4.40
2.....		8.00	2.60	5.10	5.40	3.90	4.30
3.....		6.90	2.60	5.00	5.30	5.40	4.30
4.....		6.40	2.70	4.50	5.10	6.20	4.20
5.....		6.10	3.20	4.80	4.80	6.70	4.10
6.....		6.30	4.30	4.90	4.70	6.90	4.10
7.....		5.90	6.00	4.60	4.60	6.60	3.90
8.....		5.40	6.70	4.20	4.60	6.20	3.80
9.....		5.90	6.70	4.00	4.50	5.90	3.80
10.....		6.80	5.50	3.80	4.30	5.60	4.50
11.....		8.70	4.90	3.70	4.20	5.20	4.60

*Mean daily gage height, in feet, of Cannoochee River, etc.—Continued.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12.....		10.60	4.50	3.60	4.00	5.00	4.50
13.....		9.70	4.90	3.70	3.90	4.80	4.30
14.....		9.50	7.20	3.80	3.80	4.70	4.30
15.....		9.20	8.10	7.70	3.80	4.70	4.30
16.....		9.50	10.10	13.80	3.70	4.50	4.30
17.....		10.00	11.10	17.80	3.70	4.50	4.10
18.....		9.50	17.20	18.00	5.70	5.00	3.80
19.....		8.90	16.70	17.30	7.90	5.00	3.90
20.....		8.20	16.00	16.50	8.80	4.60	3.80
21.....		5.50	15.20	15.70	9.40	4.50	3.90
22.....		5.20	15.00	14.70	8.90	4.40	4.00
23.....	5.20	4.90	16.00	13.20	7.90	4.20	4.10
24.....	5.70	3.70	15.80	11.30	6.60	4.00	4.00
25.....	5.60	3.50	15.10	9.60	6.00	4.00	4.00
26.....	5.70	3.30	13.80	8.20	5.40	4.10	4.40
27.....	5.20	3.30	12.00	7.30	4.70	4.50	5.20
28.....	6.50	3.20	10.40	6.60	4.40	4.60	5.50
29.....	8.10	3.00	8.50	6.30	4.20	4.50	6.20
30.....	9.00	2.90	7.00	6.10	4.00	4.30	6.90
31.....		2.70	6.00		3.90		7.70

*Rating table for Cannoochee River near Groveland, Ga., from June 23 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.6	142	3.9	316	6.4	1,150	9.0	2,060
2.7	151	4.0	338	6.6	1,220	9.5	2,235
2.8	160	4.2	389	6.8	1,290	10.0	2,410
2.9	170	4.4	451	7.0	1,360	10.5	2,585
3.0	180	4.6	520	7.2	1,430	11.0	2,760
3.1	191	4.8	590	7.4	1,500	11.5	2,935
3.2	203	5.0	660	7.6	1,570	12.0	3,110
3.3	216	5.2	730	7.8	1,640	12.5	3,285
3.4	230	5.4	800	8.0	1,710	13.0	3,460
3.5	245	5.6	870	8.2	1,780	13.5	3,635
3.6	261	5.8	940	8.4	1,850	14.0	3,810
3.7	278	6.0	1,010	8.6	1,920		
3.8	296	6.2	1,080	8.8	1,990		

Table not well determined below 4.45 feet gage height and above 15 feet gage height. Above 4.50 feet gage height the curve becomes a tangent, with difference of 35 per tenth.



*Estimated monthly discharge of Cannoochee River near Groveland, Ga., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 23-30 .....	2,060	730	1,141
July .....	2,620	151	1,242
August .....	4,930	142	2,100
September .....	5,210	261	1,855
October .....	2,200	278	774
November .....	1,325	296	646
December .....	1,605	296	499

#### OGEECHEE RIVER NEAR MILLEN, GA.

This station was established June 20, 1903, by F. A. Murray. It is located at Daniel's toll bridge, 1 mile west of Millen, Ga. The gage is a vertical seven-eighths inch by 4-inch pine rod, graduated to feet and tenths and numbered with tacks from zero to 10 feet and with brass figures from 10 to 12 feet. The rod is nailed to the upstream post of the third bent from the toll house. The gage was read once daily during 1903 by T. J. Lane, the tollkeeper. Discharge measurements were made from the upstream side of the wooden highway bridge to which the gage is attached. The bridge is at an angle of about 45° to the current. The initial point for soundings is the end of the hand rail at the tollhouse on the left bank, upstream, side of the bridge. The channel is straight for about 300 feet above and about 500 feet below the bridge. The current is swift in the main channel and sluggish near the banks. The right bank is low and overflows. There is a trestle approach for about 300 feet over low, swampy land on this side of the river. The left bank is lower than the right bank, the swamp extending back from the river about one-fourth of a mile. The bed of the stream is sandy and shifting. There is but one channel at ordinary stages, but several channels at high water.

Bench mark No. 1 is the top of the upstream end of the cap of the first bent from the tollhouse. It is 12 feet above the zero of the gage. Bench mark No. 2 consists of a notch and nails in the corner of the tollhouse next the river. They are 18 feet above the zero of the gage. Bench mark No. 3 is the center of the head of a large cut nail driven horizontally in a small hickory tree on the left bank about 50 feet below the bridge. Its elevation is 6.32 feet above the zero of the gage. Bench mark No. 4 is a cut on the sloping base of a hickory tree at the edge of the water on the left bank, about 70 feet above the bridge. A large nail is driven vertically in the cut. Its elevation is 5.48 feet above the zero of the gage. The station was discontinued

December 31, 1903, on account of poor conditions for accurate measurement of the flow.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Ogeechee River near Millen, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 20 .....	F. A. Murray .....	5.06	1,548
July 30 .....	M. R. Hall .....	2.35	515
October 10 .....	F. A. Murray .....	2.08	470
Do .....	do .....	2.09	519
November 20 .....	do .....	4.00	889

*Mean daily gage height, in feet, of Ogeechee River near Millen, Ga., for 1903.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		6.00	2.30	2.40	2.50	2.60	4.00
2.....		5.70	2.40	2.30	2.40	2.60	3.90
3.....		5.50	2.70	2.30	2.30	2.70	3.80
4.....		5.30	3.00	2.30	2.20	2.90	3.80
5.....		5.30	3.10	2.20	2.10	3.00	3.80
6.....		5.30	3.40	2.20	2.00	3.20	3.70
7.....		5.20	3.80	2.10	2.00	3.50	3.70
8.....		5.00	4.20	2.00	2.00	3.80	3.70
9.....		5.40	4.10	1.90	2.00	4.00	3.70
10.....		5.80	3.90	1.90	2.10	4.20	3.70
11.....	6.50	5.50	3.60	1.80	2.10	4.50	3.70
12.....	7.10	5.70	3.30	1.70	2.10	4.60	3.80
13.....	6.90	6.20	3.10	1.50	2.10	4.70	3.80
14.....	6.70	6.40	3.00	1.60	2.10	4.80	3.80
15.....	6.60	6.40	3.30	1.90	2.20	4.70	3.90
16.....	6.50	6.30	3.50	4.10	2.20	4.50	3.90
17.....	6.20	6.40	3.90	4.90	2.20	4.30	4.00
18.....	5.90	6.30	4.00	5.50	2.30	4.10	4.00
19.....	5.50	6.00	4.20	5.60	2.80	4.00	4.00
20.....	5.20	5.70	4.80	5.40	3.40	4.00	4.00
21.....	5.00	5.40	5.70	5.10	3.80	4.00	4.00
22.....	4.80	5.00	6.00	4.90	4.00	4.00	4.10
23.....	4.80	4.60	5.90	4.80	4.00	4.00	4.20
24.....	4.90	4.00	5.70	4.70	4.00	4.00	4.30
25.....	4.80	3.60	5.50	4.50	4.00	4.00	4.40
26.....	4.60	3.30	5.30	4.10	4.00	4.00	4.50
27.....	4.70	3.00	5.10	3.50	3.80	4.00	4.70
28.....	5.10	2.80	4.80	3.00	3.40	4.00	4.90
29.....	5.50	2.60	4.00	2.70	3.00	4.10	5.10
30.....	5.80	2.50	3.30	2.60	2.80	4.10	5.30
31.....		2.30	2.60		2.60		5.50

*Rating table for Ogeechee River near Millen, Ga., from June 11 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.5	418	2.8	595	4.1	933	5.4	1,860
1.6	428	2.9	611	4.2	980	5.5	1,960
1.7	440	3.0	628	4.3	1,030	5.6	2,065
1.8	452	3.1	646	4.4	1,085	5.7	2,170
1.9	465	3.2	665	4.5	1,145	5.8	2,275
2.0	478	3.3	685	4.6	1,210	6.0	2,490
2.1	492	3.4	707	4.7	1,275	6.2	2,710
2.2	506	3.5	731	4.8	1,345	6.4	2,930
2.3	520	3.6	757	4.9	1,420	6.6	3,150
2.4	534	3.7	785	5.0	1,500	6.8	3,370
2.5	549	3.8	816	5.1	1,585	7.0	3,590
2.6	564	3.9	850	5.2	1,675		
2.7	579	4.0	889	5.3	1,765		

Table not well determined.

*Estimated monthly discharge of Ogeechee River near Millen, Ga., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 11-30 .....	3,700	1,210	2,183
July .....	2,930	520	1,771
August .....	2,490	520	1,077
September .....	2,065	418	855
October .....	889	478	609
November .....	1,345	564	905
December .....	1,960	785	989

#### WILLIAMSON'S SWAMP CREEK AT DAVISBORO, GA.

This station was established June 19, 1903, by F. A. Murray. It is located at the Davisboro highway bridge, about 200 yards south of the Central of Georgia Railroad station, which is in the middle of the town. The gage is a vertical 1 by 3 inch wooden rod 10 feet long, graduated to feet and tenths with notches and numbered with brass figures. The rod is nailed to the left side of the upstream post of the bent which supports the bridge, at a point 302 feet from the initial point for soundings. The gage is read once each day by A. Baker,

a hotel proprietor. Discharge measurements are made from the upstream side of the wooden highway bridge, which is supported by wooden bents about 18 feet apart. The initial point for soundings is the outer edge of the post which supports the end of the hand rail on the left bank upstream side of the bridge. The channel is straight for about 200 feet above and below the station. The right bank is low and overflows at a gage reading of 4 to 4½ feet. The left bank will overflow at a gage height of 3 feet. The bed of the stream is sandy and is slightly shifting. There is but one channel at all stages. The current is somewhat obstructed by the bents which support the bridge at low water and by trees and brush on the banks at high water.

Bench mark No. 1 is the top of the bridge floor at the bent 302 feet from the initial point for soundings on the upstream side of the bridge. The point is marked with a cross and the letters "B. M." cut into the top of the bridge floor plank. Its elevation is 11 feet above the zero of the gage, which is attached to the same bent. Bench mark No. 2 is the center of a large wire nail driven horizontally in an ash tree which stands in the creek near the right bank about 40 feet below the bridge. The nail is on the side of the tree toward the bridge and is at an elevation of 5.50 feet above the zero of the gage. Bench mark No. 3 is the center of a large wire nail driven horizontally in a small cypress tree on the right bank about 45 feet below the bridge. The nail is on the side of the tree toward the bridge and is at an elevation of 5.50 feet above the zero of the gage. The nails for both bench marks are driven within about one-half inch of the wood, from which the bark has been removed.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Williamson's Swamp Creek at Davisboro, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 19 .....	F. A. Murray .....	2.41	83
July 18 .....	do .....	2.58	100
July 29 .....	M. R. Hall .....	1.64	46
Do .....	do .....	1.64	45
October 13 .....	F. A. Murray .....	1.72	47
Do .....	do .....	1.64	41
November 21 .....	do .....	2.58	94
December 28 .....	do .....	2.69	97

Mean daily gage height, in feet, of Williamson's Swamp Creek at Davisboro, Ga., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.50	2.10	1.80	1.70	2.10	2.40
2.....		2.30	4.00	1.90	1.80	2.20	2.50
3.....		3.30	2.40	1.70	1.80	2.10	2.70
4.....		3.70	3.50	1.70	1.70	2.40	2.80
5.....		2.30	3.00	1.70	1.50	4.40	2.40
6.....		2.30	2.40	1.80	1.60	3.20	2.40
7.....		5.80	2.10	1.70	1.60	2.90	2.20
8.....		5.00	2.00	1.70	2.00	2.50	2.30
9.....		3.50	1.80	1.70	2.00	2.40	2.40
10.....		3.90	1.90	1.70	2.00	2.40	2.50
11.....		3.20	2.10	1.70	1.90	2.50	2.60
12.....		4.30	2.30	1.70	1.80	2.40	2.50
13.....		3.60	2.30	1.80	1.70	2.60	2.50
14.....		5.10	2.20	1.90	1.70	2.60	2.40
15.....		4.70	2.10	3.00	1.70	2.50	2.50
16.....		3.40	2.10	4.00	1.80	2.50	2.50
17.....		2.80	2.30	3.00	2.90	2.50	2.50
18.....		2.60	2.10	2.80	4.00	2.50	2.50
19.....	2.40	2.50	3.00	2.50	2.40	2.70	2.40
20.....	2.50	2.50	3.80	1.90	2.10	2.50	2.60
21.....	2.50	2.30	3.60	1.80	2.20	2.60	3.00
22.....	2.60	2.10	3.20	2.00	2.20	2.60	2.80
23.....	2.40	2.10	2.10	1.90	2.10	2.50	2.50
24.....	2.30	2.10	2.00	2.00	2.00	2.50	2.50
25.....	2.20	2.30	2.10	1.90	2.10	2.40	2.80
26.....	2.20	2.30	1.90	1.90	2.00	2.40	3.30
27.....	2.20	1.90	1.80	2.00	2.00	2.50	3.80
28.....	4.40	1.80	1.80	1.90	2.00	2.50	2.60
29.....	4.00	1.70	1.70	1.80	2.10	2.50	2.70
30.....	2.90	1.80	1.70	1.80	2.10	2.40	2.70
31.....		1.80	1.80		2.20		2.70

Rating table for Williamson's Swamp Creek at Davisboro, Ga., from June 19 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.5	40	2.7	101	3.9	191	5.1	297
1.6	44	2.8	108	4.0	199	5.2	306
1.7	48	2.9	115	4.1	207	5.3	315
1.8	52	3.0	122	4.2	216	5.4	324
1.9	57	3.1	129	4.3	225	5.5	334
2.0	62	3.2	136	4.4	234	5.6	344
2.1	67	3.3	143	4.5	243	5.7	354
2.2	72	3.4	151	4.6	252	5.8	364
2.3	77	3.5	159	4.7	261	6.0	384
2.4	83	3.6	167	4.8	270		
2.5	89	3.7	175	4.9	279		
2.6	95	3.8	183	5.0	288		

Table not well determined above 2.70 feet gage height.

*Estimated monthly discharge of Williams's Swamp Creek at Davisboro, Ga., in 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 19-30 .....	234	72	107
July .....	364	48	127
August .....	199	48	85
September .....	199	48	66
October .....	199	40	65
November .....	234	67	94
December .....	183	72	97

#### MISCELLANEOUS MEASUREMENTS IN OGEECHEE RIVER DRAINAGE BASIN.

*Cannoochee River.*—At Moore's bridge,  $2\frac{1}{2}$  miles northwest of Groveland, Ga., this stream was discharging 1,958 second-feet on June 9, 1903, when the water surface was 6.87 feet below the top of first bent from right bank, upstream side of bridge.

*Buckhead Creek.*—This stream was measured at Daniel's bridge, 1 mile northwest of Millen, Ga. The bench mark is the top of first bent from a large cypress stump near the right bank, downstream side of bridge.

*Discharge measurements of Buckhead Creek at Daniel's bridge, 1 mile northwest of Millen, Ga., 1903.*

Date.	Height of bench mark above water.	Discharge.
	Feet.	Second-feet.
June 10 .....	4.68	617
June 11 .....	3.33	1,163
June 20 .....	6.71	251
July 18 .....	5.02	500
October 10 .....	9.34	107

*Cannoochee River.*—At bridge (Hendrix)  $1\frac{1}{2}$  miles from Claxton, Ga., this stream was discharging 469 second-feet on June 22, 1903, when the water surface was 13.40 feet below bridge floor at 50 feet from outer edge of post at end of hand rail, right bank upstream side.

*Cedar Creek.*—At  $1\frac{1}{2}$  miles northwest of Claxton, Ga., this stream was discharging 11 second-feet on June 22, 1903, when the water surface was 10.13 feet below bridge floor at midstream.

*Bull Creek.*—At new bridge 2 miles southeast of Claxton, Ga., this stream was discharging 18 second-feet on June 22, 1903, when the water surface was 5.40 feet below top of upstream end of cap of first bent from right bank.

*Lotts Creek.*—This stream was measured at a foot log 100 yards above its mouth, about 2 miles northwest of Groveland, Ga. The bench mark is a large spike in a 9 by 9' post near right bank.

*Discharge measurements of Lotts Creek about 2 miles northwest of Groveland, Ga., 1903.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
June 23.....	8.00	253
October 9.....	9.47	119
Do.....	9.47	112

*Williamson's Swamp Creek (west prong).*—At Buffalo Ford, near Sandersville, Ga., this stream was discharging 16 second-feet on July 2, 1903, when the water was at ordinary stage.

*Williamson's Swamp Creek (north prong).*—At Jones's bridge, near Sandersville, Ga., this stream was discharging 19 second-feet on July 2, 1903, when the water was at ordinary stage.

*Williamson's Swamp Creek.*—At Jordan's Mill bridge, near Sandersville, Ga., this stream was discharging 95 second-feet on July 2, 1903, when the water was at ordinary stage.

*Ogeechee River.*—At Harrison's bridge, 2 miles west of Agricola, Ga., this stream was discharging 24 second-feet on October 14, 1903, when the water surface was 19.56 feet below the top of bent at right end of bridge downstream side.

*Little Ogeechee River.*—Near Agricola, Ga., this stream was discharging 4.2 second-feet on October 14, 1903, when the water surface was 13.83 feet below top of floor at hand-rail brace.

*Ogeechee River.*—At wagon bridge 5 miles northeast of Davisboro, Ga., this stream was discharging 194 second-feet on November 20, 1903, when the water surface was 12.20 below top of second bent from left bank.

#### ALTAMAHA RIVER DRAINAGE BASIN.

Altamaha River is formed by the junction of Oconee and the Ocmulgee rivers, which unite at the southern boundary of Montgomery County, Ga. Ochoopee River is also a tributary and enters it, from the north side, about 50 miles below the junction of the Oconee and Ocmulgee. The Altamaha River drainage is entirely within the State of Georgia. It rises in the north-central part and flows in a southeasterly direction, emptying into the Atlantic Ocean near Darien. Below the junction of the Oconee and Ocmulgee and for a long dis-

tance above, on both rivers, there is no great amount of fall. Steamboat navigation is carried on from Darien to Macon on the Ocmulgee, and to Dublin, and at times to Milledgeville, on the Oconee.

Ochoopee River rises in Washington County and flows in a southeasterly direction to the Altamaha. It flows from the low hills of southeastern Georgia into the flat pine lands. Though it has not so much fall as the more northern streams, it has considerable fall that can be developed into power.

Oconee River rises on the southern slope of the Chattahoochee Ridge, in Hall County, and joins the Middle Oconee on the southwest boundary of Clarke County. From there it flows in a southeasterly direction to the Altamaha. Apalachee River is a large tributary which rises in Gwinnett and Walton counties and enters the Oconee near the southeastern corner of Morgan County. Little River enters the main stream, at the corner of Putnam, Hancock, and Baldwin counties, about 15 miles above Milledgeville, Ga. These tributaries have much fall, and a small part of it is developed. The Oconee has a fall of 250 feet in 45 miles. It has some very large water powers available from its source down to Milledgeville, where it crosses the fall line.

Ocmulgee River, the most westerly of the main tributaries, rises in the north-central part of Georgia on the southern slope of the Chattahoochee Ridge in Fulton, Dekalb, and Gwinnett counties. It is formed by the junction of Yellow and South rivers just south of the southern corner of Newton County. Yellow River rises in Gwinnett County and flows in a southerly direction into the Ocmulgee. South River rises in Fulton and Dekalb counties and flows in a southeasterly direction. Alcovy River joins the Ocmulgee about 5 miles below the junction of the South and Yellow rivers. Towaliga River enters the Ocmulgee at about the southwest corner of Jasper County.

All these tributaries rise in and flow through a very hilly country and have a great deal of fall. Ocmulgee River has a fall of over 210 feet in 35 miles. The last fall of much size is only a few miles above Macon, Ga.

During 1903 the United States Geological Survey maintained the following stations in this basin, under the direction of M. R. Hall: Ochoopee River near Reidsville, Ga.; Oconee River near Dublin, Ga.; Oconee River at Milledgeville, Ga.; Oconee River near Greensboro, Ga.; Apalachee River near Buckhead, Ga.; Ocmulgee River at Macon, Ga.; Ocmulgee River near Flovilla, Ga.; Alcovy River near Covington, Ga.; South River near Lithonia, Ga.

#### OCHOOPEE RIVER NEAR REIDSVILLE, GA.

This station was established June 13, 1903, by F. A. Murray. It is located at the wooden highway bridge, commonly known as Shepards bridge,  $4\frac{1}{2}$  miles west of Reidsville. The gage is on the down-



stream side of the middle post which supports the bridge protector. The section from zero to 8 feet is roughly graduated with white paint on a 1 by 3 inch pine strip which is nailed to the post. From 8 to 10 feet the post is graduated to feet and tenths with white paint, and from 10 to 13 feet to feet and half feet. From 13 to 20 feet it is graduated to feet with nails and numbered with brass figures. On November 19, 1903, a new 1 by 4 inch section 5 feet long, reading from 3 to 8 feet, was spiked to a pine plank which is securely nailed to a cypress tree on the left bank of the river about 120 feet above the bridge. This section can be extended to extreme high water on the same tree, and probably also to low water.

Bench mark No. 1 is the top of the cap of the fifth bent from the left end of the bridge on the upstream side, opposite a point 106 feet from the initial point for soundings. It is at an elevation of 20 feet above the zero of the gage. Bench mark No. 2 consists of two nails driven horizontally in the downstream side of a cypress tree on the left bank about 120 feet above the bridge. This bench mark is 8 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction M. R. Hall, district hydrographer.

*Discharge measurements of Ohoopce River near Reidsville, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 13 .....	F. A. Murray .....	12.47	5,762
June 24 .....	do .....	6.41	1,692
July 16 .....	do .....	10.34	3,667
Do .....	do .....	10.46	3,756
August 22 .....	do .....	14.00	6,441
October 8 .....	do .....	2.84	476
Do .....	do .....	2.85	462
November 19 .....	do .....	4.96	1,131
December 30 .....	do .....	6.69	1,836

*Mean daily gage height, in feet, of Ohoopce River near Reidsville, Ga., for 1903.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....		8.60	2.00	4.60	3.30	2.40	3.90
2 .....		8.30	2.10	4.30	3.10	2.40	3.70
3 .....		8.40	2.70	4.50	2.90	2.40	3.60
4 .....		7.70	3.40	4.00	2.80	3.10	3.40
5 .....		6.80	3.70	3.50	2.60	3.90	3.30
6 .....		6.00	4.00	3.40	2.50	4.60	3.20
7 .....		5.50	3.90	3.20	2.70	5.20	3.10
8 .....		5.50	3.30	3.50	2.90	5.30	3.10

*Mean daily gage height, in feet, of Ohoopsee River, etc.—Continued.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9		5.70	3.10	3.50	2.90	5.70	3.30
10		6.00	3.60	3.20	2.70	5.00	3.40
11		7.30	4.20	2.30	2.60	5.10	3.60
12		6.60	5.30	2.40	2.30	4.80	3.60
13		6.50	4.60	(a)	2.20	4.70	3.50
14		7.40	3.80	(a)	2.10	4.10	3.50
15		9.70	3.80	(a)	2.00	5.30	3.40
16		10.60	8.30	(a)	2.00	5.40	3.30
17		9.50	10.30	(a)	2.20	5.60	3.30
18		9.60	9.90	(a)	5.00	5.40	3.10
19		10.30	10.30	(a)	6.70	5.00	3.00
20		9.50	14.00	10.80	6.90	4.70	2.90
21		8.10	13.80	10.50	6.50	4.50	3.00
22		6.70	14.00	8.40	5.70	4.40	3.30
23		5.70	13.20	7.20	5.00	4.30	3.30
24	6.50	4.70	12.00	6.50	4.60	4.10	3.20
25	6.70	4.00	11.40	6.40	3.70	4.00	3.30
26	6.90	4.00	10.50	6.30	3.20	4.10	3.70
27	7.70	3.70	9.00	4.30	2.90	4.80	5.30
28	8.70	3.20	7.70	4.10	2.70	4.40	6.30
29	10.20	2.50	6.70	3.90	2.50	4.20	6.60
30	9.30	2.50	5.50	3.60	2.30	4.10	6.70
31		2.20	4.80		2.20		6.30

<sup>a</sup>Gage out.

*Rating table for Ohoopsee River near Reidsville, Ga., from June 23 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.0	280	3.3	595	5.2	1,220	7.8	2,325
2.1	296	3.4	625	5.4	1,295	8.0	2,415
2.2	314	3.5	655	5.6	1,375	8.5	2,665
2.3	326	3.6	685	5.8	1,455	9.0	2,915
2.4	350	3.7	715	6.0	1,535	9.5	3,175
2.5	375	3.8	745	6.2	1,615	10.0	3,465
2.6	400	3.9	775	6.4	1,695	10.5	3,775
2.7	426	4.0	805	6.6	1,785	11.0	4,130
2.8	453	4.2	870	6.8	1,875	12.0	4,935
2.9	480	4.4	940	7.0	1,695	13.0	5,860
3.0	508	4.6	1,010	7.2	2,055	14.0	6,860
3.1	536	4.8	1,080	7.4	2,145		
3.2	565	5.0	1,150	7.6	2,235		

Table well determined between 2.85 and 10.50 gage height; upper and lower parts somewhat uncertain.

*Estimated monthly discharge of Ohoopsee River near Reidsville, Ga., in 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 24-30 .....	3,585	1,740	2,455
July .....	3,840	314	1,872
August .....	6,860	280	2,344
September 1-12 and 20-30 <sup>a</sup> .....			1,252
October .....	1,920	280	654
November .....	1,415	350	966
December .....	1,830	480	775

<sup>a</sup> Missing dates; gage out.

#### OCONEE RIVER AT DUBLIN, GA.

Oconee River rises in the northern part of Georgia, near Gainesville, on the southern slope of the Chattahoochee Ridge, which separates the headwaters of this stream from the tributaries of Chattahoochee River. It flows in a southeasterly direction and joins the Ocmulgee at the southern border of Montgomery County to form the Altamaha. The drainage area is for the most part hilly and is made up of cultivated ground broken by extensive tracts of forest.

A station was established by the United States Weather Bureau in 1894 at Dublin, Ga., about 60 miles above the junction of the Oconee with the Ocmulgee. Records were kept, with the exception of the summer months of 1896, until April 30, 1897, when the station was discontinued. In 1898 discharge measurements were commenced by the Geological Survey, and on February 11 an observer was employed to read the gage. On October 15, 1898, the Weather Bureau again adopted the station and has maintained the gage and furnished gage heights to the Geological Survey continuously since that time. The present observer is Roger D. Flynt, who reads the gage once daily.

The gage is a heavy timber bolted to the downstream side of the center pier of the Wrightsville and Tennille Railroad bridge in the eastern part of the city of Dublin. The bridge is a drawbridge, and the pier to which the gage is attached is the circular center pier of the turn span. The gage is graduated to feet and tenths, and the markings face toward the right bank. A secondary gage is attached to a cypress tree on right bank about 200 feet above the railroad bridge. Measurements are made from the iron highway bridge, which is 500 feet upstream from the gage. This bridge is also a drawbridge, and consists of the turn span between two other spans of 75 feet each. The total length of bridge proper is 320 feet. On the left bank, which is low, there is 1,100 feet of iron frame trestle approach. There is also a short trestle on the right bank, which is high. The ordinary

width of the river is about 235 feet. At a gage height of about 20 feet the left bank begins to overflow, and it is practically covered to end of the approach at 25 feet. This ground is thickly covered with a brushy growth, which will no doubt cause the velocity of the water overflowing it to be small. The right bank does not overflow. The bed of the stream is of loose rock, sand, and gravel. The channel is straight and the current is swift and fairly uniform, except where it is broken by the three bridge piers. The initial point for soundings is the end of the bridge at the right bank, on the upstream side.

Bench mark No. 1 is the top of the upstream end of the crossbeam on top of the first tubular pier and is 41.30 feet above the zero of the gage. Bench mark No. 2 is a point on the fifth step from the bottom at the south entrance of the court-house, 6 inches from the east end of the step. Its elevation is 82.51 feet above the zero of the gage. Bench mark No. 3 is the top of the granite water table  $2\frac{1}{2}$  feet west of the southeast corner of the court-house. Its elevation is 80.97 feet above the zero of the gage. Bench mark No. 4 consists of three large nails driven into the tree to which the secondary gage is fastened at a point 3 feet above the zero of the gage.

The observations at this station have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Oconee River at Dublin, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 3 .....	J. M. Giles .....	15.40	20,165
April 4 .....	do .....	14.95	19,802
June 6 .....	F. A. Murray .....	8.81	9,804
Do .....	do .....	8.51	9,432
June 15 .....	do .....	4.47	5,017
July 15 .....	do .....	5.95	6,579
August 24 .....	do .....	4.61	4,475
October 6 .....	do .....	.12	1,713
November 14 .....	M. R. Hall .....	1.15	2,472

*Mean daily gage height, in feet, of Oconee River at Dublin, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.00	4.30	7.90	15.10	3.40	3.30	4.20	0.60	0.40	0.50	0.30	0.80
2.....	.90	3.80	9.00	14.90	3.10	2.80	3.20	.90	.40	.40	.30	.80
3.....	2.50	3.40	10.00	15.50	3.00	4.50	2.50	1.00	.00	.30	.60	.60
4.....	3.50	3.40	12.00	15.00	3.20	6.00	2.20	2.10	-.10	.10	.80	.70
5.....	4.00	4.00	13.50	14.10	4.80	7.50	2.30	4.20	-.20	.00	1.90	.80
6.....	5.00	5.80	13.40	12.90	6.00	8.40	1.80	4.60	-.10	-.10	3.80	.70
7.....	4.50	6.60	12.40	10.90	5.50	9.30	2.80	3.30	-.20	.10	3.00	.80

*Mean daily gage height, in feet, of Oconee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8.....	4.00	7.80	11.80	8.90	4.30	10.50	4.80	2.00	-0.20	0.30	3.00	0.90
9.....	3.20	8.80	11.90	8.20	4.10	11.70	5.90	1.50	-.20	.60	2.20	.90
10.....	2.60	11.00	10.80	8.80	4.50	13.00	6.80	.90	-.20	.60	1.80	1.00
11.....	2.30	21.00	9.50	9.20	4.40	13.10	5.20	1.00	.10	.40	1.10	1.40
12.....	2.80	24.00	8.80	10.00	3.90	11.20	3.20	1.00	-.10	.20	1.00	2.00
13.....	3.60	23.40	8.60	10.50	3.50	8.50	3.20	1.20	.00	.10	1.10	1.80
14.....	4.00	22.70	8.50	10.10	3.30	6.30	4.00	1.00	.10	.10	1.10	1.80
15.....	4.40	21.50	8.40	9.50	5.30	4.70	5.80	1.20	.50	.00	1.10	1.10
16.....	3.90	20.00	8.60	9.00	8.50	3.60	6.70	2.60	2.20	.00	1.00	1.30
17.....	3.20	18.40	8.40	8.50	9.80	3.20	7.30	3.80	6.50	.50	1.10	1.30
18.....	3.20	16.90	8.30	7.30	10.80	2.70	6.80	5.40	7.60	1.20	1.00	1.30
19.....	3.20	15.40	7.70	6.00	11.50	2.50	3.70	6.00	9.00	4.30	1.30	1.10
20.....	2.80	15.60	6.80	5.30	10.40	2.30	2.50	7.00	10.70	3.00	1.60	1.00
21.....	2.50	16.90	6.00	5.20	5.90	2.20	2.10	8.00	9.90	1.80	1.60	1.00
22.....	2.40	16.80	5.90	5.40	4.20	2.40	1.70	8.80	9.00	1.60	1.60	1.20
23.....	2.40	15.80	7.50	5.30	3.60	2.10	1.30	9.10	2.00	.90	1.00	1.50
24.....	2.30	14.30	8.80	4.50	3.00	2.60	1.20	5.00	1.50	.60	1.00	1.70
25.....	2.40	12.00	9.80	4.10	2.70	2.40	1.00	2.50	1.30	.50	.90	1.60
26.....	2.70	8.20	11.30	3.80	2.40	2.00	.90	1.80	1.00	.40	.90	2.50
27.....	3.30	6.30	13.40	3.90	2.30	2.10	.70	1.50	.90	.30	.90	3.70
28.....	5.70	6.30	15.10	4.70	2.30	3.50	.60	1.00	.80	.20	.90	3.50
29.....	6.00	-----	17.00	4.30	2.80	3.90	.50	.90	.70	.20	.80	3.20
30.....	5.40	-----	17.60	3.60	5.30	4.70	.50	.60	.50	.20	.80	2.60
31.....	5.00	-----	16.70	-----	3.80	-----	.60	.50	-----	.30	-----	2.00

*Rating table for Oconee River at Dublin, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
-0.2	1,530	1.2	2,410	5.0	5,470	12.0	14,620
-0.1	1,580	1.4	2,550	5.5	6,020	13.0	16,270
0.0	1,630	1.6	2,690	6.0	6,620	14.0	17,920
0.1	1,685	1.8	2,830	6.5	7,220	15.0	19,620
0.2	1,740	2.0	2,970	7.0	7,820	16.0	21,320
0.3	1,800	2.2	3,120	7.5	8,420	17.0	23,020
0.4	1,865	2.4	3,270	8.0	9,020	18.0	24,720
0.5	1,930	2.6	3,420	8.5	9,645	19.0	26,420
0.6	1,995	2.8	3,570	9.0	10,270	20.0	28,120
0.7	2,060	3.0	3,720	9.5	10,945	21.0	29,820
0.8	2,130	3.5	4,120	10.0	11,620	22.0	31,520
0.9	2,200	4.0	4,520	10.5	12,345	23.0	33,220
1.0	2,270	4.5	4,970	11.0	13,070	24.0	34,920

Table was made from measurements between 0.12 and 15.4 feet gage heights; becomes tangent above 14 feet, with a difference of 170 per tenth.

*Estimated monthly discharge of Oconee River at Dublin, Ga., for 1903.*

[Drainage area, 4,182 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	6,620	2,200	4,090	0.98	1.13
February .....	34,920	4,040	16,766	4.01	4.18
March .....	24,040	6,500	12,704	3.04	3.50
April .....	20,470	4,200	10,120	2.42	2.70
May .....	13,845	3,195	5,701	1.36	1.57
June .....	16,435	2,970	6,537	1.56	1.74
July .....	8,180	1,930	4,016	.96	1.11
August .....	10,405	1,930	3,964	.95	1.10
September .....	12,635	1,530	3,563	.85	.95
October .....	4,790	1,580	2,044	.49	.56
November .....	4,360	1,800	2,501	.60	.67
December .....	4,280	1,995	2,634	.63	.73
The year .....	34,920	1,530	6,220	1.49	19.94

#### OCONEE RIVER AT MILLEDGEVILLE, GA.

This station was established August 22, 1903, by M. R. Hall, although several discharge measurements were made before that time. The first one was made by C. C. Babb on October 19, 1895. The bench mark to which the present gage is referred was used to get the water height at the time of each of these measurements.

The station is located at the iron highway bridge in the eastern part of Milledgeville, which consists of 4 spans, 100 feet, 150 feet, 150 feet, and 80 feet long, beginning at the right bank end, and short wooden trestles about 25 feet long at each end.

At low water the river is about 300 feet wide, including 2 piers, and often a sand bar of considerable extent in the third span. This bar sometimes practically stops the third-span channel, leaving the river about 200 feet wide. The bed is sandy and shifting, and the water is shallow and swift. These conditions are unfavorable to accurate measurements as well as a constant rating. The channel is only slightly curved. Both banks are high and will not overflow. Measurements are made from the downstream side of the bridge, and the initial point is the end of the iron bridge at the right bank, downstream. The chain gage is attached to the downstream-side fencing of the bridge. The pulley is fastened to the top plank at a point 138.3

feet from the initial point for soundings. The zero of the scale is 2 feet to the right of the pulley. The length of the chain from the end of the weight to the marker is 46.03 feet. The gage is read once daily by J. A. Brooks.

Bench mark No. 1 is the top of the third crossbeam from the pier on the east bank, downstream end. It is 39 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Oconee River at Milledgeville, Ga., for 1903.*

Date.	Hydrographer.	Gage Height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
August 22 .....	M. R. Hall .....	3.95	2,301
September 11 .....	do .....	2.39	1,141
September 12 .....	do .....	2.27	1,042
October 16 .....	F. A. Murray .....	2.39	1,140
December 16 .....	do .....	3.05	1,908
December 18 .....	do .....	2.74	1,720

*Mean daily gage height, in feet, of Oconee River at Milledgeville, Ga., for 1903.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.50	2.50	2.55	2.70	17.....		17.30	3.50	2.80	2.90
2.....		2.45	2.50	2.55	2.65	18.....		8.60	5.70	3.40	2.85
3.....		2.40	2.40	2.55	2.65	19.....		5.30	3.60	3.20	2.75
4.....		2.40	2.40	2.65	2.65	20.....		3.90	3.00	2.90	2.75
5.....		2.35	2.40	3.90	2.75	21.....		3.40	2.90	2.85	3.00
6.....		2.40	2.30	3.80	2.75	22.....		3.20	2.75	2.85	2.95
7.....		2.40	2.25	3.70	2.75	23.....		3.10	2.65	2.85	2.95
8.....		2.20	3.10	3.20	2.70	24.....		3.00	2.60	2.85	3.00
9.....		3.50	2.65	3.10	2.65	25.....	3.20	2.90	2.55	2.80	3.00
10.....		2.50	2.60	2.70	3.40	26.....	3.10	2.85	2.45	2.80	3.90
11.....		2.50	2.40	2.85	3.40	27.....	3.00	2.60	2.40	2.75	3.70
12.....		2.50	2.25	2.70	3.20	28.....	2.85	2.60	2.50	2.70	3.30
13.....		2.10	2.20	2.85	2.95	29.....	2.75	2.60	2.50	2.70	3.00
14.....		2.45	2.35	2.85	3.00	30.....	2.65	2.50	2.50	2.70	2.90
15.....		3.40	2.30	2.85	3.10	31.....	2.55		2.55		2.90
16.....		17.30	2.40	2.80	3.10						

OCONEE RIVER NEAR GREENSBORO, GA.

This station was established July 25, 1903, by M. R. Hall. It is located at the new wagon bridge, about 5 miles west of Greensboro, on the road to Madison, Ga. The bridge is of two spans. The first one from the right bank is 80 feet long, and is not over the water except at time of floods. The main span over river is 144 feet long.

There is also 52 feet of iron trestle and about 40 feet of wooden trestle on the right bank, and 253 feet of iron trestle and about 325 feet of wooden trestle on the left bank. Ordinarily the river is about 120 feet wide. The bed is sandy and shifting. The channel is nearly straight, and the current is regular and sluggish at low stages. The right bank is high and rocky, with the exception of a low bench under the bridge and approach. The left bank is low and will overflow at a gage height of 12 to 15 feet to the end of the approach, a distance of about 600 feet, and extreme high water may pass beyond the end of the approach.

Discharge measurements are made from the downstream side of the bridge. The initial point is the end of the iron trestle on the right bank, downstream.

The boxed chain gage is bolted to the lower chord of the downstream side of the bridge 163 to 165 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 38.73 feet. The gage is read once each day by M. A. Stevens.

Bench mark No. 1 is the top of the downstream end of the second crossbeam from the right-bank pier. Its elevation is 36 feet above gage datum. Bench mark No. 2 is a copper plug set in the rock under the upstream side of the bridge opposite a point 84 feet from the initial point for soundings. Its elevation is 13.55 feet above gage datum. Bench mark No. 3 is on a hickory tree 26 feet downstream from the end of the wooden trestle on the right bank. Its elevation is 33.15 feet above gage datum. Bench mark No. 4 is the concrete foundation under the iron post below the initial point for soundings. Its elevation is 27.58 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Oconee River near Greensboro, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 12 .....	M. R. Hall .....	4.00	1,521
July 25 .....	do .....	1.75	733
August 28 .....	do .....	1.70	665
October 9 .....	do .....	1.70	690
December 2 .....	M. R. and W. E. Hall .....	1.66	725



*Mean daily gage height, in feet, of Oconee River near Greensboro. Ga., for 1903.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.90	1.60	1.60	1.60	1.80	17.....		4.10	8.90	1.80	1.90	1.80
2.....		4.50	1.40	1.50	1.60	1.70	18.....		9.60	6.80	1.70	1.70	1.70
3.....		6.90	1.40	1.50	1.80	1.60	19.....		13.20	5.20	1.70	1.90	1.70
4.....		5.60	1.40	1.50	3.70	1.50	20.....		5.80	2.60	1.60	2.00	1.60
5.....		4.00	1.40	1.50	2.80	1.50	21.....		3.50	2.10	1.60	2.10	1.60
6.....		2.90	1.30	1.50	3.70	1.60	22.....		2.90	2.20	1.50	1.80	1.80
7.....		2.20	1.30	1.60	2.60	1.60	23.....		2.60	2.00	1.50	1.60	1.80
8.....		2.10	1.20	1.80	2.40	1.80	24.....		2.10	1.90	1.50	1.60	2.40
9.....		1.90	1.20	1.70	2.10	2.00	25.....		1.90	1.80	1.50	1.90	2.20
10.....		2.50	1.70	1.70	2.10	1.90	26.....	1.60	1.90	1.80	1.50	1.90	2.20
11.....		2.10	1.80	1.40	1.90	1.90	27.....	1.60	1.80	1.70	1.50	1.80	2.00
12.....		1.50	1.40	1.40	1.90	1.80	28.....	1.70	1.80	1.60	1.40	1.70	2.10
13.....		1.50	.90	1.30	1.80	1.70	29.....	1.60	1.60	1.60	1.30	1.60	2.00
14.....		4.10	1.20	1.20	1.80	1.70	30.....	2.00	1.50	1.60	1.30	1.60	1.80
15.....		2.50	1.80	1.30	1.90	1.90	31.....	2.40	1.50		1.50		1.80
16.....		5.00	10.20	4.50	1.70	2.00							

#### APALACHEE RIVER NEAR BUCKHEAD, GA.

This station was established February 13, 1901, by M. R. Hall. It is located at the iron wagon bridge over Apalachee River about  $3\frac{1}{2}$  miles north of the town of Buckhead, Ga. The bridge is a single span 103 feet long, supported by tubular piers. Its trestle approaches are about 500 feet long on the right bank and about 100 feet on the left. At ordinary stages the channel is about 80 feet wide, and it is only slightly curved above and below the bridge. The bed of the river is part rock and part sand. The current is moderately swift and is somewhat broken and irregular on account of ruins of old pier bases about 50 feet upstream. The right bank is low for a distance of 400 feet and will overflow at a gage height of 10 feet. The low portion is thickly covered with trees and a brushy growth, which will greatly retard the flood water passing over it. The left bank is high and will not overflow, except to a short distance up the steep slope. Measurements are made from the downstream side of the bridge, and the initial point is the outside edge of the iron pier, left bank, downstream. The gage is graduated to feet and tenths with brass figures and staples and consists of two parts. The first section, extending from zero to 10 feet, is fastened to a small ash tree on the left bank about 100 feet below the bridge. The second section, extending from 6 to 20 feet, is nailed to the upstream post of the last wooden bent next to the iron bridge on the right bank.

Bench mark No. 1 is the top of the iron pier from the right bank, downstream side. Its elevation is 25 feet from the zero of the gage. Bench mark No. 2 is the top of the downstream end of the first cross beam from the right bank. Its elevation is 25.50 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock 10 feet west of the upstream tubular pier on right bank and 3 feet

upstream from the line of the upper edge of the bridge. Its elevation is 3.73 feet above the zero of the gage.

The observer is G. A. T. Adams, a farmer living about one-third of a mile from the bridge. Readings are made once a day.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Apalachee River near Buckhead, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 15	M. R. Hall	2.33	444
May 27	do	1.88	361
June 12	do	3.07	643
July 25	do	1.51	266
August 28	do	1.31	214
October 9	do	1.45	237
December 1	M. R. and W. E. Hall	1.60	255

*Mean daily gage height, in feet, of Apalachee River near Buckhead, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	2.50	7.80	8.80	2.70	4.00	2.20	1.20	1.10	1.70	1.20	1.90
2	2.60	3.10	7.00	5.70	2.60	10.00	2.00	3.40	.90	1.70	1.20	1.90
3	2.50	3.40	6.00	5.00	2.70	8.50	2.10	5.10	1.60	1.70	1.90	1.90
4	2.80	4.20	4.50	4.50	3.10	4.40	2.20	4.70	1.50	1.70	2.90	1.90
5	2.60	4.50	4.20	4.40	3.40	5.50	2.00	2.90	1.50	1.80	2.70	1.80
6	2.70	5.50	4.00	4.20	2.80	9.00	2.40	3.10	1.40	1.10	2.40	1.90
7	2.60	5.90	4.00	4.10	2.70	9.20	2.00	2.10	.90	1.80	2.40	1.90
8	2.40	17.00	4.00	5.00	2.60	4.50	6.20	1.90	.90	1.70	2.00	1.80
9	2.40	15.00	3.80	9.50	2.70	3.30	4.20	1.80	1.20	1.70	1.40	2.00
10	2.00	11.00	5.50	7.00	2.60	3.20	2.30	1.60	1.50	1.70	2.00	2.00
11	2.00	10.00	7.00	4.90	2.50	4.00	2.70	1.70	1.40	1.50	2.00	2.00
12	3.00	13.00	5.00	4.20	2.40	3.70	2.50	1.60	1.30	1.40	1.90	2.00
13	2.90	9.00	4.40	3.80	2.40	3.50	4.20	1.90	1.20	1.70	1.80	2.00
14	2.60	7.10	4.00	6.00	2.70	2.70	8.50	1.90	1.30	1.70	1.90	1.80
15	2.40	5.20	3.90	4.90	3.20	2.50	10.00	2.40	1.90	1.70	1.90	1.90
16	2.30	4.50	3.80	4.50	4.60	2.30	3.80	3.30	7.50	1.90	1.80	1.90
17	2.30	7.20	3.60	3.90	4.00	2.10	2.70	3.50	8.50	1.80	1.90	1.90
18	2.20	6.50	3.40	3.50	2.80	2.10	2.70	7.00	4.30	2.10	2.00	1.80
19	2.20	5.20	3.20	3.00	2.50	2.00	2.30	3.70	2.50	1.80	2.00	1.90
20	2.15	4.50	3.00	3.10	2.40	2.00	2.10	2.30	2.10	1.90	1.90	1.90
21	2.40	4.00	3.10	3.50	2.30	2.60	2.10	2.20	1.90	1.80	1.90	1.80
22	2.30	4.00	7.00	3.20	2.20	2.70	2.00	2.10	1.80	1.80	2.00	1.90
23	2.30	3.60	10.00	3.00	2.20	2.20	1.90	1.80	1.70	1.70	1.50	1.90
24	2.20	3.20	15.00	2.90	2.20	2.00	1.80	1.70	1.60	1.70	1.90	1.80
25	2.20	2.90	13.20	2.80	2.10	1.90	1.80	1.90	1.80	1.50	1.90	1.80
26	2.10	3.00	7.00	3.50	2.00	2.00	1.70	1.90	1.90	1.80	2.00	1.80
27	2.00	3.10	4.90	3.40	1.90	2.80	1.60	1.70	1.80	1.80	2.00	1.70
28	3.00	6.20	4.10	3.00	1.80	2.80	1.50	1.60	1.50	1.70	2.00	1.70
29	2.80		4.50	2.80	1.90	3.00	1.40	1.30	1.60	1.50	1.50	1.80
30	2.50		8.00	2.70	2.00	3.40	1.40	1.50	1.70	1.40	1.90	1.90
31	2.40		11.00		2.00		1.30	1.40		1.30		1.90

*Rating table for Apalachee River near Buckhead, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	180	2.3	442	4.2	965	8.0	2,010
1.1	191	2.4	470	4.4	1,020	8.5	2,147
1.2	203	2.5	497	4.6	1,075	9.0	2,285
1.3	216	2.6	525	4.8	1,130	9.5	2,422
1.4	231	2.7	552	5.0	1,185	10.0	2,560
1.5	248	2.8	580	5.2	1,240	10.5	2,697
1.6	267	2.9	607	5.4	1,295	11.0	2,835
1.7	288	3.0	635	5.6	1,350	11.5	2,972
1.8	310	3.2	690	5.8	1,405	12.0	3,110
1.9	333	3.4	745	6.0	1,460	13.0	3,385
2.0	360	3.6	800	6.5	1,597	14.0	3,660
2.1	388	3.8	855	7.0	1,735		
2.2	415	4.0	910	7.5	1,872		

Table depends upon measurements made between 1.31 and 6.45 feet gage height. Beyond these points the table is uncertain. Above 2 feet the 1901, 1902, and 1903 tables are the same.

*Estimated monthly discharge of Apalachee River near Buckhead, Ga., for 1903.*

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	635	360	481	1.09	1.26
February .....	4,485	497	1,522	3.46	3.60
March .....	3,935	635	1,406	3.20	3.69
April .....	2,422	552	1,009	2.29	2.55
May .....	1,075	310	520	1.18	1.36
June .....	2,560	334	854	1.94	2.16
July .....	2,560	216	593	1.35	1.56
August .....	1,735	203	495	1.12	1.29
September .....	2,147	170	407	.93	1.04
October .....	388	191	287	.65	.75
November .....	607	203	348	.79	.88
December .....	360	288	328	.75	.86
The year .....	4,485	170	688	1.56	21.00

## SOUTH RIVER NEAR LITHONIA, GA.

This station was established August 17, 1903, by F. A. Murray. The station is located a short distance above Albert Shoals, 6 miles south of Lithonia, Ga. The gage is a vertical 10-foot rod fastened to a tree on the right bank just below the bridge. It is read once each day by W. N. New. Discharge measurements are made from the 3-span wooden highway bridge. The initial point for soundings is the end of the bridge on the right bank, upstream side. The channel above the station is nearly straight for about 300 feet, and the current is sluggish, being held back by rock ledges below the station. Below the station the channel curves slightly and the current is sluggish for about 400 feet, at which point the shoals begin. The right bank is low and overflows at a gage height of 9 or 10 feet into a second channel, which has a width at high water of about 200 feet. The left bank is high and rocky and does not overflow. The bottom is solid rock.

Bench mark No. 1 is the top of the upstream end of the first wooden crossbeam from the right bank. Its elevation is 15 feet above the zero of the gage. Bench mark No. 2 is the center of a wire nail driven horizontally in the upstream side of the base of a willow tree on the left bank about 40 feet upstream from the bridge. Its elevation is 4 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of South River near Lithonia, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
August 17 .....	F. A. Murray .....	3.55	179
September 10 .....	M. R. Hall .....	3.46	120
Do .....	do .....	3.43	104
October 5 .....	do .....	3.40	104

*Mean daily gage height, in feet, of South River near Lithonia, Ga., for 1903.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	.....	3.50	3.50	3.50	3.50	17 .....	3.50	3.90	3.50	3.50	3.50
2 .....	.....	3.40	3.50	3.50	3.50	18 .....	4.10	3.60	3.60	3.60	3.50
3 .....	.....	3.50	3.50	3.50	3.50	19 .....	3.80	3.50	3.50	3.50	3.50
4 .....	.....	3.40	3.50	4.60	3.50	20 .....	3.60	3.40	3.50	3.50	3.60
5 .....	.....	3.40	3.50	4.00	3.50	21 .....	3.50	3.50	3.50	3.50	3.50
6 .....	.....	3.40	3.50	3.60	3.50	22 .....	3.60	3.50	3.50	3.50	3.50
7 .....	.....	3.50	3.50	3.60	3.50	23 .....	3.40	3.50	3.50	3.50	3.50
8 .....	.....	3.40	3.50	3.60	3.50	24 .....	3.50	3.50	3.50	3.50	3.50
9 .....	.....	3.40	3.50	3.60	3.50	25 .....	3.50	3.50	3.50	3.50	3.50
10 .....	.....	3.40	3.50	3.60	3.50	26 .....	3.50	3.50	3.50	3.50	3.60
11 .....	.....	3.50	3.50	3.60	3.50	27 .....	3.60	3.50	3.50	3.60	3.50
12 .....	.....	3.40	3.50	3.50	3.50	28 .....	3.50	3.50	3.50	3.60	3.50
13 .....	.....	3.50	3.50	3.50	3.60	29 .....	3.60	3.50	3.50	3.50	3.50
14 .....	.....	3.40	3.50	3.60	3.50	30 .....	3.60	3.50	3.50	3.50	3.50
15 .....	.....	4.50	3.50	3.50	3.50	31 .....	3.40	.....	3.50	.....	3.50
16 .....	.....	4.40	3.50	3.50	3.50						

#### OCMULGEE RIVER AT MACON, GA.

Ocmulgee River rises in the north-central part of Georgia and flows in a southeasterly direction, joining the Oconee south of Mount Vernon to form Altamaha River. The drainage area has the same general features as that of the Oconee. A station was established at Macon, Ga., by the United States Weather Bureau, on January 21, 1893. Discharge measurements were begun by the United States Geological Survey in 1895, and a wire gage was established on the bridge of the Macon, Dublin and Savannah Railroad, and was set on the same datum as the Weather Bureau gage. For a time gage height records were maintained by the Geological Survey, as the Weather Bureau records were for a part of the year only and were discontinued altogether from June 30, 1897, to June 1, 1899. Since June 1, 1899, the Weather Bureau gage height records have been taken continuously, and have been furnished to the Geological Survey.

The gage is a heavy timber graduated to feet and tenths by copper nails and is bolted to the downstream portion of the right bank stone pier of the Central of Georgia Railroad bridge. Discharge measurements are made from the downstream side of the Fifth Street Bridge, an iron bridge of two 190-foot spans, located about 500 feet above the railroad bridge to which the gage is attached. The initial point for soundings is the end of the iron hand rail of the footway at the right bank on the downstream side. The channel is straight and without obstructions, except one bridge pier. The banks are high and not subject to overflow. The bed of the river is soft and changeable. The station was a fairly good one until the spring of 1902, when the bed of the stream (which is of shifting sand) below the station changed to such an extent as to make the current very sluggish at low stages.

Bench mark No. 1 is the top of the iron rim of the sidewalk 80 feet from the initial point for soundings. Its elevation is 34.35 feet above the zero of the gage. It was determined by measuring down to the water surface. Bench mark No. 2 is the top of a cast-iron post at the end of the hand rail on the right bank, downstream side, of the Fifth street wagon bridge. Its elevation is 37.37 feet above the zero of the gage. Bench mark No. 3 is the top of the downstream side of the capstone of the right bank abutment of the Central of Georgia Railroad bridge. Its elevation is 32.30 feet above the zero of the gage. Bench mark No. 4 is an aluminum tablet on the wall at the west side of the door of the United States Government building at the Mulberry street front. This bench mark is marked 334 feet and has an elevation of 64.37 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Ocmulgee River at Macon, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	Second-feet.
January 26 .....	M. R. Hall .....	4.00	1,794
April 4 .....	J. M. Giles .....	9.00	5,118
April 2 .....	do .....	11.30	7,244
April 21 .....	E. C. Murphy .....	7.88	4,396
July 14 .....	M. R. Hall .....	11.00	7,676
Do .....	F. A. Murray .....	11.00	7,314
August 24 .....	do .....	3.61	1,382
October 15 .....	J. M. Giles .....	2.22	926
Do .....	do .....	2.28	915
September 30 .....	F. A. Murray .....	2.55	1,022
Do .....	do .....	2.56	1,057
November 13 .....	M. R. Hall .....	2.84	1,236
December 21 .....	J. M. Giles .....	2.88	1,264
Do .....	do .....	2.95	1,329

*Mean daily gage height, in feet, of Ocmulgee River at Macon, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. ....	4.80	4.20	14.30	14.30	5.30	7.20	4.40	4.10	2.90	2.30	2.20	2.50
2. ....	4.50	4.00	12.30	11.40	5.10	13.50	4.30	3.50	2.70	2.30	2.30	2.40
3. ....	4.70	4.00	9.30	9.90	5.20	11.50	4.40	3.70	2.60	2.40	2.50	2.30
4. ....	4.70	4.30	8.30	9.00	6.10	9.40	4.60	5.60	2.40	2.40	2.80	2.30
5. ....	5.20	5.70	9.50	8.90	6.60	12.90	4.90	6.30	2.00	2.40	3.50	2.40
6. ....	4.90	7.80	10.00	8.10	6.40	17.40	4.40	7.40	2.50	2.50	4.10	2.70
7. ....	4.60	6.70	8.80	8.30	5.80	12.90	4.40	5.50	2.30	2.50	3.20	2.80

*Mean daily gage height, in feet, of Ocmulgee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	4.40	20.00	7.80	7.70	7.00	12.30	4.90	3.90	2.20	2.50	3.00	2.80
9	4.20	20.70	7.70	12.20	6.50	8.80	6.00	3.50	2.20	2.60	2.90	2.90
10	4.00	18.40	12.60	13.00	6.00	8.20	5.60	3.40	2.10	2.60	2.60	3.30
11	3.90	15.75	11.20	10.00	5.50	6.90	4.50	3.20	2.10	2.50	2.60	3.30
12	4.90	17.60	11.40	8.90	5.30	6.40	7.30	3.10	2.10	2.40	2.50	3.20
13	5.40	16.30	11.20	7.70	5.10	5.80	6.60	3.50	2.20	2.30	2.90	2.90
14	4.90	12.90	9.30	8.90	5.30	5.30	10.20	3.60	2.20	2.40	2.80	2.90
15	4.40	10.60	8.10	8.80	7.20	5.10	11.00	5.90	9.90	2.40	2.70	3.20
16	4.20	10.20	9.20	7.70	11.00	4.70	7.40	7.30	14.70	2.30	2.80	2.90
17	4.20	16.30	8.70	6.90	8.20	4.50	5.30	7.30	13.00	2.90	2.70	2.70
18	4.10	16.50	7.50	6.60	6.30	4.40	4.60	5.70	8.30	4.90	2.90	2.70
19	3.90	14.10	6.90	6.30	5.70	4.40	4.30	9.80	5.50	3.50	2.90	2.60
20	3.80	11.10	6.50	6.20	5.20	4.20	4.20	11.20	4.40	3.10	3.10	2.40
21	3.80	9.40	6.40	8.20	5.10	4.10	3.90	5.70	3.80	2.90	3.00	2.90
22	3.80	7.90	11.50	7.30	4.90	4.40	3.90	5.10	3.60	2.70	2.90	3.20
23	3.80	7.30	15.20	6.20	4.70	4.50	3.60	4.10	3.00	2.40	2.70	3.10
24	3.80	6.90	18.30	5.80	4.90	4.40	3.50	4.30	3.20	2.40	2.80	2.90
25	4.00	6.30	18.30	5.70	4.50	4.20	3.40	4.00	3.20	2.40	2.80	2.90
26	4.10	6.20	15.60	6.60	4.30	4.00	3.40	3.20	3.10	2.30	2.70	3.70
27	4.80	6.10	11.30	6.50	4.20	4.20	3.30	3.10	3.00	2.30	2.60	3.40
28	5.10	8.00	9.20	5.90	4.70	5.30	3.20	2.90	3.00	2.30	2.60	3.40
29	5.10	-----	8.30	5.60	5.30	6.70	3.40	2.80	2.70	2.30	2.60	3.20
30	5.30	-----	14.50	5.40	4.70	5.40	3.20	2.70	2.50	2.30	2.50	2.80
31	4.70	-----	16.10	-----	4.60	-----	5.30	2.70	-----	2.30	-----	2.70

*Rating table for Ocmulgee River at Macon, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.0	810	3.3	1,505	5.2	2,640	7.8	4,290
2.1	860	3.4	1,560	5.4	2,760	8.0	4,420
2.2	910	3.5	1,620	5.6	2,880	8.5	4,770
2.3	960	3.6	1,680	5.8	3,000	9.0	5,170
2.4	1,010	3.7	1,740	6.0	3,120	9.5	5,570
2.5	1,065	3.8	1,800	6.2	3,250	10.0	6,060
2.6	1,120	3.9	1,860	6.4	3,380	10.5	6,700
2.7	1,175	4.0	1,920	6.6	3,510	11.0	7,380
2.8	1,230	4.2	2,040	6.8	3,640	12.0	9,020
2.9	1,285	4.4	2,160	7.0	3,770	13.0	11,140
3.0	1,340	4.6	2,280	7.2	3,900	14.0	13,900
3.1	1,395	4.8	2,400	7.4	4,030		
3.2	1,450	5.0	2,520	7.6	4,160		

Table made from measurements between 2.22 and 13 feet gage height. For rating table above 14 feet see the 1902 table. Table only approximate above 13 feet.

*Estimated monthly discharge of Ocmulgee River at Macon, Ga., for 1903.*

[Drainage area, 2,425 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	2,760	1,800	2,191	0.90	1.04
February .....	42,040	1,920	11,845	4.89	5.09
March .....	31,960	3,380	9,561	3.94	4.54
April .....	15,160	2,760	5,003	2.06	2.30
May .....	7,380	2,040	2,991	1.23	1.42
June .....	28,180	1,920	4,962	2.05	2.29
July .....	7,380	1,450	2,558	1.05	1.21
August .....	7,660	1,175	2,460	1.01	1.16
September .....	16,840	810	2,380	.98	1.09
October .....	2,460	960	1,110	.46	.53
November .....	1,980	910	1,235	.51	.57
December .....	1,740	960	1,272	.52	.60
The year .....	42,040	810	3,964	1.63	21.84

#### OCMULGEE RIVER NEAR FLOVILLA, GA.

A station was established on July 26, 1901, on Ocmulgee River at Lamars Ferry, one-half mile below Lamar's mill and 5 miles east of Flovilla, Ga. The object of this station was to compare the discharge of the river at this point with its discharge below at Macon through the low-water season.

The gage consisted of a  $\frac{5}{8}$  by 5 inch by 10 foot poplar board, graduated to feet and tenths with brass figures, staples, and tacks. The rod was nailed to a 16-foot pine plank, which was spiked to an ash tree 25 feet below the ferry landing. The tree was graduated with nails 1 foot apart, extending the gage up to 20 feet above datum.

The gage and bench marks were washed away by a flood on February 27, 1902. The station was reestablished June 18, 1903, at Lamars Ferry, by M. R. Hall. The vertical-timber gage is in two sections. The first section is a 1 by 4 inch board, reading from 0 to 5 feet, nailed to a 2 by 6 inch scantling which is spiked to a willow tree at the mouth of a small branch about 20 feet above the ferry landing on the right bank. The second section, reading from 5 to 15 feet, is nailed to an ash tree about 60 feet from the river up the same branch. No attempt was made to place this gage on the same datum of the old one. Measurements are made from the ferry boat. The



initial point for soundings is the windlass on the right bank. The channel is straight for 1,000 feet above and 5,000 feet below the station. The current is swift and regular; the right bank is high, but overflows at extreme high water. The left bank is somewhat lower. The bed of the stream is sandy and shifting, and there is but one channel.

Bench mark No. 1 is a nail driven in a large cottonwood tree about 200 feet from the river on the branch on which the gage is located. Its elevation is 14 feet above the zero of the gage. Bench mark No. 2 is a cross in the solid rock, 100 feet uphill from the first bench mark and 140 feet north from the wagon road, at a point 250 feet west of the ferry. Its elevation is 34.24 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Ocmulgee River near Flowilla, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 18 .....	M. R. Hall .....	2.00	1,383
August 25 .....	F. A. Murray .....	1.61	893
September 29 .....	do .....	1.35	771
October 13 .....	J. M. Giles .....	1.10	701
November 12 .....	M. R. Hall .....	1.78	1,070
December 19 .....	J. M. Giles .....	1.61	879

*Mean daily gage height, in feet, of Ocmulgee River near Flowilla, Ga., for 1903.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.20	1.60	1.20	1.30	1.20	1.50	17.....	2.90	3.30	6.50	1.80	1.50	1.70
2.....	1.90	1.40	1.10	1.30	1.20	1.50	18.....	2.40	7.50	3.90	1.80	1.70	1.70
3.....	2.30	2.10	1.10	1.30	1.30	1.40	19.....	2.30	6.10	2.80	1.70	1.70	1.60
4.....	2.90	4.00	1.30	1.20	1.40	1.70	20.....	2.10	3.40	2.40	1.50	1.80	1.70
5.....	2.70	3.40	1.10	1.20	3.20	1.60	21.....	1.90	2.70	1.90	1.40	1.50	2.00
6.....	2.10	2.70	.90	1.20	2.20	1.60	22.....	1.70	2.40	1.80	1.30	1.50	2.00
7.....	2.60	2.10	.90	1.20	2.10	1.60	23.....	1.60	2.10	1.70	1.20	1.60	1.90
8.....	3.20	1.70	.90	1.30	2.30	1.70	24.....	1.50	1.90	1.60	1.20	1.60	1.70
9.....	3.80	1.50	.80	1.30	1.50	1.60	25.....	1.50	1.60	1.50	1.10	1.70	1.70
10.....	2.80	1.40	.70	1.30	1.60	2.10	26.....	1.40	1.50	1.50	1.10	1.60	2.00
11.....	3.20	1.30	.90	1.20	1.40	2.00	27.....	1.30	1.40	1.40	1.10	1.60	2.50
12.....	5.30	1.70	.80	1.10	1.80	1.80	28.....	1.20	1.30	1.40	1.20	1.50	1.90
13.....	4.50	1.30	.80	1.10	1.70	1.70	29.....	1.30	1.20	1.40	1.20	1.50	1.80
14.....	9.50	3.80	1.10	1.00	1.60	1.90	30.....	1.50	1.10	1.30	1.20	1.50	1.70
15.....	6.60	5.20	6.20	.90	1.50	1.80	31.....	2.00	1.20		1.20		1.70
16.....	4.00	9.20	9.90	1.20	1.50*	1.70							

*Rating table for Ocmulgee River near Flovilla, Ga., from July 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.7	635	2.0	1,120	3.3	2,010	5.0	3,200
.8	648	2.1	1,185	3.4	2,080	5.5	3,550
.9	663	2.2	1,250	3.5	2,150	6.0	3,900
1.0	680	2.3	1,315	3.6	2,220	6.5	4,250
1.1	700	2.4	1,380	3.7	2,290	7.0	4,600
1.2	725	2.5	1,450	3.8	2,360	7.5	4,950
1.3	755	2.6	1,520	3.9	2,430	8.0	5,300
1.4	790	2.7	1,590	4.0	2,500	8.5	5,650
1.5	832	2.8	1,660	4.1	2,570	9.0	6,000
1.6	880	2.9	1,730	4.2	2,640	9.5	6,350
1.7	935	3.0	1,800	4.3	2,710	10.0	6,700
1.8	995	3.1	1,870	4.4	2,780		
1.9	1,055	3.2	1,940	4.5	2,850		

Above 2.40 feet gage height the curve becomes a tangent with difference of 70 per tenth.

*Estimated monthly discharge of Ocmulgee River near Flovilla, Ga., for 1903.*

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July -----	6,350	725	1,681	1.12	1.29
August -----	6,140	700	1,635	1.09	1.26
September -----	6,630	635	1,285	.86	.96
October -----	995	663	754	.50	.58
November -----	1,940	725	932	.62	.69
December -----	1,450	790	981	.65	.75

#### ALCOVY RIVER NEAR COVINGTON, GA.

This station was established on April 30, 1901. It is located about 3 miles east of Covington, at a low wooden bridge which is often under water. The gage is a vertical rod 10 feet long, graduated to feet and tenths, marked by tacks and brass figures. It is spiked to a birch tree on the left bank of the river 2 feet from the upstream side of the bridge. The observer is Stephen Belcher, a farmer living near, who

is paid by the Georgia geological survey. Discharge measurements are made from the upstream side of a low two-span wooden bridge about 100 feet long. The initial point for soundings is the end of the bridge floor on the left bank, upstream side. The banks are low and liable to overflow. The ground on the right bank is low and swampy for several hundred yards and is flooded by a moderate rise. The bed of the stream is sandy and shifting, and the water is sluggish at low stages.

Bench mark No. 1 is a notch and nail in a maple tree on the right bank, about 15 feet from the upper side of the bridge. Its elevation is 5.91 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in the solid rock on the north edge of the side ditch on the upstream side of the road, 100 feet from the end of the bridge, on the left bank of the river. Its elevation is 7.82 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Alcovy River near Covington, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 11.....	M. R. Hall.....	4.41	575
May 28.....	do.....	3.48	385
July 24.....	do.....	1.92	174
August 27.....	do.....	1.60	127
October 8.....	do.....	1.50	120
November 14.....	F. A. Murray.....	1.90	157
December 19.....	do.....	1.85	155

*Mean daily gage height, in feet, of Alcovy River near Covington, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.20	2.50	4.90	6.30	3.00	7.00	2.80	1.90	1.20	1.50	1.70	1.90
2.....	3.00	2.50	5.50	5.70	3.00	6.70	2.60	2.50	1.20	1.40	1.70	1.90
3.....	2.90	2.70	5.20	5.00	3.00	5.70	2.70	4.50	1.20	1.40	1.80	1.80
4.....	3.00	3.00	4.70	4.80	5.70	5.20	2.80	3.80	1.20	1.60	2.30	1.80
5.....	2.90	3.60	4.50	4.70	5.00	5.40	2.70	3.00	1.40	1.60	2.70	1.80
6.....	2.80	4.00	4.20	4.50	4.50	6.10	2.60	2.70	1.30	1.50	3.00	2.20
7.....	2.70	4.40	4.20	4.30	4.00	6.00	4.50	2.60	1.20	1.50	2.50	2.10
8.....	2.60	8.00	4.10	4.80	3.40	5.50	5.50	2.40	1.20	1.50	2.00	2.00
9.....	2.50	7.50	4.00	6.10	3.50	4.50	4.40	1.80	1.20	1.50	1.90	2.10
10.....	2.30	7.00	4.50	5.90	3.30	4.00	3.70	1.70	1.20	1.50	1.90	2.50
11.....	2.80	6.50	4.40	5.60	3.10	3.80	4.80	1.60	1.10	1.40	1.90	2.20
12.....	3.00	6.50	4.30	4.50	3.00	3.50	4.00	1.60	1.10	1.40	1.90	2.00
13.....	3.30	6.60	4.70	4.40	2.90	3.30	6.50	1.60	1.00	1.40	1.90	2.00

*Mean daily gage height, in feet, of Alcovy River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14.....	2.90	6.20	5.10	4.70	3.30	3.00	6.30	2.20	1.20	1.40	1.90	2.10
15.....	2.80	5.30	4.70	4.50	4.00	2.90	5.10	3.00	3.30	1.40	1.90	2.50
16.....	2.70	4.90	4.60	4.30	4.20	2.80	4.20	4.00	4.40	1.40	1.90	2.30
17.....	2.60	6.50	4.50	4.00	4.00	2.70	3.20	4.50	4.70	1.40	2.50	2.20
18.....	2.50	6.70	4.00	3.80	3.50	2.60	2.90	3.50	4.00	2.00	2.20	2.00
19.....	2.40	6.60	3.80	3.80	3.10	2.40	2.70	2.40	3.70	1.90	2.20	1.80
20.....	2.30	5.40	3.70	3.70	2.90	2.40	2.50	2.00	2.40	1.80	2.00	2.00
21.....	2.20	4.80	3.80	3.60	2.80	3.00	2.30	2.40	2.20	1.70	2.00	2.20
22.....	2.20	4.60	5.50	3.40	2.70	2.80	2.10	3.60	2.00	1.60	2.00	2.30
23.....	2.20	4.30	7.50	3.10	2.60	2.60	2.00	3.00	1.90	1.60	2.00	2.20
24.....	2.40	4.00	8.60	2.00	2.50	2.40	1.90	2.50	1.80	1.60	2.00	2.10
25.....	2.50	3.80	7.40	2.00	2.50	2.30	1.90	2.00	1.70	1.50	2.00	2.00
26.....	2.50	3.70	6.10	2.90	2.50	2.20	2.90	1.70	1.70	1.50	2.00	2.00
27.....	2.80	3.60	5.30	3.30	3.30	3.60	2.70	1.60	1.80	1.50	1.90	2.50
28.....	3.10	4.30	4.90	3.50	3.50	3.60	2.60	1.50	1.70	1.60	1.90	2.40
29.....	3.00	-----	4.20	3.30	3.10	3.20	2.40	1.40	1.60	1.60	1.90	2.30
30.....	2.90	-----	5.70	3.10	2.80	3.00	2.00	1.30	1.50	1.50	1.90	2.20
31.....	2.60	-----	6.20	-----	2.70	-----	2.00	1.30	-----	1.50	-----	2.10

*Rating table for Alcovy River near Covington Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	88	2.3	206	3.6	410	4.9	670
1.1	94	2.4	218	3.7	430	5.0	690
1.2	100	2.5	232	3.8	450	5.1	710
1.3	107	2.6	246	3.9	470	5.2	730
1.4	114	2.7	260	4.0	490	5.3	750
1.5	122	2.8	274	4.1	510	5.4	770
1.6	130	2.9	290	4.2	530	5.5	790
1.7	140	3.0	306	4.3	550	5.6	810
1.8	150	3.1	322	4.4	570	5.7	830
1.9	160	3.2	338	4.5	590	5.8	850
2.0	170	3.3	356	4.6	610	5.9	870
2.1	182	3.4	374	4.7	630	6.0	890
2.2	194	3.5	392	4.8	650		

At about 6 feet gage height the right bank overflows for a width of about 1,000 feet. Bank is covered by a thick swamp growth, so the velocity is probably small.

*Estimated monthly discharge of Alcorn River near Covington, Ga., for 1903.*

[Drainage area, 228 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	356	194	262	1.15	1.33
February .....	1,290	232	691	3.03	3.16
March .....	1,410	430	689	3.02	3.48
April .....	950	170	535	2.35	2.62
May .....	830	232	371	1.63	1.88
June .....	1,090	194	468	2.05	2.29
July .....	990	160	375	1.64	1.89
August .....	590	107	244	1.07	1.23
September .....	630	88	186	.82	.91
October .....	170	114	126	.55	.63
November .....	306	140	178	.79	.88
December .....	232	150	185	.81	.93
The year .....	1,410	88	359	1.58	21.23

#### MISCELLANEOUS MEASUREMENTS IN ALTAMAHA RIVER DRAINAGE BASIN.

*Ocmulgee River.*—At Bridges Ferry, near Berner, Ga., this stream was discharging 1,535 second-feet on June 16, 1903; gage height, 3.77 feet. The bench mark is a nail in birch tree at upper side of ferry landing, on right bank; elevation, 10.91 feet above datum.

*Pendleton Creek.*—This stream was measured at Gordon Bridge,  $3\frac{1}{2}$  miles from Lyons, Ga. The bench mark is a spike in a tupelo tree on right bank, 30 feet below bridge.

*Discharge measurements of Pendleton Creek at Gordon Bridge,  $3\frac{1}{2}$  miles from Lyons, Ga., 1903.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
June 8 .....	5.30	1,071
October 7 .....	11.60	100
Do .....	11.25	104

*Ohoopce River.*—At Janill Bridge, near Ohoopce, Ga., this stream was discharging 1,481 second-feet on June 8, 1903, when the water surface was 7.1 feet below the top of crossbeam, 58 feet from end of hand rail, on right bank going downstream.

*Yellow River.*—At Woods Bridge, near Almon, Ga., this stream was discharging 79 second-feet on September 12, 1903, when the water surface was 17.46 feet below top of crossbeam, 75 feet from right end of bridge going downstream.

*Yellow River.*—At wagon bridge near Lithonia, Ga., this stream was discharging 104 second-feet on October 5, 1903, when the water surface was 16.25 feet below top of wooden stringer on downstream side of bridge, at inside face of right-bank stone abutment.

*Little River.*—This stream was measured at wagon bridge  $6\frac{1}{4}$  miles northwest of Eatonton, Ga. The bench mark is top of bridge floor, 20 feet from end of bridge, on left bank going upstream.

*Discharge measurements of Little River at wagon bridge  $6\frac{1}{4}$  miles northwest of Eatonton, Ga., 1903.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
October 18 .....	8.73	118
December 17 .....	9.07	88

*Swift Creek.*—Near Lyons, Ga., this stream was discharging 31 second-feet on October 7, 1903.

*Ocmulgee River.*—This stream was measured at Holton, Ga. The bench mark is two nails in upstream side of birch tree 20 feet above old ferry landing, right bank.

*Discharge measurements of Ocmulgee River at Holton, Ga., 1903.*

Date.	Height of bench mark abovewater.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
October 14 .....	7.1	893
Do .....	7.0	963

*Indian Creek.*—This stream was measured at wagon bridge at Hudson's mill, 6 miles northwest of Eatonton, Ga. The bench mark is at top of bridge floor,  $27\frac{1}{2}$  feet from end of hand rail, right bank, upstream.

*Discharge of Indian Creek at wagon bridge at Hudson's mill, 6 miles northwest of Eatonton, Ga., 1903.*

Date.	Height of bench mark above wa- ter.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
October 18 .....	8.79	85
December 17 .....	9.10	49

*Sanford Creek.*—At wagon bridge, 3 miles from Eatonton, Ga., this stream was discharging 3.6 second-feet on December 17, 1903, when the water surface was 5.44 feet below bridge floor 21 feet from post on right bank.

*Gladys Creek.*—At wagon bridge,  $3\frac{1}{2}$  miles from Eatonton, Ga., this stream was discharging 7 second-feet on December 17, 1903, when the water surface was 6.14 feet below bridge floor 60 feet from right end of bridge, going upstream.

*Town Creek.*—At wagon bridge, 1 mile east of Eatonton, Ga., this stream was discharging 2.7 second-feet on December 18, 1903, when the water surface was 8.57 feet below top of bridge floor 24 feet from right end of bridge, going downstream.

## EASTERN GULF DRAINAGE.

The rivers flowing into the eastern portion of the Gulf of Mexico are for the most part similar in character to those in the southern Atlantic drainage, though in their lower courses their flow is usually more sluggish. In this report the rivers in this section from which the United States Geological Survey has obtained data during 1903 have been grouped into the following drainage areas: The Apalachicola, the Mobile, and the Pearl.

### APALACHICOLA RIVER DRAINAGE BASIN.

Apalachicola River is formed by the union of Flint and Chattahoochee rivers at the Georgia-Florida line. It flows in a southerly direction through Florida to the Gulf of Mexico. It is navigable, and boats run up Flint River to Albany, Ga., and up the Chattahoochee River to Columbus, Ga.

Flint River rises a few miles south of Atlanta, Ga., in Fulton County. It flows in a southerly direction to Talbot County, southeasterly to Macon County, southerly to Worth County, and southwesterly to Apalachicola River. It drains the south-central portion of Georgia, extending from Atlanta south to the Florida line. The tributaries to Flint River are mainly large creeks with much fall.

The principal ones among these are Whitewater, Redoak, Big Potato, Muckalee, Kinchafoonee, Ichawaynochaway, and Spring creeks.

Flint River has many good water powers on its course. Between a point opposite Woodbury, Ga., and a point opposite Knoxville, Ga., in Crawford County, a distance of about 45 miles, the river falls 334 feet. Very little of its power is yet developed.

Chattahoochee River rises in the Blue Ridge, in White County, and flows in a southwesterly direction until it reaches the Alabama line at the southwest corner of Troup County, Ga. From there it flows in a southerly direction, forming the western boundary of Georgia, until it flows into Apalachicola River at the southern boundary of the State. It drains almost all of the north-central, middle-west, and southwest portions of Georgia, and has a drainage area of 4,900 square miles at Columbus, Ga., which is at the fall line.

Soque River joins the Chattahoochee on the western edge of Habersham County. This river rises in Habersham County and flows in a southwesterly direction. It has considerable fall, dropping as much as 40 feet within a few hundred feet.

Farther down the Chattahoochee, at the west boundary of Hall County, Chestatee River enters. It rises in Lumpkin County and flows in a southerly direction through a very hilly and steep country and has much fall all along its course.

From its source down to Columbus the Chattahoochee River is an excellent water-power stream. From the lower edge of Lumpkin County down to Columbus, Ga., there is a fall of over 850 feet, 366 feet of this fall being between Westpoint and Columbus. All along its course there are many small tributaries flowing from a high, hilly country. These have much fall, and many small water powers are available.

During 1903 the United States Geological Survey maintained the following stations in this basin, under the direction of M. R. Hall: On Flint River at Albany, and near Woodbury, Ga.; on Kinchafoonee and Muckalee creeks near Albany, Ga.; on Chattahoochee River at Westpoint, at Oakdale, near Norcross, and near Gainesville, Ga.

#### FLINT RIVER AT ALBANY, GA.

This station was originally established by the United States Weather Bureau on April 10, 1893, and has been maintained from that date to the present. The gage was washed out and replaced in 1898. It was again injured in 1902, and was replaced by a new gage on June 17, 1902, which was read for the first time on June 18. The new gage was set 9 inches, or seventy-five hundredths of a foot, lower than the old gage. The gage as it existed prior to June 17, 1902, is described in Water-Supply Paper No. 48, on page 156. R. V. Watson was employed by the Weather Bureau to make and set the



new gage, and it appears from Mr. Watson's description of this gage on June 17, 1902, that a certain bench mark cut in the lower iron pier of the county bridge and described in Paper No. 48, above referred to, as being 10 feet above zero of gage, was in reality only 9 feet and 3 inches above the zero of the old gage. As Mr. Watson set the new gage 10 feet below this bench mark, its zero is 9 inches lower than that of the old gage. The gage heights have been corrected from January 1 to June 17, 1902, inclusive, to correspond with the new gage, so that one rating table will apply to the whole year.

Albany station is and has always been a Weather Bureau station, and John E. Clark has been the observer for years. Discharge measurements were begun by the United States Geological Survey in 1901.

The following is Mr. Watson's description of the present gage: The name of the bridge to which the gage is attached is the Dougherty County Flint River bridge, located at Albany, Ga., about 700 feet below the Atlantic Coast Line Railway bridge. The gage is in three parts or sections. No. 1 is attached to the crib around the middle piers (the crib is filled with rocks, being 30 by 14 feet), and extends about 3 feet above ordinary low water. This section reads to 4 feet above zero. It is securely spiked to the wooden crib. Section No. 2 is securely spiked to a green cypress tree just above the bridge on the west bank of the river, and reads from 2 to 17 feet above the zero on No. 1. No. 3 is securely spiked to a cedar post 16 feet high, the post being put 3 feet into the firm ground. This section begins at 17 feet above the zero on No. 1 and reads to 32 feet, which is about  $2\frac{1}{2}$  feet above any high water known since 1840. The gage is subdivided into feet and tenths, and is read once each day by D. W. Brosnan. Discharge measurements are made from the two-span railroad bridge, with 475 feet of trestle approach on the right bank and 240 feet on the left bank.

The initial point for soundings is the center of the tubular iron pier on the upstream side of the bridge on the left bank. The channel above the station is straight for about 1,000 feet and is rough. Below the station the channel is straight for 700 feet. The river overflows both banks, but only under the approaches to the bridge. The bed is constant, but is rough, and the current is irregular.

Bench mark No. 1 is a copper plug set in the downstream corner of the brick abutment on the right bank, under the Dougherty County bridge. Its elevation is 33.81 feet above the zero of the gage. Bench mark No. 2 is the top of the first crossbeam from the right bank, upstream end of the railroad bridge. Its elevation is 43.20 feet above the zero of the gage. Bench mark No. 3 is a chisel mark on the tubular pier of the wagon bridge on the right bank, downstream side. Its elevation is 10 feet above the zero of the gage. Bench mark No. 4 is the top of the third granite block of the Confederate monument at the center of Jackson and Pine streets. This is at the bottom of the polished

block which bears the inscription. Its elevation is 61.09 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Flint River at Albany, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 6.....	F. A. Murray.....	13.68	18,634
May 21.....	M. R. Hall.....	16.80	23,120
July 3.....	F. A. Murray.....	5.65	7,744
October 14.....	M. R. Hall.....	1.90	3,484
September 18.....	do.....	13.06	16,641
December 22.....	F. A. Murray.....	3.25	5,035

*Mean daily gage height, in feet, of Flint River at Albany, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.10	4.50	8.10	14.40	5.90	4.80	6.50	2.40	2.50	2.60	1.70	3.10
2.....	3.50	4.90	7.00	13.70	4.60	4.40	6.40	2.30	2.40	2.50	1.70	2.90
3.....	3.00	5.30	7.90	13.00	4.70	4.50	5.80	2.20	2.40	2.40	1.90	2.80
4.....	3.20	5.60	8.50	13.00	4.00	5.60	4.70	2.10	2.30	2.30	2.90	2.80
5.....	3.40	5.40	9.60	13.00	3.90	7.30	4.00	2.50	2.20	2.20	5.00	2.70
6.....	3.90	5.10	13.50	12.60	3.70	9.00	4.60	3.40	2.00	2.10	7.50	2.70
7.....	4.20	5.10	14.50	11.50	4.50	11.40	4.50	5.40	1.90	2.00	7.80	2.60
8.....	4.20	5.00	13.90	10.00	5.20	13.20	4.30	6.50	1.80	2.00	6.70	2.60
9.....	4.20	5.00	13.50	9.00	5.90	13.70	4.70	6.90	1.70	1.90	5.50	2.90
10.....	4.60	5.40	11.70	8.50	6.90	13.10	6.00	7.00	1.50	1.90	4.60	3.20
11.....	4.70	7.20	11.60	9.00	7.70	12.40	6.60	5.50	1.40	2.00	3.90	3.50
12.....	5.20	8.90	10.70	9.60	8.00	11.50	7.20	4.60	1.20	2.10	3.70	3.70
13.....	5.20	15.80	9.30	10.10	9.00	9.40	8.20	4.30	1.10	2.10	3.80	3.80
14.....	5.40	21.60	8.70	10.90	9.20	7.00	8.30	4.00	1.50	1.90	4.00	3.80
15.....	5.40	22.80	8.50	11.00	9.80	5.50	7.40	4.10	6.60	1.70	3.90	3.60
16.....	5.40	24.60	8.50	11.50	11.90	4.40	6.40	4.40	11.80	1.60	3.80	3.50
17.....	5.20	25.00	8.50	12.00	16.30	3.80	6.30	5.20	12.80	1.90	3.70	3.40
18.....	4.70	24.10	8.00	12.30	16.70	3.40	6.20	6.80	13.00	2.50	3.60	3.30
19.....	4.70	22.60	7.50	12.50	15.70	3.20	5.50	8.00	13.40	3.20	3.60	3.10
20.....	4.40	21.80	7.00	12.00	16.00	3.10	4.10	9.10	15.00	3.90	3.60	3.10
21.....	4.40	19.70	6.50	10.00	16.70	3.10	3.60	10.00	16.80	4.20	3.50	3.10
22.....	4.60	16.20	6.50	8.00	16.60	3.00	3.00	10.70	17.00	3.60	3.50	3.30
23.....	4.60	14.10	6.30	7.60	14.50	3.00	2.50	10.80	15.40	3.00	3.40	3.50
24.....	4.10	13.90	6.50	7.60	10.00	3.50	2.30	10.70	10.70	2.50	3.30	3.70
25.....	3.70	12.60	7.00	7.70	6.30	4.10	2.60	10.70	4.80	2.30	3.30	3.70
26.....	3.50	11.20	7.10	7.30	5.50	3.70	3.00	10.60	4.00	2.10	3.20	5.00
27.....	3.30	10.60	9.00	6.20	4.90	3.50	3.40	10.60	3.70	2.00	3.30	6.20
28.....	3.40	9.10	10.00	5.40	4.20	3.60	3.90	7.30	3.40	1.90	3.30	7.10
29.....	3.60	-----	11.80	5.30	4.40	4.70	3.60	3.30	3.20	1.80	3.30	7.30
30.....	4.10	-----	14.40	5.20	4.50	6.00	2.80	2.90	2.80	1.80	3.20	6.80
31.....	4.30	-----	14.80	-----	5.00	-----	2.60	2.60	-----	1.70	-----	6.10

*Rating table for Flint River at Albany, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.1	2,610	2.8	4,530	7.5	10,345	15.0	20,400
1.2	2,720	3.0	4,760	8.0	10,970	16.0	21,950
1.3	2,830	3.2	4,995	8.5	11,595	17.0	23,500
1.4	2,940	3.4	5,235	9.0	12,220	18.0	25,050
1.5	3,050	3.6	5,475	9.5	12,845	19.0	26,600
1.6	3,160	3.8	5,720	10.0	13,470	20.0	28,150
1.7	3,270	4.0	5,970	10.5	14,095	21.0	29,700
1.8	3,380	4.5	6,595	11.0	14,720	22.0	31,250
1.9	3,495	5.0	7,220	11.5	15,345	23.0	32,800
2.0	3,610	5.5	7,845	12.0	15,970	24.0	34,350
2.2	3,840	6.0	8,470	12.5	16,650	25.0	35,900
2.4	4,070	6.5	9,095	13.0	17,350		
2.6	4,300	7.0	9,720	14.0	18,850		

Above gage height 13.50 feet the curve becomes a tangent with a difference of 155 per tenth.

*Estimated monthly discharge of Flint River at Albany, Ga., for 1903.*

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	7,720	4,760	6,305	1.26	1.45
February .....	35,900	6,595	17,694	3.54	3.69
March .....	20,090	8,845	13,001	2.60	3.00
April .....	19,470	7,470	13,510	2.70	3.01
May .....	23,035	5,595	11,769	2.35	2.71
June .....	18,385	4,760	8,869	1.77	1.97
July .....	11,345	3,955	7,076	1.42	1.64
August .....	14,470	3,725	8,529	1.71	1.97
September .....	23,500	2,610	8,709	1.74	1.94
October .....	6,220	3,160	3,976	.80	.92
November .....	10,720	3,270	5,837	1.17	1.31
December .....	10,095	4,300	5,789	1.16	1.34
The year .....	35,900	2,610	9,255	1.85	24.95

## KINCHAFOONEE CREEK NEAR ALBANY, GA.

This station was established as a temporary station March 9, 1903, by F. A. Murray. It is located at the wagon bridge 3 miles north of Albany, Ga., 200 feet below the Central of Georgia Railroad bridge and about one-half mile above the mouth of the creek. The gage is a vertical rod fastened to the cypress tree on the left bank 100 feet above the bridge, and reads from 0 to 10 feet. During 1903 it was read once daily by T. M. Nelson. Discharge measurements are made from the single-span highway bridge and its approaches, which cross the river at an angle to the direction of the current. The initial point for soundings is the center of the iron pier on the left bank, downstream side. The channel is curved both above and below the station. Both banks are high and all water passes beneath the bridge and its approaches. The bed is probably somewhat shifting.

Bench mark No. 1 is the top of the crossbeam 30 feet from the initial point for soundings on the upstream side of the bridge. Its elevation is 26.52 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in a rock on the left bank about 25 feet below the bridge. Its elevation is 6.97 feet above the zero of the gage. Bench mark No. 3 is the top of the iron pier on the left bank, upstream side. Its elevation is 26.37 feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Kinchafoonee Creek near Albany, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 6.....	F. A. Murray.....	4.28	3,886
May 22.....	M. R. Hall.....	3.32	1,682
July 2.....	F. A. Murray.....	1.84	944
September 19.....	do.....	3.29	2,051
October 15.....	M. R. Hall.....	.98	422
December 22.....	F. A. Murray.....	1.76	851

*Mean daily gage height, in feet, of Kinchafoonee Creek near Albany, Ga., for 1903.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.90	1.50	1.90	1.80	1.20	1.00	1.20	0.90	1.60
2.....		2.90	1.50	1.60	1.80	1.30	1.00	1.10	1.10	1.00
3.....		2.80	1.50	1.50	1.80	1.30	1.00	1.10	1.50	1.60
4.....		2.80	1.50	1.80	1.90	1.20	1.00	1.10	2.00	1.60
5.....		2.80	1.90	2.00	1.70	1.20	1.00	1.10	2.50	1.60
6.....		2.70	2.60	2.60	1.60	1.20	.90	1.10	2.80	1.60

*Mean daily gage height, in feet, of Kinchafoonee Creek, etc.—Continued.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7		2.60	2.60	2.90	1.70	1.30	.90	1.00	2.80	1.60
8		2.50	2.70	3.20	1.90	1.50	.90	1.00	2.70	1.60
9	3.20	2.40	2.90	2.80	2.20	1.50	.90	1.00	2.50	1.60
10	3.00	2.40	2.70	2.40	2.60	1.50	.80	1.00	2.30	1.60
11	2.80	2.40	2.70	2.00	2.60	1.50	.80	1.00	2.20	1.60
12	2.60	2.40	2.90	1.90	2.60	1.50	.80	.90	2.10	1.60
13	2.40	2.50	3.10	1.70	2.60	1.60	.80	.90	2.10	1.60
14	2.20	2.60	3.60	1.70	2.70	1.70	1.60	.90	2.10	1.60
15	2.20	3.00	4.60	1.60	2.70	1.80	3.90	.80	2.00	1.60
16	2.20	3.40	8.60	1.50	2.50	1.80	4.30	.80	2.00	1.60
17	2.20	3.60	11.80	1.40	2.10	1.80	4.60	.80	2.00	1.60
18	2.20	3.50	9.30	1.30	1.70	2.40	4.20	.80	2.00	1.60
19	2.20	3.00	6.60	1.30	1.50	2.80	3.30	1.40	2.00	1.60
20	2.20	2.80	5.20	1.30	1.30	3.20	2.90	1.40	2.00	1.60
21	2.30	2.70	4.60	1.30	1.30	3.70	2.70	1.30	2.00	1.60
22	2.30	2.60	3.70	1.20	1.20	3.90	2.50	1.30	2.00	1.60
23	2.30	2.50	2.90	1.20	1.20	2.90	2.10	1.00	1.90	1.60
24	2.40	2.40	2.70	1.40	1.20	2.20	1.50	.90	1.90	1.60
25	2.40	2.20	2.60	1.50	1.20	1.90	1.40	.90	1.80	1.60
26	2.50	2.00	2.30	1.40	1.30	1.70	1.30	.90	1.80	1.60
27	2.50	1.80	2.00	1.50	1.40	1.50	1.30	.90	1.70	1.90
28	2.50	1.70	1.90	1.50	1.50	1.30	1.30	.90	1.60	2.40
29	2.60	1.70	2.00	1.60	1.30	1.10	1.20	.90	1.60	2.60
30	2.70	1.60	2.00	1.80	1.30	1.10	1.20	.90	1.60	2.60
31	2.80		2.00		1.30	1.00		.90		2.60

*Rating table for Kinchafoonee Creek near Albany, Ga., from March 9 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.8	332	2.1	1,070	4.0	2,490	6.6	3,900
.9	381	2.2	1,135	4.2	2,630	6.8	4,000
1.0	432	2.3	1,200	4.4	2,760	7.0	4,100
1.1	485	2.4	1,265	4.6	2,880	7.5	4,350
1.2	539	2.5	1,330	4.8	3,000	8.0	4,600
1.3	594	2.6	1,400	5.0	3,100	8.5	4,850
1.4	650	2.7	1,470	5.2	3,200	9.0	5,100
1.5	707	2.8	1,540	5.4	3,300	9.5	5,350
1.6	765	3.0	1,690	5.6	3,400	10.0	5,600
1.7	824	3.2	1,850	5.8	3,500	11.0	6,100
1.8	884	3.4	2,010	6.0	3,600	12.0	6,600
1.9	945	3.6	2,170	6.2	3,700		
2.0	1,007	3.8	2,330	6.4	3,800		

Rating table not well determined above 3 feet gage height.

*Estimated monthly discharge of Kinchafoonee Creek near Albany, Ga., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 9-31.....	1,850	1,135	1,314
April.....	2,170	765	1,398
May.....	6,500	707	1,954
June.....	1,850	539	874
July.....	1,470	539	892
August.....	2,410	432	911
September.....	2,880	332	934
October.....	650	332	438
November.....	1,540	381	1,006
December.....	1,400	765	848

#### MUCKALEE CREEK NEAR ALBANY, GA.

This station was established March 9, 1903, as a temporary station, by F. A. Murray. It is located at the wagon bridge 3 miles north of Albany, Ga., and a short distance below the mouth of Kinchafoonee Creek. The gage is a vertical rod of 1 by 4 inch board nailed to a scantling, fastened to a tree on the left bank, just above the bridge, and reads from zero to 14 feet. During 1903 it was read once each day by T. M. Nelson. Discharge measurements are made from the single-span highway bridge and its approaches. The initial point for soundings is the river side of the iron pier on the right bank, downstream side of the bridge. The channel is straight for 300 feet above the station and for 200 feet below. The current is regular and of moderate velocity. Both banks are high and will not overflow. The bed is rocky and probably permanent. The river flows in one channel at all stages. Backwater from the Flint River affects the discharge at high stages.

Bench mark No. 1 is the top of the upstream pier on the right bank; its elevation is 27.65 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in a rock on the right bank about 40 feet below the bridge. Its elevation is 11.91 feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Muckalee Creek near Albany, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 6	F. A. Murray	6.60	5,141
May	M. R. Hall	7.40	2,829
July 2	F. A. Murray	1.88	1,473
September 19	do	6.22	4,195
October 15	M. R. Hall	.72	644
December 22	F. A. Murray	1.59	1,343

*Mean daily gage height, in feet, of Muckalee Creek near Albany, Ga., for 1903.*

Day.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		4.80	1.60	1.90	1.90	1.20	1.10	1.30	1.00	1.60
2.		5.00	1.60	1.80	2.00	1.30	1.10	1.30	1.10	1.60
3.		4.90	1.60	1.70	1.90	1.30	1.00	1.20	1.50	1.60
4.		4.90	1.60	1.90	1.90	1.20	1.00	1.20	2.00	1.60
5.		4.90	2.00	2.60	1.70	1.20	1.00	1.20	2.50	1.60
6.		4.80	2.70	3.10	1.70	1.30	.90	1.20	2.80	1.60
7.		4.40	2.70	3.30	1.60	1.50	.90	1.10	2.80	1.60
8.		3.90	2.80	2.90	1.70	1.60	.90	1.10	2.70	1.60
9.	4.80	3.00	3.00	2.50	1.90	1.60	.90	1.10	2.50	1.60
10.	4.60	2.80	3.20	2.10	2.20	1.60	.80	1.10	2.30	1.60
11.	4.40	2.70	3.20	2.00	2.60	1.60	.80	1.00	2.20	1.60
12.	4.20	2.70	3.50	1.90	2.60	1.60	.80	1.00	2.10	1.60
13.	3.00	3.00	3.90	1.80	2.60	1.60	.80	1.00	2.10	1.60
14.	2.80	3.50	4.60	1.80	2.70	1.70	1.60	1.00	2.10	1.60
15.	2.80	4.00	5.60	1.70	2.70	1.80	4.10	1.00	2.00	1.60
16.	2.80	5.30	8.80	1.50	2.50	1.90	6.50	1.00	2.00	1.60
17.	2.80	5.40	12.60	1.50	2.10	2.10	8.60	1.00	2.00	1.60
18.	2.80	5.00	11.90	1.50	1.70	2.70	8.00	1.00	2.00	1.60
19.	2.80	4.60	7.90	1.40	1.60	3.10	7.10	1.50	2.00	1.60
20.	2.80	3.00	7.80	1.40	1.50	3.50	6.00	1.50	2.00	1.60
21.	2.90	2.80	7.60	1.40	1.30	3.70	6.00	1.30	2.00	1.60
22.	2.90	2.60	7.60	1.40	1.20	4.00	6.00	1.30	2.00	1.60
23.	2.90	2.50	6.00	1.30	1.20	3.00	5.20	1.20	1.90	1.60
24.	2.90	2.40	4.50	1.50	1.20	2.30	2.60	1.10	1.90	1.60
25.	2.90	2.40	3.70	1.60	1.30	2.00	1.50	1.10	1.80	1.60
26.	3.00	2.30	2.60	1.50	1.30	1.80	1.50	1.00	1.80	1.60
27.	3.00	2.10	2.10	1.60	1.40	1.60	1.50	1.00	1.70	1.90
28.	3.00	1.80	2.00	1.60	1.50	1.40	1.50	1.00	1.60	2.40
29.	3.20	1.70	2.00	1.60	1.30	1.20	1.40	1.00	1.60	2.60
30.	4.40	1.70	1.90	1.80	1.30	1.20	1.40	1.00	1.60	2.60
31.	4.60		1.90		1.30	1.20		1.00		2.60

*Rating table for Muckalee Creek near Albany, Ga., from March 9 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.7	630	1.8	1,320	2.9	2,090	4.0	2,860
.8	675	1.9	1,390	3.0	2,160	4.1	2,930
.9	720	2.0	1,460	3.1	2,230	4.2	3,000
1.0	770	2.1	1,530	3.2	2,300	4.3	3,070
1.1	830	2.2	1,600	3.3	2,370	4.4	3,140
1.2	900	2.3	1,670	3.4	2,440	4.5	3,210
1.3	970	2.4	1,740	3.5	2,510	4.6	3,280
1.4	1,040	2.5	1,810	3.6	2,580	4.7	3,350
1.5	1,110	2.6	1,880	3.7	2,650	4.8	3,420
1.6	1,180	2.7	1,950	3.8	2,720	4.9	3,490
1.7	1,250	2.8	2,020	3.9	2,790	5.0	3,560

Table not well determined, especially above 5 feet gage height, where back-water from Flint River greatly affects the rating.

*Estimated monthly discharge of Muckalee Creek near Albany, Ga., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 9-31	3,420	2,020	2,382
April	3,840	1,250	2,508
May 1-14 and 24-31 <sup>a</sup>			1,928
June	2,370	970	1,357
July	1,950	900	1,311
August	2,860	900	1,388
September 1-15 and 23-30 <sup>a</sup>			1,120
October	1,110	770	850
November	2,020	770	1,451
December	1,880	1,180	1,205

<sup>a</sup>Discharges for missing days not given on account of backwater.

#### FLINT RIVER NEAR WOODBURY, GA.

Measurements of the flow of Flint River were made during 1897 and 1898 at Molina, Ga., but the river bed was so shifting that the station was discontinued on June 2, 1898. Two measurements were made in 1899 at the Macon and Birmingham Railroad bridge, near Woodbury Ga., 5 miles below the Molina station. On March 29,



1900, a gage was put in near this bridge, and the station was reestablished.

The gage is graduated on a 1 by 5 inch plank in 5-foot sections; the part reading from zero to 10 feet is attached to a willow tree on the left bank about 300 feet above the bridge and about 50 feet below Riggins's old ferry; the section reading from 10 to 15 feet is fastened to a sweet gum tree 50 feet from the left bank and 150 feet upstream from the bridge. This gage was maintained by the Georgia geological survey until November 1, 1900, when it was adopted by the United States Weather Bureau instead of the one at Reynolds, Ga. The observer is J. C. Wright, who is paid by the United States Weather Bureau. Discharge measurements are made from the Macon and Birmingham Railroad bridge and its trestle approaches. This is a two-span iron bridge with the base of its rails 27.5 feet above low water. The initial point for soundings is the end of the iron bridge on the right bank, downstream side. The bridge and its piers are oblique to the direction of the current and the bed is rough and irregular and probably permanent. The channel above and below the station is slightly curved for 800 feet. Both banks are subject to overflow, but all water passes beneath the bridge and its approaches.

Bench mark No. 1 is the top of the downstream end of the second and third crossbeams from the left bank end of the bridge. The elevation of this bench mark is 27 feet above the zero of the gage. Bench mark No. 2 is a cut in the hickory tree on the upstream side of the old ferry landing, 50 feet from the left bank of the river and about 75 feet upstream from the gage. Its elevation is 7 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock on the west side of the river about 100 feet from the water and 100 feet upstream from a point opposite the gage. Its elevation is 16.24 feet above the zero of the gage. The zero of the gage is at an elevation of 660 feet above sea level.

The observations at the station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Flint River near Woodbury, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 12 .....	M. R. Hall .....	9.20	16,287
March 26 .....	J. M. Giles .....	5.45	8,861
April 22 .....	E. C. Murphy .....	2.45	2,718
Do .....	do .....	2.45	2,679
June 29 .....	J. M. Giles .....	1.48	1,591
July 30 .....	do .....	.37	503
September 30 .....	M. R. Hall .....	.28	387

*Mean daily gage height, in feet, of Flint River near Woodbury, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.20	1.00	4.70	4.50	1.00	1.20	1.00	0.60	0.10	0.20	0.30	0.30
2.....	1.10	.90	3.70	3.90	.90	1.50	.90	.70	.20	.20	.40	.30
3.....	1.00	.90	2.90	3.00	1.00	1.30	2.50	.80	.10	.20	.30	.30
4.....	1.20	1.00	3.00	2.70	1.10	1.40	1.10	1.00	.00	.20	.40	.40
5.....	1.10	1.20	4.20	2.30	1.00	2.20	.90	1.50	.20	.20	.50	.40
6.....	1.00	1.20	3.60	2.00	.90	2.50	.80	2.50	.10	.10	.60	.40
7.....	.90	1.50	2.90	1.70	2.00	2.90	2.00	1.40	.10	.20	.50	.60
8.....	.80	13.00	2.40	1.80	1.90	2.80	1.20	1.00	.00	.50	.40	.50
9.....	.70	11.50	2.20	2.20	1.80	2.40	1.30	.80	.00	.80	.40	.60
10.....	.60	10.00	2.40	2.10	1.50	2.20	1.00	1.30	.00	.50	.30	.90
11.....	.60	9.00	3.00	2.30	1.30	1.50	.90	.90	.00	.30	.40	.80
12.....	.50	9.50	3.10	2.20	1.00	1.20	.80	.50	.00	.30	.40	.70
13.....	1.50	7.50	2.60	3.10	1.10	.90	1.70	.60	.00	.20	.50	.60
14.....	1.20	5.70	2.00	2.90	1.30	.60	2.80	.80	.20	.20	.40	.80
15.....	1.10	3.80	2.10	2.50	4.60	.30	2.40	.90	5.30	.10	.40	.70
16.....	1.00	2.70	1.90	2.20	6.00	.50	2.00	1.00	5.90	.20	.50	.60
17.....	.90	7.00	1.80	1.90	4.10	.60	1.60	1.20	4.20	.60	.50	.50
18.....	.80	6.40	1.70	1.70	2.70	.50	1.00	2.70	2.70	1.10	.80	.50
19.....	.70	5.40	1.60	1.40	1.80	.50	.60	6.00	1.60	.70	.70	.40
20.....	.80	3.90	1.50	2.10	1.50	.50	1.00	3.60	1.20	.50	.60	.60
21.....	.90	2.70	1.40	2.90	1.30	.40	.60	2.00	.80	.40	.50	.90
22.....	.80	2.00	1.80	2.50	1.20	.50	.40	1.40	.70	.40	.60	.90
23.....	.70	1.70	5.60	1.90	1.10	.50	.20	1.10	.60	.30	.50	.80
24.....	.80	1.50	7.50	1.50	1.00	.50	.10	.90	.50	.30	.50	.70
25.....	.90	1.40	5.80	1.30	.90	.40	.20	.50	.40	.20	.40	.60
26.....	.90	1.30	5.80	2.20	.80	.50	.80	.40	.40	.30	.50	.50
27.....	.80	1.40	3.70	2.00	.70	1.90	.60	.20	.30	.20	.40	.40
28.....	1.40	3.00	2.20	1.50	.60	1.50	.40	.30	.40	.20	.40	.80
29.....	1.50	-----	2.50	1.20	.80	1.60	.30	.20	.30	.30	.40	.70
30.....	1.30	-----	4.50	1.10	.90	1.30	.20	.10	.30	.30	.40	.70
31.....	1.10	-----	4.90	-----	.80	-----	.50	.30	-----	.20	-----	.60

*Rating table for Flint River near Woodbury, Ga., for 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.0	290	2.6	2,890	5.2	6,880	7.8	12,750
.2	360	2.8	3,150	5.4	7,260	8.0	13,250
.4	470	3.0	3,410	5.6	7,640	8.2	13,750
.6	620	3.2	3,680	5.8	8,040	8.4	14,250
.8	800	3.4	3,960	6.0	8,450	8.6	14,750
1.0	1,005	3.6	4,240	6.2	8,880	8.8	15,250
1.2	1,225	3.8	4,540	6.4	9,320	9.0	15,750
1.4	1,455	4.0	4,840	6.6	9,780	9.2	16,250
1.6	1,685	4.2	5,160	6.8	10,260	9.4	16,750
1.8	1,920	4.4	5,480	7.0	10,750	9.6	17,250
2.0	2,160	4.6	5,820	7.2	11,250	9.8	17,750
2.2	2,400	4.8	6,160	7.4	11,750	10.0	18,250
2.4	2,640	5.0	6,520	7.6	12,250	11.0	21,250

Table same as that for 1902.

*Estimated monthly discharge of Flint River near Woodbury, Ga., for 1903.*

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	1,570	540	977	0.99	1.14
February .....	25,750	900	6,508	6.59	6.86
March .....	12,000	1,455	3,915	3.96	4.57
April .....	5,650	1,115	2,460	2.49	2.78
May .....	8,450	620	1,755	1.78	2.05
June .....	3,280	410	1,315	1.33	1.48
July .....	3,150	320	1,107	1.12	1.29
August .....	8,450	320	1,363	1.38	1.59
September .....	8,240	290	1,203	1.22	1.36
October .....	1,115	320	451	.46	.53
November .....	800	410	985	1.00	1.12
December .....	900	410	629	.64	.74
The year .....	25,750	290	1,889	1.91	25.51

## CHATTAHOOCHEE RIVER AT WEST POINT, GA.

This station was established July 30, 1896, by M. R. Hall, and is now maintained by the United States Weather Bureau. It is located at Montgomery street wagon bridge. The boxed chain gage is securely bolted to the outside of the iron railing of the downstream footway at a point 122 to 124 feet from the initial point for soundings. The boxed gage is so constructed that the length of the chain is always 2 feet greater than the elevation of the bottom of the box above gage datum. The length of the chain is 29.26 feet from the end of the weight to the marker. The wagon bridge from which discharge measurements are made is in three spans, with short approaches from each end. The floor of the bridge is about 24 feet above low water. The initial point for soundings is the end of the hand rail on the right bank, downstream side of the bridge. The channel is straight for about 2,000 feet above and 3,000 feet below the station. The current has a fair velocity, except at low stages. The right bank is high and overflows only at high water, when most of the town is covered. The left bank is somewhat lower and overflows for about 800 feet at a gage height of 20 feet. The bed of the stream is of sand and gravel and is unstable.

Bench mark No. 1 is the top of the downstream end of the second iron crossbeam under the bridge floor from the right-bank end of the

highway bridge. Its elevation is 24.19 feet above gage datum. Bench mark No. 2 is the top of the thirty-eighth milepost on the Franklin and West Point survey of the United States engineers. This post is a cast-iron cap 6 inches square, set in concrete, and approximately on a level with the ground. It is marked "U. S. 38." A raised point in the center of the cap is the bench mark; its elevation is 15.68 feet above gage datum. The location of this post is on the right bank of the river, 340 feet upstream from the wagon bridge and 50 feet from the edge of the river. It is 60 feet south of the Episcopal Church, and is 132 feet east of the northeast corner of a lot belonging to W. G. Sheafers, which is the southwest corner of Jasper and Front streets. Bench mark No. 3 is the top of the first marble block and bottom of the second marble block of the Confederate monument in the center of the street, 1,300 feet from the initial point of soundings and 860 feet from the east end of the bridge. Its elevation is 25.56 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Chattahoochee River at West Point, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 6 .....	M. R. Hall .....	3.95	5,056
April 22 .....	E. C. Murphy and M. R. Hall.	5.39	8,713
Do .....	E. C. Murphy .....	5.38	8,610
June 5 .....	M. R. Hall .....	9.70	20,957
June 6 .....	do .....	11.30	25,622
July 30 .....	J. M. Giles .....	3.46	4,761
July 31 .....	do .....	4.07	5,993
September 23 .....	M. R. Hall .....	2.40	2,451
September 24 .....	do .....	2.32	2,416
December 17 .....	W. E. Hall .....	2.37	2,460

*Mean daily gage height, in feet, of Chattahoochee River at West Point, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.10	3.70	11.60	12.20	4.40	5.70	4.00	3.80	2.20	2.10	2.00	2.20
2.....		3.40	11.20	10.20	4.40	6.70	3.70	3.00	2.20	2.10	2.10	2.20
3.....	4.10	3.30	11.30	7.00	4.40	6.10	3.50	3.70	2.20	2.00	2.20	2.20
4.....	4.10	3.60	7.40	6.40	4.40	8.80	3.60	3.80	2.10	2.00	2.50	2.20
5.....	4.10	6.40	7.00	6.10	4.40	9.30	4.10	4.60	2.10	2.00	3.50	2.20
6.....	4.00	6.90	6.40	5.70	4.30	10.80	3.80	4.50	2.10	2.00	2.80	2.30
7.....	3.80	6.20	6.10	5.50	5.40	11.90	4.00	4.00	2.30	2.00	2.60	2.30
8.....	3.60	18.50	5.70	5.40	5.20	11.40	4.00	3.30	2.10	2.00	2.80	2.30

*Mean daily gage height, in feet, of Chattahoochee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9.....	3.40	20.10	5.30	9.20	4.80	6.70	4.30	2.90	2.10	2.50	2.50	2.40
10.....	3.30	13.90	6.10	8.00	4.50	6.10	4.00	2.80	2.00	2.20	2.30	2.50
11.....	3.30	12.00	7.60	6.80	4.30	5.10	3.70	2.80	2.00	2.10	2.30	2.50
12.....	4.10	14.90	9.20	5.70	4.20	6.10	3.70	2.70	2.20	2.10	2.30	2.40
13.....	4.20	12.80	10.20	6.20	6.60	5.10	3.60	2.90	2.00	2.00	2.50	2.40
14.....	5.20	10.10	8.70	6.90	5.90	4.60	6.40	3.00	2.00	2.00	2.50	2.40
15.....	4.20	6.40	6.30	8.20	12.70	4.20	6.10	2.80	3.50	2.00	2.40	2.40
16.....	3.80	5.50	5.90	10.10	9.00	4.00	4.50	4.00	4.70	2.00	2.40	2.40
17.....	3.60	14.50	5.60	6.30	6.10	3.90	3.70	4.30	5.30	2.50	2.30	2.40
18.....	3.50	15.90	5.30	5.60	4.80	3.80	3.40	4.70	4.50	2.50	2.70	2.30
19.....	3.30	14.60	5.00	5.30	4.40	3.70	3.20	5.70	3.40	2.40	2.90	2.30
20.....	3.20	14.20	4.90	7.20	4.20	3.60	3.10	5.10	3.00	2.30	2.70	2.30
21.....	3.20	6.30	5.70	7.20	4.10	3.60	3.00	3.80	2.60	2.30	2.60	2.60
22.....	3.20	5.50	8.20	5.70	4.00	3.80	2.90	3.10	2.50	2.20	2.50	2.60
23.....	3.10	5.10	13.10	5.10	3.90	3.60	2.90	2.90	2.40	2.10	2.40	2.60
24.....	3.10	4.90	14.70	4.90	3.80	3.60	2.90	2.70	2.40	2.00	2.30	2.60
25.....	3.20	4.60	14.60	4.70	3.70	3.50	3.10	2.60	2.30	2.00	2.30	2.50
26.....	3.20	4.50	15.20	5.10	3.60	4.00	3.00	2.50	2.30	2.00	2.30	3.00
27.....	3.20	4.40	14.30	5.00	3.60	4.50	2.80	2.40	2.20	2.00	2.30	3.00
28.....	3.50	8.30	6.40	4.90	3.60	5.00	2.70	2.30	2.10	2.00	2.30	2.80
29.....	3.70	-----	7.00	4.60	3.60	5.20	2.70	2.30	2.10	2.00	2.20	2.70
30.....	3.50	-----	12.00	4.50	3.60	4.70	3.00	2.30	2.10	2.00	2.20	2.50
31.....	3.90	-----	13.50	-----	5.50	-----	4.00	2.30	-----	2.00	-----	2.40

*Rating table for Chattahoochee River at West Point, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.0	935	2.3	2,240	4.2	5,880	9.5	20,750
1.1	970	2.4	2,380	4.4	6,400	10.0	22,200
1.2	1,000	2.5	2,530	4.6	6,940	10.5	23,650
1.3	1,090	2.6	2,680	4.8	7,490	11.0	25,100
1.4	1,180	2.7	2,840	5.0	8,040	12.0	28,800
1.5	1,280	2.8	3,000	5.5	9,420	13.0	33,410
1.6	1,380	2.9	3,170	6.0	10,800	14.0	38,030
1.7	1,540	3.0	3,340	6.5	12,177	15.0	42,630
1.8	1,600	3.2	3,700	7.0	13,560	16.0	47,230
1.9	1,720	3.4	4,080	7.5	14,954	17.0	51,830
2.0	1,840	3.6	4,480	8.0	16,400	18.0	56,430
2.1	1,970	3.8	4,920	8.5	17,850		
2.2	2,100	4.0	5,370	9.0	19,300		

Table same as that for 1898.

*Estimated monthly discharge of Chattahoochee River at West Point, Ga., for 1903.*

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	8,592	3,520	4,708	1.43	1.65
February .....	66,090	3,890	21,593	6.54	6.81
March .....	43,550	7,765	19,626	5.95	6.86
April .....	29,720	6,670	12,345	3.74	4.17
May .....	32,030	4,480	7,896	2.39	2.76
June .....	28,340	4,280	9,976	3.02	3.37
July .....	11,904	2,840	4,782	1.45	1.67
August .....	9,972	2,240	4,203	1.27	1.46
September .....	8,868	1,840	2,825	.86	.96
October .....	2,530	1,840	1,988	.60	.69
November .....	4,280	1,840	2,485	.75	.84
December .....	3,340	2,100	2,463	.75	.86
The year .....	66,090	1,840	7,908	2.40	32.10

#### CHATTAHOOCHEE RIVER AT OAKDALE, GA.

This station was established at Oakdale by Cyrus C. Babb on October 17, 1895. It is located at the Southern Railway bridge, 1 mile above the mouth of Proctor Creek, 2 miles below the mouth of Peachtree Creek, one-fourth mile west of Chattahoochee, 1 mile east of Oakdale, and 8 miles northwest of Atlanta.

On July 30, 1896, the location of the station was changed to Mason & Turner's ferry, 1 mile below Oakdale. The gage at this point, known as the "Oakdale lower gage," is nailed to a tree on the right bank 100 feet below the ferry and set 1 foot lower than the gage at the Southern Railway bridge. On June 1, 1899, the lower gage was discontinued and the upper gage resumed and adopted by the United States Weather Bureau, the United States Geological Survey still receiving the records and making the current-meter discharge measurements at this point. The gage now used is in two sections, the first, reading from zero to 8 feet, fastened to a willow tree 100 feet above the bridge on the left bank; the second, reading from 8 to 26 feet, fastened to an ash tree 30 feet above the bridge on the left bank. It is set on the same datum as the old wire gage of the United States Geological Survey established at that point by Mr. Babb in 1895 and above referred to. Its zero point is 753.5 feet above sea level. Discharge measurements are made from the railway bridge. The initial point for soundings is the end of the iron bridge on the right bank, upstream side.

Bench mark No. 1 is a railroad spike in the corner of the pier on the right bank 12.39 feet above datum of gage. Bench mark No. 2 is a large bridge spike, in a sycamore tree about 50 feet above the bridge on the left bank; it is at an elevation of 11 feet above the zero of the gage. Bench mark No. 3, determined by measuring down to the water, is the top of the iron girder, 40 feet from the initial point for soundings, on the upstream side of the bridge. Its elevation is 57.55 feet above the zero of the gage. The flow is obstructed by rafts, which have to be cleared from the channel occasionally. The channel is straight and the current swift. The banks are subject to overflow. The bed of the stream is constant and the results are fairly good, except at high stages, when the water flows through the trestlework. The observer is J. B. Austin.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Chattahoochee River at Oakdale, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 2 .....	M. R. Hall .....	9.95	9,787
March 23 .....	J. M. Giles .....	21.85	33,617
April 23 .....	E. C. Murphy .....	5.03	4,836
June 2 .....	J. M. Giles .....	12.20	12,481
September 2 .....	do .....	1.25	1,612
October 7 .....	do .....	1.10	1,359
November 5 .....	do .....	1.90	1,882

*Mean daily gage height, in feet, of Chattahoochee River at Oakdale, Ga., for 1903.<sup>a</sup>*

Day.	Jan.	Feb.	Mar.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Nov.	Dec.
1 .....	2.60	3.00	19.40	1.00	1.00	17 .....	2.50	24.00	5.90	1.30	1.30
2 .....	2.80	2.90	12.00	-----	1.00	18 .....	2.40	25.60	4.80	1.70	1.30
3 .....	3.10	3.40	7.20	1.50	1.00	19 .....	2.20	9.40	4.60	1.50	1.30
4 .....	2.80	7.60	6.60	2.00	1.00	20 .....	2.10	4.90	5.00	1.50	1.50
5 .....	2.50	10.20	5.80	2.00	1.00	21 .....	2.00	2.70	11.40	1.50	1.60
6 .....	2.40	6.70	6.40	3.00	1.00	22 .....	2.00	3.00	13.00	1.30	1.60
7 .....	2.60	7.70	5.80	2.00	1.00	23 .....	1.90	3.20	21.00	1.30	1.50
8 .....	2.80	18.00	5.80	1.50	1.00	24 .....	2.20	3.70	23.40	1.20	1.50
9 .....	2.70	15.60	5.50	1.50	1.00	25 .....	2.50	4.10	22.40	1.10	1.50
10 .....	2.50	7.80	7.40	1.30	1.20	26 .....	2.40	3.70	8.80	1.20	1.70
11 .....	3.30	11.00	12.40	1.30	1.20	27 .....	2.00	4.20	7.50	1.00	1.70
12 .....	4.00	16.00	15.00	1.50	1.00	28 .....	2.30	11.40	6.80	1.00	1.50
13 .....	4.90	10.60	11.40	1.40	1.30	29 .....	2.70	-----	10.80	1.00	1.50
14 .....	3.80	4.70	7.70	1.30	1.50	30 .....	4.50	-----	16.60	1.00	1.40
15 .....	3.20	5.80	6.80	1.20	1.50	31 .....	3.40	-----	15.80	-----	1.30
16 .....	2.80	5.80	6.00	1.20	1.30						

<sup>a</sup> Gage heights from April 1 to October 31 not reliable.

*Rating table for Chattahoochee River at Oakdale, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	1,300	4.8	4,440	8.6	8,500	16.0	17,940
1.2	1,420	5.0	4,640	8.8	8,720	16.5	18,650
1.4	1,545	5.2	4,840	9.0	8,940	17.0	19,400
1.6	1,675	5.4	5,040	9.2	9,180	17.5	20,160
1.8	1,810	5.6	5,240	9.4	9,420	18.0	20,960
2.0	1,950	5.8	5,440	9.6	9,660	18.5	21,800
2.2	2,095	6.0	5,640	9.8	9,900	19.0	22,800
2.4	2,245	6.2	5,860	10.0	10,140	19.5	23,800
2.6	2,400	6.4	6,080	10.5	10,740	20.0	25,000
2.8	2,560	6.6	6,300	11.0	11,340	20.5	26,300
3.0	2,730	6.8	6,520	11.5	11,940	21.0	27,800
3.2	2,900	7.0	6,740	12.0	12,540	21.5	29,550
3.4	3,080	7.2	6,960	12.5	13,190	22.0	31,300
3.6	3,260	7.4	7,180	13.0	13,840	22.5	33,050
3.8	3,450	7.6	7,400	13.5	14,490	23.0	34,800
4.0	3,640	7.8	7,620	14.0	15,140	23.5	36,550
4.2	3,840	8.0	7,840	14.5	15,840	24.0	38,300
4.4	4,040	8.2	8,060	15.0	16,540	25.0	41,800
4.6	4,240	8.4	8,280	15.5	17,240		

Above 21 feet gage height the curve becomes a tangent with difference of 350 per tenth.

*Estimated monthly discharge of Chattahoochee River at Oakdale, Ga., for 1903.<sup>a</sup>*

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,540	1,880	2,570	1.65	1.90
February	43,500	2,480	9,710	6.22	6.48
March	36,200	4,240	11,501	7.37	8.51
November	2,730	1,300	1,567	1.00	1.12
December	1,740	1,300	1,483	.95	1.10

<sup>a</sup>Gage heights from Apr. 1 to Oct. 31 discarded because they were unreliable.

#### CHATTAHOOCHEE RIVER NEAR NORCROSS, GA.

This station was established June 10, 1902, by M. R. Hall. It is located at Medlock's toll bridge, about  $4\frac{1}{2}$  miles north of Norcross,



Ga. This point is above the mouth of Johns Creek and below the mouth of Sewanee Creek. A vertical section of gage, reading from zero to 8 feet, is attached to an oak tree on the right bank of the river, 100 feet above the bridge. A chain gage was established March 14, 1903. The center of the pulley is 28.32 feet above the zero of the gage, and the length of the chain from the end of the weight to the marker is 28.75 feet. The gage is read once each day by W. O. Medlock, the bridge keeper. Discharge measurements are made from the downstream side of the single-span bridge and its approaches. The initial point for soundings is 50 feet to right of the center of the downstream tubular pier on the right bank. The channel is slightly curved for 600 feet above and 700 feet below this station. The current is sluggish at low stages. The right bank is high and will overflow only for 50 feet from the water's edge; the left bank will overflow for about 800 feet at a gage height of from 16 to 18 feet. The bed of the stream is sandy and probably changes.

Bench mark No. 1 is the top of the iron pier on the right bank, downstream side. Its elevation is 27 feet above gage datum. Bench mark No. 2 is a copper plug set in a stone post set flush with the surface of the ground at the side of the road just outside of the toll bridge on the right bank. The post is on line with the downstream side of the bridge and is 145 feet from the center of the pier at the right-bank end of the bridge. Its elevation is 26.92 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Chattahoochee River near Norcross, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 9 .....	M. R. Hall .....	2.70	1,837
March 14 .....	do .....	5.35	4,940
May 5 .....	do .....	4.08	3,543
May 29 .....	J. M. Giles .....	3.15	2,378
June 26 .....	do .....	3.13	2,447
July 17 .....	M. R. Hall .....	3.06	2,254
Do .....	do .....	3.06	2,255
August 19 .....	do .....	3.15	2,337
Do .....	do .....	3.05	2,288
Do .....	F. A. Murray .....	3.15	2,281
Do .....	do .....	3.05	2,203
September 26 .....	do .....	2.06	1,197
October 23 .....	do .....	1.94	1,078
November 25 .....	do .....	1.95	1,062
Do .....	do .....	1.95	1,071

*Mean daily gage height, in feet, of Chattahoochee River near Norcross, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.90	14.10	7.00	4.00	4.50	3.20	3.10	2.10	2.00	1.90	1.90
2.....		2.80	7.00	6.00	4.00	9.70	3.10	2.60	2.00	2.00	2.00	1.90
3.....		3.20	5.60	5.50	4.00	7.50	3.30	6.10	2.00	2.00	2.70	1.90
4.....		5.20	5.00	5.40	4.20	4.90	3.20	3.60	2.00	2.00	2.30	1.90
5.....		8.30	4.70	5.10	4.10	9.70	3.10	3.20	2.20	2.00	2.40	1.90
6.....		4.90	4.80	4.80	3.90	11.20	3.00	2.80	2.10	2.00	2.70	1.90
7.....		4.30	4.60	4.70	3.80	7.30	3.50	2.60	2.00	2.00	2.20	1.90
8.....		10.60	4.80	5.80	3.80	5.50	3.10	2.50	2.00	2.00	2.10	1.90
9.....	2.70	8.60	5.30	7.90	3.80	4.70	3.30	2.40	2.30	2.20	2.00	1.90
10.....	2.60	5.20	5.00	5.40	3.70	4.40	2.90	2.40	2.20	2.20	2.00	2.00
11.....	2.70	6.40	8.70	5.00	3.60	5.10	3.20	2.40	2.10	2.00	2.00	1.90
12.....	5.80	11.10	11.50	4.80	3.60	4.90	3.30	2.70	2.00	2.00	2.10	1.90
13.....	4.20	6.20	6.40	4.70	3.70	4.10	6.80	2.50	2.00	1.90	2.00	2.00
14.....	3.40	4.90	5.50	12.60	3.80	3.90	4.60	2.50	1.90	1.90	2.00	2.10
15.....	3.20	4.80	5.10	7.80	3.90	3.70	3.60	3.20	3.60	1.90	2.00	2.20
16.....	3.00	4.50	4.80	5.90	3.70	3.60	3.20	3.20	4.90	1.90	2.00	2.00
17.....	2.90	14.90	4.60	5.40	3.60	3.50	3.00	4.30	3.60	2.00	2.00	1.90
18.....	2.80	13.70	4.50	5.10	3.50	3.50	3.00	5.00	2.80	2.20	2.30	1.90
19.....	2.70	5.90	4.30	4.90	3.40	3.50	2.90	3.50	2.40	2.20	2.50	1.90
20.....	2.60	5.10	4.20	4.80	3.40	3.40	2.80	2.70	2.30	2.00	2.10	1.90
21.....	2.60	4.70	5.90	4.90	3.40	3.30	2.80	2.60	2.20	2.00	2.00	2.20
22.....	2.70	4.40	8.00	4.60	3.40	3.30	2.70	2.50	2.20	2.00	2.00	2.30
23.....	2.60	4.20	16.70	4.50	3.30	3.20	2.70	2.40	2.10	1.90	2.00	2.10
24.....	2.50	4.00	19.40	4.40	3.20	3.20	2.60	2.30	2.10	1.90	2.00	2.00
25.....	2.70	3.90	9.00	4.30	3.20	3.10	2.60	2.30	2.10	1.90	2.00	2.00
26.....	2.70	3.80	6.40	4.40	3.10	3.10	2.50	2.20	2.10	1.90	2.00	2.20
27.....	2.60	3.70	5.80	4.40	3.10	4.00	2.50	2.20	2.10	1.90	1.90	2.20
28.....	2.70	8.60	5.50	4.20	3.10	3.80	2.50	2.10	2.10	1.90	1.90	2.00
29.....	3.60		5.40	4.10	3.10	3.70	2.50	2.10	2.00	1.90	1.90	2.00
30.....	4.00		10.00	4.00	3.50	3.50	2.50	2.10	2.00	1.90	1.90	2.00
31.....	3.20		11.40		5.20		2.60	2.30		1.90		1.90

*Rating table for Chattahoochee River near Norcross, Ga., from January 9 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.9	1,015	2.9	2,080	3.9	3,205	4.9	4,425
2.0	1,120	3.0	2,190	4.0	3,320	5.0	4,555
2.1	1,225	3.1	2,300	4.1	3,440	5.1	4,685
2.2	1,330	3.2	2,410	4.2	3,560	5.2	4,815
2.3	1,435	3.3	2,520	4.3	3,680	5.3	4,945
2.4	1,540	3.4	2,630	4.4	3,800	5.4	5,075
2.5	1,645	3.5	2,745	4.5	3,920	5.5	5,210
2.6	1,750	3.6	2,860	4.6	4,045	5.6	5,345
2.7	1,860	3.7	2,975	4.7	4,170	5.8	5,615
2.8	1,970	3.8	3,090	4.8	4,295	6.0	5,885

No measurements have been made above gage height 5.35.

*Estimated monthly discharge of Chattahoochee River near Norcross, Ga., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January 9-31, 23 days.....	5, 615	1, 645	2, 281
February, 19 days <sup>a</sup> .....		1, 970	-----
March, 19 days <sup>a</sup> .....		3, 560	-----
April, 26 days <sup>a</sup> .....		3, 320	-----
May.....	4, 815	2, 300	2, 923
June, 25 days <sup>a</sup> .....		2, 300	-----
July.....	7, 005	1, 645	2, 343
August.....	6, 020	1, 225	2, 055
September.....	4, 425	1, 015	1, 466
October.....	1, 330	1, 015	1, 103
November.....	1, 860	1, 015	1, 222
December.....	1, 435	1, 015	1, 110

<sup>a</sup> Higher discharges omitted because of lack of high-discharge measurements. Maximum and mean for February, March, April, and June not known.

#### CHATTAHOOCHEE RIVER NEAR GAINESVILLE, GA.

This station was established on June 26, 1901,  $3\frac{1}{2}$  miles northwest of Gainesville, at Thompson's bridge. The gage as originally established was a 15-foot vertical rod, graduated to feet and tenths. It was on the right bank about 50 feet below the bridge.

A standard chain gage is attached to a beam on the upstream side of the bridge about 160 feet from the initial point for soundings. The length of the chain from the end of the chain to the marker is 34.68 feet. During 1903 the observer was Jack Elrod. The bridge from which discharge measurements are made is a three-span wooden structure supported on stone piers. At low water nearly the whole of the river flows through the center span, which is 100 feet long. It is entirely housed in, but holes are cut in the floor along the upstream side at intervals of 12 feet, through which the meter can be lowered for gaging.

The initial point for soundings is the end of the bridge on the left-bank upstream side. The channel is slightly curved for 1,000 feet above and below the station. The bed is of sand and is very changeable.

Bench mark No. 1 is the top of the downstream wooden stringer supporting the bridge floor, about 2 feet to the left of the first stone pier on the left bank. Its elevation is 31 feet above gage datum. Bench mark No. 2 is the first plank of the bridge floor on the right-bank downstream side. Its elevation is 28.70 feet above gage datum. Bench mark No. 3 is a cut on a rock on the south side of the road

about 40 feet from the end of the road on the right bank. Its elevation is 31 feet above gage datum. Bench mark No. 4 is a copper plug set in solid rock on the hill about 50 feet from the river and 115 feet downstream from the bridge on the right bank. Its elevation is 42.73 feet above gage datum. Bench mark No. 5 consists of five large nails in a walnut tree on the north side of the road, 175 feet from the left-bank end of the bridge and about 6 feet above ground. These nails are at an elevation of 29.58 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Chattahoochee River near Gainesville, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 10	M. R. Hall	3.09	958
March 28	J. M. Giles	5.43	2,670
April 24	M. R. Hall	4.80	2,248
Do	E. C. Murphy	5.10	2,195
May 4	M. R. Hall	4.87	2,234
June 25	J. M. Giles	3.40	1,519
August 1	F. A. Murray	3.16	1,052
August 29	do	2.52	677
September 25	do	2.43	728
December 9	M. R. and W. E. Hall	2.22	531

*Mean daily gage height, in feet, of Chattahoochee River near Gainesville, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.50	3.50	8.00	6.10	4.60	7.00	3.60	3.00	2.60	2.40	2.20	2.20
2	3.40	3.70	6.00	5.70	4.50	13.20	3.60	3.10	2.60	2.30	2.30	2.10
3	3.70	4.40	4.60	5.50	4.70	9.00	3.50	3.20	2.60	2.30	2.50	2.10
4	4.20	7.40	4.20	5.40	4.80	6.50	3.50	3.20	2.60	2.30	2.60	2.10
5	3.90	6.00	4.00	5.30	4.40	10.60	3.50	3.10	2.60	2.30	2.70	2.10
6	3.60	4.50	5.10	5.10	4.20	6.20	3.80	3.10	2.60	2.30	2.70	2.20
7	3.40	4.90	4.70	5.00	4.20	5.90	3.40	3.00	2.60	2.30	2.60	2.20
8	3.40	11.20	5.70	8.60	4.20	5.80	3.40	3.00	2.60	2.60	2.30	2.20
9	3.20	6.40	5.40	5.70	4.20	5.40	3.40	2.90	2.60	2.40	2.30	2.20
10	3.10	5.30	6.00	5.50	4.10	5.10	3.40	2.80	2.60	2.40	2.30	2.20
11	6.00	12.10	12.90	5.40	4.00	5.00	3.70	4.10	2.60	2.30	2.30	2.20
12	5.40	8.70	7.00	5.10	3.90	4.30	6.30	2.90	2.60	2.20	2.40	2.20
13	4.10	5.40	6.00	15.80	4.00	4.00	4.50	3.20	2.60	2.20	2.40	2.50
14	3.70	5.00	5.10	9.70	4.30	4.00	3.70	3.30	2.60	2.20	2.40	2.60
15	3.60	4.20	5.00	6.60	4.10	3.90	3.50	4.10	6.00	2.20	2.30	2.30
16	3.50	9.90	4.90	5.80	4.00	3.90	3.40	7.50	4.70	2.20	2.20	2.20
17	3.50	15.60	4.70	5.50	4.00	3.80	3.40	5.80	3.90	2.20	2.40	2.20
18	3.40	7.10	4.50	5.30	4.00	3.80	3.20	5.00	3.10	2.20	3.10	2.20

*Mean daily gage height, in feet, of Chattahoochee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19.....	3.30	5.40	4.40	5.50	4.00	3.80	3.10	3.50	2.80	2.20	2.80	2.20
20.....	3.30	5.00	4.10	5.40	3.90	3.80	3.10	5.00	2.60	2.20	2.30	2.60
21.....	3.20	4.70	7.70	5.10	3.90	3.70	3.10	3.20	2.60	2.20	2.30	2.60
22.....	3.20	4.50	10.50	5.00	3.80	3.70	3.10	3.00	2.60	2.20	2.30	2.50
23.....	3.20	4.20	25.20	4.80	3.80	3.60	3.00	2.90	2.60	2.10	2.30	2.30
24.....	3.20	4.00	9.40	4.80	3.80	3.60	3.00	2.80	2.60	2.10	2.30	2.30
25.....	3.10	3.80	7.00	4.80	3.70	3.50	3.00	2.80	2.50	2.10	2.20	2.40
26.....	3.10	3.80	6.30	4.80	3.70	3.70	3.00	2.70	2.50	2.10	2.20	2.40
27.....	3.10	5.60	5.90	4.70	3.70	4.50	2.90	2.70	2.50	2.10	2.20	2.30
28.....	3.70	14.50	5.50	4.70	3.60	4.00	2.90	2.60	2.40	2.10	2.20	2.30
29.....	5.50	-----	6.90	4.60	3.60	3.80	2.90	2.60	2.40	2.10	2.20	2.30
30.....	4.00	-----	12.20	4.60	3.70	3.70	2.90	2.60	2.40	2.10	2.20	2.30
31.....	3.70	-----	8.20	-----	5.40	-----	3.20	2.60	-----	2.10	-----	2.30

*Rating table for Chattahoochee River near Gainesville, Ga., for 1901, 1902, and 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.0	350	5.6	2,690	9.2	5,030	14.0	8,150
2.2	480	5.8	2,820	9.4	5,160	15.0	8,800
2.4	610	6.0	2,950	9.6	5,290	16.0	9,450
2.6	740	6.2	3,080	9.8	5,420	17.0	10,100
2.8	870	6.4	3,210	10.0	5,550	18.0	10,750
3.0	1,000	6.6	3,340	10.2	5,680	19.0	11,400
3.2	1,130	6.8	3,470	10.4	5,810	20.0	12,050
3.4	1,260	7.0	3,600	10.6	5,940	21.0	12,700
3.6	1,390	7.2	3,730	10.8	6,070	22.0	13,350
3.8	1,520	7.4	3,860	11.0	6,200	23.0	14,000
4.0	1,650	7.6	3,990	11.2	6,330	24.0	14,650
4.2	1,780	7.8	4,120	11.4	6,460	25.0	15,300
4.4	1,910	8.0	4,250	11.6	6,590	26.0	15,950
4.6	2,040	8.2	4,380	11.8	6,720	27.0	16,600
4.8	2,170	8.4	4,510	12.0	6,850	28.0	17,250
5.0	2,300	8.6	4,640	12.5	7,175	29.0	17,900
5.2	2,430	8.8	4,770	13.0	7,500	30.0	18,550
5.4	2,560	9.0	4,900	13.5	7,825	31.0	19,200

*Estimated monthly discharge of Chattahoochee River near Gainesville, Ga.,  
for 1903.*

[Drainage area, 544 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	2,950	1,065	1,442	2.65	3.06
February .....	9,190	1,325	3,247	5.97	6.22
March .....	15,430	1,650	3,602	6.62	7.63
April .....	9,320	2,040	2,861	5.26	5.87
May .....	2,560	1,390	1,709	3.14	3.62
June .....	7,630	1,325	2,361	4.34	4.84
July .....	3,145	935	1,273	2.34	2.70
August .....	3,925	740	1,258	2.31	2.66
September .....	2,950	610	883	1.62	1.81
October .....	740	415	497	.91	1.05
November .....	1,065	480	599	1.10	1.23
December .....	740	415	535	.98	1.13
The year .....	15,430	415	1,689	3.10	41.82

MISCELLANEOUS MEASUREMENTS IN APALACHICOLA RIVER DRAINAGE  
BASIN.

*Chattahoochee River.*—This stream was measured at Bull Sluice, near Roswell (Morgan Falls post-office), Ga. The gage was maintained by the engineers in charge of construction of the dam.

*Discharge measurements of Chattahoochee River at Bull Sluice, near Roswell (Morgan Falls post-office), Ga.*

Date.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
January 8 .....	13.90	5,979
July 21 .....	11.25	2,427
October 22 .....	10.36	1,359
November 23 .....	10.40	1,284

*Little River.*—This stream was measured below Dunlap's mill, near Gainesville, Ga.

*Discharge measurements of Little River below Dunlap's mill, near Gainesville, Ga., 1903.*

Date.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 29.....	2.52	83
September 25.....	2.40	82

*Nickajack Creek.*—At Oakdale, Ga., this stream was discharging 22 second-feet on September 22, 1903. Oakdale gage, 1.25 feet.

*Snake Creek.*—Near Banning, Ga., this stream was discharging 27 second-feet on October 27, 1903.

*Chestatee River.*—Near Dahlonga, Ga., this stream was discharging 1,284 second-feet on October 29, 1903.

*Peachtree Creek.*—Near Clarkston, Ga., this stream was discharging 4.6 second-feet on December 21, 1903.

*Kinchafoonee Creek.*—At highway bridge 1 mile west of Leesburg, Ga., this stream was discharging 635 second-feet on December 24, 1903, when the water surface was 19.39 feet below top of iron pier on right bank, downstream side of bridge.

*Muckalee Creek.*—At wagon bridge 2 miles east of Leesburg, Ga., this stream was discharging 522 second-feet on December 24, 1903, when the water surface was 12.29 feet below top of center pier, upstream side of bridge.

### MOBILE RIVER DRAINAGE BASIN.

This is the largest drainage basin in Georgia and Alabama, and is designated the Mobile basin because its waters all enter the Gulf through Mobile River, at Mobile, Ala. It is formed as follows: Beginning at the headwaters, Cartecay and Ellijay rivers unite at Ellijay, Ga., to form Coosawattee River. Just above Resaca, Ga., this unites with the Conasauga to form Oostanaula River. At Rome, Ga., the Oostanaula and the Etowah unite to form Coosa River. Six miles above Montgomery, Ala., the Coosa and the Tallapoosa unite to form Alabama River; and not far from the coast the Tombigbee unites with the Alabama to form Mobile River, which flows into Mobile Bay, an arm of the Gulf of Mexico.

Cahaba River is the principal tributary of the Alabama and joins it about 10 miles below Selma. Hillabee Creek flows into Tallapoosa River just above Sturdevant and near Alexander. Talladega Creek is a tributary of the Coosa.

Tombigbee River rises in the northeastern part of Mississippi and enters Alabama in Pickens County. Its principal tributary is the Black Warrior, which is formed by the junction of Mulberry Fork and Sipsey Fork. Locust Fork enters the Black Warrior some distance below the junction. During 1903 the following stations were maintained in this basin under the supervision of M. R. Hall: On the

Cahaba at Centerville, Ala.; on the Alabama at Selma and at Montgomery, Ala.; on Choccolocco Creek near Jenifer, Ala.; on the Tallapoosa at Milstead and at Sturdevant, Ala.; on Hillabee Creek near Alexander, Ala.; on Talladega Creek at Nottingham, Ala.; on the Coosa at Riverside, Ala.; on the Black Warrior at Tuscaloosa and near Cordova, Ala.; on the Black Warrior (Locust Fork) at Palos, Ala.; on the Coosa and Etowah at Rome, Ga.; on the Etowah at Canton, Ga.; on the Coosawattee at Carters, Ga.; on the Tombigbee at Columbus, Miss.

#### CAHABA RIVER AT CENTERVILLE, ALA.

The station was established on August 7, 1901, and is situated at the iron highway bridge one-fourth mile west of Centerville, Ala., one-half mile above the Mobile and Ohio Railroad bridge. The bridge is a single span supported by tubular iron piers.

The chain gage is fastened to the timber fencing along the downstream side of the bridge. The pulley is 100 feet from the initial point, which is the end of the iron bridge on the left bank, downstream side. The length of the chain from the end of the weight to the marker is 51.35 feet. The observer is Clyde Lowrey.

The channel is straight for 1,500 feet above the station and for one-half mile below. The current is swift. The right bank overflows at extreme high water. The left bank overflows only under the approach to the bridge. The bed is nearly all rock, and there is but one channel.

Bench mark No. 1 is the downstream end of the crossbeam 100 feet from the initial point for soundings and is 42.85 feet above gage datum. Bench mark No. 2 is a copper plug set in a solid rock about 6 feet from the edge of the water and 250 feet below the bridge on the left bank. Its elevation is 6.44 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

#### *Discharge measurements of Cahaba River at Centerville, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 8 .....	J. M. Giles .....	5.15	1,637
April 9 .....	do .....	6.65	2,225
June 17 .....	do .....	2.05	416
June 18 .....	do .....	2.00	394
July 20 .....	do .....	3.23	757
July 21 .....	do .....	2.36	516
September 28 .....	do .....	1.31	212
September 29 .....	do .....	1.30	218
November 9 .....	do .....	1.32	203
November 10 .....	do .....	1.40	223



*Mean daily gage height, in feet, of Cahaba River at Centerville, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.90	5.80	23.80	8.20	3.00	2.80	2.40	4.80	1.50	1.30	1.60	1.40
2.....	6.40	4.90	18.10	7.00	3.10	2.70	2.20	6.10	1.50	1.20	1.60	1.40
3.....	7.70	6.40	12.60	6.30	3.00	2.70	2.10	4.60	1.50	1.20	1.50	1.40
4.....	7.40	8.80	12.00	5.80	2.90	2.80	2.10	3.00	1.50	1.30	1.50	1.40
5.....	6.10	12.90	13.30	5.10	2.80	2.90	2.00	2.90	1.50	1.30	1.50	1.40
6.....	5.60	12.00	11.10	4.90	2.70	2.90	1.90	2.40	1.50	1.30	1.50	1.50
7.....	4.90	20.60	9.80	4.70	2.80	3.10	3.60	2.80	1.50	1.30	1.40	1.60
8.....	4.50	31.60	12.30	4.70	3.10	3.20	3.40	2.90	1.40	2.80	1.40	1.60
9.....	4.30	26.80	15.10	6.60	3.00	3.40	2.80	2.80	1.40	2.10	1.30	1.50
10.....	4.10	20.50	12.40	6.30	2.80	2.80	2.90	3.70	1.40	1.80	1.30	1.50
11.....	10.60	22.00	16.30	5.60	2.70	2.90	2.80	2.10	1.40	1.60	1.40	1.50
12.....	14.70	20.50	15.80	5.20	3.30	2.80	2.90	1.90	1.40	1.50	1.60	1.50
13.....	11.30	16.90	15.20	4.60	5.00	2.50	2.80	1.90	1.40	1.50	1.70	1.50
14.....	7.90	11.70	14.60	5.80	12.90	2.40	2.80	1.80	1.60	1.50	1.60	1.60
15.....	6.50	9.60	13.90	5.70	17.80	2.30	2.30	2.70	1.70	1.40	1.50	1.60
16.....	5.80	22.90	12.20	4.80	17.70	2.20	2.10	3.50	1.70	1.40	1.30	1.60
17.....	5.30	26.40	10.90	4.40	9.40	2.10	2.00	5.10	1.60	1.40	1.30	1.60
18.....	4.90	24.50	8.20	4.20	7.20	2.00	2.00	4.70	1.60	1.40	1.30	1.50
19.....	4.60	16.60	7.30	4.00	5.80	2.00	2.80	3.80	1.50	1.30	1.40	1.50
20.....	4.30	12.40	6.80	3.90	4.90	1.90	3.80	3.40	1.50	1.30	1.40	1.50
21.....	4.20	9.90	6.30	5.50	4.40	1.90	2.30	2.70	1.60	1.30	1.40	1.50
22.....	4.00	8.10	7.00	5.10	4.00	2.70	1.90	2.40	1.60	1.30	1.30	1.60
23.....	3.90	7.30	6.80	4.30	3.70	3.40	1.70	2.20	1.50	1.30	1.30	1.60
24.....	3.80	6.70	6.30	3.90	3.50	2.60	1.60	2.10	1.50	1.30	1.40	1.60
25.....	4.00	5.80	5.90	3.70	3.20	2.80	2.40	2.00	1.50	1.30	1.40	1.70
26.....	3.80	5.20	5.40	3.60	3.10	2.90	1.70	1.90	1.50	1.30	1.40	2.00
27.....	3.80	5.90	5.10	3.50	3.00	3.40	1.70	1.80	1.50	1.30	1.40	1.90
28.....	6.00	27.20	5.10	3.30	2.90	3.30	1.60	1.80	1.40	1.30	1.40	1.70
29.....	6.40	-----	6.30	3.20	2.80	3.10	1.60	1.60	1.30	1.30	1.40	1.50
30.....	6.20	-----	7.70	3.00	2.70	2.60	1.50	1.50	1.30	1.30	1.40	1.50
31.....	5.90	-----	9.20	-----	2.90	-----	5.70	1.50	-----	1.50	-----	1.50

*Rating table for Cahaba River at Centerville, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	143	1.9	365	2.8	676	3.7	1,035
1.1	163	2.0	397	2.9	715	3.8	1,075
1.2	184	2.1	430	3.0	755	3.9	1,115
1.3	206	2.2	463	3.1	795	4.0	1,155
1.4	229	2.3	497	3.2	835	4.1	1,195
1.5	253	2.4	532	3.3	875	4.2	1,235
1.6	279	2.5	568	3.4	915	4.3	1,275
1.7	306	2.6	604	3.5	955	4.4	1,315
1.8	335	2.7	640	3.6	995		

Table is made from measurements between gage heights 1.30 and 6.65 feet. Above 3 feet gage height the difference is 40 per tenth.

*Estimated monthly discharge of Cahaba River at Centerville, Ala., for 1903.*

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	5,435	1,075	1,940	1.87	2.16
February .....	12,195	1,515	5,412	5.20	5.41
March .....	9,075	1,595	3,849	3.70	4.27
April .....	2,835	755	1,514	1.46	1.63
May .....	6,675	640	1,518	1.46	1.68
June .....	915	365	648	.62	.69
July .....	1,835	253	560	.54	.62
August .....	1,995	253	721	.69	.80
September .....	306	206	252	.24	.27
October .....	676	184	243	.23	.27
November .....	306	206	237	.23	.26
December .....	397	229	268	.26	.30
The year .....	12,195	184	1,430	1.38	18.36

## ALABAMA RIVER AT SELMA, ALA.

This station, which was originally established by the United States Engineer Corps, is now maintained by the United States Weather Bureau. The station is at the iron highway bridge one block from Water street, Selma, Ala. The gage is in two sections. The first section, reading from  $-3$  to  $+5.1$  feet, is fastened to the lower side of the cofferdam on the second pier; the upper section, reading from  $5.1$  to  $55$  feet, is bolted to the draw pier. Discharge measurements are made from the bridge and the trestle approach on the left bank. The initial point for soundings is the end of the drawbridge on the right bank, upstream side. The channel above the station is slightly curved for 1,000 feet and straight for 2,000 feet below the station. The velocity is good and the current is regular. The right bank is high and rocky and will not overflow. The left bank is high, but overflows at extreme high water. The bed is mostly soft blue rock, and the water is confined to one channel.

Bench mark No. 1 is an iron bolt driven into the rock bluff 182 feet from the first pier on the road leading to the boat landing; its elevation is 26 feet above the zero of the gage and 88 feet above mean sea level.

Bench mark No. 2 is the top of the capstone of the pivot pier. Its elevation is 56 feet above the zero of the gage.

Bench mark No. 3 is the edge of the coping on the right bank abutment, just under the downstream side of the drawbridge; its elevation is 59.51 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Alabama River at Selma, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 10.....	J. M. Giles .....	22.35	59,101
June 19 .....	do .....	6.45	18,815
November 11.....	do .....	1.00	8,290

*Mean daily gage height, in feet, of Alabama River at Selma, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.80	7.00	33.50	28.00	9.60	7.00	10.00	3.50	1.50	0.10	-0.20	0.40
2.....	8.00	6.90	38.00	30.20	9.40	8.00	9.80	4.80	1.60	.00	-.20	.50
3.....	8.90	6.80	41.00	31.40	8.80	9.60	9.00	6.80	1.60	.00	-.10	.50
4.....	11.00	7.00	42.60	31.40	8.70	12.70	8.00	6.80	1.40	-.20	.00	.40
5.....	11.90	7.00	42.80	30.20	8.70	13.50	7.00	6.10	1.40	-.20	.10	.50
6.....	13.00	9.60	42.00	29.00	8.40	13.20	6.80	5.00	1.20	-.20	.10	.30
7.....	11.00	14.00	40.20	27.80	7.80	14.50	6.40	5.50	1.00	-.30	.30	.40
8.....	10.00	23.50	38.50	26.30	7.80	16.00	6.40	5.00	.70	-.30	.20	.40
9.....	9.50	33.00	36.70	24.50	8.00	17.00	7.60	5.00	.50	-.30	.50	.50
10.....	8.20	39.00	35.00	22.40	10.00	17.00	8.80	5.40	.40	.00	.90	.50
11.....	7.00	44.30	34.00	22.20	9.80	17.00	9.00	6.60	.40	.40	1.00	.50
12.....	7.90	48.00	31.30	20.70	9.00	16.00	8.00	6.10	.30	.50	1.10	.60
13.....	10.60	49.50	29.80	21.50	11.20	14.00	6.80	5.00	.20	.60	1.00	.80
14.....	12.80	50.20	27.50	20.80	16.00	11.00	6.60	4.60	.10	.40	1.00	.90
15.....	13.00	50.60	27.00	20.00	21.00	9.50	6.40	3.30	.10	.20	1.00	.90
16.....	12.00	49.90	27.00	20.30	25.00	8.60	5.80	3.00	.00	.40	.90	.90
17.....	11.80	49.00	27.00	20.80	30.00	8.00	6.50	2.80	.60	.40	.90	.90
18.....	10.00	47.70	26.30	20.90	31.20	7.40	8.80	4.00	.30	.60	.80	.80
19.....	9.00	47.30	24.00	19.60	29.70	6.80	8.60	5.00	2.20	.60	.70	.60
20.....	7.90	47.80	21.30	17.60	24.00	6.50	7.00	6.70	2.50	.50	.70	.60
21.....	7.00	47.90	18.00	15.40	16.50	5.90	6.00	7.70	1.70	.50	.80	.50
22.....	6.40	47.00	16.00	17.20	11.80	5.90	5.00	7.40	1.50	.40	.80	.60
23.....	6.00	45.00	16.00	17.50	9.80	6.40	4.50	5.00	1.50	.40	.80	1.00
24.....	5.80	42.00	19.00	14.80	8.70	7.40	3.80	4.00	1.30	.40	.70	1.00
25.....	5.40	38.00	23.00	12.80	7.90	7.50	3.60	3.10	.80	.50	.80	1.00
26.....	5.20	33.80	25.10	11.70	7.60	7.50	3.50	3.00	.60	.60	.90	1.10
27.....	5.20	28.00	26.30	11.00	7.00	7.00	3.70	2.60	.60	.50	1.00	2.00
28.....	5.80	28.90	26.70	10.80	6.80	6.80	4.00	2.00	.60	.20	.80	3.00
29.....	6.00	.....	25.40	10.00	6.40	9.50	4.00	1.70	.60	.00	.50	3.10
30.....	7.00	.....	25.20	9.80	6.70	11.40	3.50	1.60	.50	.00	.50	2.60
31.....	7.20	.....	26.20	.....	6.50	.....	3.50	1.50	.....	.00	.....	1.80

*Rating table for Alabama River at Selma, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
— 0.3	6,262	1.9	9,070	5.2	15,450	9.6	25,140
— .2	6,364	2.0	9,230	5.4	15,870	9.8	25,600
— .1	6,470	2.1	9,390	5.6	16,290	10.0	26,060
.0	6,580	2.2	9,550	5.8	16,720	10.2	26,520
.1	6,692	2.3	9,710	6.0	17,160	10.4	26,980
.2	6,806	2.4	9,880	6.2	17,600	10.6	27,440
.3	6,922	2.5	10,050	6.4	18,040	10.8	27,900
.4	7,040	2.6	10,220	6.6	18,480	11.0	28,360
.5	7,160	2.7	10,400	6.8	18,920	11.2	28,820
.6	7,282	2.8	10,590	7.0	19,360	11.4	29,280
.7	7,406	2.9	10,780	7.2	19,800	11.6	29,740
.8	7,532	3.0	10,970	7.4	20,240	11.8	30,200
.9	7,660	3.2	11,370	7.6	20,680	12.0	30,660
1.0	7,790	3.4	11,770	7.8	21,120	12.5	31,860
1.1	7,920	3.6	12,170	8.0	21,560	13.0	33,110
1.2	8,060	3.8	12,570	8.2	22,000	13.5	34,410
1.3	8,200	4.0	12,970	8.4	22,440	14.0	35,750
1.4	8,340	4.2	13,370	8.6	22,880	15.0	38,450
1.5	8,480	4.4	13,770	8.8	23,320	16.0	41,200
1.6	8,620	4.6	14,190	9.0	23,760		
1.7	8,770	4.8	14,610	9.2	24,220		
1.8	8,920	5.0	15,030	9.4	24,680		

Tangent at 15 feet with differences of 275 second-feet per tenth.

*Estimated monthly discharge of Alabama River at Selma, Ala., for 1903.*

[Drainage area, 15,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	33, 110	15, 450	23, 039	1. 50	1. 73
February .....	136, 350	18, 920	90, 958	5. 91	6. 15
March .....	114, 900	41, 200	78, 139	5. 07	5. 85
April .....	83, 560	25, 600	53, 852	3. 50	3. 90
May .....	83, 000	18, 040	33, 338	2. 16	2. 49
June .....	43, 950	16, 940	27, 142	1. 76	1. 96
July .....	26, 060	11, 970	18, 122	1. 18	1. 36
August .....	20, 900	8, 480	14, 205	. 92	1. 06
September .....	10, 050	6, 580	7, 781	. 51	. 57
October .....	7, 282	6, 262	6, 835	. 44	. 51
November .....	7, 920	6, 364	7, 310	. 47	. 52
December .....	11, 170	6, 922	7, 801	. 51	. 59
The year .....	136, 350	6, 262	30, 710	1. 99	26. 69

## ALABAMA RIVER AT MONTGOMERY, ALA.

A gage rod was established by the United States Engineer Corps a number of years ago at the Montgomery wharf, near the union passenger station, at the foot of Commerce street. The readings are now taken by the Weather Bureau and are furnished to this Survey. The gage rod is in six sections, as follows: Section 1, from -2 to +10 feet, on the fender pile at the face of the wharf, 108 feet from the lower end; section 2, from 10 to 15 feet, at the upper end of the pile protection to the Louisville and Nashville Railroad bank at the corner pile, the 15-foot mark being 1.1 feet above the top of the pile; section 3, 15 to 27 feet, on the bent in the center of the drain on the lower side of the Commerce street sewer; section 4, 27 to 36 feet, on the upper side of the sewer, on the third bent; section 5, 36 to 46 feet, on the same side of the sewer, on the sixth bent; section 6, 46 to 50 feet, on the same side of the sewer, on the seventh bent. The rods are of pine timber, painted, and graduated to feet and tenths. There are also two new sections, 15 to 25 feet and 25 to 37 feet, on trees about 50 yards south of the old gage. The bench mark is the northeast corner of the stone doorsill in the north door of Windsor Hotel, on Commerce street. It is 59.7 feet above the zero of the gage, and is 163.4 feet above sea level. The high-water mark for Montgomery is 59.7 feet, and was reached in April, 1886. The danger line

is placed at 35 feet. The width of the river at low water is 690 feet. The only point where measurements can be made is at the iron bridge of the Louisville and Nashville Railroad, about 3 miles above Montgomery. This bridge is 60.6 feet above low water, with three spans over the river, the center one being a draw or turn span.

The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Mean daily gage height, in feet, of Alabama River at Montgomery, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.20	5.40	33.70	28.00	6.90	6.20	6.90	3.90	1.60	0.40	0.30	0.50
2.....	6.40	5.40	38.30	29.50	6.70	8.00	7.40	5.60	1.50	.30	.40	.40
3.....	7.80	5.50	39.70	29.50	6.60	11.00	6.60	5.80	1.30	.30	.50	.40
4.....	9.50	5.50	38.80	28.20	6.80	13.50	5.50	5.00	1.60	.30	.60	.40
5.....	9.40	7.10	37.00	26.30	6.40	11.00	5.40	4.00	1.10	.30	.70	.40
6.....	8.80	12.00	35.50	24.80	5.90	11.60	5.40	3.30	.90	.30	.70	.40
7.....	8.10	16.00	33.00	23.30	5.80	13.70	5.20	4.00	.80	.20	.80	.50
8.....	7.40	27.50	31.40	20.90	6.90	15.00	5.80	4.50	.70	.30	.80	.50
9.....	6.60	39.60	30.70	18.30	7.90	14.90	6.40	5.30	.70	.80	.90	.60
10.....	5.60	44.50	28.80	18.90	7.70	15.30	6.50	5.30	.60	.80	1.40	.70
11.....	5.30	45.90	26.20	19.00	7.10	13.90	5.80	4.60	.50	.70	1.40	.80
12.....	7.80	47.50	23.00	18.80	6.50	11.50	5.10	3.50	.40	.70	1.20	.90
13.....	9.80	48.50	21.00	15.90	7.70	9.30	4.70	2.60	.50	.50	1.10	.90
14.....	9.90	47.50	20.00	15.50	12.80	7.40	4.50	2.20	.40	.60	1.10	.90
15.....	9.80	45.30	22.40	16.70	18.00	6.90	4.50	2.00	.50	.50	1.10	1.00
16.....	9.30	42.00	22.00	18.00	24.60	6.50	5.40	1.80	.50	.40	1.00	.90
17.....	8.20	41.00	21.50	18.90	28.50	5.80	7.70	2.40	1.90	.50	1.00	.90
18.....	6.90	43.00	20.00	17.00	26.00	5.20	7.50	4.00	2.30	.50	1.00	.80
19.....	6.00	44.70	17.00	14.70	18.50	4.90	5.70	5.50	2.10	.60	1.00	.60
20.....	5.30	44.10	15.00	10.70	11.00	4.50	4.50	6.50	1.50	.60	.90	.60
21.....	5.00	42.00	13.50	14.80	8.40	4.30	3.90	5.90	1.50	.50	.80	.90
22.....	4.70	39.00	11.90	15.80	7.30	5.00	3.40	3.80	1.60	.50	.80	1.00
23.....	4.40	35.50	15.50	12.90	6.70	6.00	3.00	2.60	1.30	.40	.80	1.10
24.....	4.10	31.40	20.00	10.00	6.20	5.80	2.80	2.00	1.10	.80	.90	1.00
25.....	4.10	27.30	22.80	9.20	5.80	4.90	2.70	1.60	.90	.70	.90	1.20
26.....	4.00	21.00	24.10	8.50	5.50	4.60	3.30	1.30	.80	.50	.80	1.70
27.....	3.90	14.00	24.10	8.30	5.20	5.20	3.30	1.00	.60	.40	.70	2.60
28.....	4.50	22.40	22.80	7.90	5.00	9.00	3.40	.70	.60	.40	.60	2.50
29.....	5.20	-----	21.30	7.30	4.80	8.00	2.80	.50	.40	.30	.60	2.10
30.....	5.50	-----	22.00	7.10	4.80	7.60	2.50	1.50	.50	.30	.50	1.60
31.....	5.50	-----	25.00	-----	5.00	-----	2.50	1.50	-----	.40	-----	1.30

#### TALLAPOOSA RIVER AT MILSTEAD, ALA.

A gaging station was established on August 7, 1897, at the bridge of the Tallassee and Montgomery Railway, about one-fourth of a mile from Milstead, Ala. The bridge is of iron, two spans of about 155 feet each, with short wooden trestles at each end. The initial point for soundings is the end of the iron bridge, on the left bank, downstream side. The rod of the wire gage is fastened to the outside of the guard rail on the downstream side of the bridge. The bench

mark is the top of the second crossbeam from the left-bank pier at the downstream end, and is 60 feet above datum. The channel is straight at the bridge and bends above and below. The current is sluggish at low water and obstructed by the center pier of the bridge. The banks are high, but overflow at extreme high water for several hundred feet on each side. The bed is fairly constant, and all the water is confined to the main channel by railroad embankments.

The large new dams at Tallassee Falls—6 and 9 miles, respectively, above this station—almost stop the flow of the river at certain times, so that discharge measurements at Milstead do not represent the amount of water furnished by the stream. The station at Sturdevant, Ala., about 30 miles above these dams, has been established to replace the station at Milstead, which was discontinued April 30, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Mean daily gage height, in feet, of Tallapoosa River at Milstead, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1.....	5.10	3.50	37.70	21.50	17.....	3.70	22.70	9.20	8.00
2.....	4.40	3.20	32.60	18.70	18.....	3.50	33.90	8.00	7.40
3.....	6.40	3.00	23.60	13.50	19.....	3.40	27.00	7.50	6.50
4.....	5.40	3.50	11.20	10.20	20.....	3.20	22.00	6.90	6.40
5.....	4.90	5.00	14.10	9.00	21.....	3.10	14.40	6.70	17.20
6.....	4.40	6.60	12.00	8.30	22.....	3.00	9.40	8.30	9.80
7.....	3.80	5.60	11.50	7.60	23.....	2.90	8.00	12.50	8.40
8.....	3.60	36.50	10.80	8.90	24.....	2.80	7.20	20.50	6.30
9.....	3.20	44.50	10.50	11.70	25.....	3.00	6.80	19.90	5.80
10.....	3.00	34.00	10.10	16.00	26.....	3.10	6.40	16.50	5.90
11.....	3.20	27.10	10.00	13.40	27.....	3.00	6.20	21.40	6.20
12.....	6.90	37.80	12.00	9.50	28.....	3.70	25.00	8.70	5.40
13.....	6.80	32.70	10.30	8.90	29.....	4.50	-----	8.50	5.20
14.....	6.00	22.60	11.10	13.30	30.....	4.20	-----	19.40	4.80
15.....	4.70	14.90	9.70	11.50	31.....	3.90	-----	23.70	-----
16.....	4.00	11.00	9.20	9.70					

#### TALLAPOOSA RIVER AT STURDEVANT, ALA.

This station was established July 19, 1900, by J. R. Hall. It is located at the Columbus and Western Railroad bridge, a fourth of a mile west of Sturdevant. This railroad belongs to the Central of Georgia Railway. This station, being above the big new dams at Tallassee, is intended to replace Milstead station. Map and profile of Tallapoosa River is published in Twenty-second Annual Report, part 4. The gage is a vertical timber in two sections. The first section, reading from zero to 5.2 feet, is fastened to a post on the east bank about 20 feet below the bridge. The second section, reading from 5 to 20 feet, is fastened to the east side of the first pier in the water on the east bank. The gage is read once each day by B. F. Neighbors. At ordinary stages discharge measurements are made from a footway supported by the bracing of the lower chord of the deck bridge. At

low stages measurements are made from a boat about 2,000 feet upstream. The initial point for soundings is the end of the iron bridge on the east or left bank, downstream side. Distances are marked in white paint along the hand rail of the footway.

The channel is slightly curved directly above the bridge and for about one-half mile below. The current is swift and much broken by shoals below the bridge, but is sluggish at low stages at and near the station. Both banks are high, the right overflowing for about 150 feet and the left for about 200 feet. The bed is of rock and gravel and is probably permanent.

Bench mark No. 1 is a wire nail driven in the southwest corner of the second pier on the east bank. Its elevation is 14.20 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in solid rock in the bed of the river about 80 feet below the bridge, at a point 400 feet from the end of the bridge at the left bank. This is solid bed rock projecting above the water at ordinary stages. Its elevation is 4.89 feet above the zero of the gage. Bench mark No. 3 is a white paint mark on the top of the downstream end of the lower crossbeam at a point 278 feet from the initial point for soundings. Its elevation is 27.65 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Tallapoosa River at Sturdevant, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 22 .....	J. M. Giles .....	4.00	4,580
July 25 .....	do .....	2.45	2,247
August 22 .....	do .....	2.20	1,837
August 24 .....	do .....	1.88	1,485
Do .....	do .....	1.86	1,616
October 3 .....	do .....	1.05	834
Do .....	do .....	1.05	835
November 24 .....	do .....	1.58	1,148

*Mean daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.60	2.90	11.00	9.00	3.80	3.50	3.60	4.70	2.10	1.10	1.20	1.40
2.....	3.70	2.70	9.20	7.80	3.80	5.00	3.50	4.10	1.90	1.10	1.30	1.40
3.....	3.60	2.60	7.60	5.90	3.70	4.50	3.40	3.80	1.60	1.10	1.50	1.50
4.....	3.50	3.20	6.50	5.50	3.70	4.20	3.30	3.50	1.40	1.00	1.80	1.50
5.....	3.50	4.10	5.90	5.20	3.90	6.20	4.40	3.20	1.30	1.00	2.00	1.50
6.....	3.40	4.30	5.50	5.10	5.40	8.10	3.60	3.40	1.20	1.00	2.10	1.60
7.....	3.30	4.50	5.40	5.00	4.90	5.30	4.00	3.20	1.20	.90	2.10	1.60



*Mean daily gage height, in feet, of Tallapoosa River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8.....	3.20	19.20	5.10	4.90	4.50	5.00	4.40	3.00	1.10	1.10	2.00	1.60
9.....	3.10	14.00	4.90	8.10	4.30	4.80	4.50	2.80	1.10	2.70	1.80	1.70
10.....	3.00	10.00	5.30	7.60	4.10	4.50	3.60	2.70	1.00	2.00	1.60	1.80
11.....	3.10	12.10	6.50	6.00	4.00	5.50	3.30	2.50	1.00	1.50	1.50	1.80
12.....	3.70	13.80	5.80	5.50	4.00	4.50	3.10	2.20	.90	1.20	1.40	1.70
13.....	3.50	9.30	5.30	6.00	6.50	4.00	3.00	2.10	.90	1.00	2.10	1.70
14.....	3.30	6.60	5.10	6.20	6.30	3.80	3.20	2.00	1.00	.90	1.90	1.70
15.....	3.20	5.40	5.00	5.60	13.70	3.60	3.40	1.90	2.10	.90	1.80	1.60
16.....	3.00	4.80	4.90	5.20	9.50	3.50	3.10	3.00	3.20	1.00	1.70	1.60
17.....	2.80	14.60	4.80	4.70	6.80	3.30	2.90	3.80	2.80	1.20	1.60	1.00
18.....	2.70	12.00	4.70	4.50	5.30	3.20	2.70	5.60	2.40	1.50	1.60	1.60
19.....	2.60	10.20	4.60	4.40	4.90	3.10	2.60	3.80	2.20	1.40	1.80	1.50
20.....	2.60	8.90	4.50	10.60	4.40	3.10	2.50	3.00	2.00	1.30	1.70	1.90
21.....	2.50	5.20	4.50	6.50	4.20	3.00	2.40	2.50	1.90	1.20	1.70	2.00
22.....	2.50	4.60	5.30	5.40	4.10	2.90	2.30	2.30	1.70	1.10	1.70	1.90
23.....	2.50	4.20	8.40	5.10	3.80	2.90	2.20	2.20	1.50	1.10	1.60	1.90
24.....	2.50	4.00	9.50	4.60	3.70	2.80	2.10	2.10	1.40	1.00	1.60	1.90
25.....	2.50	3.80	8.20	4.20	3.60	2.80	2.10	1.80	1.40	1.00	1.60	2.10
26.....	2.50	3.70	6.00	4.10	3.50	3.00	2.40	1.70	1.30	1.00	1.50	2.90
27.....	2.50	3.70	5.60	4.00	3.50	5.80	2.20	1.60	1.30	.90	1.50	2.50
28.....	3.00	16.00	5.40	3.90	3.40	5.10	2.10	1.50	1.20	.90	1.50	2.20
29.....	3.10	-----	5.30	3.90	3.30	4.50	2.00	1.50	1.20	.90	1.50	2.00
30.....	3.10	-----	10.00	3.90	3.30	4.00	1.90	2.00	1.20	1.00	1.50	1.90
31.....	3.10	-----	9.80	-----	3.20	-----	5.80	2.40	-----	1.10	-----	1.70

*Rating table for Tallapoosa River at Sturdevant, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.9	765	1.7	1,288	2.5	2,320	3.3	3,520
1.0	810	1.8	1,390	2.6	2,470	3.4	3,670
1.1	859	1.9	1,500	2.7	2,620	3.5	3,820
1.2	912	2.0	1,620	2.8	2,770	3.6	3,970
1.3	970	2.1	1,750	2.9	2,920	3.7	4,120
1.4	1,036	2.2	1,885	3.0	3,070	3.8	4,270
1.5	1,110	2.3	2,025	3.1	3,220	3.9	4,420
1.6	1,194	2.4	2,170	3.2	3,370	4.0	4,570

Tangent at 2.4, with differences of 150 second-feet per tenth.

*Estimated monthly discharge of Tallapoosa River at Sturdevant, Ala., for 1903.*

[Drainage area, 2,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	4, 120	2, 320	3, 128	1. 25	1. 44
February .....	27, 370	2, 470	9, 841	3. 94	4. 10
March .....	15, 070	5, 320	8, 035	3. 21	3. 70
April .....	14, 470	4, 420	6, 988	2. 79	3. 11
May .....	19, 120	3, 370	5, 688	2. 27	2. 62
June .....	10, 720	2, 770	4, 845	1. 94	2. 16
July .....	7, 270	1, 500	3, 204	1. 28	1. 48
August .....	6, 970	1, 110	2, 771	1. 11	1. 28
September .....	3, 370	765	1, 271	. 51	. 57
October .....	2, 620	765	939	. 37	. 43
November .....	1, 750	912	1, 285	. 51	. 57
December .....	2, 920	1, 036	1, 410	. 56	. 65
The year .....	27, 370	765	4, 117	1. 645	22. 11

#### HILLABEE CREEK NEAR ALEXANDER, ALA.

This station, which was established August 29, 1900, by J. R. Hall is located  $6\frac{1}{2}$  miles northeast of Alexander, on the road leading from that town to Newsite. The gage is graduated to feet and tenths, is placed vertically, and is in two sections. The short section, which reads from 0 to 5.50 feet, is fastened to a post in the edge of the water on the north bank, 20 feet from the upstream side of the bridge. The long section, which reads from 5.50 to 16 feet, is fastened to the upstream end of the first pier on the north bank. Both sections can be easily read from the north approach to the bridge. The initial point for soundings is on the south side of the first pier on the north bank. The gage is referred to a bench mark at the top of the chord on the downstream side of the bridge at the second pier from the north bank, and is 27.6 feet above the zero of the gage. The bridge is in three spans, having a total length of 276 feet, with a north approach of 116 feet and a south approach of 124 feet, making a total, over all, of 516 feet. The observer is J. H. Chisolm, a farmer, whose post-office address is Alexander, Ala. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Hillabee Creek near Alexander, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 21 .....	J. M. Giles .....	2.65	766
July 24 .....	do .....	1.50	212
August 21 .....	do .....	1.50	213
Do .....	do .....	1.50	205
October 5 .....	do .....	.94	84
November 25 .....	do .....	1.15	114

*Mean daily gage height, in feet, of Hillabee Creek near Alexander, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. ....	1.90	1.60	.....	2.20	2.20	2.30	2.40	2.40	2.70	1.10	1.00	1.10
2. ....	4.00	1.60	.....	2.10	2.30	2.30	2.20	4.00	2.60	1.10	1.00	1.00
3. ....	3.60	1.50	.....	2.20	2.30	2.70	3.30	4.00	2.40	1.10	1.00	1.00
4. ....	3.00	3.00	.....	2.10	2.30	2.70	3.30	1.80	2.40	1.00	1.50	1.90
5. ....	2.50	2.00	.....	2.70	2.30	3.80	2.10	1.80	2.40	1.00	1.60	1.90
6. ....	1.80	1.90	.....	2.30	2.90	3.50	2.00	2.00	2.80	1.10	1.30	1.00
7. ....	1.80	4.00	.....	2.60	3.10	2.80	2.00	1.80	2.60	1.10	1.20	1.00
8. ....	1.90	16.50	.....	3.10	2.10	2.80	2.90	1.70	2.40	1.10	1.00	1.00
9. ....	1.90	(a)	.....	2.60	2.20	2.90	3.40	2.00	2.00	1.00	1.00	1.00
10. ....	1.90	.....	.....	2.50	2.50	2.80	2.40	2.00	1.90	1.00	1.10	1.10
11. ....	3.00	.....	.....	2.20	2.90	3.50	2.70	1.80	1.70	1.00	1.20	1.10
12. ....	2.10	.....	.....	2.40	2.90	2.10	2.60	1.90	1.50	1.00	1.90	1.10
13. ....	2.00	.....	.....	2.40	4.50	2.00	2.20	1.90	1.30	1.00	1.20	1.00
14. ....	1.70	.....	.....	2.80	4.20	2.80	2.00	1.60	1.30	1.00	1.50	1.10
15. ....	1.70	.....	.....	2.70	12.00	1.80	2.00	1.60	1.30	1.00	1.30	1.20
16. ....	1.70	.....	.....	2.60	4.60	1.70	1.90	1.60	1.40	1.10	1.30	1.20
17. ....	1.60	.....	.....	2.60	3.90	1.70	1.90	1.60	1.30	1.20	1.70	1.10
18. ....	1.60	.....	.....	2.60	2.90	1.70	1.90	1.60	1.30	1.10	1.70	1.10
19. ....	1.50	.....	.....	2.70	4.80	1.60	2.20	1.70	1.30	1.00	1.50	1.20
20. ....	1.70	.....	.....	11.00	2.80	1.60	2.00	1.70	1.20	1.00	1.20	1.20
21. ....	1.70	.....	.....	2.80	2.70	2.20	2.00	1.70	1.20	1.00	1.20	1.30
22. ....	1.80	.....	3.10	2.80	2.60	5.90	2.00	1.70	1.20	1.00	1.50	1.20
23. ....	1.90	.....	3.60	2.70	2.40	1.90	2.00	1.60	1.20	1.00	1.50	1.20
24. ....	1.80	.....	3.30	2.50	2.00	1.80	2.00	1.60	1.20	1.00	1.50	1.20
25. ....	1.80	.....	3.10	2.20	1.90	1.80	2.00	1.50	1.10	1.00	1.50	1.10
26. ....	1.80	.....	3.00	2.90	1.80	3.80	1.80	1.50	1.00	1.00	1.50	1.20
27. ....	1.90	.....	2.90	2.70	1.80	4.00	1.80	1.50	1.00	1.00	1.50	1.30
28. ....	3.00	.....	2.80	2.70	1.80	3.80	1.90	1.40	1.00	1.00	1.50	1.40
29. ....	2.70	.....	3.10	2.50	1.90	3.60	1.90	1.40	1.10	1.00	1.20	1.30
30. ....	2.50	.....	3.60	2.50	1.90	3.00	1.80	2.40	1.10	1.00	1.20	1.20
31. ....	1.90	.....	4.10	.....	1.80	.....	3.80	2.80	.....	1.00	.....	1.20

a Gage washed out.

*Rating table for Hillabee Creek at Alexander, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.9	80	2.0	425	3.1	920	4.2	1,415
1.0	90	2.1	470	3.2	965	4.3	1,460
1.1	106	2.2	515	3.3	1,010	4.4	1,505
1.2	126	2.3	560	3.4	1,055	4.5	1,550
1.3	150	2.4	605	3.5	1,100	4.6	1,595
1.4	178	2.5	650	3.6	1,145	4.7	1,640
1.5	210	2.6	695	3.7	1,190	4.8	1,685
1.6	248	2.7	740	3.8	1,235	4.9	1,730
1.7	290	2.8	785	3.9	1,280	5.0	1,775
1.8	335	2.9	830	4.0	1,325	5.5	2,000
1.9	380	3.0	875	4.1	1,370	11.0	4,475

No measurements above 2.65 feet gage height. Table is only approximate above this point.

Tangent at 2.9 with difference of 45 per tenth.

*Estimated monthly discharge of Hillabee Creek at Alexander, Ala., for 1903.*

[Drainage area, 214 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	1,325	210	479	2.24	2.58
February 1 to 8 .....			1,333	6.23	1.85
March 22 to 31 .....			992	4.64	1.72
April .....	4,475	470	796	3.72	4.15
May .....	4,925	335	865	4.04	4.66
June .....	2,180	248	739	3.45	3.85
July .....	1,235	335	547	2.56	2.95
August .....	1,325	178	393	1.84	2.12
September .....	785	90	298	1.39	1.55
October .....	126	90	95	.44	.51
November .....	380	90	173	.81	.90
December .....	380	90	133	.62	.71

## TALLADEGA CREEK AT NOTTINGHAM, ALA.

This station was established August 16, 1900, by J. R. Hall. The station is maintained by the Alabama geological survey. It is located on the Southern Railway bridge, a fourth of a mile from the depot at Nottingham, Ala., and 1 mile north of Alpine, Ala. The gage, which is graduated to feet and tenths and is 20 feet long, is fastened vertically to a tree on the right bank, about 50 feet upstream from the bridge. The observer is R. M. McClatchy, station agent at Nottingham.

The initial point for soundings is end of iron bridge, upstream, right bank. The channel is straight for about 500 feet above and below the station and the current is sluggish at low stages. The right bank is high and does not overflow; the left bank is lower than the right and overflows at high stages; but all water passes beneath the bridge. The bed of the stream is of sand and silt and is fairly constant.

Bench mark No. 1 is a nail on the upstream corner of the right bank abutment; its elevation is 14.25 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in the limestone rock at a large spring 335 feet above the railway track on the right bank; its elevation is 6.28 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Talladega Creek at Nottingham, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 25.....	J. M. Giles.....	2.05	243
July 27.....	do.....	1.37	111
August 20.....	do.....	1.30	116
October 2.....	do.....	1.00	57
November 14.....	do.....	1.21	80

*Mean daily gage height, in feet, of Talladega Creek at Nottingham, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.70	1.30	6.40	3.80	2.00	2.50	1.90	1.70	1.00	1.00	1.00	1.10
2.....	2.10	1.30	4.20	3.40	1.90	2.30	1.80	1.80	1.00	1.00	1.00	1.10
3.....	2.20	1.30	4.00	3.20	1.80	2.00	1.70	1.60	.90	1.00	1.00	1.10
4.....	2.10	2.30	3.80	3.00	1.80	1.90	2.00	1.60	.90	1.00	1.00	1.10
5.....	1.90	2.10	3.50	2.80	1.80	1.80	2.50	1.40	.90	1.00	1.00	1.10
6.....	1.80	1.70	4.20	2.60	1.80	2.20	2.00	1.50	.90	1.00	1.00	1.20
7.....	1.60	6.80	3.40	2.50	2.80	2.00	1.80	1.50	.90	1.00	1.60	1.10
8.....	1.50	13.00	3.20	2.40	2.30	1.80	1.70	1.40	.90	1.60	1.10	1.10
9.....	1.30	5.50	3.20	2.20	2.00	1.80	2.00	1.40	.90	1.50	1.10	1.10
10.....	1.20	3.60	3.50	2.00	1.90	1.70	1.80	1.30	.90	1.30	1.10	1.10
11.....	1.50	9.20	3.60	2.20	1.80	3.60	1.80	1.30	.90	1.10	1.10	1.10
12.....	2.70	6.50	3.50	3.00	1.80	2.20	1.80	1.30	.90	1.00	1.50	1.10
13.....	1.80	3.80	3.30	3.20	2.80	2.00	1.70	1.30	.90	1.00	1.50	1.10
14.....	1.60	3.20	3.60	3.00	4.10	1.80	1.60	1.30	.90	1.00	1.20	1.10
15.....	1.50	2.80	3.30	2.80	10.80	1.80	1.50	1.80	.90	1.10	1.20	1.10
16.....	1.40	7.50	3.40	2.60	5.20	1.80	1.50	1.50	1.00	1.10	1.20	1.10
17.....	1.40	10.00	3.20	2.50	3.50	1.80	1.50	1.30	1.50	1.20	1.20	1.10
18.....	1.50	4.40	2.90	2.50	2.90	1.70	1.50	1.30	1.20	1.20	1.20	1.10
19.....	1.30	3.50	2.80	2.40	2.70	1.60	1.50	1.40	1.20	1.20	1.20	1.10
20.....	1.30	3.10	2.70	4.70	2.60	1.50	1.80	1.40	1.20	1.20	1.20	1.10
21.....	1.20	2.80	3.00	3.00	2.40	1.50	1.40	1.30	1.10	1.20	1.20	1.10
22.....	1.20	2.60	3.50	2.50	2.20	2.50	1.40	1.20	1.10	1.20	1.20	1.10
23.....	1.20	2.30	5.50	2.40	2.00	1.80	1.40	1.20	1.10	1.20	1.10	1.10
24.....	1.20	2.20	4.00	2.30	2.00	1.60	1.40	1.10	1.10	1.20	1.10	1.10
25.....	1.20	2.20	3.50	2.20	2.00	1.50	1.40	1.10	1.00	1.10	1.10	1.10
26.....	1.20	2.20	3.10	2.20	2.00	1.70	1.20	1.00	1.00	1.10	1.10	1.10
27.....	1.20	2.30	2.90	2.10	2.00	2.50	1.30	1.00	1.00	1.10	1.10	1.10
28.....	1.60	16.00	2.70	2.00	1.90	6.00	1.50	1.00	1.00	1.00	1.10	1.10
29.....	1.50	-----	2.90	2.00	1.90	2.50	1.40	1.00	1.00	1.00	1.10	1.10
30.....	1.40	-----	8.70	2.00	2.80	2.00	1.40	1.00	1.00	1.10	1.10	1.10
31.....	1.30	-----	4.80	-----	2.30	-----	1.60	1.00	-----	1.10	-----	1.10

*Rating table for Talladega Creek at Nottingham, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.9	46	1.5	133	2.1	256	2.7	400
1.0	57	1.6	151	2.2	280	2.8	424
1.1	69	1.7	170	2.3	304	2.9	448
1.2	83	1.8	190	2.4	328	3.0	472
1.3	99	1.9	211	2.5	352		
1.4	116	2.0	233	2.6	376		

No measurements made above 3 feet gage height. Table approximate above that height. Tangent at 2.8 with differences of 24 per tenth.

*Estimated monthly discharge of Talladega Creek at Nottingham, Ala., for 1903.*

[Drainage area, 156 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	400	83	144	0.92	1.06
February .....	3,592	99	832	5.33	5.55
March .....	1,840	400	637	4.08	4.70
April .....	880	233	388	2.49	2.78
May .....	2,344	190	387	2.48	2.86
June .....	1,192	133	265	1.70	1.90
July .....	352	83	161	1.03	1.19
August .....	190	57	105	.67	.77
September .....	133	46	59	.38	.42
October .....	151	57	74	.47	.54
November .....	133	57	75	.48	.54
December .....	83	69	69	.44	.51
The year .....	3,592	46	266	1.71	22.82

## CHOCOLOC CO CREEK NEAR JENIFER, ALA.

The station was established August 20, 1902, by J. M. Giles. It is located at the Louisville and Nashville bridge,  $1\frac{1}{4}$  miles north of Jenifer, Ala. There are small shoals both above and below the bridge. The gage consists of a vertical 1 by 4 inch pine plank, nailed to a 3 by 8 inch pine timber which is spiked to a birch tree 20 feet upstream from the bridge on the left bank. It reads from 0.30 to 10 feet. The observer is W. J. Tolbert. Discharge measurements are made from the single-span bridge and its trestle approach on the right bank. The initial point for soundings is the end of the bridge on the left bank, and distances are marked with white paint on the upstream guard rail. The channel is straight for 1,500 feet above and below the station and has a width between abutments of 145 feet and 100 feet at low water. The right bank overflows at a gage reading of about 6 feet. The left bank is high and will not overflow except under the bridge. The bed is rocky and not likely to change.

Bench mark No. 1 is the top of a crossbeam at a point 50 feet from the initial point for soundings. Its elevation is 23 feet above the zero of the gage. Bench mark No. 2 is a copper plug in the upstream wing of the abutment; its elevation is 14.19 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Choccolocco Creek near Jenifer, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
July 23 .....	J. M. Giles	2.25	186
Do .....	do	2.25	180
August 20 .....	do	2.26	183
August 25 .....	do	2.12	146
October 2 .....	do	1.82	90
November 14 .....	do	2.08	130

*Mean daily gage height, in feet, of Choccolocco Creek near Jenifer, Ala., for 1903.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....		2.00	1.80	1.80	1.90	17 .....		2.10	1.80	1.90	1.90
2 .....		2.00	1.80	1.80	1.80	18 .....		2.10	1.90	1.90	1.90
3 .....		2.00	1.80	1.80	1.80	19 .....		2.00	1.90	1.90	1.90
4 .....		2.00	1.80	1.80	1.80	20 .....	2.20	2.00	1.90	1.90	1.90
5 .....		2.00	1.80	1.90	1.90	21 .....	2.20	1.90	1.90	1.90	1.90
6 .....		2.00	1.80	2.10	1.90	22 .....	2.10	1.90	1.90	1.90	1.90
7 .....		2.00	1.80	2.00	1.90	23 .....	2.10	1.90	1.80	1.90	2.10
8 .....		2.00	2.60	1.90	1.90	24 .....	2.10	1.90	1.80	1.90	2.00
9 .....		1.90	2.10	1.90	1.90	25 .....	2.10	1.90	1.80	1.90	1.90
10 .....		1.90	2.00	1.90	1.90	26 .....	2.10	1.90	1.80	1.90	2.00
11 .....		1.90	2.00	1.80	1.90	27 .....	2.10	1.90	1.80	1.90	2.00
12 .....		1.90	1.90	2.00	1.90	28 .....	2.00	1.90	1.80	1.90	1.90
13 .....		1.90	1.90	2.00	1.90	29 .....	2.10	1.80	1.80	1.90	1.90
14 .....		1.90	1.80	2.00	1.90	30 .....	2.00	1.80	1.80	1.90	1.90
15 .....		1.90	1.80	2.00	1.90	31 .....	2.00		1.80		1.90
16 .....		2.00	1.80	1.90	1.90						

*Rating table for Choccolocco Creek near Jenifer, Ala., from August 20 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.8	88	2.1	138	2.4	249
1.9	101	2.2	164	2.5	297
2.0	117	2.3	202	2.6	345



*Estimated monthly discharge of Choccolocco Creek near Jenifer, Ala., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
August 20 to 31 .....	164	117	137
September .....	138	88	108
October .....	345	88	103
November .....	138	88	103
December .....	138	88	102

#### COOSA RIVER AT RIVERSIDE, ALA.

This station was established September 25, 1896, by M. R. Hall. It is located at the Southern Railroad bridge, Riverside, Ala., about 4 miles below Lock No. 4. The 24-inch boxed chain gage is fastened to the downstream guard rail at a point 570 feet from the initial point for soundings. The length of the chain from the marker to the end of the weight is 35.02 feet. The gage is read once each day by J. W. Foster. Discharge measurements are made from the railway bridge to which the gage is attached. The initial point for soundings is the water face of the abutment on the left bank, downstream side. Distances are marked on the guard rail with white paint. The channel is straight above the station for about 400 feet and below for about 3,000 feet. The current is swift, but is broken by a ledge of rock 300 feet above the bridge. The channel is 614 feet between bridge abutments and is broken by four piers. The width at ordinary stages is about 575 feet. Both banks are high; the left bank is liable to overflow, but all water passes beneath the bridge. The bed of the stream is rocky and permanent and not very rough.

Bench mark No. 1 is the capstone on the circular pier of the turn span, the elevation of which is 26.80 feet above gage datum. Bench mark No. 2 is a copper plug set in solid rock on the right bank, about 100 feet above the bridge. Its elevation is 11.95 feet above gage datum. The observer is paid by the Alabama geological survey.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Coosa River at Riverside, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 16 .....	J. M. Giles .....	10.75	40,072
April 11 .....	do .....	8.80	30,710
June 20 .....	do .....	2.87	7,374
July 22 .....	do .....	2.30	5,549
August 26 .....	do .....	1.64	4,001
October 1 .....	do .....	1.05	2,687
November 13 .....	do .....	1.37	3,136

*Mean daily gage height, in feet, of Coosa River at Riverside, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	3.20	4.20	12.90	13.40	4.20	6.10	4.00	3.00	1.25	1.10	1.10	1.20
2 .....	4.00	3.90	14.30	13.60	4.00	7.80	3.80	3.45	1.25	1.05	1.15	1.20
3 .....	4.50	3.85	14.60	13.75	3.85	7.60	3.00	3.20	1.30	1.10	1.25	1.15
4 .....	5.50	5.40	14.60	13.65	3.80	6.90	2.80	3.00	1.40	1.10	1.25	1.15
5 .....	5.55	6.30	14.65	13.50	3.60	7.00	2.70	2.65	1.30	1.05	1.30	1.10
6 .....	5.60	9.40	15.15	12.80	3.50	9.30	2.65	3.00	1.25	1.00	1.35	1.05
7 .....	5.35	11.30	15.00	10.50	3.45	8.60	2.65	3.75	1.25	1.00	1.60	1.05
8 .....	5.10	15.20	14.50	7.75	3.40	10.05	2.60	4.95	1.20	1.30	1.80	1.05
9 .....	4.50	14.80	13.40	8.90	4.00	9.00	2.60	3.50	1.20	1.10	1.90	1.10
10 .....	3.50	14.20	10.90	9.70	4.10	7.30	2.60	2.45	1.20	1.00	1.80	1.15
11 .....	4.20	15.10	9.30	8.80	4.00	5.60	2.55	2.20	1.15	1.20	1.60	1.20
12 .....	5.00	16.00	9.60	7.40	3.65	4.80	2.65	2.00	1.15	1.40	1.40	1.15
13 .....	5.90	15.75	9.70	6.60	3.35	4.40	2.70	1.80	1.10	1.50	1.35	1.15
14 .....	6.60	14.80	11.60	8.90	3.60	5.00	3.30	1.50	1.10	1.30	1.40	1.15
15 .....	6.30	14.10	11.55	10.10	8.70	4.40	6.00	1.50	1.20	1.20	1.40	1.20
16 .....	5.30	14.00	10.80	10.35	7.90	3.90	6.60	1.50	1.25	1.10	1.35	1.20
17 .....	4.45	17.25	9.30	10.00	6.30	3.60	5.50	1.80	1.25	1.10	1.30	1.20
18 .....	3.90	16.40	7.90	8.10	5.25	3.40	3.90	2.00	2.00	1.20	1.25	1.15
19 .....	3.60	15.50	6.85	6.70	4.05	3.10	3.15	3.25	2.05	1.20	1.25	1.15
20 .....	3.40	14.40	6.20	6.30	3.90	2.90	2.75	2.70	1.80	1.30	1.30	1.20
21 .....	3.25	14.20	5.70	5.60	3.70	2.75	2.60	2.35	1.50	1.20	1.25	1.20
22 .....	2.90	14.00	7.10	5.10	3.20	2.65	2.35	2.30	1.35	1.20	1.20	1.25
23 .....	2.85	13.80	9.10	4.80	3.10	2.10	2.20	2.05	1.25	1.25	1.30	1.25
24 .....	2.85	12.20	10.20	4.75	3.00	2.60	2.20	1.90	1.20	1.30	1.30	1.30
25 .....	2.65	8.20	11.00	4.65	2.90	2.65	2.30	1.75	1.20	1.25	1.35	1.40
26 .....	2.70	5.80	11.65	4.55	2.90	2.80	2.20	1.65	1.15	1.20	1.30	1.35
27 .....	2.70	5.40	11.90	4.50	2.90	2.70	2.10	1.50	1.15	1.15	1.30	1.30
28 .....	2.90	8.40	11.55	4.40	2.70	2.65	2.10	1.40	1.20	1.05	1.40	1.30
29 .....	3.40	-----	9.40	4.40	2.60	2.80	2.20	1.40	1.30	1.00	1.35	1.30
30 .....	3.60	-----	10.00	4.30	3.00	5.10	2.15	1.35	1.20	1.05	1.25	1.20
31 .....	3.90	-----	12.35	-----	3.90	-----	2.20	1.30	-----	1.10	-----	1.25

*Rating table for Coosa River at Riverside, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.0	2,620	2.5	6,160	4.0	11,240	5.5	17,110
1.1	2,800	2.6	6,460	4.1	11,610	5.6	17,520
1.2	2,990	2.7	6,770	4.2	11,990	5.7	17,930
1.3	3,180	2.8	7,090	4.3	12,370	5.8	18,340
1.4	3,380	2.9	7,420	4.4	12,750	5.9	18,760
1.5	3,590	3.0	7,750	4.5	13,130	6.0	19,180
1.6	3,810	3.1	8,080	4.6	13,520	6.1	19,600
1.7	4,040	3.2	8,410	4.7	13,910	6.2	20,020
1.8	4,270	3.3	8,750	4.8	14,300	6.3	20,440
1.9	4,510	3.4	9,090	4.9	14,690	6.4	20,860
2.0	4,750	3.5	9,440	5.0	15,090	6.5	21,280
2.1	5,010	3.6	9,790	5.1	15,490	6.6	21,710
2.2	5,290	3.7	10,140	5.2	15,890	6.7	22,140
2.3	5,580	3.8	10,500	5.3	16,290	6.8	22,570
2.4	5,870	3.9	10,870	5.4	16,700	7.0	23,430

Differences above 6.5 feet, 430 per tenth. Table made from measurements between gage height 1.05 and 10.75 feet. Table is approximate above 10.75 feet.

*Estimated monthly discharge of Coosa River at Riverside, Ala., for 1903.*

[Drainage area, 7,065 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	21,710	6,610	12,066	1.71	1.97
February .....	67,500	10,680	43,155	6.11	6.36
March .....	58,470	17,930	40,682	5.76	6.64
April .....	52,450	12,370	28,983	4.10	4.57
May .....	30,740	6,460	11,294	1.60	1.84
June .....	36,540	6,460	15,654	2.22	2.48
July .....	21,710	5,010	7,994	1.13	1.30
August .....	14,890	3,180	5,910	.84	.97
September .....	4,880	2,800	3,211	.45	.50
October .....	3,590	2,620	2,922	.41	.47
November .....	4,510	2,800	3,334	.47	.52
December .....	3,380	2,710	2,983	.42	.48
The year .....	67,500	2,620	14,849	2.10	28.10

## COOSA RIVER AT ROME, GA.

Coosa River is formed by the junction of Etowah and Oostanaula rivers at Rome, Ga. Both the tributary rivers rise in the northern part of Georgia and flow for the most part through a hilly, broken country, well wooded, about one-fourth of the land being under cultivation. The measurements at Rome are made on the Oostanaula and the Etowah just above their junction. The Etowah is measured at the Second Avenue Bridge and the Oostanaula at the Fifth Avenue Bridge in Rome, and the results are added to give the flow of the Coosa. The gage height is taken from the United States Weather Bureau gage at the Fifth Avenue Bridge on the Oostanaula. There is practically no fall on Oostanaula River from the Fifth Avenue Bridge to the junction; hence the gage is used as a Coosa River gage, and the gage heights are considered as gage heights of Coosa River. The gage is a 4 by 6 inch timber in two sections. The first section, 0 to 5 feet, is fastened to the downstream, left-hand corner of the cofferdam around the center pier of the turn span. The second section, 5 to 44 feet, is fastened to the downstream side of the same pier. The zero of the gage is 576 feet above sea level. The United States Weather Bureau has maintained a station here for many years. They now maintain it only from November 1 to April 30, but during 1903 W. M. Towers, the observer, has furnished the Geological Survey with monthly reports of the daily gage height for the entire year. The channel of the Etowah is straight and the current swift and unobstructed, but the Oostanaula is rather sluggish and somewhat obstructed by piers. The banks are high and are liable to overflow at high stages. The station was discontinued December 31, 1903, on account of the uncertain velocity at low stages of the Oostanaula section.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Coosa River at Rome, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 14.....	O. P. Hall.....	9.70	16,146
June 5.....	J. M. Giles.....	12.55	25,008
July 1.....	do.....	2.80	5,305
July 3.....	do.....	2.70	4,653
July 18.....	M. R. Hall.....	2.85	4,403
September 4.....	J. M. Giles.....	.90	2,211
November 28.....	Hall and Hall.....	.75	1,892

*Mean daily gage height, in feet, of Coosa River at Rome, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.80	28.60	24.90	3.60	6.00	3.00	2.80	1.00	0.40	0.70	0.90
2	3.90	2.80	27.10	22.00	3.60	7.70	3.20	2.60	.90	.40	.70	.90
3	3.90	4.20	24.00	19.50	3.60	9.00	2.90	3.00	.90	.40	.80	.80
4	5.00	8.40	22.30	14.60	3.50	7.50	2.70	3.30	.90	.30	1.50	.70
5	4.30	13.20	20.50	8.00	3.50	11.70	2.60	3.20	.80	.30	1.50	.70
6	4.00	13.40	15.40	7.00	3.30	17.10	2.60	6.20	.70	.30	2.00	.70
7	3.70	9.70	9.90	6.40	3.40	11.70	2.60	4.60	.70	.20	2.00	.70
8	3.00	18.70	7.70	7.70	3.50	6.90	2.40	3.60	.60	.50	1.60	.70
9	2.80	21.60	6.60	10.50	3.50	5.30	2.60	3.40	.60	1.40	1.40	.70
10	2.40	16.50	10.50	8.40	3.40	4.40	2.60	3.00	.60	1.60	1.30	.70
11	3.00	15.10	11.60	6.70	3.30	4.30	2.50	2.60	.60	1.50	1.20	.70
12	5.00	21.80	16.00	6.30	3.30	6.00	2.90	2.20	.60	1.40	1.20	.60
13	5.00	19.60	14.00	5.60	3.00	4.60	5.90	2.00	.60	1.30	1.20	.60
14	4.80	14.50	10.10	14.30	3.00	4.20	11.10	2.00	.60	1.10	1.20	.60
15	3.90	11.10	9.40	13.00	3.10	4.00	6.70	1.60	.60	.90	1.00	.60
16	2.50	8.70	7.80	9.50	3.30	3.80	3.70	4.30	.90	.80	1.00	.60
17	2.40	24.70	6.80	7.40	3.00	3.40	3.50	3.20	1.70	1.20	1.00	.60
18	2.40	28.70	6.30	6.20	3.00	3.00	3.30	2.80	2.00	1.30	1.00	.60
19	2.40	25.50	5.70	5.30	2.80	2.40	3.60	2.20	1.50	1.20	1.50	.60
20	2.40	21.00	5.30	5.70	2.50	2.70	2.90	2.10	1.20	1.00	1.40	.60
21	2.20	15.20	11.00	5.80	2.50	2.50	2.50	2.00	.90	.80	1.30	.70
22	2.00	7.10	11.60	5.50	2.60	2.40	2.40	2.00	.80	.80	1.20	1.30
23	2.00	5.80	16.90	4.90	2.60	2.20	3.00	1.90	.70	.70	1.10	1.30
24	2.00	5.10	22.60	4.70	2.50	2.20	3.00	1.80	.50	.70	1.00	1.00
25	2.00	4.80	20.60	4.40	2.50	2.20	2.60	1.60	.50	.70	1.00	.80
26	2.00	4.50	16.00	4.90	2.30	2.20	2.40	1.50	.50	.60	1.00	.90
27	2.00	4.00	9.70	4.70	2.10	2.40	2.10	1.40	.50	.60	1.00	.80
28	2.40	23.10	6.90	4.00	2.00	6.80	2.00	1.40	.50	.50	.90	.90
29	3.20	-----	7.80	3.90	2.00	6.80	1.80	1.30	.40	.40	.90	.90
30	4.20	-----	22.50	3.70	2.40	4.00	2.30	1.30	.40	.40	.90	.80
31	3.80	-----	27.60	-----	6.70	-----	2.60	1.20	-----	.70	-----	.90

*Rating table for Coosa River at Rome, Ga., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.2	1,280	1.5	2,920	2.8	4,795	5.2	9,112
.3	1,390	1.6	3,060	2.9	4,945	5.4	9,514
.4	1,510	1.7	3,200	3.0	5,095	5.6	9,916
.5	1,630	1.8	3,340	3.2	5,405	5.8	10,318
.6	1,750	1.9	3,480	3.4	5,725	6.0	10,720
.7	1,880	2.0	3,620	3.6	6,055	7.0	12,730
.8	2,010	2.1	3,765	3.8	6,400	8.0	14,740
.9	2,140	2.2	3,910	4.0	6,760	9.0	16,750
1.0	2,270	2.3	4,055	4.2	7,140	10.0	18,760
1.1	2,400	2.4	4,200	4.4	7,520	11.0	20,770
1.2	2,530	2.5	4,345	4.6	7,910	12.0	22,780
1.3	2,660	2.6	4,495	4.8	8,310		
1.4	2,790	2.7	4,645	5.0	8,710		

Constructed from measurements between gage heights 0.60 and 12.55. Measurements of previous years used. Approximate above 10 feet gage height.

*Estimated monthly discharge of Coosa River at Rome, Ga., for 1903.*

[Drainage area, 4,006 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	8,710	3,620	5,442	1.36	1.57
February .....	56,347	4,795	25,376	6.34	6.60
March .....	56,146	9,313	27,111	6.78	7.82
April .....	48,709	6,225	15,788	3.95	4.41
May .....	12,127	3,620	5,278	1.32	1.52
June .....	33,031	3,910	9,594	2.40	2.68
July .....	20,971	3,340	5,616	1.40	1.61
August .....	11,122	2,530	4,472	1.12	1.29
September .....	3,620	1,510	2,002	.50	.56
October .....	3,060	1,280	2,002	.50	.58
November .....	3,620	1,880	2,512	.63	.70
December .....	2,660	1,750	1,985	.50	.58
The year .....	56,347	1,280	8,932	2.23	29.92

#### ETOWAH RIVER AT ROME, GA.

Measurements have been made here for several years as a part of Coosa River at Rome. Measurements were referred to a bench mark on the bridge, and the gage put in July 1 was referred to the same bench mark.

The gage was established July 1, 1903, by J. M. Giles. It is located at the Second Avenue Bridge in the city of Rome, Ga., about 1 mile above the mouth of the river. The gage is a vertical timber of 1 by 4 inch pine nailed to a 3 by 8 inch timber, which is driven into the bed of the river and spiked to a birch tree on the left bank about 50 feet below the bridge. The foot marks are numbered with brass figures. During 1903 the observer has been Hal Hawkins. Discharge measurements have been made from the sidewalk on the upstream side of the single-span iron bridge and its approaches. The initial point for soundings is the center of the post at the end of the iron hand rail on the right bank, upstream side. The channel is curved for 1,000 feet above and below the station. Both banks are high and overflow only under the approaches to the bridge. The bed of the stream is of rock and is permanent. The channel is obstructed by the crib of an old pier foundation in the middle of the river.

Bench mark No. 1 is the top of the downstream end of the third crossbeam from the left-bank end of the bridge. Its elevation is 43

feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Etowah River at Rome, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 14.....	O. P. Hall.....	9.70	6,316
June 5.....	J. M. Giles.....	12.75	17,133
July 1.....	do.....	3.27	2,986
July 3.....	do.....	3.15	2,704
July 18.....	M. R. Hall.....	2.98	2,376
September 4.....	J. M. Giles.....	1.20	1,293
November 28.....	Hall and Hall.....	1.01	1,080

*Mean daily gage height, in feet, of Etowah River at Rome, Ga., for 1903.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.30	3.00	1.00	1.00	1.00	1.00	17.....	3.40	2.90	2.00	1.20	1.30	1.00
2.....	3.00	3.60	.90	1.00	1.00	1.00	18.....	3.20	2.70	1.90	(a)	1.50	1.00
3.....	3.30	3.40	.80	.90	1.30	1.00	19.....	3.10	2.40	1.80	(a)	2.20	1.00
4.....	3.00	3.30	.70	.80	1.90	1.00	20.....	3.00	2.20	1.80	(a)	1.80	1.00
5.....	3.50	4.00	.60	.80	2.80	1.00	21.....	2.90	2.00	1.70	(a)	1.30	1.00
6.....	2.70	3.20	.60	.80	2.20	1.00	22.....	2.80	1.70	1.60	(a)	1.20	1.00
7.....	2.70	2.90	.60	.70	2.00	1.00	23.....	2.70	1.60	1.50	(a)	1.10	1.00
8.....	3.10	2.70	.60	.80	1.80	1.00	24.....	2.50	1.60	1.50	(a)	1.10	1.10
9.....	3.40	2.30	.50	1.00	1.30	1.00	25.....	2.40	1.50	1.40	(a)	1.10	1.20
10.....	3.30	2.10	.50	1.70	1.00	1.20	26.....	2.30	1.40	1.30	(a)	1.00	1.30
11.....	3.20	1.90	.50	1.60	1.10	1.10	27.....	2.40	1.30	1.20	(a)	1.00	1.30
12.....	3.20	1.80	.50	1.40	1.00	1.00	28.....	2.40	1.30	1.20	(a)	1.00	1.30
13.....	8.60	1.70	.50	1.10	1.60	1.00	29.....	2.30	1.20	1.10	1.00	1.00	1.30
14.....	9.00	1.60	.60	1.10	1.50	1.00	30.....	2.90	1.20	1.10	1.10	1.00	1.30
15.....	6.40	1.80	1.00	1.00	1.30	1.00	31.....	2.80	1.10	.....	1.00	.....	1.20
16.....	4.60	4.10	2.00	1.00	1.30	1.00							

a Observer died on October 17. New observer employed October 29.

*Rating table for Etowah River at Rome, Ga., from July 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.5	900	1.8	1,598	3.2	2,772	5.8	6,180
.6	944	1.9	1,665	3.4	3,010	6.0	6,470
.7	989	2.0	1,733	3.6	3,250	6.2	6,770
.8	1,035	2.1	1,801	3.8	3,490	6.4	7,070
.9	1,082	2.2	1,869	4.0	3,730	6.6	7,375
1.0	1,130	2.3	1,937	4.2	3,975	6.8	7,685
1.1	1,179	2.4	2,005	4.4	4,224	7.0	8,000
1.2	1,230	2.5	2,077	4.6	4,478	7.5	8,800
1.3	1,285	2.6	2,155	4.8	4,741	8.0	9,600
1.4	1,344	2.7	2,241	5.0	5,020	8.5	10,400
1.5	1,405	2.8	2,335	5.2	5,310	9.0	11,200
1.6	1,468	2.9	2,437	5.4	5,600		
1.7	1,532	3.0	2,546	5.6	5,890		

*Estimated monthly discharge of Etowah River at Rome, Ga., for 1903.*

[Drainage area, 1,854 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July .....	11,200	1,937	3,246	1.75	2.02
August .....	3,852	1,179	2,001	1.08	1.25
September .....	1,733	900	1,206	.65	.73
October 1-17 and 29-31 <sup>a</sup> .....			1,162	.63	.47
November .....	2,335	1,130	1,359	.73	.81
December .....	1,285	1,130	1,168	.63	.73

<sup>a</sup> Observer died October 17. New observer employed October 29.

#### ETOWAH RIVER AT CANTON, GA.

This station was established in 1892 by the United States Weather Bureau. Measurements were begun in 1896 by United States Geological Survey. It is located at the wagon bridge in Canton, Ga., one-half mile above the mouth of Canton Creek and 1,000 feet upstream from the Atlanta, Knoxville and Northern Railroad station. The gage is a heavy vertical timber, bolted to the edge of the left-bank pier, on the upstream side. The footmarks are numbered with brass



figures. The gage is read once each day by J. M. McAfee who is paid by the United States Weather Bureau for six months of the year. Discharge measurements are made from the upstream side of the iron highway bridge, which is about 25 feet above low water, and to which the gage is attached. The initial point for soundings is the river side of the right-bank pier at the end of the main span. The channel is straight for 1,000 feet above and 500 feet below the bridge. The current is affected by a fish-trap dam about 1 foot high, which was constructed in 1902, and which has since caused some trouble by being occasionally washed away and built up again. Up to 3 feet gage height the river is only 116 feet wide and flows between the piers on its lower banks. Up to about 14 feet it is confined between its upper banks, which are the abutments at the outer end of the approaches. Above this point it begins to overflow the bottom lands. The bed is fairly constant.

Bench mark No. 1 is a cut on a silver maple tree on the east side of the road, 20 feet from the end of the bridge on the south or left bank of the river; its elevation is 20.36 feet above the zero of the gage. Bench mark No. 2 is a cut on a persimmon tree 4 feet from the upper side of the bridge and 10 feet toward the river from the south end of the bridge; its elevation is 16.88 feet above the zero of the gage. Bench mark No. 3 is the center of the head of a large wire nail, driven horizontally in the side toward the river of a walnut tree on the east side of the road, 25 feet north of the north end of the bridge; its elevation is 18.52 feet above the zero of the gage. Bench mark No. 4 is the top of the iron bar on the top of the left-bank pier at the end of the center span of the bridge; its elevation is 23.39 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Etowah River at Canton, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 28 .....	M. R. Hall .....	1.07	922
March 27 .....	Olin P. Hall .....	2.50	2,562
April 27 .....	E. C. Murphy .....	1.80	1,873
June 25 .....	M. R. Hall .....	.94	1,166
Do .....	do .....	.93	1,119
September 4 .....	do .....	.51	570
Do .....	do .....	.51	575
October 10 .....	O. P. Hall .....	.60	513

*Mean daily gage height, in feet, of Etowah River at Canton, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.50	1.00	9.20	3.90	1.70	4.50	1.20	0.60	0.50	0.50	0.70	0.40
2.....	1.50	1.10	4.00	3.40	1.70	7.20	1.20	.80	.50	.50	.80	.40
3.....	1.00	1.60	2.00	2.90	1.60	4.70	1.10	1.10	.50	.50	1.00	.40
4.....	1.00	3.20	2.50	2.80	1.80	4.00	1.70	.70	.50	.50	1.00	.40
5.....	1.00	4.00	2.40	2.50	1.60	10.80	1.10	.70	.60	.50	1.50	.40
6.....	.80	2.00	2.90	2.30	1.40	7.50	1.00	.70	.60	.50	1.00	.40
7.....	.80	2.60	2.30	2.20	1.40	6.00	1.00	.70	.50	.50	.70	.40
8.....	.80	8.00	2.50	3.40	1.40	2.50	1.30	.60	.50	.50	.50	.40
9.....	.80	4.20	2.60	3.40	1.40	2.50	1.20	.60	.50	.90	.50	.40
10.....	.70	2.50	3.50	2.50	1.30	2.60	1.20	.60	.50	.60	.50	.40
11.....	2.80	7.00	11.00	2.20	1.30	2.50	1.20	.60	.40	.60	.50	.40
12.....	2.00	6.20	5.50	2.20	1.30	2.00	1.20	.70	.40	.60	.50	.40
13.....	1.80	3.10	3.50	5.20	1.30	1.60	5.30	.70	.40	.60	.50	.50
14.....	1.80	2.10	2.90	6.00	1.30	1.50	2.70	.70	.40	.60	.50	.50
15.....	1.60	2.80	2.50	3.20	1.20	1.30	2.00	2.50	1.00	.60	.50	.40
16.....	1.60	9.90	2.30	2.50	1.20	1.20	2.00	1.00	1.90	.60	.50	.40
17.....	1.40	17.70	2.20	2.40	1.10	1.20	2.00	1.00	.80	.80	.50	.40
18.....	1.40	5.10	2.00	2.30	1.10	1.20	1.90	2.20	.70	1.00	.80	.40
19.....	1.30	3.20	1.90	2.10	1.10	1.20	1.70	1.00	.50	.80	.60	.40
20.....	1.30	2.50	1.80	2.10	1.10	1.10	1.60	.90	.50	.80	.60	.50
21.....	1.30	2.40	5.50	2.20	1.10	1.10	1.60	.80	.50	.70	.50	.40
22.....	1.80	2.10	3.30	2.10	1.10	1.00	1.40	.80	.50	.70	.50	.40
23.....	1.60	2.00	13.00	2.00	1.00	1.00	1.20	.70	.50	.60	.50	.40
24.....	1.40	1.70	6.70	1.80	.90	1.00	1.00	.60	.50	.60	.50	.40
25.....	1.20	1.50	5.50	1.70	.90	1.00	.90	.50	.50	.60	.50	.60
26.....	1.20	1.60	3.00	2.30	.90	1.00	.80	.50	.50	.60	.50	.50
27.....	1.20	1.50	2.60	1.80	.90	1.10	.70	.50	.50	.70	.50	.50
28.....	1.20	15.00	2.40	1.70	.90	3.00	.70	.50	.50	.70	.50	.60
29.....	1.20	-----	2.90	1.70	.90	1.70	.70	.50	.50	.70	.40	.60
30.....	1.20	-----	12.20	1.70	1.80	1.50	.60	.50	.50	.70	.40	.50
31.....	1.20	-----	5.50	-----	2.60	-----	.60	.50	-----	.70	-----	.50

*Rating table for Etowah River at Canton, Ga., from January 1 to August 15, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.6	800	2.6	2,620	8.0	7,130	14.0	12,110
.7	900	2.8	2,800	8.5	7,545	14.5	12,525
.8	1,000	3.0	2,980	9.0	7,960	15.0	12,940
.9	1,090	3.5	3,395	9.5	8,375	15.5	13,355
1.0	1,180	4.0	3,810	10.0	8,790	16.0	13,770
1.2	1,360	4.5	4,225	10.5	9,205	16.5	14,185
1.4	1,540	5.0	4,640	11.0	9,620	17.0	14,600
1.6	1,720	5.5	5,055	11.5	10,035	17.5	15,015
1.8	1,900	6.0	5,470	12.0	10,450	18.0	15,430
2.0	2,080	6.5	5,885	12.5	10,865		
2.2	2,260	7.0	6,300	13.0	11,280		
2.4	2,440	7.5	6,715	13.5	11,695		

*Rating table for Etowah River at Canton, Ga., from August 16 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.4	430	0.9	780	1.4	1,220	1.9	1,670
.5	500	1.0	860	1.5	1,310	2.0	1,760
.6	570	1.1	950	1.6	1,400	2.1	1,850
.7	640	1.2	1,040	1.7	1,490	2.2	1,940
.8	710	1.3	1,130	1.8	1,580	2.3	2,030

*Estimated monthly discharge of Etowah River at Canton, Ga., for 1903.*

[Drainage area, 604 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	2,800	900	2,136	3.54	4.08
February .....	15,181	1,180	3,934	6.52	6.79
March .....	11,280	1,900	4,004	6.63	7.64
April .....	5,470	1,810	2,618	4.34	4.84
May .....	2,620	1,090	1,450	2.40	2.77
June .....	9,454	1,180	2,640	4.37	4.88
July .....	4,889	800	1,544	2.56	2.95
August .....	2,530	500	856	1.42	1.64
September .....	1,670	430	558	.92	1.03
October .....	860	500	598	.99	1.14
November .....	1,310	430	586	.97	1.08
December .....	570	430	459	.76	.88
The year .....	15,181	430	1,782	2.95	39.72

#### COOSAWATTEE RIVER AT CARTERS, GA.

This river is formed by the junction of Ellijay and Cartecay rivers at Ellijay, Ga., and flows in a southwesterly direction, joining the Conasauga to form the Oostanaula. Its drainage area is for the most part mountainous and covered with forest growth. This station was established August 15, 1896, by M. R. Hall, at the iron highway bridge at Carters, Murray County, Ga., about 20 miles northeast of Calhoun, the most convenient railroad station. Carters is at the head of navigation, small boats running to Rome, Ga., and the Coosa

River below. It is at the foot of the great shoals made by this stream in cutting through the Cohutta Mountains. The chain gage is fastened to the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 37.08 feet. The observer was H. S. Weems, a merchant at Carters, Ga., until the end of 1903, when he was succeeded by R. P. Messer. Discharge measurements are made from the single-span highway bridge and its approaches. The initial point for soundings is land side of the pier on the right bank. The channel is curved for 1,000 feet above and 500 feet below the station. The current is swift and broken. Both banks are high, but overflow at flood stages. The bed of the stream is of gravel, and is not liable to change. The bench mark is the top of the cylindrical iron pier at the right bank, downstream side. Its elevation is 30.35 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Coosawattee River at Carters, Ga., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 18.....	O. P. Hall.....	3.56	1,588
July 22.....	do.....	2.35	963
September 8.....	M. R. Hall.....	1.22	456
Do.....	O. P. Hall.....	1.22	444
October 16.....	do.....	1.07	374
December 31.....	do.....	1.26	416

*Mean daily gage height, in feet, of Coosawattee River at Carters, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.70	2.00	9.20	6.00	3.40	4.50	2.60	2.20	1.30	1.00	1.20	1.10
2.....	2.00	2.50	5.40	5.20	3.20	5.00	2.50	2.30	1.20	1.00	1.20	1.10
3.....	2.50	3.00	4.60	4.90	3.20	5.20	2.40	2.40	1.20	1.00	1.40	1.20
4.....	2.00	10.00	4.10	5.00	3.10	5.00	2.30	2.50	1.20	1.00	1.30	1.20
5.....	1.60	9.00	4.10	4.40	3.00	6.80	2.30	2.40	1.20	1.00	1.20	1.20
6.....	1.60	7.00	5.00	4.20	2.80	5.50	2.20	2.30	1.30	.90	1.20	1.10
7.....	1.50	8.00	3.70	4.10	2.80	4.20	2.10	2.20	1.30	.90	1.10	1.05
8.....	1.40	7.00	5.90	8.00	2.70	3.50	2.00	2.10	1.20	2.00	1.10	1.05
9.....	1.40	6.00	4.60	4.10	2.70	3.60	2.20	2.30	1.20	1.40	1.05	1.10
10.....	1.20	6.00	5.10	4.20	2.70	3.00	2.30	2.40	1.15	1.20	1.05	1.10
11.....	3.30	9.00	8.90	4.00	2.60	4.70	2.50	2.30	1.10	1.00	1.20	1.10
12.....	2.70	6.50	4.80	3.80	2.60	4.20	3.00	2.20	1.05	1.05	1.30	1.20
13.....	2.40	4.50	4.30	10.00	2.50	3.50	9.00	2.10	1.05	1.00	1.10	1.40
14.....	2.10	4.00	4.20	5.40	2.50	3.40	6.00	2.10	1.10	1.00	1.10	1.30
15.....	2.00	4.00	4.00	4.80	2.40	3.00	4.20	2.00	1.20	1.00	1.10	1.30
16.....	2.00	10.50	3.80	4.40	2.50	2.80	3.80	2.20	1.60	1.05	1.20	1.20

*Mean daily gage height, in feet, of Coosawattee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17.....	1.90	9.00	3.70	4.10	2.50	2.60	3.50	2.10	1.40	1.60	2.80	1.20
18.....	2.00	6.00	3.40	3.90	2.50	2.50	3.00	2.00	1.30	1.30	2.60	1.20
19.....	1.90	4.20	3.40	4.00	2.40	2.40	2.80	1.90	1.20	1.20	2.40	1.20
20.....	1.80	4.00	3.30	4.00	2.40	2.20	2.40	1.80	1.10	1.20	2.00	1.50
21.....	1.80	3.50	4.30	3.90	2.60	2.20	2.30	1.70	1.10	1.10	1.90	1.20
22.....	1.70	3.30	6.10	3.90	2.40	2.00	2.20	1.60	1.10	1.05	1.70	1.10
23.....	1.70	3.20	18.20	3.80	2.40	2.10	2.10	1.50	1.05	1.00	1.40	1.10
24.....	1.60	3.10	8.10	3.80	2.50	2.20	2.20	1.40	1.10	1.00	1.30	1.20
25.....	1.60	3.00	5.20	3.70	2.60	3.00	2.10	1.40	1.10	1.05	1.20	1.20
26.....	1.50	2.90	4.60	3.70	2.60	3.50	2.00	1.30	1.05	1.10	1.20	1.70
27.....	1.50	3.40	4.20	3.60	2.40	4.00	2.00	1.30	1.05	1.10	1.20	1.40
28.....	1.50	21.50	4.40	3.50	2.30	3.00	2.20	1.20	1.05	1.00	1.30	1.20
29.....	2.50	-----	6.40	3.60	3.00	3.00	2.10	1.20	1.05	1.00	1.20	1.10
30.....	2.20	-----	21.00	3.50	3.50	2.90	2.20	1.20	1.05	1.10	1.10	1.10
31.....	2.00	-----	7.80	-----	5.00	-----	2.40	1.30	-----	1.20	-----	1.10

*Rating table for Coosawattee River at Carters, Ga., 1902-3.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.8	280	3.8	1,750	6.8	3,846	12.0	7,590
1.0	345	4.0	1,875	7.0	3,990	13.0	8,310
1.2	420	4.2	2,010	7.2	4,134	14.0	9,030
1.4	495	4.4	2,145	7.4	4,278	15.0	9,750
1.6	575	4.6	2,280	7.6	4,422	16.0	10,470
1.8	670	4.8	2,415	7.8	4,566	17.0	11,190
2.0	765	5.0	2,550	8.0	4,710	18.0	11,910
2.2	865	5.2	2,694	8.2	4,854	19.0	12,630
2.4	970	5.4	2,838	8.4	4,998	20.0	13,350
2.6	1,075	5.6	2,982	8.6	5,142	21.0	14,070
2.8	1,180	5.8	3,126	8.8	5,286	22.0	14,790
3.0	1,290	6.0	3,270	9.0	5,430	23.0	15,510
3.2	1,400	6.2	3,414	9.5	5,790		
3.4	1,510	6.4	3,558	10.0	6,150		
3.6	1,625	6.6	3,702	11.0	6,870		

*Estimated monthly discharge of Coosawattee River at Carters, Ga., for 1903.*

[Drainage area, 531 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	1,455	420	721	1.36	1.57
February .....	14,430	765	3,294	6.20	6.46
March .....	14,070	1,455	3,295	6.20	7.15
April .....	6,150	1,565	2,244	4.23	4.72
May .....	2,550	917	1,172	2.21	2.55
June .....	3,846	765	1,631	3.07	3.43
July .....	5,430	765	1,233	2.32	2.67
August .....	1,022	420	729	1.37	1.58
September .....	575	364	408	.77	.86
October .....	765	310	389	.73	.84
November .....	1,180	364	512	.96	1.07
December .....	622	364	421	.79	.91
The year .....	14,430	310	1,337	2.52	33.81

#### BLACK WARRIOR RIVER AT TUSCALOOSA, ALA.

A continuous record of gage heights at Tuscaloosa since 1889 has been kept by the United States Engineer Corps. During 1895 and 1896 a number of discharge measurements were also made, from which a rating table was obtained, and since that time measurements of flow have been made by the United States Geological Survey. The station is located about one-fourth of a mile above Mobile and Ohio Railroad bridge. There are three locks and dams within about 3 miles above the station.

The gage is located about three-fourths of a mile from the business center of Tuscaloosa, Ala. It is reached by passing down Bridge street to the river, thence down the east bank 1,800 feet. There is also a vertical iron gage on the downstream side of the second pier from the left bank of the highway bridge, from which the discharge measurements are made. Discharge measurements are made from the iron highway bridge above the gage. The initial point for soundings is the end of the iron bridge on the left bank, downstream side. The channel is straight for 15,000 feet above and below the station; its width at low water is 280 feet, and at high stages 625 feet. The current is sluggish at low stages. Both banks are high and steep and overflow only at extreme stages. The greater part of the bed is of rock and is permanent. There is but one channel, broken by the three bridge piers.

Bench mark No. 1 is on a willow tree 10 feet west of the gage; its elevation is 10.54 feet above the zero of the gage and 97.34 feet above the Mobile datum. Bench mark No. 2 is on a small hackberry tree 30 feet south of the upper end of the gage; its elevation is 52.06 feet above the zero of the gage and 139.36 feet above the Mobile datum. Daily gage heights are furnished to the Geological Survey by R. C. McCalla, United States assistant engineer.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Black Warrior River at Tuscaloosa, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
July 20. ....	J. M. Giles. ....	5.45	862
July 21. ....	do. ....	5.44	719

*Mean daily gage height, in feet, of Black Warrior River at Tuscaloosa, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. ....	13.20	13.35	54.30	16.70	8.50	9.60	6.43	6.95	5.10	3.98	5.03	4.71
2. ....	13.75	12.55	52.41	16.65	8.15	12.50	5.90	7.40	5.15	3.95	5.17	4.72
3. ....	16.53	13.75	47.25	15.30	7.90	14.21	5.65	8.55	5.00	3.80	5.68	4.78
4. ....	23.50	18.55	41.42	14.12	7.75	12.35	5.44	7.65	4.91	3.75	5.55	4.84
5. ....	22.52	35.00	36.90	13.10	7.45	12.40	5.80	6.95	4.80	3.61	5.21	4.85
6. ....	19.81	37.85	33.11	12.30	7.15	13.35	6.35	6.50	4.73	3.98	5.04	4.87
7. ....	17.10	36.00	37.82	11.50	6.92	16.83	6.15	6.80	4.55	4.20	4.98	4.88
8. ....	15.11	56.35	36.50	11.15	6.89	16.50	5.90	6.72	4.45	4.70	4.90	4.86
9. ....	13.31	55.85	39.15	12.30	7.00	12.20	5.75	6.55	4.40	4.75	4.88	4.88
10. ....	12.10	51.50	39.20	22.35	6.90	10.50	6.50	6.10	4.42	4.90	4.84	4.89
11. ....	12.53	52.00	37.75	20.10	6.75	10.85	6.25	6.35	4.31	4.97	4.80	4.90
12. ....	23.95	53.75	35.12	16.50	7.05	11.00	6.35	6.15	4.25	5.10	4.87	4.92
13. ....	28.41	51.10	33.80	14.35	8.65	10.35	6.52	6.10	4.21	5.15	4.91	4.87
14. ....	25.75	46.15	36.15	21.20	14.35	9.45	6.70	6.00	4.19	4.95	4.87	4.85
15. ....	21.90	41.11	36.00	32.12	36.85	8.30	6.55	5.95	4.13	4.96	4.92	4.87
16. ....	19.01	40.50	33.84	28.20	43.40	7.65	6.25	6.25	4.10	4.93	4.97	4.86
17. ....	16.11	56.65	31.12	23.40	43.10	7.08	5.90	6.60	4.00	4.98	4.98	4.86
18. ....	14.50	56.75	28.65	18.25	37.10	6.70	5.81	6.85	4.03	5.01	4.91	4.84
19. ....	12.51	52.95	26.15	16.00	30.65	6.45	5.70	7.82	4.08	4.99	4.90	4.80
20. ....	11.85	46.75	23.50	14.50	25.80	6.20	5.45	7.60	4.03	4.98	4.88	4.92
21. ....	11.05	41.30	20.85	14.90	21.55	6.23	5.10	6.91	3.98	4.90	4.86	5.05
22. ....	10.84	36.50	18.80	17.95	17.60	7.20	5.05	6.55	3.94	4.85	4.80	5.28
23. ....	9.98	32.30	17.55	15.90	13.85	6.95	4.75	6.10	3.90	4.76	4.78	5.15
24. ....	9.51	28.85	16.15	13.81	11.10	6.75	4.70	5.65	3.89	4.65	4.75	5.48
25. ....	8.65	26.10	14.80	12.30	9.80	6.83	4.83	5.45	3.86	4.60	4.73	5.60
26. ....	8.25	23.95	13.48	11.30	9.00	7.80	4.90	5.25	3.80	4.50	4.75	5.51
27. ....	8.05	22.00	12.40	10.50	8.35	7.52	4.80	5.15	3.75	4.50	4.74	5.39
28. ....	9.85	45.42	11.85	10.00	7.80	7.15	4.65	5.05	3.70	4.60	4.75	5.15
29. ....	12.35	-----	11.62	9.45	7.45	6.91	7.85	4.95	3.81	4.68	4.73	5.12
30. ....	14.72	-----	11.78	8.95	7.15	6.55	4.75	5.35	3.95	4.76	4.70	5.09
31. ....	14.55	-----	13.50	-----	7.32	-----	6.50	5.15	-----	4.81	-----	5.07

## BLACK WARRIOR RIVER NEAR CORDOVA, ALA.

This station is located at the Kansas City, Memphis and Birmingham Railroad bridge, which crosses the river below the junction of the Mulberry and Spipsey forks, and about three-fourths of a mile from Cordova, Ala. The gage was established by the United States Weather Bureau, but observations were discontinued by that Bureau sometime ago. From 12 to 55 feet the gage is a vertical timber bolted to the inside of the bridge pier on the left bank of the river. Below 12 feet the gage was sloping, but it was out of position and could not be used when the station was established by the Geological Survey on May 21, 1900, so a short new section was put in at that time. This section is a 2 by 10 inch plank, graduated to feet and tenths, from  $-1.5$  to  $+12.5$  feet, and spiked to a willow tree on the right bank of the river about 200 feet below the bridge.

Measurements are made from the downstream side of the railroad bridge, which is a two-span, iron through bridge. The span across the river is 300 feet long. The span on the left bank is about 150 feet long. At low stages discharge measurements are made from a boat at a point some distance below the bridge. The channel is curved for 500 feet above and straight for 1,000 feet below the station. The right bank is a rock bluff and will not overflow. The left bank overflows only under the second span of the bridge. The bed of the stream is of rock and is permanent. The channel has a width of about 180 feet at low water and about 450 feet at high stages.

Bench mark No. 1 is the top of the fourth crossbeam from the initial point for soundings, on the downstream side. Its elevation is 60.09 feet above the zero of the gage. Bench mark No. 2 is a copper plug in the solid rock about 110 feet above the bridge, 50 feet from the initial point for soundings. Its elevation is 32.12 feet above the zero of the gage. The top of the pier at the left bank is 55.10 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.



*Discharge measurements of Black Warrior River near Cordova, Ala., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 6.....	J. M. Giles.....	13.90	19,252
March 13.....	do.....	6.90	9,486
May 19.....	do.....	4.34	5,159
June 15.....	do.....	.50	1,036
July 17.....	do.....	— .30	306
August 27.....	do.....	— .48	208
August 29.....	do.....	— .65	142
September 25.....	do.....	— .90	78

*Mean daily gage height, in feet, of Black Warrior River near Cordova, Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.30	2.30	27.60	3.70	0.80	2.80	-0.10	0.00	-0.70	-0.90	-0.40	-0.50
2.....	2.40	3.40	21.60	3.30	.70	3.80	— .20	.00	— .70	— .90	— .40	— .50
3.....	7.80	3.30	13.50	2.70	.70	2.50	— .20	.50	— .70	— .90	— .40	— .60
4.....	8.20	9.00	7.20	2.30	.70	1.60	— .30	.30	— .70	— .90	— .40	— .60
5.....	6.00	15.80	6.20	2.30	.70	1.80	.00	.10	— .70	— .90	— .40	— .60
6.....	4.90	10.00	13.70	2.30	.60	4.70	— .10	— .10	— .70	— .90	— .50	— .60
7.....	3.80	8.70	11.40	1.90	.60	3.80	— .20	— .20	— .70	— .90	— .50	— .60
8.....	3.00	26.10	10.10	2.00	.50	2.60	.00	— .20	— .70	— .50	— .60	— .60
9.....	2.60	25.40	15.70	10.00	.50	2.00	— .10	— .20	— .80	— .40	— .60	— .60
10.....	2.40	16.10	11.90	5.40	.50	2.40	— .20	— .30	— .80	— .30	— .60	— .60
11.....	3.90	21.20	10.20	4.00	.50	2.00	.00	— .30	— .80	— .30	— .60	— .60
12.....	10.00	25.30	8.20	3.40	.50	2.00	— .10	— .30	— .80	— .30	— .40	— .60
13.....	7.80	18.00	6.70	5.50	.80	1.40	— .10	— .30	— .80	— .40	— .40	— .60
14.....	5.60	9.00	8.60	12.20	6.60	.90	— .20	— .40	— .80	— .50	— .50	— .60
15.....	4.50	11.10	8.60	8.00	20.10	.60	— .30	— .40	— .80	— .60	— .60	— .50
16.....	3.60	14.30	6.90	5.80	19.40	.50	— .30	— .30	— .80	— .60	— .60	— .50
17.....	2.50	29.50	5.90	4.60	11.20	.30	— .30	— .30	— .80	— .70	— .60	— .50
18.....	2.80	27.30	5.30	3.90	6.80	.20	— .40	— .40	— .90	— .70	— .60	— .50
19.....	2.40	17.80	4.50	2.90	4.90	.10	— .40	— .40	— .90	— .70	— .60	— .50
20.....	1.80	10.50	4.00	3.20	3.80	.00	— .40	— .50	— .90	— .70	— .50	— .50
21.....	1.70	7.90	3.40	6.80	2.80	.00	— .40	— .50	— .90	— .70	— .50	— .20
22.....	1.80	5.40	3.00	4.50	2.40	.00	— .50	— .60	— .90	— .70	— .50	.50
23.....	1.60	5.00	3.00	3.40	1.80	.20	— .50	— .60	— .90	— .70	— .50	.10
24.....	1.40	4.50	2.90	3.00	1.50	.70	— .50	— .60	— .90	— .70	— .50	.10
25.....	1.40	3.70	2.70	2.60	1.30	.50	— .50	— .60	— .90	— .70	— .50	— .30
26.....	1.40	3.30	2.30	2.00	1.00	.40	— .50	— .60	— .90	— .70	— .50	— .40
27.....	1.30	3.00	2.00	1.70	.80	.30	— .60	— .60	— .90	— .70	— .50	— .30
28.....	1.90	21.90	1.80	1.50	.60	.20	— .60	— .60	— .90	— .70	— .50	— .30
29.....	3.50	.....	1.70	1.40	.50	.20	— .60	— .70	— .90	— .80	— .50	— .40
30.....	3.40	.....	2.30	1.00	.40	.10	— .60	— .70	— .90	— .80	— .50	— .40
31.....	2.80	.....	2.90	.....	.80	.....	— .20	— .70	.....	— .50	.....	— .40

*Rating table for Black Warrior River near Cordova, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
— .9	78	0.4	800	1.7	1,840	3.0	3,300
— .8	100	.5	875	1.8	1,940	3.1	3,430
— .7	126	.6	950	1.9	2,040	3.2	3,560
— .6	159	.7	1,025	2.0	2,140	3.3	3,695
— .5	198	.8	1,100	2.1	2,250	3.4	3,830
— .4	247	.9	1,175	2.2	2,360	3.5	3,970
— .3	307	1.0	1,250	2.3	2,475	3.6	4,110
— .2	374	1.1	1,325	2.4	2,590	3.7	4,255
— .1	442	1.2	1,400	2.5	2,705	3.8	4,400
+ .0	510	1.3	1,480	2.6	2,820	3.9	4,550
.1	580	1.4	1,560	2.7	2,935	4.0	4,700
.2	650	1.5	1,650	2.8	3,050		
.3	725	1.6	1,740	2.9	3,175		

Above 3.8 feet gage height, differences 150 per tenth.

*Estimated monthly discharge of Black Warrior River near Cordova, Ala., for 1903.*

[Drainage area, 1,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	13,700	1,480	4,306	2.27	2.62
February .....	42,950	2,475	17,941	9.44	9.83
March .....	40,100	1,840	10,203	5.37	6.19
April .....	17,000	1,250	4,773	2.51	2.80
May .....	28,850	800	4,176	2.20	2.54
June .....	5,750	510	1,661	.87	.97
July .....	510	159	317	.17	.20
August .....	875	126	306	.16	.18
September .....	126	78	97	.051	.057
October .....	307	78	148	.078	.090
November .....	247	159	198	.10*	.11
December .....	875	159	252	.13	.15
The year .....	42,950	78	3,698	1.95	25.74

## LOCUST FORK OF BLACK WARRIOR RIVER AT PALOS, ALA.

Locust Fork of Black Warrior River rises in Blount County, Ala., and, flowing in a southwesterly course, enters Black Warrior River a short distance above Wilmington, Ala. Its drainage basin is hilly, and only a small part of its area is in cultivation. Palos station was established November 26, 1901, by R. C. McCalla, United States assistant engineer, who furnishes the daily gage heights to the Geological Survey. It is maintained by the United States Engineer Corps. The gage is a 4 by 8 inch timber, on the right bank of the river, just below the Kansas City, Memphis and Birmingham Railroad bridge. One section follows the slope of the bank from low water to a tree on top of the bank, and from there up a vertical section is fastened to the tree. The slope is 17 feet in elevation, measured vertically, and the vertical section of the rod is 15 feet. The rod is graduated to feet and tenths, with copper figures at the 5-foot points and round-head tacks at intermediate foot marks. The total height is 32 feet. The plane of reference (about 251.71 feet above Mobile datum) is supposed to be extreme low water. High water, April, 1900, was about 37 feet above the plane of reference.

Measurements are made from the Drennan bridge, which is about a quarter of a mile below the Kansas City, Memphis and Birmingham Railroad bridge. The Drennan bridge is the property of the Drennan Coal Mining Company. It is a mining railroad bridge, having width for a double-track tramway of 3 feet gage. One track is laid and in operation. The bridge has two iron spans of 100 feet each and trestle approaches at both ends.

Low-water measurements are made by wading at a shoal one-third mile below the bridge. The initial point for soundings is the left-bank end of the iron bridge on the downstream side. The channel is curved for 1,500 feet above the station and is straight for 3,000 feet below. At low water the channel is 180 feet wide. There is a ledge of rock about 200 feet below the station with about 3 feet fall. Both banks are high and wooded. The right bank overflows at flood stages, but only under the approach to the bridge. The bed is mainly of rock and is permanent.

Bench mark No. 1 is the top of the crossbeam at a point 80 feet from the initial point for soundings on the downstream side. Its elevation is 46.70 feet above the surface of the water, less the reading of the gage. It was established by measuring down to water surface with a steel tape. Bench mark No. 2 is a copper plug in a water-oak tree on the right hand, 20 feet downstream from the gage. Its elevation is 21.68 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Locust Fork of Black Warrior River at Palos, Ala.,  
in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 7 .....	J. M. Giles .....	4. 75	7,450
March 14 .....	do .....	3. 55	5,342
May 20 .....	do .....	1. 75	2,148
June 16 .....	do .....	. 62	431
Do .....	do .....	. 62	404
July 18 .....	do .....	. 40	228
August 28 .....	do .....	. 13	84
Do .....	do .....	. 13	93
September 26 .....	do .....	. 02	47

*Mean daily gage height, in feet, of Locust Fork of Black Warrior River at Palos,  
Ala., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	1.20	1.10	17.00	2.60	0.90	1.20	0.40	0.70	0.40	0.00	0.20	0.10
2 .....	1.30	1.10	7.40	2.20	.90	2.10	.40	1.00	.30	.00	.20	.10
3 .....	1.50	1.60	4.20	1.90	.80	1.40	.40	.70	.20	.00	.20	.10
4 .....	1.50	3.30	3.20	1.70	.80	1.20	.80	.90	.10	.00	.10	.10
5 .....	1.60	7.60	2.80	1.60	.80	1.10	.80	.80	.10	.00	.10	.10
6 .....	1.50	4.80	4.60	1.50	.70	1.60	.70	.60	.10	.00	.10	.10
7 .....	1.40	4.30	5.20	1.40	.70	1.40	.60	.50	.10	.00	.10	.10
8 .....	1.30	18.10	3.80	1.50	.70	1.20	.60	.40	.10	.00	.00	.10
9 .....	1.20	12.20	4.30	4.00	.60	1.10	.50	.40	.00	.40	.00	.10
10 .....	1.00	6.40	3.50	3.70	.60	1.10	.50	.40	.00	.30	.00	.10
11 .....	1.50	12.60	3.80	2.20	.60	1.50	.50	.40	.00	.20	.20	.10
12 .....	3.20	12.50	2.80	1.80	.60	1.10	.40	.30	.00	.20	.30	.10
13 .....	2.70	6.60	2.50	1.80	.70	1.00	.50	.30	.00	.10	.30	.10
14 .....	2.00	4.40	3.60	10.20	1.00	.80	.80	.30	.00	.10	.30	.10
15 .....	1.70	4.20	3.70	7.20	5.80	.70	.90	.60	.00	.00	.20	.10
16 .....	1.60	7.50	3.10	3.80	11.90	.60	.70	.80	.00	.00	.10	.10
17 .....	1.40	23.00	2.60	2.60	5.70	.60	.50	.70	.00	.00	.10	.10
18 .....	1.40	18.10	2.30	2.10	3.00	.60	.40	.70	.00	.00	.10	.10
19 .....	1.20	7.40	2.00	1.90	2.10	.60	.30	.70	.00	.00	.10	.10
20 .....	1.10	4.20	1.80	1.90	1.80	.50	.30	.60	.00	.00	.10	.20
21 .....	1.10	3.10	1.70	2.50	1.50	.50	.20	.60	.00	.00	.10	.10
22 .....	1.00	2.60	1.70	2.00	1.30	.40	.20	.60	.00	.00	.10	.10
23 .....	1.00	2.20	1.80	1.70	1.20	.50	.20	.40	.00	.00	.10	.10
24 .....	.10	2.00	1.70	1.50	1.10	.40	.20	.30	.00	.00	.10	.10
25 .....	.90	1.80	1.60	1.40	1.00	.40	.20	.30	.00	.00	.10	.10
26 .....	.90	1.70	1.50	1.30	.90	.40	.20	.20	.00	.00	.10	.20
27 .....	.80	1.60	1.40	1.20	.80	.50	.20	.20	.00	.00	.10	.20
28 .....	.80	20.00	1.30	1.10	.70	.50	.10	.10	.00	.00	.10	.20
29 .....	1.20	-----	1.30	1.00	.70	.50	.10	.10	.00	.00	.10	.20
30 .....	1.30	-----	1.40	1.00	.80	.50	.10	.10	.00	.00	.10	.20
31 .....	1.20	-----	2.70	-----	.90	-----	.30	.10	-----	.30	-----	.20

*Rating table for Locust Fork of Black Warrior River at Palos, Ala., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.0	46	0.8	605	1.6	1,770	2.4	3,210
.1	77	.9	720	1.7	1,950	2.5	3,390
.2	115	1.0	845	1.8	2,130	2.6	3,570
.3	167	1.1	980	1.9	2,310	2.7	3,750
.4	230	1.2	1,120	2.0	2,490	2.8	3,930
.5	306	1.3	1,265	2.1	2,670	3.0	4,290
.6	398	1.4	1,420	2.2	2,850		
.7	500	1.5	1,590	2.3	3,030		

Tangent at 2 feet with difference of 180 per tenth thereafter.

*Estimated monthly discharge of Locust Fork of Black Warrior River at Palos, Ala., for 1903.*

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	4,650	605	1,428	1.40	1.61
February .....	40,290	980	11,498	11.27	11.74
March .....	29,490	1,265	4,833	4.74	5.46
April .....	17,250	845	3,246	3.18	3.55
May .....	20,310	398	2,097	2.06	2.37
June .....	2,670	230	758	.74	.83
July .....	720	77	276	.27	.31
August .....	845	77	326	.32	.37
September .....	230	46	64	.06	.07
October .....	230	46	66	.06	.07
November .....	167	46	89	.09	.10
December .....	115	77	86	.08	.09
The year .....	40,290	46	2,064	2.02	26.57

#### TOMBIGBEE RIVER AT COLUMBUS, MISS.

The gage is located about 1,000 feet below the county highway bridge, 1 mile from the Southern Railway station at Columbus, Miss. A vertical 3 by 10 inch pine timber is fastened to the blue rock bluff on the left bank and is marked with brass figures and brass nails from -5 to +43 feet. Discharge measurements are made from the county highway bridge at the south end of Main street. The initial point for soundings is the end of the iron bridge on the right bank, downstream side. The channel is slightly curved for 500 feet above and 1,000 feet below the station. The current is sluggish at low stages and very swift above a gage height of 12 feet. The right bank is high and sel-

dom overflows. The left bank overflows from gage height 18 to 22 feet. The bed of the stream is of soft blue rock.

Bench mark No. 1 is the top of the downstream girder at a point 250 feet from the initial point for soundings. Its elevation is 39.88 feet above the zero of the gage. This point is on the movable portion of the drawbridge and may vary in elevation. Bench mark No. 2 is a copper plug in a tree at the southeast corner of First street and Second avenue. Its elevation is 17.94 feet above the zero of the gage. This tree has boards nailed to it, showing the names of the streets. Bench mark No. 3 is the top of the rail at the depot of the Southern Railway and is 55.2 feet above gage datum and 191 feet above mean sea level.

The observer, J. J. Richards, is paid by the United States Weather Bureau.

The width of the river at low water is 160 feet. The maximum recorded height of the river was on April 8, 1892, when the gage registered 42 feet. The lowest recorded height was on October 26, 1893, when the gage reading was -3.9 feet. The danger line is at 33 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Tombigbee River at Columbus, Miss., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 9.....	J. M. Giles .....	15.50	26,452
March 12.....	do .....	17.30	29,015
May 18.....	do .....	12.50	17,804
July 16.....	do .....	- 1.70	1,340
July 17.....	do .....	- 1.80	1,278
September 22.....	do .....	- 3.70	252
September 25.....	do .....	- 3.70	263

*Mean daily gage height, in feet, of Tombigbee River at Columbus, Miss., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.80	9.00	10.40	3.50	- 0.40	3.10	0.00	-2.20	-3.40	-3.70	-3.20	-3.00
2.....	8.40	8.20	10.80	3.40	- .60	2.90	- .80	-2.10	-3.40	-3.70	-2.80	-2.60
3.....	11.80	7.70	11.50	3.00	- .90	3.00	-1.30	-2.20	-3.50	-3.70	-2.00	-2.60
4.....	12.20	8.50	11.70	2.50	- 1.10	3.00	-1.40	-2.40	-3.50	-3.70	-1.80	-2.80
5.....	11.80	8.80	11.40	2.00	- 1.10	2.90	-1.60	-1.60	-3.50	-3.70	-1.70	-3.00
6.....	12.20	9.00	11.50	1.70	- 1.20	2.30	-1.70	-2.80	-3.60	-3.70	-1.60	-3.00
7.....	12.00	12.00	12.40	1.30	- 1.30	2.30	-2.00	-2.90	-3.60	-3.70	-1.40	-3.00
8.....	11.00	18.60	13.60	1.00	- 1.40	2.30	-1.80	-3.00	-3.60	-3.60	-1.40	-3.00
9.....	8.80	19.80	15.30	.80	- 1.40	2.10	-2.00	-2.40	-3.60	-3.70	-1.50	-3.00
10.....	8.50	20.50	16.00	1.60	- 1.40	1.90	-2.00	-2.30	-3.60	-3.70	-1.50	-3.00
11.....	8.90	22.30	17.00	2.60	- 1.40	1.30	-2.00	-1.50	-3.60	-3.70	-1.50	-3.00
12.....	9.50	23.90	17.30	2.40	- 1.10	1.20	-2.00	-1.00	-3.70	-3.60	-1.50	-2.90
13.....	9.80	23.80	17.50	2.20	1.00	.80	-2.10	-1.00	-3.70	-3.60	-1.40	-2.80
14.....	9.90	22.70	18.50	1.90	8.00	.10	-1.70	- .80	-3.70	-3.60	-2.30	-2.60
15.....	10.40	21.50	19.80	2.70	10.60	- .40	-1.80	-1.20	-3.70	-3.60	-2.60	-2.60
16.....	10.40	20.90	20.00	3.60	12.00	- .80	-1.90	-1.20	-3.70	-3.60	-3.00	-2.90

*Mean daily gage height, in feet, of Tombigbee River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17.....	9.40	22.50	19.80	3.60	12.00	-1.00	-1.90	-1.50	-3.70	-3.50	-3.00	-3.00
18.....	7.60	23.00	19.20	3.30	12.50	-1.60	-2.10	-1.70	-3.70	-3.50	-3.20	-3.00
19.....	5.60	23.10	18.30	2.80	11.90	-1.80	-2.30	-1.90	-3.70	-3.60	-2.70	-2.80
20.....	4.60	23.60	16.70	2.20	10.10	-1.90	-2.40	-1.00	-3.70	-3.60	-2.70	-2.60
21.....	5.50	23.30	14.00	1.50	7.60	-1.90	-2.50	-1.70	-3.70	-3.50	-2.70	-2.50
22.....	3.20	21.70	12.10	1.00	5.70	-2.00	-2.60	-1.40	-3.70	-3.50	-2.70	-2.50
23.....	2.70	19.80	10.80	1.60	3.00	-2.00	-2.60	-2.00	-3.80	-3.50	-2.80	-2.60
24.....	2.30	17.00	9.80	2.00	1.20	-1.70	-3.00	-2.30	-3.80	-3.60	-2.80	-2.90
25.....	2.00	15.80	9.50	2.00	.40	-1.50	-3.00	-2.50	-3.70	-3.60	-2.60	-2.90
26.....	1.90	14.60	8.80	1.60	-.20	-1.60	-3.00	-2.60	-3.70	-3.50	-2.70	-2.70
27.....	1.90	8.70	6.90	1.40	-.60	.80	-3.00	-2.90	-3.70	-3.50	-2.70	-2.10
28.....	5.60	9.20	5.10	.60	-1.00	1.90	-3.00	-2.90	-3.70	-3.50	-2.80	-1.70
29.....	7.60	.....	4.00	.10	-1.00	1.50	-3.10	-3.00	-3.70	-3.50	-2.80	-1.60
30.....	8.00	.....	3.40	-.20	-1.10	.80	-3.10	-3.10	-3.70	-3.60	-3.00	-1.60
31.....	8.80	.....	3.50	.....	.10	.....	-3.10	-3.30	.....	-3.50	.....	-1.80

*Rating table for Tombigbee River at Columbus, Miss., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
-3.8	220	-1.0	1,900	3.6	6,620	8.2	12,840
-3.7	260	-.8	2,060	3.8	6,860	8.4	13,140
-3.6	300	-.6	2,220	4.0	7,110	8.6	13,440
-3.5	340	-.4	2,400	4.2	7,360	8.8	13,740
-3.4	380	-.2	2,580	4.4	7,610	9.0	14,040
-3.3	425	.0	2,760	4.6	7,860	9.2	14,350
-3.2	470	+.2	2,940	4.8	8,120	9.4	14,660
-3.1	520	.4	3,140	5.0	8,380	9.6	14,970
-3.0	570	.6	3,340	5.2	8,640	9.8	15,280
-2.9	620	.8	3,540	5.4	8,910	10.0	15,590
-2.8	675	1.0	3,740	5.6	9,180	10.2	15,900
-2.7	730	1.2	3,940	5.8	9,450	10.4	16,210
-2.6	785	1.4	4,160	6.0	9,720	10.6	16,530
-2.5	840	1.6	4,380	6.2	9,990	10.8	16,850
-2.4	895	1.8	4,600	6.4	10,260	11.0	17,170
-2.3	950	2.0	4,820	6.6	10,540	11.2	17,490
-2.2	1,010	2.2	5,040	6.8	10,820	11.4	17,810
-2.1	1,070	2.4	5,260	7.0	11,100	11.6	18,140
-2.0	1,135	2.6	5,480	7.2	11,380	11.8	18,470
-1.8	1,275	2.8	5,700	7.4	11,670	12.0	18,800
-1.6	1,420	3.0	5,920	7.6	11,960	12.1	18,970
-1.4	1,580	3.2	6,140	7.8	12,250		
-1.2	1,740	3.4	6,380	8.0	12,540		

Above 6 feet gage height 1902 and 1903 rating tables are the same. Above 12 feet gage height differences 170 per tenth.

*Estimated monthly discharge of Tombigbee River at Columbus, Miss., for 1903.*

[Drainage area, 4,440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	19,140	4,710	12,300	2.77	3.19
February .....	39,030	12,105	27,631	6.22	6.48
March .....	32,400	6,380	20,465	4.61	5.32
April .....	6,620	2,580	4,828	1.09	1.22
May .....	19,650	1,580	6,250	1.41	1.63
June .....	6,030	1,135	3,439	.77	.86
July .....	2,760	520	1,084	.24	.28
August .....	2,060	425	1,139	.26	.30
September .....	380	220	281	.06	.07
October .....	340	260	300	.07	.08
November .....	1,580	470	961	.22	.25
December .....	1,420	570	770	.17	.20
The year .....	39,030	220	6,621	1.49	19.88

#### MISCELLANEOUS MEASUREMENTS IN MOBILE RIVER DRAINAGE BASIN.

*Little River.*—At wagon bridge  $3\frac{1}{4}$  miles west of Cedar Bluff, Ala., this stream was discharging 123 second-feet on July 2, 1903. The bench mark is the third crossbeam from left-bank end of bridge. Elevation is 27 feet; gage height, 1.60 feet.

*Chattooga River.*—At wagon bridge at Gaylesville, Ala., this stream was discharging 325 second-feet on July 2, 1903. The bench mark is top of plate on bottom of first vertical strut from left bank. Elevation, 28 feet; gage height, 2.05 feet.

*Luxapelila Creek.*—At Columbus city waterworks, Columbus, Miss., this stream was discharging 272 second-feet on July 16, 1903. The bench mark is top of upstream end of crossbeam 90 feet from right-bank end of bridge. Elevation, 26.45 feet above datum; gage height, 3 feet.



*Discharge measurements of East Cahaba River in 1903.*

Date.	Locality.	Discharge.
		<i>Second-feet.</i>
September 30 .....	Deshazo's mill, near Bridgeton, Ala .....	30
Do .....	.....do .....	29
November 12 .....	.....do .....	28
Do .....	$\frac{1}{2}$ mile above Deshazo's mill .....	21
Do .....	Pledger's mill .....	13.3
Do .....	3 miles southwest of Leeds .....	6.8

**PEARL RIVER DRAINAGE BASIN.**

Pearl River rises in the eastern part of Mississippi. It flows south into Lake Borgne, an arm of the Gulf of Mexico, forming part of the boundary between Louisiana and Mississippi. The United States Geological Survey maintains one station on this river. It is located at Jackson, Miss.

**PEARL RIVER AT JACKSON, MISS.**

This station was established June 24, 1901, by K. T. Thomas. It is located 2 miles from the Union station at Jackson, Miss., one-eighth mile above the Alabama and Vicksburg Railroad, and two blocks east from the end of the South State street car line. The chain gage is fastened to the downstream side of the bridge at a point 130 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 41.91 feet. The gage is read once each day by James Hurst. Discharge measurements are made from the single-span highway bridge and from an approach of 680 feet of iron trestle on the left bank. The initial point for soundings is the end of the bridge on the right bank. The channel makes a 90° curve about 200 feet above the bridge. It is nearly straight for about one-fourth mile below the bridge. The right bank is high and rocky and does not overflow. The left bank is of cleared ground and overflows at about 20 feet gage height. The width of the stream at low stages is about 130 feet and at flood stages about 900 feet. The bed is of sand and gravel and is shifting. The current velocity is moderate, but is not well distributed, and is broken by an old pier and some short piles under the bridge. At low stages the discharge can be measured by wading about one-fourth mile above the bridge. The bench mark is the downstream end of the top of the iron crossbeam, 120 feet from the right-bank end of the bridge. Its elevation is 39 feet above gage datum. The elevation of the bridge floor at the same point is 40.15 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Pearl River at Jackson, Miss., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 10.....	J. M. Giles.....	24.00	16,050
July 13.....	do.....	4.15	1,348
July 14.....	do.....	5.37	1,988
September 24.....	do.....	.80	128
Do.....	do.....	.78	142

*Mean daily gage height, in feet, of Pearl River at Jackson, Miss., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	10.90	6.70	26.00	12.60	2.80	2.30	1.70	2.00	2.20	0.70	0.30	0.30
2.....	13.80	7.40	25.10	10.90	2.70	2.30	1.80	2.00	2.00	.70	.30	.30
3.....	14.90	12.20	24.20	9.80	2.60	2.20	1.80	1.80	1.90	.70	.30	.30
4.....	15.20	13.40	23.00	9.20	2.60	2.20	1.90	1.70	1.80	.70	.30	.30
5.....	15.80	14.60	22.40	8.50	2.50	2.10	2.00	1.50	1.60	.70	.30	.40
6.....	16.60	15.80	21.80	7.80	2.50	2.20	2.10	1.60	1.60	.70	.30	.50
7.....	16.00	19.00	21.60	7.10	2.40	2.20	2.20	2.50	1.50	.70	.30	.60
8.....	16.00	23.00	21.60	6.70	2.40	2.30	2.30	2.60	1.30	.60	.30	.80
9.....	15.90	23.40	23.50	6.10	2.50	3.50	2.40	2.80	1.20	.60	.30	.90
10.....	15.60	24.60	23.90	5.70	2.50	3.40	2.50	2.90	1.20	.60	.30	.90
11.....	15.60	27.50	24.70	5.20	2.40	2.50	2.70	3.50	1.10	.60	.30	1.00
12.....	15.40	30.40	24.90	5.00	2.40	2.40	2.80	4.40	1.10	.60	.30	1.00
13.....	14.00	32.50	25.20	5.80	2.50	2.30	2.70	4.50	1.00	.60	.30	1.00
14.....	14.60	33.70	25.40	4.60	2.60	2.30	5.30	4.60	1.00	.60	.30	1.00
15.....	13.80	33.50	25.70	4.40	2.80	2.40	4.60	4.60	1.00	.50	.30	1.20
16.....	13.40	33.20	25.90	4.30	3.00	2.50	4.30	4.50	1.00	.50	.30	1.20
17.....	13.10	33.10	25.90	4.50	3.10	2.30	3.80	4.60	.90	.50	.30	1.30
18.....	13.20	32.80	25.80	4.70	3.50	2.20	2.70	4.00	.90	.50	.30	1.30
19.....	13.10	32.30	25.30	4.60	4.00	2.10	2.50	4.60	.80	.50	.30	1.30
20.....	13.00	31.50	24.60	4.50	4.40	2.00	2.40	4.80	.80	.50	.30	1.30
21.....	12.50	30.90	23.70	4.30	4.50	1.90	2.20	5.10	.80	.60	.30	1.30
22.....	11.40	30.90	23.70	4.20	4.20	1.80	2.00	4.80	.80	.60	.30	1.30
23.....	10.40	30.10	23.40	4.00	3.90	1.70	1.90	4.60	.80	.60	.30	1.30
24.....	9.50	30.00	22.80	3.80	3.70	1.60	1.70	4.30	.80	.60	.30	1.40
25.....	8.40	29.80	21.90	3.60	3.50	1.70	1.60	4.10	.80	.50	.30	1.40
26.....	8.90	28.70	20.90	3.40	3.40	1.80	1.50	3.80	.80	.50	.30	1.40
27.....	7.80	27.60	19.60	3.20	3.30	1.80	1.50	3.40	.80	.50	.30	1.40
28.....	7.30	26.70	18.00	3.00	3.10	1.70	1.40	3.00	.80	.50	.30	1.40
29.....	6.80	-----	16.50	2.90	3.50	1.70	1.30	2.70	.80	.40	.30	1.40
30.....	6.50	-----	15.30	2.80	2.70	1.80	1.20	2.50	.80	.30	.30	1.30
31.....	6.60	-----	13.80	-----	2.50	-----	1.20	2.30	-----	.30	.30	1.30

*Rating table for Pearl River at Jackson, Miss., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.3	98	2.2	467	4.1	1,300	6.1	2,450
.4	103	2.3	503	4.2	1,350	6.2	2,510
.5	109	2.4	540	4.3	1,400	6.3	2,570
.6	117	2.5	580	4.4	1,455	6.4	2,630
.7	126	2.6	620	4.5	1,510	6.5	2,695
.8	136	2.7	660	4.6	1,565	6.6	2,760
.9	148	2.8	700	4.7	1,620	6.7	2,825
1.0	162	2.9	740	4.8	1,675	6.8	2,890
1.1	177	3.0	785	4.9	1,730	6.9	2,955
1.2	194	3.1	830	5.0	1,790	7.0	3,020
1.3	214	3.2	875	5.1	1,850	7.2	3,160
1.4	235	3.3	920	5.2	1,910	7.4	3,300
1.5	257	3.4	965	5.3	1,970	7.6	3,440
1.6	280	3.5	1,010	5.4	2,030	7.8	3,585
1.7	305	3.6	1,055	5.6	2,150	8.0	3,735
1.8	333	3.7	1,100	5.7	2,210	8.1	3,810
1.9	365	3.8	1,150	5.8	2,270	16.0	9,735
2.0	398	3.9	1,200	5.9	2,330	16.1	9,815
2.1	432	4.0	1,250	6.0	2,390		

From gage height 8 feet to gage height 16 feet, differences 75 per tenth; above gage height 16 feet, differences 80 per tenth. Table determined by one flood measurement above gage height 6 feet.

*Estimated monthly discharge of Pearl River at Jackson, Miss., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January	10,215	2,695	7,082
February	23,895	2,825	17,421
March	17,735	8,085	15,162
April	7,185	700	2,265
May	1,510	540	821
June	1,010	280	463
July	1,970	194	558
August	1,850	257	1,023
September	467	136	197
October	126	98	115
November	98	98	98
December	235	98	178
The year	23,835	98	3,782

## EASTERN MISSISSIPPI RIVER DRAINAGE.

For convenience of classification the drainage areas of the tributaries from the east that contribute to the Mississippi River drainage have been grouped together. These tributaries vary widely in character, as regards both the types of the rivers and the topography of the areas which they drain. Those draining the comparatively low rolling country adjacent to the Valley of the Mississippi are as a rule sluggish streams, with few falls of importance, while the upper Ohio River and its numerous tributaries drain a country of high elevations, their upper courses being through narrow V-shaped valleys, with frequent falls and with high rocky banks. Owing to the steep slopes the run-off is rapid, causing sudden fluctuations in the streams and giving rise to the high floods and extreme low waters for which the Ohio basin is noted, and the influence of which is felt to a marked degree even in the flow of the Mississippi below Cairo.

In this report these drainage areas have been arranged geographically from north to south, and the Ohio River drainage has been divided into its smaller systems. The following are the systems from which the United States Geological Survey has obtained data during 1903: Those which enter the Mississippi above the mouth of the Ohio are Rum and St. Croix rivers in Minnesota; Chippewa, Black, and Wisconsin rivers in Wisconsin, and Rock River and Illinois River. Those that enter the Ohio from the north are the Wabash, Miami, Muskingum, Little Miami, Scioto, and McMahon rivers, Cross Creek, Mahoning, and Allegheny rivers. Those entering the Ohio from the south are the Monongahela, the Kanawha, the Cumberland, and the Tennessee. Entering below the mouth of the Ohio is the Yazoo.

## MISSISSIPPI RIVER NEAR SAUK RAPIDS, MINN.

This station was established by W. R. Hoag April 23, 1903. It is located about  $1\frac{1}{2}$  miles south of Watab station on the Northern Pacific Railroad and about 5 miles north of Sauk Rapids, 7 miles north of St. Cloud. The gage is a vertical timber fastened to a post driven into the bed on the left side of the river. It is read daily by Frank McCrae. Discharge measurements are made from a boat running on a  $\frac{5}{16}$ -inch cable, which is securely fastened to trees on both sides of the river. The point to which the soundings are referred is a nail head in the root of a tree on the left bank, to which the cable is fastened. The channel is straight for 4,000 feet above the station and for 600 feet below. Both banks are high and not subject to overflow. The bed is regular, of sand and gravel, and is probably permanent. There is but one channel at all stages. The channel has a width of about 625 feet at low water and about 700 feet at high stages.

Bench mark No. 1 is the top of a large pointed rock 150 feet upstream from the gage and 10 feet from the water's edge. Its eleva-

tion above the zero of the gage is 18.58 feet. Bench mark No. 2 is a  $\frac{3}{4}$ -inch iron stake, driven on the left shore between the cable and bench mark No. 1. Its elevation is 14.22 feet above the zero of the gage. Bench mark No. 3 is on the root of a small tree on the left bank just below the cable. Its elevation is 18.29 feet above the zero of the gage. A short distance above the old gage is a large rock with a vertical face at an elevation of 14.45 feet above the zero of the gage. Observations of the river height can be made by determining distances from the top of this rock to the water surface.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Mississippi River near Sauk Rapids, Minn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 3 .....	W. R. Hoag .....	14.02	7,841
June 13 .....	do .....	12.02	6,471
August 4 .....	do .....	13.22	7,914
September 9 .....	E. C. Murphy .....	11.85	5,015
Do .....	Murphy and Stockman .....	11.85	5,043
October 17 .....	L. R. Stockman .....	15.60	17,448

*Mean daily gage height, in feet, of Mississippi River near Sauk Rapids, Minn., for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		13.85	12.05	12.80	11.80	13.30	12.85	12.70
2.....		13.70	12.15		11.70	13.25	12.70	12.45
3.....	14.00	13.60	12.40		11.90	13.45	12.70	12.45
4.....	14.05	13.30	13.15		11.85	14.80	12.70	12.45
5.....	14.15	12.95	12.80		11.85	15.35	12.70	12.28
6.....	14.25	12.65	12.50		11.75	16.10	12.60	11.99
7.....	14.35	12.60	12.65		11.55	17.10	12.50	11.95
8.....	14.25	12.15	12.75		12.00	17.05	12.40	11.95
9.....	14.20	12.25	13.20	12.80	11.85	17.15	12.40	11.95
10.....	14.30	12.20	13.40	12.70	12.10	17.10	12.35	12.13
11.....	14.80	12.15	13.20	12.50	12.55	16.80	12.30	12.45
12.....	15.30	12.10	13.10	12.90	13.00	16.60	12.20	12.28
13.....	15.75	12.05	13.00	12.80	13.80	16.45	12.20	12.28
14.....	16.10	11.95	13.20	12.50	14.25	16.15	12.05	12.28
15.....	16.25	11.80	13.45	12.40	15.25	16.00		12.45
16.....	15.60	11.90	13.10	12.05	15.55	15.85		12.66
17.....	15.50	12.00	11.90	12.10	15.65	15.65		12.66
18.....	15.25	11.80	11.90	11.75	15.75	15.55		12.45
19.....	15.10	11.85	11.80	11.85	15.70	15.45		12.37
20.....	14.95	12.05	11.65	11.70	15.60	15.20		11.40
21.....	14.90	12.00	11.35	11.75	15.45	15.05		11.40
22.....	14.85	12.10	11.55	11.75	15.30	14.85		11.20
23.....	14.85	11.65	11.50	11.75	15.00	14.70		11.10
24.....	14.90	12.00	11.55	11.70	14.70	14.50		11.00
25.....	14.90	11.60	11.70	11.50	14.60	14.30		11.00

*Mean daily gage height, in feet of Mississippi River, etc.—Continued.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26.....	14.75	11.75	11.60	12.00	14.50	14.10	-----	10.90
27.....	14.65	11.50	11.90	11.90	14.15	13.85	13.87	11.80
28.....	14.55	11.45	12.15	11.90	13.80	13.65	13.91	11.80
29.....	14.50	11.45	12.30	12.00	13.70	13.50	13.32	11.80
30.....	14.25	11.40	12.40	12.20	13.45	13.25	12.78	11.70
31.....	14.05	-----	12.45	12.20	-----	13.00	-----	11.70

### RUM RIVER DRAINAGE BASIN.

Rum River rises in Lake Onamio in eastern Minnesota, flows south and enters the Mississippi near Anoka. In its course of about 100 miles it has a total fall of about 225 feet or an average fall of 2.25 feet per mile. This stream, though not very large, is fairly constant in its flow, due to its rising in the Mille Lacs region, and there are several points on it at which there are sudden falls of from 10 to 20 feet, consequently this is a fairly good stream for water-power purposes. The United States Geological Survey maintained a station on this river during the early part of 1903 at a point near St. Francis, Minn., where its drainage area is 1,330 square miles.

#### RUM RIVER AT ST. FRANCIS, MINN.

This station was established April 23, 1903, by W. R. Hoag, and is located one-half mile from St. Francis, Minn., and one-half mile below a dam and flour mill. The gage is a vertical  $1\frac{1}{2}$  by 6 inch board, 7 feet long, and is read once each day by R. G. Streetly. Discharge measurements are made from a boat running on a cable. The initial point for soundings is 20 feet from the center of the tree to which the cable is attached on the right bank. The channel is straight for 1,000 feet above and 400 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is of rock and gravel, and there is but one channel. The bench mark is on a 24-inch tree, 140 feet upstream on the north bank of the river, and is at an elevation of 6.46 feet above the zero of the gage. The station was discontinued in August, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Rum River at St. Francis, Minn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 23.....	W. R. Hoag.....	3.27	2,492
May 23.....	do.....	2.90	2,605
July 31.....	do.....	3.42	2,196
September 5.....	do.....	1.15	703

*Mean daily gage height, in feet, of Rum River at St. Francis, Minn., for 1903.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1.....		2.70	2.30	1.30		1.45	17.....		5.15	1.60	3.80		
2.....		2.70	2.35	1.40		1.50	18.....		5.30	1.60	3.60		
3.....		2.75	2.30	1.50		1.50	19.....		4.80	1.55	3.70		
4.....		2.90	1.80	1.60		1.45	20.....		4.50	1.60	3.85		
5.....		2.95	1.60	1.60		1.15	21.....		4.10	1.40	3.70		
6.....		3.20	1.50	1.60			22.....		3.20	1.30	3.50		
7.....		3.20	1.50	1.90			23.....		2.90	1.20	3.40		
8.....		3.20	1.50	2.60			24.....		2.50	1.00	3.40	1.35	
9.....		3.15	1.60	2.95			25.....		2.40	.90	3.35	.95	
10.....		2.90	1.60	3.40	3.05		26.....	3.00	2.50	.90		1.25	
11.....		2.80	1.50	3.90	2.70		27.....	2.95	2.60	.90		1.25	
12.....		2.80	1.50	4.45	2.35		28.....	3.00	2.40	.90		1.30	
13.....		3.00	1.45	4.40	2.15		29.....	2.95	2.40	1.10		1.35	
14.....		3.20	1.45	4.35	2.00		30.....	2.80	2.35	1.25			
15.....		3.60	1.50	4.20	1.80		31.....		2.25			1.45	
16.....		4.60	1.50	4.20									

### ST. CROIX RIVER DRAINAGE BASIN.

St. Croix River is formed by the junction of Moose and Eau Claire rivers, both of which rise in Douglas County, Wis., flows south, forming for most of its course part of the boundary between Wisconsin and Minnesota, and enters the Mississippi near Prescott, Wis. This river has a rapid fall and in several places there are unusual opportunities for the development of water power. Prominent among these are Taylors Falls, Minn., and St. Croix, Wis. The United States Geological Survey has carried on during 1903 measurements of the flow at Taylors Falls, where the drainage area is 6,370 square miles.

### ST. CROIX RIVER NEAR TAYLORS FALLS, MINN.

This station is located 4 miles upstream from Taylors Falls and about  $3\frac{1}{2}$  miles above the Falls of St. Croix, Wis. The gage heights are referred to four iron pins on the right bank just below the gaging station, the elevations of which are referred to the datum of the bench marks of the St. Croix River survey. Their elevations are as follows:

	Feet.
Pin No. 1.....	732.08
Pin No. 2.....	734.54
Pin No. 3.....	736.10
Pin No. 4.....	737.57

A large number of measurements were obtained during 1903, and the gage was read daily by V. H. Caneday. Discharge measurements were made from a boat held in place by a wire cable stretched across the river between two trees. The initial point for soundings is a vertical rod on the left bank. The channel is straight for about 800 feet above and 1,000 feet below the station, while the banks are high and can not overflow. The section is regular, smooth, and permanent,

and the velocity is never sluggish, making this on the whole a station at which good results are obtainable. Its drainage area at this point is 6,370 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of St. Croix River near Taylors Falls, Minn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 22 .....	E. Johnson, jr .....	4.00	10,747
August 11 .....	W. R. Hoag .....	2.70	7,470
October 9 .....	L. R. Stockman .....	3.84	10,244

### CHIPPEWA RIVER DRAINAGE BASIN.

Chippewa River rises in the southeastern part of Ashland County, Wis. It flows southwest, emptying into the Mississippi near Wabasha, Minn. Its principal tributary is the Flambeau, which enters from the east in Gates County. During the latter part of 1902 the United States Geological Survey began systematic measurements in this and other drainage basins of Wisconsin.

Gaging stations have been maintained in this basin on the Chippewa at Eau Claire, and on the Flambeau at Ladysmith, Wis.

#### CHIPPEWA RIVER NEAR EAU CLAIRE, WIS.

This station was established November 13, 1902, by L. R. Stockman. It is located 2 miles below Eau Clair, at a suburb known as Shawtown. The gage is a vertical board fastened to the downstream side of the center pier of the highway bridge. The gage is read twice each day by R. F. Duncan. Discharge measurements are made from the two-span highway bridge, at which a cable has been installed to be used as a stay wire for flood measurements. The channel is straight above and below the station, and the current is swift. The right bank is protected by a high masonry wall. The left bank is low, but the water is confined by an earthen embankment. The bed is composed of gravel, with a few rocks, and is permanent. There are two channels at all stages. The width is 450 feet at low water and 500 feet at flood stages.

Bench mark No. 1 is a nail in the top of a 6-inch white-oak stump which is attached to a tree still standing. It is located about 200 feet east of the road and 200 feet south of the river. Its elevation is 20.09 feet above the zero of the gage. The initial point for soundings is a point marked by two nails in the footway at the right end of the bridge, also marked 0 in white paint.



The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Chippewa River near Eau Claire, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 17 .....	L. R. Stockman .....	4.15	<i>a</i> 1,979
February 10 .....	do .....	3.80	<i>a</i> 1,778
March 9 .....	do .....	4.85	<i>b</i> 3,818
April 6 .....	do .....	7.40	10,688
May 5 .....	do .....	11.85	26,458
June 15 .....	do .....	4.70	4,107
July 10 .....	do .....	9.25	17,167
August 20 .....	do .....	5.13	4,336
September 5 .....	do .....	6.20	8,032
October 13 .....	do .....	8.77	15,087
November 24 .....	do .....	4.90	3,511

*a* Frozen.

*b* Partly frozen.

*Mean daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1902.*

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
5 .....		4.50	12 .....		4.20	19 .....	11.35	4.30	26 .....	6.45	4.90
6 .....		4.45	13 .....		4.45	20 .....	9.60	4.25	27 .....	6.20	5.10
7 .....		4.00	14 .....	13.70	4.25	21 .....	8.50	4.30	28 .....	6.00	4.60
8 .....		4.05	15 .....	10.20	4.55	22 .....	7.55	4.25	29 .....	5.75	4.50
9 .....		4.05	16 .....	12.40	4.25	23 .....	7.40	4.50	30 .....	5.55	4.85
10 .....		4.10	17 .....	13.05	4.30	24 .....	7.15	4.70	31 .....		4.50
11 .....		4.25	18 .....	12.60	4.10	25 .....	7.00	4.30			

*Mean daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	4.30	3.70	3.20	6.85	12.80	( <i>a</i> )	7.65	5.05	5.90	6.90	5.55	( <i>a</i> )
2 .....	4.35	4.25	3.75	7.15	13.10	( <i>a</i> )	8.05	5.20	6.45	7.00	5.55	( <i>a</i> )
3 .....	4.15	4.10	3.85	7.45	12.15	( <i>a</i> )	10.60	5.85	5.65	7.35	5.45	( <i>a</i> )
4 .....	4.20	4.05	3.90	7.95	11.85	( <i>a</i> )	13.50	6.85	5.85	9.90	5.50	( <i>a</i> )
5 .....	4.40	4.10	3.75	7.85	11.55	( <i>a</i> )	15.30	7.50	5.75	11.25	5.25	( <i>a</i> )
6 .....	3.90	4.05	3.75	7.40	10.90	( <i>a</i> )	15.20	9.10	6.45	11.65	5.20	4.30
7 .....	4.15	4.15	3.85	7.50	10.30	6.85	13.75	9.00	5.85	11.60	5.15	4.65
8 .....	4.40	4.15	4.10	7.90	9.20	5.45	11.30	11.05	6.30	11.15	5.10	4.50
9 .....	4.20	4.00	4.60	8.55	9.15	6.45	10.30	6.70	8.00	11.35	5.05	4.60
10 .....	4.40	3.85	5.05	8.00	7.65	5.95	9.40	7.55	8.05	10.95	5.00	4.70
11 .....	4.80	3.80	5.80	7.60	8.95	6.50	10.10	7.25	9.15	9.95	5.00	4.55

*a* Observer absent.

*Mean daily gage height, in feet, of Chippewa River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12.....	4.65	3.85	6.00	8.15	12.00	5.90	9.95	6.75	12.85	9.45	5.00	4.50
13.....	4.75	3.90	7.05	7.70	13.25	9.25	8.90	6.85	14.00	9.00	5.05	4.70
14.....	4.60	3.90	8.20	7.65	13.40	3.75	8.10	6.90	16.75	8.80	5.30	4.85
15.....	4.85	3.90	8.05	7.80	13.25	4.65	7.80	9.65	17.85	8.45	5.40	4.75
16.....	4.30	4.50	7.00	7.80	11.85	4.95	7.20	5.10	18.50	7.75	4.95	4.70
17.....	4.20	4.10	7.00	7.50	10.45	4.95	6.50	6.80	17.45	7.70	4.95	4.60
18.....	4.30	4.15	7.55	6.75	9.90	4.90	8.80	6.65	15.50	7.40	4.25	4.65
19.....	4.65	4.30	11.80	6.65	9.15	4.30	5.95	6.00	13.45	7.55	4.40	4.65
20.....	4.40	4.25	13.95	6.85	9.15	5.15	6.70	5.10	11.80	7.05	4.15	4.60
21.....	4.50	4.20	13.65	6.80	9.30	4.70	6.15	5.15	10.50	7.05	4.20	4.60
22.....	4.35	3.35	12.65	6.65	9.50	4.20	5.70	7.50	9.95	6.75	4.35	4.80
23.....	4.35	3.80	11.70	6.40	9.05	4.20	5.60	5.60	9.15	6.70	4.85	4.70
24.....	4.45	4.15	10.45	6.40	9.10	4.15	6.00	5.10	7.80	6.55	4.95	4.80
25.....	3.50	4.05	9.40	8.60	9.85	4.25	9.20	5.15	7.60	6.30	4.95	4.00
26.....	4.20	3.90	8.75	6.55	10.20	4.15	5.25	5.25	7.00	6.15	4.90	4.40
27.....	4.10	3.95	8.40	7.15	12.50	6.75	5.05	4.70	7.65	5.95	4.85	3.40
28.....	4.10	3.85	7.75	7.00	15.15	4.20	5.20	5.45	7.05	6.10	4.60	3.70
29.....	3.85	-----	7.60	7.30	16.70	4.60	5.15	5.60	7.05	6.10	-----	3.60
30.....	4.15	-----	7.15	11.70	16.10	4.95	5.15	5.20	7.05	6.10	-----	3.60
31.....	4.25	-----	6.80	-----	-----	-----	5.10	5.60	-----	5.90	-----	3.40

*Rating table for Chippewa River near Eau Claire, Wis., from March 12 to December 1, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.8	2,160	5.7	6,290	7.6	11,310	11.0	23,310
3.9	2,340	5.8	6,530	7.7	11,610	11.2	24,070
4.0	2,530	5.9	6,770	7.8	11,910	11.4	24,830
4.1	2,730	6.0	7,010	7.9	12,210	11.6	25,590
4.2	2,930	6.1	7,270	8.0	12,510	11.8	26,350
4.3	3,130	6.2	7,530	8.2	13,150	12.0	27,110
4.4	3,330	6.3	7,790	8.4	13,790	12.5	29,010
4.5	3,540	6.4	8,050	8.6	14,450	13.0	30,910
4.6	3,760	6.5	8,310	8.8	15,130	13.5	32,810
4.7	3,980	6.6	8,570	9.0	15,810	14.0	34,710
4.8	4,200	6.7	8,830	9.2	16,530	14.5	36,610
4.9	4,420	6.8	9,090	9.4	17,250	15.0	38,510
5.0	4,640	6.9	9,350	9.6	17,990	15.5	40,410
5.1	4,860	7.0	9,610	9.8	18,750	16.0	42,310
5.2	5,090	7.1	9,890	10.0	19,510	16.5	44,210
5.3	5,330	7.2	10,170	10.2	20,270	17.0	46,110
5.4	5,570	7.3	10,450	10.4	21,030	17.5	48,010
5.5	5,810	7.4	10,730	10.6	21,790	18.0	49,910
5.6	6,050	7.5	11,010	10.8	22,550		

*Rating table for Chippewa River near Eau Claire, Wis., from November 30, 1902, to March 12, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.2	840	4.0	1,985	4.8	3,610	5.6	5,670
3.3	940	4.1	2,165	4.9	3,850	5.7	5,930
3.4	1,055	4.2	2,345	5.0	4,110	5.8	6,190
3.5	1,190	4.3	2,535	5.1	4,370	5.9	6,450
3.6	1,335	4.4	2,735	5.2	4,630	6.0	6,710
3.7	1,490	4.5	2,940	5.3	4,890		
3.8	1,655	4.6	3,150	5.4	5,150		
3.9	1,825	4.7	3,370	5.5	5,410		

To be used only when river is frozen.

*Estimated monthly discharge of Chippewa River near Eau Claire, Wis.*

[Drainage area, 6,740 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
November <sup>a</sup> .....			14,835	2.20	1.39
December <sup>b</sup> .....			2,789	.41	.41
1903.					
January .....	3,730	1,190	2,593	.38	.44
February .....	2,940	995	2,023	.30	.31
March .....	34,520	840	11,573	1.72	1.98
April .....	25,970	8,050	11,240	1.67	1.86
May <sup>c</sup> .....	44,970	11,460	24,761	3.67	4.23
June <sup>d</sup> .....	36,990	2,070	8,720	1.29	1.44
July .....	39,650	4,750	14,698	2.18	2.51
August .....	23,500	3,980	8,602	1.28	1.48
September .....	51,810	6,170	19,584	2.90	3.24
October .....	25,780	6,770	13,524	2.01	2.32
November .....	5,930	2,830	4,562	.68	.76
December .....	3,980	1,055	2,855	.42	.48
The year .....	51,810	840	10,395	1.54	21.05

<sup>a</sup> 13 to 29, inclusive.    <sup>b</sup> 5 to 31, inclusive.    <sup>c</sup> May 31, estimated.    <sup>d</sup> 1 to 4, inclusive, estimated.

#### FLAMBEAU RIVER NEAR LADYSMITH, WIS.

This station was established February 13, 1903, by L. R. Stockman. It is located three-fourths mile south of the Minneapolis, St. Paul

and Sault Ste. Marie Railroad station, three-fourths mile south of Ladysmith, and one-half mile below the dam of the Menasha Pulp Company. The standard chain gage is fastened to the upstream side of the right span. The length of the chain from the end of the weight to the marker is 25.40 feet. The gage is read twice each day by J. A. Newlun. Discharge measurements are made from the three-span highway bridge, to which the gage is attached. The initial point for soundings is a point marked by two nails and a straight white line at the right end of the bridge. The channel is straight for about 500 feet above and below the station. The right bank is low, but the overflow passes beneath the bridge. The left bank is high and covered with trees. The gaging section is broad and shallow, with a bed of small boulders, gravel, and sand, and is not liable to shift. The stream is divided into three channels by the bridge piers. The channels are somewhat obstructed by log jams during the rafting season. The bench mark is a cut on a rivet head on the post to which the pulley of the chain gage is attached. When the gage reads zero this mark is 36.28 feet above the water surface. An arrow cut on the iron guard rail is exactly opposite the 10-foot mark of the scale of the chain gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Flambeau River near Ladysmith, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 13.....	L. R. Stockman.....	16.20	<i>a</i> 773
March 19.....	do.....	18.95	<i>b</i> 3,312
April 8.....	do.....	17.40	3,727
May 6.....	do.....	18.97	7,113
June 16.....	do.....	16.00	1,345
July 11.....	do.....	18.10	4,222
August 21.....	do.....	16.85	2,681
September 10.....	E. C. Murphy.....	18.05	5,303
October 23.....	L. R. Stockman.....	17.21	3,899

*a* River frozen.

*b* Log jam below.

*Mean daily gage height, in feet, of Flambeau River near Ladysmith, Wis., for 1903.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		16.15	17.00	18.30	19.80	15.65		17.00	17.20	16.00	15.90
2.....		16.60	16.80	18.40	19.65	16.15		16.70	17.30	16.25	15.75
3.....		16.50	16.90	18.60	18.95	17.25		16.80	17.60	15.85	15.95
4.....		16.10	16.90	19.05	18.60	18.10		16.30	19.65	15.85	15.60
5.....		16.30	17.05	19.10	18.10	18.90		16.80	19.70	15.85	15.80
6.....		16.50	16.40	19.10	17.55	19.05		16.90	19.35	15.85	15.80

*Mean daily gage height, in feet, of Flambeau River, etc.—Continued.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7.....		16.60	16.90	19.10	17.55	19.20		16.90	19.25	15.90	16.95
8.....		16.10	17.45	18.80	17.30	18.85		17.30	19.25	15.65	15.80
9.....		16.50	17.35	18.70	16.95	18.70		18.20	19.30	15.70	14.70
10.....		16.50	17.25	17.95	16.60	18.60	18.20	18.20	19.35	15.85	16.50
11.....		16.05	17.25	18.25	16.75	18.75	18.00	18.00	18.95	16.00	16.35
12.....		16.45	17.30	18.80	16.80	18.55	17.90	18.40	18.65	15.85	16.30
13.....		16.35	17.25	19.55	16.30	18.30	17.80	19.00	18.45	15.85	16.50
14.....		16.35	17.50	19.80	16.15	17.85	17.70	19.80	18.25	15.80	16.45
15.....	16.00	16.60	17.40	19.65	16.35	17.70	17.50	20.40	17.90	15.80	16.55
16.....	16.10	16.15	17.20	19.55	16.50	17.65	17.30	20.50	17.85	15.75	16.35
17.....	16.05	16.20	16.95	19.40	16.05	17.60	17.30	20.50	17.80	15.80	16.40
18.....	16.00	16.30	17.00	19.45	16.05	17.35	17.20	20.30	17.50	15.00	16.70
19.....	15.90	18.25	16.90	19.05	15.85	17.35	17.00	20.00	17.35	15.50	16.60
20.....	16.00	20.35	16.85	19.20	15.80	17.20	17.00	19.70	17.25	15.50	16.67
21.....	15.90	19.30	16.90	19.25	15.85	17.15	17.10	19.30	17.25	15.45	16.67
22.....	16.05	18.50	16.65	18.85	15.95	16.70	16.90	18.90	17.15	15.25	16.67
23.....	16.00	18.45	16.65	19.15	15.65	16.70	16.70	18.50	17.05	15.40	16.66
24.....	16.25	17.30	17.30	18.90	15.90	16.70	16.80	18.20	17.00	15.65	17.00
25.....	16.00	17.60	17.30	19.00	15.60	16.80	17.10	18.00	16.80	15.45	16.69
26.....	15.95	17.25	17.25	19.55	15.85	(a)	16.80	17.70	17.00	15.55	16.66
27.....	16.40	17.00	17.15	20.60	15.60	(a)	17.00	17.85	16.80	15.85	16.50
28.....	16.25	17.10	17.20	21.45	15.70	(a)	16.90	17.50	16.55	15.80	16.10
29.....		17.00	17.40	21.45	15.95	(a)	16.80	17.30	16.65	15.80	16.80
30.....		16.75	18.45	21.20	15.80	(a)	16.70	17.20	16.05	15.85	16.80
31.....		16.60		21.45		(a)	16.80		16.20		16.70

*a* Chain gage stolen.

*Rating table for Flambeau River near Ladysmith, Wis., from March 19 to December 1, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
15.0	530	16.3	1,765	17.6	4,280	18.9	7,140
15.1	555	16.4	1,925	17.7	4,500	19.0	7,360
15.2	600	16.5	2,085	17.8	4,720	19.2	7,800
15.3	665	16.6	2,245	17.9	4,940	19.4	8,240
15.4	745	16.7	2,405	18.0	5,160	19.6	8,680
15.5	825	16.8	2,575	18.1	5,380	19.8	9,120
15.6	915	16.9	2,755	18.2	5,600	20.0	9,560
15.7	1,010	17.0	2,960	18.3	5,820	20.2	10,000
15.8	1,110	17.1	3,180	18.4	6,040	20.4	10,440
15.9	1,220	17.2	3,400	18.5	6,260	20.6	10,880
16.0	1,340	17.3	3,620	18.6	6,480	21.0	11,760
16.1	1,465	17.4	3,840	18.7	6,700		
16.2	1,610	17.5	4,060	18.8	6,920		

Made from measurements between gage heights 16 and 18.95 feet. Curve above and below these points is approximate. To be used only for open river.

*Estimated monthly discharge of Flambeau River near Ladysmith, Wis., for 1903.*

[Drainage area, 2,120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....					
February <sup>a</sup> .....			860	0.41	0.21
March .....	10,330	833	2,736	1.29	1.49
April .....	6,150	1,925	3,266	1.54	1.72
May .....	12,750	5,050	8,187	3.86	4.45
June .....	9,120	915	2,749	1.30	1.45
July <sup>b</sup> .....			4,598	2.17	2.02
August <sup>c</sup> .....			3,431	1.62	1.33
September .....	10,660	1,765	5,777	2.72	3.03
October .....	8,900	1,400	4,807	2.27	2.62
November .....	1,685	530	1,054	.50	.56
December .....					

<sup>a</sup>February 15 to 28, inclusive.

<sup>b</sup>July 1 to 25, inclusive.

<sup>c</sup>August 10 to 31, inclusive.

### BLACK RIVER DRAINAGE BASIN.

Black River rises in Taylor County, Wis., and flows southwest, emptying into the Mississippi about 20 miles above La Crosse. The United States Geological Survey maintained a station on this river at Melrose during part of the year 1903.

#### BLACK RIVER NEAR MELROSE, WIS.

This station was established November 12, 1902, by L. R. Stockman. It is located 1 mile south of Melrose, Wis., on the highway bridge. The river at this point flows in two channels, which at present have practically the same elevation. The gage is a plain staff, graduated to feet and tenths, nailed to the piling of the bridge. It is read daily by William H. Westfall. The channel is straight both above and below the station for about 500 feet. Both banks are high. The bed of the stream is sandy and shifting. The initial point for soundings is a nail in the footboard on the right bank. Bench mark No. 1 consists of a nail driven into the root of a 16-inch black oak 50 feet west of the north end of the bridge; elevation, 15.23 feet above zero of the gage. Bench mark No. 2 is a nail in the root of a white-oak tree 35 feet west of the north end of the bridge. Its elevation is 14.72 feet above the zero of the gage. This station was discontinued August 1, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Black River near Melrose, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 15 .....	L. R. Stockman .....	4.30	<sup>a</sup> 598
February 7 .....	do .....	4.30	<sup>a</sup> 508
April 4 .....	do .....	5.90	2,982
May 1 .....	do .....	11.00	10,931
June 13 .....	do .....	3.90	842

<sup>a</sup> Frozen.

*Mean daily gage height, in feet, of Black River near Melrose, Wis.*

Day.	1902.	1903.							
	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1.....		5.05	4.10	4.30	5.10	11.00	7.60	3.60	3.75
2.....		5.00	4.10	4.35	4.85	10.00		6.70	
3.....		4.90	4.10	4.40	5.30	10.25		11.20	
4.....	3.75	4.75	4.10	4.45	5.65	10.50		10.90	
5.....	3.95	4.60	4.10	4.60	5.90	9.65	6.00	13.00	
6.....	4.00	4.60	4.20	4.75	6.50	9.05	4.70	12.30	
7.....	3.80	4.50	4.20	( <sup>a</sup> )	6.65	8.15	4.40	10.20	
8.....	4.35	4.50	4.20	6.25	6.50	7.00	4.30	7.90	
9.....	4.35	( <sup>a</sup> )	4.20	8.20	6.20	6.95	4.25	6.90	
10.....	4.30	4.40	4.20	9.30	5.50	6.55	4.00	7.40	
11.....	4.35	4.40	4.30	9.70	5.60	6.10	4.00	8.70	
12.....	4.20	4.40	4.25	10.75		6.65	3.95	7.20	
13.....	4.20	4.40	4.20	12.05	5.45	10.60	3.95	6.70	
14.....	4.10	4.40	4.20	12.55	5.60	12.00	3.80	6.20	
15.....	4.15	( <sup>a</sup> )	4.20	11.55	5.95	10.90	3.80	5.80	
16.....	4.10	4.30	4.10	9.85	5.85	9.15	3.80	5.30	
17.....	4.00	4.30	4.15	9.40	6.05	7.80	3.70	4.50	
18.....	4.00	4.30	4.00	10.25	5.60	6.55	3.70	4.20	
19.....	4.05	4.30	3.95	11.95	5.00	6.50	3.70	4.10	
20.....	4.25	4.20	3.90	13.40	5.15	6.40	3.70	4.00	
21.....	4.60	4.20	3.90	12.90	4.50	6.30	3.70	4.00	
22.....	4.85	4.20	4.00	11.40	4.65	5.90	3.70	4.00	
23.....	5.80	4.20	4.00	9.65	4.30	6.50	3.70	3.90	
24.....	6.05	4.20	4.00	8.05	4.30	5.70	3.60	3.80	
25.....	5.85	4.20	4.05	7.65	4.35	5.80	3.60	3.80	
26.....	5.80	4.20	4.10	6.65	4.65	5.95	3.50	3.75	
27.....	5.65	4.20	4.20	6.02	4.85	8.40	3.50	3.90	
28.....	5.50	4.20	4.35	6.55	5.00	11.85	3.50	4.20	
29.....	5.35	4.20		5.70	5.65	12.60	3.50	4.00	
30.....	5.20	4.20		6.55	6.80	10.95	3.50	3.80	
31.....		4.10		5.30		9.50		3.75	

<sup>a</sup> Observer absent.

## WISCONSIN RIVER DRAINAGE BASIN.

Wisconsin River is the largest river in the State of Wisconsin. It rises in the northern part and flows south through the central portion of the State to Portage, where it turns at nearly a right angle and flows west, emptying into the Mississippi about 60 miles above Dubuque.

Gaging stations have been established in this basin at Necedah, Muscodah, and Merrill. These stations divide the river into three nearly equal reaches of about 90 miles each, so furnishing ample opportunity for a systematic study.

## WISCONSIN RIVER AT MUSCODA, WIS.

This station was established December 20, 1902, by L. R. Stockman. It is situated three-fourths of a mile north of Muscodah on the toll highway bridge. The gage is a horizontal wire with a scale board graduated to feet and tenths and fastened to the top of the bridge. The initial point for soundings is on the left bank, at the end of the drawbridge. The channel is straight for 1,500 feet above and 1,000 feet below the station, and has a width of about 800 feet, broken by 13 piers. The right bank is low and liable to overflow. The water is confined to the bridge opening. The left bank is high and rocky. The bed of the stream is rocky, with spots of gravel, and is liable to shift. The flow is moderately rapid. The gage is read twice a day by Charles H. Lovell, the bridge tender.

Bench mark No. 1, elevation 684 feet above sea level, bolt in south end of east guard rail at south end of bridge. Its elevation has been determined by United States Geological Survey levels. Bench mark No. 2, elevation 681.17 feet, nail in root on north side of 20-inch black oak tree standing about 40 paces south by east from the south end of the drawbridge. Bench mark No. 3, elevation 680.95 feet, a projecting point on a sandstone rock on the east end of south abutment, near the supporting wheel at end of drawbridge. On the vertical face of the stone is an arrow pointing upward to this point. The stone is also marked B. M. Bench mark No. 4, elevation 684.25 feet, a point marked X on foundation stone at the southeast corner of Lampi's brewery. The 15-foot mark has an elevation of 668.62 feet. There is a line cut on the girder opposite the 10-foot mark. This station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.



*Discharge measurements of Wisconsin River at Muscoda, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 10 .....	L. R. Stockman .....	14.85	<i>a</i> 4,812
January 28 .....	do .....	14.65	<i>a</i> 4,649
March 26 .....	do .....	19.70	38,182
April 21 .....	do .....	16.25	14,163
July 2 .....	A. C. Lootz .....	15.20	5,870
October 9 .....	L. R. Stockman .....	18.33	18,954

*a* Partly frozen.*Mean daily gage height, in feet, of Wisconsin River at Muscoda, Wis., for 1902.*

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
20 .....	15.00	23 .....	15.05	26 .....	14.80	29 .....	14.55
21 .....	15.05	24 .....	15.05	27 .....	14.70	30 .....	14.75
22 .....	15.00	25 .....	14.85	28 .....	14.55	31 .....	14.75

*Mean daily gage height, in feet, of Wisconsin River at Muscoda, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	14.75	14.90	15.85	18.05	15.97	18.68	15.23	15.40	16.78	18.05	16.52	16.33
2 .....	14.85	14.90	15.80	17.50	16.07	18.95	15.18	15.43	16.68	17.85	16.42	16.25
3 .....	14.90	14.95	15.70	17.25	15.98	19.28	15.25	15.30	16.65	17.75	16.40	16.25
4 .....	14.90	15.00	15.60	17.02	16.35	19.55	15.18	15.38	16.83	17.32	16.32	16.22
5 .....	14.90	14.90	15.50	16.75	17.15	19.78	15.20	15.53	16.85	17.30	16.32	16.22
6 .....	14.90	14.90	15.40	16.70	17.70	19.52	17.00	15.68	16.73	17.32	16.30	16.20
7 .....	14.80	14.85	15.55	16.60	17.95	18.50	17.90	15.55	16.53	17.47	16.25	16.35
8 .....	14.70	14.85	15.90	16.50	18.07	17.75	18.40	15.58	16.50	17.87	16.17	16.35
9 .....	14.65	15.00	15.70	16.32	18.22	17.42	18.60	16.05	16.63	18.40	16.10	16.40
10 .....	14.75	15.00	15.40	16.22	18.40	17.07	18.90	16.75	16.85	18.60	16.10	16.38
11 .....	14.65	15.05	15.20	16.20	18.40	16.85	19.10	17.33	16.98	18.60	16.20	16.30
12 .....	14.60	15.15	15.00	16.22	18.20	16.65	19.08	17.43	17.12	18.65	16.20	16.32
13 .....	14.65	15.20	15.05	16.30	17.80	16.47	18.35	17.28	17.48	18.85	16.12	16.32
14 .....	14.70	15.15	15.55	16.22	17.50	16.22	17.63	17.15	17.83	18.90	16.10	-----
15 .....	14.65	15.05	15.75	16.12	17.45	16.15	17.30	17.23	17.75	19.00	16.10	16.15
16 .....	14.75	15.00	16.30	16.00	17.50	16.05	16.95	17.47	17.83	18.72	16.05	16.15
17 .....	14.75	14.85	16.50	16.00	17.90	15.87	16.87	17.47	18.38	18.35	16.10	16.25
18 .....	14.70	14.70	16.65	16.10	18.15	15.82	17.45	17.37	18.90	18.05	16.15	16.28
19 .....	14.75	14.70	16.95	16.20	18.25	15.65	16.92	17.13	19.30	17.90	16.10	16.42
20 .....	14.80	14.65	17.45	16.30	18.40	15.65	16.65	17.05	19.80	17.75	16.32	15.62
21 .....	14.70	14.70	17.85	16.35	18.20	15.73	16.45	16.95	20.80	17.47	17.00	15.62
22 .....	14.75	14.65	17.93	16.30	18.00	15.63	16.25	16.70	22.23	17.37	17.05	15.72
23 .....	14.70	14.70	18.05	16.12	17.45	15.53	16.17	16.53	22.70	17.27	17.25	15.75
24 .....	14.80	14.75	18.35	16.00	17.30	15.45	16.05	16.30	22.43	17.17	17.30	15.78
25 .....	14.70	14.75	18.90	15.90	17.45	15.40	15.85	16.23	22.50	17.00	17.27	15.72
26 .....	14.75	14.75	19.72	15.78	17.60	15.43	15.65	16.23	21.38	16.87	17.12	15.65
27 .....	14.85	14.95	20.50	15.70	17.75	15.30	15.58	16.43	20.70	16.72	16.47	16.40
28 .....	14.85	15.90	20.37	15.62	17.95	15.13	15.60	16.65	19.95	16.67	16.40	16.40
29 .....	14.95	-----	19.80	15.67	18.20	15.10	15.58	17.08	19.10	16.60	16.33	16.40
30 .....	14.80	-----	19.27	15.87	18.25	15.23	15.48	17.08	18.35	16.55	16.30	16.40
31 .....	14.90	-----	18.65	-----	18.40	-----	15.45	16.98	-----	16.55	-----	16.40

## WISCONSIN RIVER NEAR NECEDAH, WIS.

This station was established December 2, 1902, by L. R. Stockman. It is located on the highway toll bridge 3 miles east of Necedah, Wis., and 3 miles from the Chicago, Milwaukee and St. Paul and Chicago and Northwestern Railroad stations. Yellow River flows into the Wisconsin about 4 miles below the station. There are islands both above and below the station, but they are several hundred feet away. The gage is a vertical board graduated to feet and tenths and fastened to the lower end of the center pier. It is read twice each day by Edw. Bundy. Discharge measurements are made from the two-span highway bridge to which the gage is attached. The initial point for soundings is a point over the right abutment, marked by a nail in the floor of the bridge and also marked zero with paint. The general direction of the channel is straight for 2,000 feet above and below the station. The velocity is rapid and rather poorly distributed on account of an ice breaker above the middle pier and the variation in width of the channel just above the bridge. The width of the channel at ordinary stages is about 325 feet, broken by one pier. The right bank is high and rocky; the left bank overflows, making the width of the channel from 500 to 600 feet. During the spring floods of 1903 the water overflowed the turnpike. The right side of the bed of the stream is rocky, but the remainder is sandy and liable to shift.

Bench mark No. 1 is a nail in the top of a red-oak stump,  $2\frac{1}{2}$  feet in diameter, about 60 feet south of the center of the roadbed and about 50 feet from the river at ordinary stages. Its elevation above the zero of the gage is 12.99 feet. Bench mark No. 2 is a nail in the root of a large cottonwood tree, 280 feet south of the bridge and about 80 feet from the river. Its elevation above the zero of the gage is 11.90 feet. Bench marks Nos. 1 and 2 are on the east side of the river. Bench mark No. 3 is a cross on a large sandstone rock, 70 feet south of the center of the roadway and 15 feet west of the water's edge on the west bank of the river. Its elevation above the zero of the gage is 20.36 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Wisconsin River near Necedah, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 13	L. R. Stockman	5.65	a 2,840
February 5	do	5.80	a 2,585
March 5	do	5.80	a 2,422
March 26	E. Johnson, jr	11.05	21,284
April 2	L. R. Stockman	7.55	10,187
April 28	do	6.50	7,123
June 12	do	6.00	5,888
July 7	do	10.50	20,855
August 19	do	6.20	6,962
September 4	do	5.30	5,047
October 12	do	9.43	12,501

a Frozen.

*Mean daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1902.*

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
1		8	4.30	14	5.30	20	5.45	26	6.30
2	4.90	9	4.85	15	5.35	21	5.30	27	6.60
3	4.95	10	5.25	16	5.65	22	5.30	28	6.15
4	5.10	11	5.20	17	5.65	23	5.40	29	6.05
5	4.85	12	5.40	18	5.30	24	5.60	30	6.20
6	4.75	13	5.25	19	5.50	25	6.40	31	6.00
7	4.70								

*Mean daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.90	5.75	5.75	7.70	6.65	10.55	4.70	4.80	5.20	7.10	5.70	5.60
2	5.90	5.70	5.60	7.55	8.30	9.85	4.60	4.95	5.50	6.60	5.55	6.20
3	5.80	5.90	5.85	7.35	9.35	8.85	7.70	4.75	5.40	6.80	5.70	6.90
4	5.75	5.80	5.80	7.50	9.75	8.15	8.90	4.80	5.30	6.80	5.75	7.10
5	5.60	5.75	5.75	7.40	9.95	7.60	10.10	4.85	5.30	7.05	5.55	6.80
6	5.70	5.90	5.80	7.25	10.15	7.40	10.00	5.65	5.40	8.30	5.45	6.80
7	5.65	5.80	5.90	7.15	10.05	7.15	10.60	6.65	5.60	9.05	5.30	6.60
8	5.45	5.70	5.50	7.20	9.70	6.85	10.60	7.75	6.10	8.95	5.50	6.70
9	5.60	5.60	5.50	7.10	9.30	6.65	9.70	8.00	6.10	9.15	5.35	6.50
10	5.50	5.80	6.25	7.25	8.80	6.55	8.40	7.70	6.80	9.80	5.30	6.40
11	5.45	5.75	6.40	7.05	8.25	6.20	7.80	7.50	7.30	9.80	5.25	6.30
12	5.50	5.65	7.05	6.90	8.15	6.00	7.50	7.20	7.30	9.35	5.30	6.00
13	5.65	5.90	7.65	6.80	8.45	6.15	7.10	6.90	7.20	8.90	5.30	a 4.10
14	5.75	5.80	6.75	6.75	9.05	5.85	6.70	6.70	8.60	8.30	5.30	4.40
15	5.45	5.75	7.30	6.80	9.80	5.70	6.55	6.70	10.90	7.90	5.35	4.50

a River frozen December 13 to 31.

*Mean daily gage height, in feet, of Wisconsin River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16.....	5.80	5.65	7.75	6.95	10.10	5.45	6.25	6.40	12.50	7.65	5.25	4.40
17.....	5.65	5.65	8.35	7.10	9.90	5.35	6.00	6.20	13.40	7.55	5.35	4.00
18.....	5.55	5.55	8.70	7.25	9.35	5.60	6.10	6.40	14.60	7.25	4.90	4.40
19.....	5.45	5.75	8.85	7.10	8.70	5.45	5.90	6.10	14.60	6.95	4.90	4.30
20.....	5.75	5.70	10.00	6.90	8.30	5.25	6.00	5.70	14.60	7.00	5.00	5.00
21.....	5.65	5.70	11.40	6.50	7.95	5.15	5.90	5.90	13.80	6.95	5.10	4.80
22.....	5.55	5.65	12.70	6.55	7.90	4.90	5.60	5.40	12.70	6.55	5.05	4.90
23.....	5.85	5.55	13.55	6.30	7.75	5.20	5.40	5.10	11.40	6.40	4.95	4.60
24.....	5.80	5.70	12.85	6.20	7.45	4.95	5.20	5.10	10.60	6.40	5.20	4.80
25.....	5.80	5.65	11.80	6.05	7.35	4.70	5.30	5.40	9.90	6.30	5.20	4.70
26.....	5.65	5.65	10.90	6.10	7.60	4.80	5.30	5.20	8.70	6.10	5.05	4.70
27.....	5.85	5.70	10.05	6.35	8.00	4.75	5.00	5.30	8.15	6.05	5.00	4.90
28.....	5.80	5.85	9.35	6.50	8.70	4.80	5.10	5.30	7.95	5.95	5.15	4.80
29.....	5.70	-----	8.95	6.85	9.55	4.70	5.00	5.20	7.65	6.00	5.00	4.90
30.....	5.80	-----	8.50	6.60	10.55	4.85	4.90	5.00	7.55	5.80	5.40	4.90
31.....	5.80	-----	8.00	-----	11.00	-----	4.80	5.00	-----	5.70	-----	4.90

*Rating table for Wisconsin River near Necedah, Wis., from March 10 to July 5, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
4.6	3,400	5.9	5,680	7.2	9,160	9.0	14,800
4.7	3,540	6.0	5,900	7.3	9,460	9.2	15,440
4.8	3,690	6.1	6,130	7.4	9,760	9.4	16,080
4.9	3,840	6.2	6,370	7.5	10,060	9.6	16,720
5.0	4,000	6.3	6,620	7.6	10,360	9.8	17,360
5.1	4,160	6.4	6,880	7.7	10,670	10.0	18,000
5.2	4,320	6.5	7,150	7.8	10,980	10.5	19,600
5.3	4,490	6.6	7,430	7.9	11,290	11.0	21,200
5.4	4,670	6.7	7,710	8.0	11,600	11.5	22,920
5.5	4,860	6.8	8,000	8.2	12,240	12.0	24,670
5.6	5,060	6.9	8,290	8.4	12,880	13.0	28,360
5.7	5,260	7.0	8,580	8.6	13,520		
5.8	5,470	7.1	8,870	8.8	14,160		

Flood in July changed channel.

*Rating table for Wisconsin River near Necedah, Wis., from July 6 to December 12, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
4.8	4,200	6.1	6,730	7.4	10,440	9.4	17,160
4.9	4,350	6.2	6,970	7.5	10,760	9.6	17,840
5.0	4,510	6.3	7,220	7.6	11,080	9.8	18,520
5.1	4,680	6.4	7,480	7.7	11,410	10.0	19,200
5.2	4,860	6.5	7,750	7.8	11,740	10.5	20,900
5.3	5,040	6.6	8,030	7.9	12,070	11.0	22,600
5.4	5,230	6.7	8,320	8.0	12,400	11.5	24,300
5.5	5,430	6.8	8,620	8.2	13,080	12.0	26,000
5.6	5,630	6.9	8,920	8.4	13,760	12.5	27,700
5.7	5,840	7.0	9,220	8.6	14,440	13.0	29,400
5.8	6,050	7.1	9,520	8.8	15,120	14.0	32,800
5.9	6,270	7.2	9,820	9.0	15,800		
6.0	6,500	7.3	10,130	9.2	16,480		

*Estimated monthly discharge of Wisconsin River near Necedah, Wis., for 1903.*

[Drainage area, 5,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....			<i>a</i> 2,600	0.45	0.52
February .....			<i>a</i> 2,550	.44	.46
March <sup>b</sup> .....	30,450		11,859	2.04	2.35
April .....	10,670	6,015	8,322	1.43	1.60
May .....	21,200	7,570	14,492	2.50	2.88
June .....	19,760	3,540	6,897	1.19	1.33
July .....	21,240	3,400	9,022	1.56	1.80
August .....	12,400	4,125	6,648	1.15	1.33
September .....	34,840	4,860	15,832	2.73	3.05
October .....	18,520	5,840	10,586	1.83	2.11
November .....	5,945	4,350	5,007	.86	.96
December 1-12 <sup>c</sup> .....	9,520	<i>d</i> 5,630	<i>d</i> 7,798	<i>d</i> 1.34	<i>d</i> 60

<sup>a</sup> Estimated.

<sup>b</sup> March 1 to 9, inclusive, estimated.

<sup>c</sup> December 13 to 31, river frozen.

<sup>d</sup> Twelve-day period.

#### WISCONSIN RIVER AT MERRILL, WIS.

This station was established November 17, 1902, by L. R. Stockman. It is located on the highway bridge in the city of Merrill, Wis., three

blocks from the Lincoln County court-house, one-half mile from the Chicago, Milwaukee and St. Paul Railroad station, and 1,000 feet below the dam of the electric power house. Prairie River enters about one-half mile above the station and there is an island about 600 feet below. There is a vertical gage fastened to the mill abutment, from which part of the gage readings for 1903 have been made. June 17, 1903, a chain gage was established on the bridge and made to read the same as the old gage at the mill. It is fastened to the guard timber on the downstream side, and the zero is marked by a brass screw driven into the guard timber. The fall of the water from the old to the new gage is 2.70 feet when the water is at a high stage. The length of the chain from the end of the weight to the marker is 23.60 feet. The gage is read twice each day by A. F. Lueck. The initial point for soundings is a nail in the footboard at the left end of the bridge, opposite the center of the iron hand-rail post. This point is marked "zero." Discharge measurements are made from the 2-span highway bridge, to which the chain gage is fastened. Each span of the bridge is 175 feet in length. The channel is straight from the dam above to the bridge and for about 400 feet below. The velocity is rapid and the surface rough. The station is so near the dam that at high stages the velocity is affected and it is possible that the bed of the stream may be subject to slight change, although it is of rock and gravel and is very rough. The channel is about 300 feet wide at low stages and 400 feet wide at high water. Both banks are high and do not overflow. Bench mark No. 1 is a cross cut in the sandstone rock in the bridge seat of the abutment nearest to the city. Its elevation above the zero of the gage is 16.25 feet. This bench mark is 18.28 feet below the United States bench mark located at the corner of the engine house opposite the city hall.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Wisconsin River at Merrill, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 20 .....	L. R. Stockman .....	4.05	<i>a</i> 1,376
February 16 .....	do .....	3.70	<i>a</i> 1,250
March 20 .....	do .....	8.90	9,995
May 7 .....	do .....	6.85	7,893
June 7 .....	do .....	4.72	2,258
July 13 .....	do .....	5.70	2,993
August 22 .....	do .....	5.00	2,638
September 11 .....	E. C. Murphy .....	6.59	5,614
October 24 .....	L. R. Stockman .....	6.08	4,159

*a* Partly frozen.

*Mean daily gage height, in feet, of Wisconsin River at Merrill, Wis., for 1902.*

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
10		4.00	16	3.60	3.85	22	1.55	3.80	23	0.05	3.80
11		3.95	17	3.80	3.85	23	1.05	3.75	29	.10	3.70
12		4.00	18	2.50	3.90	24	.90	3.85	30		3.70
13		4.00	19	2.05	3.85	25	1.05	4.05	31		3.70
14		3.85	20	1.90	4.05	26	.55	3.95			
15		3.65	21	1.90	3.80	27	.15	3.90			

*Mean daily gage height, in feet, of Wisconsin River at Merrill, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.65	3.80	3.70	6.75	6.65		7.05	4.30		6.50	5.85	5.10
2	3.70	3.80	3.70	6.70	8.30		7.65	4.30	5.50	5.90	5.60	5.10
3	3.85	3.85	3.80	6.55			7.65	4.90	5.70	6.90	5.30	5.25
4	3.80	3.80	3.75	6.65			8.70	5.60	5.80	7.85	5.30	5.10
5	3.75	3.85	3.80	6.75			8.80	6.55	6.00	8.00	5.30	5.25
6	3.70	3.85	3.70	6.70			8.70	7.45	6.10	7.80	5.75	5.15
7	3.75	3.90	3.80	6.80			8.30	7.35	6.10	8.85	5.30	5.20
8	3.70	3.80	3.75	6.90			8.10	7.25	6.50	8.55	5.10	5.20
9	3.65	3.90	3.75	6.75			7.70	(a)	6.60	8.35	5.20	5.15
10	3.65	3.85	3.90	6.70			7.60		6.80	8.20	5.10	5.05
11	3.70	3.55	4.05	6.75			7.50		6.90	7.70	5.20	4.95
12	3.70	3.85	4.20	6.55			7.30		9.10	7.25	5.25	4.70
13	3.80	3.75	4.75	6.05			6.30		9.40	7.35	5.25	4.90
14	3.75	3.70	5.00	6.70			5.50		10.00	7.10	5.25	4.80
15	3.65	3.75	5.05	6.75			6.00		11.10	7.10	5.05	5.30
16	3.50	3.80	5.05	6.80			5.40		11.50	6.75	5.50	4.55
17	3.70	3.90	5.50	6.85			5.50		10.80	6.60	5.25	5.00
18	3.70	3.75	5.55	6.75			5.40		10.10	6.60	4.65	5.10
19	4.20	3.55	7.90	7.10		5.15	5.15		9.40	6.60	4.75	5.10
20	4.00	3.70	8.35	7.20		5.20	5.55		8.90	6.35	4.85	5.20
21	3.85	3.65	8.30	7.10		5.55	4.65		8.50	6.35	4.75	5.20
22	4.00	3.85	8.00	6.80		5.60	4.90		8.10	6.35	4.55	4.80
23	4.00	3.45	8.25	6.75		6.00	5.40		7.90	6.40	4.60	4.80
24	4.00	3.65	7.50	6.80		6.45	5.10		7.70	6.15	4.70	5.10
25	4.10	3.70	7.35	7.05		6.40	4.65		7.10	6.05	4.90	5.00
26	4.05	3.70	7.00	6.10		5.85	5.10		7.20	6.00	5.25	5.20
27	4.00	3.60	6.65	6.35		5.35	4.10		7.20	5.85	5.25	5.50
28	3.85	3.65	6.05	6.50		5.35	4.50		7.05	5.75	4.85	5.60
29	3.95		6.80	6.85		6.20	5.60		5.40	5.85	4.85	5.50
30	3.90		6.45	6.60		6.75	4.50		6.05	5.95	5.05	5.80
31	3.85		6.70				4.30			5.60		5.60

<sup>a</sup> Chain gage stolen.

## ROCK RIVER DRAINAGE BASIN.

Rock River, with its tributaries, the Pecatonica and Kishwaukee rivers, is one of the most important streams in Illinois. It rises in the southeastern part of Wisconsin, flows south and southwest, and enters the Mississippi just below Rock Island, Ill. This river has much

power already developed along its course, and there are several points at which large water-power plants could be situated. Two stations have been maintained during 1903 by the United States Geological Survey on Rock River—one for a short time at Rockton above the mouth of the Pecatonica and the second at Rockton below the mouth of the Pecatonica. This latter one is still being maintained. A station was maintained on the Catfish River at Madison, Wis., up to August 4, 1903, and gage heights were taken of Lake Mendota at the same place.

The drainage area at the station above the Pecatonica is 3,606 square miles. At the station below the Pecatonica it is 6,150 square miles.

#### ROCK RIVER BELOW PECATONICA CREEK AT ROCKTON, ILL.

This station was established May 13, 1903, by E. Johnson, jr., assisted by L. R. Stockman. It is located at the village highway bridge, one-half mile from the Chicago, Milwaukee and St. Paul Railroad station, 1 mile below the dam, and three-fourths of a mile below the junction of Pecatonica River with Rock River. There are small islands a short distance above and immediately below the station. The chain gage is located on the first span from the left end of the bridge, on the downstream side. The gage is read twice each day by O. T. Bartholomew. The length from end of weight to marker is 26.45 feet. Discharge measurements are made from the upstream side of the five-span highway bridge to which the gage is attached. The initial point for soundings is the face of the abutment on the left end of the bridge. The channel is straight for 2,000 feet above and 1,000 feet below the station. Both banks are high and will not overflow. The channel is about 565 feet wide between bridge abutments and is broken by four piers. The bed of the stream is composed of small rocks and gravel.

Bench mark No. 1 is a hammered cross on the top stone of the left abutment, about 1 foot from the bridge shoe and 1 foot from the south edge. Its elevation above gage datum is 16.85 feet. Bench mark No. 2 is the top of the west end of the south rail of the railroad track, 250 feet north of the north end of the bridge, at a point where the sidewalk on the west side of the street crosses the track. Its elevation above gage datum is 16.49 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.



*Discharge measurements of Rock River below mouth of Pecatonica Creek at Rockton, Ill.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 13.....	L. R. Stockman.....	2.90	2,522
June 30.....	A. C. Lootz.....	2.30	1,501
August 18.....	L. R. Stockman.....	4.07	4,611
September 4.....	F. W. Hanna.....	4.08	4,607
October 9.....	do.....	5.35	7,464
November 9.....	do.....	2.85	2,874
December 10.....	do.....	2.60	2,384

*Mean daily gage height, in feet, of Rock River below Pecatonica Creek at Rockton, Ill., for 1903.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.50	4.10	4.40	3.70	3.10	2.70
2.....		2.60		4.30	3.60	3.20	2.80
3.....		2.90		4.20	3.70	3.20	2.70
4.....		3.70		4.10	3.50	3.10	2.70
5.....		3.50		4.00	3.70	3.10	2.80
6.....		3.40		3.90	3.70	3.00	2.70
7.....		3.40		3.60	4.70	2.90	2.60
8.....		3.30		3.60	6.00	2.60	2.60
9.....		3.00	4.10	4.00	5.40	2.70	2.70
10.....		3.30	4.00	4.10	5.10	2.60	2.60
11.....		3.50	3.60	4.30	5.00	2.80	2.70
12.....		3.90	3.20	4.50	4.70	2.90	2.60
13.....		4.70	3.20	4.30	4.60	3.20	3.80
14.....		4.60	3.10	5.00	4.40	3.40	3.30
15.....		4.10	3.40	5.30	4.40	3.30	3.30
16.....		3.90	3.70	5.70	4.40	3.30	3.40
17.....		4.00	4.30	5.90	4.30	3.20	3.20
18.....		3.80	4.20	6.00	4.30	2.70	3.00
19.....		5.20	3.80	5.70	4.00	3.00	3.30
20.....		5.70	3.60	5.30	4.10	2.90	3.30
21.....		6.20	3.50	5.00	4.00	3.00	3.20
22.....		6.90	3.40	4.80	4.00	2.90	3.20
23.....		7.20	3.40	4.60	3.80	2.90	3.20
24.....		7.00	3.50	4.40	3.80	2.80	3.10
25.....		6.70	3.40	4.00	3.60	2.80	3.10
26.....		5.80	3.30	3.90	3.60	2.50	3.20
27.....		4.60	3.60	3.80	3.50	3.10	3.10
28.....	2.40	4.60	3.90	4.00	3.40	2.70	3.00
29.....	2.20	4.10	4.30	3.90	3.30	2.90	3.10
30.....	2.70	4.20	4.60	3.80	3.30	2.90	3.10
31.....		4.20	4.40		3.10		3.00

*Rating table for Rock River below Pecatonica Creek at Rockton, Ill., from May 13 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.2	1,600	3.5	3,635	4.8	6,180	6.1	9,240
2.3	1,735	3.6	3,815	4.9	6,390	6.2	9,490
2.4	1,875	3.7	3,995	5.0	6,610	6.3	9,740
2.5	2,015	3.8	4,180	5.1	6,830	6.4	9,990
2.6	2,160	3.9	4,365	5.2	7,050	6.5	10,240
2.7	2,305	4.0	4,555	5.3	7,280	6.6	10,490
2.8	2,455	4.1	4,745	5.4	7,510	6.7	10,740
2.9	2,610	4.2	4,940	5.5	7,750	6.8	10,990
3.0	2,770	4.3	5,140	5.6	7,990	6.9	11,240
3.1	2,935	4.4	5,345	5.7	8,240	7.0	11,490
3.2	3,105	4.5	5,550	5.8	8,490		
3.3	3,280	4.6	5,760	5.9	8,740		
3.4	3,455	4.7	5,970	6.0	8,990		

*Estimated monthly discharge of Rock River below Pecatonica Creek at Rockton, Ill., for 1903.*

[Drainage area, 6,150 square miles.]

Month.	Discharge in second feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July .....	11,990	2,015	5,584	0.91	1.05
August 1 and 9-31 .....			3,880	.63	.56
September .....	8,990	3,815	5,578	.91	1.02
October .....	8,990	2,935	4,786	.78	.90
November .....	3,455	2,015	2,712	.44	.49
December .....	4,180	2,160	2,795	.45	.52

#### ROCK RIVER ABOVE PECATONICA CREEK NEAR ROCKTON, ILL.

This station was established May 13, 1903, by E. Johnson, jr., assisted by L. R. Stockman. The station, which has since been discontinued, was located on the highway bridge above the mouth of Pecatonica River, about 1 mile from Rockton, Ill., and one-half mile below the dam. The bridge is on a bend in the stream and is at an angle to the thread of the current. A canal takes water from Rock River and discharges it below this station but above the lower station. The chain gage was located on the downstream side of left

span and was read once each day by George W. Blackmar. Discharge measurements were made from the two-span highway bridge, to which the gage was fastened. The face of the abutment at the right end of the bridge was used as the initial point for soundings. Both banks are high and the bed is composed of gravel. The station was discontinued August 18, 1903, on account of being subject to backwater from Pecatonica River and on account of the poor conditions for accurate measurement. No bench marks were established.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Rock River above Pecatonica Creek, near Rockton, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	Second-feet.
May 13.....	L. R. Stockman .....	3.90	950
July 2.....	do .....	3.00	223

*Mean daily gage height, in feet, of Rock River above Pecatonica Creek at Rockton, Ill., for 1903.*

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1.....		2.50	5.30	12.....		5.20	4.10	23.....	3.20	7.70	-----
2.....		2.80	5.20	13.....		5.20	4.00	24.....	2.80	7.60	-----
3.....		2.20	5.10	14.....		4.80	3.90	25.....	2.80	7.50	-----
4.....		3.10	4.90	15.....		4.70	3.90	26.....	2.90	6.70	-----
5.....		3.50	4.90	16.....		4.60	4.90	27.....	2.90	6.40	-----
6.....		3.90	4.70	17.....		4.50	4.70	28.....	3.30	6.20	-----
7.....		4.10	4.70	18.....		5.60	4.60	29.....	3.20	5.90	-----
8.....		4.20	4.80	19.....		6.80		30.....	2.50	5.60	-----
9.....		4.30	4.20	20.....		6.70		31.....		5.40	-----
10.....		4.50	4.40	21.....	3.40	6.60	-----				
11.....		4.70	4.10	22.....	2.90	7.40	-----				

#### CATFISH RIVER AT MADISON, WIS.

This station was established December 18, 1902, by L. R. Stockman. The gage is located on the lower side of the Main Street Bridge. An additional gage was maintained a few blocks away at the outlet of Lake Mendota, in order to keep a record of its water surface. Both gages are plain staffs, graduated to feet and tenths. That on the bridge is nailed to the middle pier. Both gages were read once daily by James Mackin. The channel is straight both above and below the station for over 1,000 feet; it has a width of 55 feet and does not overflow. The bed is of soft material and is overgrown with long grass. The flow is sluggish and is affected by back water from Lake Monona.

Bench mark No. 1, elevation assumed 1,000 feet, is the water table at the northwest corner of Nievuhr's saloon. Bench mark No. 2,

elevation 1,004.46 feet, water table at the west corner of Hausmann's malt house. The 17-foot mark on gage at Main Street Bridge has an elevation of 992.15 feet. The 16-foot mark on gage in Lake Mendota has an elevation of 997.27 feet, or 7.19 feet below bench mark No. 2. The 16-foot mark at the dam is 6.12 feet above the 16-foot mark of Main street gage.

This station was discontinued August 4, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Catfish River at Madison, Wis., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
January 8 .....	L. R. Stockman .....	14.20	" 53
January 27 .....	do .....	14.10	60
February 23 .....	do .....	13.95	58
March 30 .....	do .....	15.00	197
April 18 .....	do .....	14.85	174
July 21 .....	E. C. Murphy .....	15.05	35

<sup>a</sup>Partly frozen.

*Mean daily gage height, in feet, of Catfish River at Madison, Wis., for 1902.*

Day.	Dec.	Day.	Dec.	Day.	Dec.
18 .....	13.9	23 .....	14.00	28 .....	14.30
19 .....	13.9	24 .....	14.10	29 .....	14.30
20 .....	13.9	25 .....	14.10	30 .....	14.30
21 .....	13.9	26 .....	14.30	31 .....	14.30
22 .....	13.9	27 .....	14.30		

*Mean daily gage height, in feet, of Catfish River at Madison, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1 .....	14.10	14.00	14.00	15.00	14.80	17 .....	14.80	14.10	15.10	14.90	-----
2 .....	14.10	14.00	14.10	15.00	14.55	18 .....	14.30	14.10	15.20	14.80	-----
3 .....	14.10	14.10	14.10	15.00	14.50	19 .....	14.30	14.10	15.30	14.80	-----
4 .....	14.10	14.30	14.30	15.00	14.50	20 .....	14.30	14.00	15.30	14.80	-----
5 .....	14.10	14.20	14.30	15.00	14.50	21 .....	14.30	14.00	15.20	14.80	-----
6 .....	14.00	14.20	14.30	15.00	14.60	22 .....	14.30	14.00	15.20	14.80	-----
7 .....	14.00	14.20	14.30	14.90	14.60	23 .....	14.30	14.00	15.20	14.80	-----
8 .....	14.00	14.10	14.30	14.90	14.65	24 .....	14.30	14.00	15.20	14.80	-----
9 .....	14.10	14.10	14.60	14.80	14.70	25 .....	14.30	14.00	15.20	14.80	-----
10 .....	14.10	14.10	14.60	14.80	-----	26 .....	14.20	14.00	15.20	14.80	-----
11 .....	14.20	14.10	14.70	14.80	-----	27 .....	14.20	14.00	15.10	14.80	-----
12 .....	14.20	14.10	14.80	14.90	-----	28 .....	14.20	14.00	15.10	14.70	-----
13 .....	14.20	14.00	14.70	14.90	-----	29 .....	14.10	-----	15.10	14.65	-----
14 .....	14.30	14.00	14.80	14.90	-----	30 .....	14.10	-----	15.10	14.65	-----
15 .....	14.30	14.00	14.70	14.90	-----	31 .....	14.10	-----	15.00	-----	-----
16 .....	14.30	14.10	14.70	14.90	-----						

## LAKE MENDOTA AT MADISON, WIS.

*Mean daily gage height, in feet, of Lake Mendota at Madison, Wis., for 1902.*

Day.	Dec.	Day.	Dec.	Day.	Dec.
22.....	12.3	25.....	12.5	30.....	12.5
23.....	12.3	27.....	12.5	31.....	12.5
24.....	12.4	28.....	12.5		
25.....	12.4	29.....	12.5		

*Mean daily gage height, in feet, of Lake Mendota at Madison, Wis., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1.....	12.50	12.30	12.40	12.80	12.50	17.....	12.30	12.40	12.80	12.70	-----
2.....	12.50	12.30	12.50	12.80	12.50	18.....	12.30	12.40	12.80	12.70	-----
3.....	12.50	12.30	12.50	12.80	12.50	19.....	12.30	12.40	12.90	12.70	-----
4.....	12.50	12.30	12.50	12.80	12.50	20.....	12.30	12.40	13.00	12.70	-----
5.....	12.50	12.30	12.50	12.70	12.50	21.....	12.30	12.40	13.00	12.65	-----
6.....	12.50	12.50	12.50	12.70	12.50	22.....	12.30	12.40	13.00	12.60	-----
7.....	12.50	12.30	12.50	12.70	12.45	23.....	12.30	12.40	13.00	12.60	-----
8.....	12.50	12.30	12.70	12.70	12.45	24.....	12.30	12.40	13.00	12.60	-----
9.....	12.30	12.30	12.80	12.70	12.40	25.....	12.30	12.40	13.00	12.60	-----
10.....	12.30	12.30	12.80	12.70	12.40	26.....	12.30	12.40	13.00	12.55	-----
11.....	12.30	12.30	12.80	12.70	12.35	27.....	12.30	12.40	12.90	12.50	-----
12.....	12.30	12.30	12.80	12.80	12.30	28.....	12.30	12.40	12.90	12.50	-----
13.....	12.30	12.30	12.80	12.80	12.30	29.....	12.30	-----	12.90	12.50	-----
14.....	12.30	12.40	12.80	12.80	12.30	30.....	12.30	-----	12.90	12.50	-----
15.....	12.30	12.40	12.80	12.80	12.25	31.....	12.30	-----	12.80	-----	-----
16.....	12.30	12.40	12.80	12.70	12.25						

## ILLINOIS RIVER DRAINAGE BASIN.

Illinois River is formed by the Desplaines and Kankakee rivers, which unite about 4 miles below the point where Dupage River enters the Desplaines. The principal tributaries to these rivers are Vermilion River, which enters the Illinois proper a short distance below Lasalle; Sangamon River; Dupage River, which enters the Desplaines below Joliet; Mazon River, which enters the Illinois near Morris; and Fox River. The following list gives the stations at which measurements were made during 1903: Illinois River at Peoria, Illinois River at Lasalle, Illinois River at Ottawa, Fox River at Ottawa, Illinois River near Seneca, Illinois River near Minooka, Desplaines River near Channahon, Desplaines River above mouth of Jackson Creek near Channahon, and the Sangamon near Springfield.

The drainage areas at the points where stations have been maintained are as follows:

*Drainage areas in Illinois basin at gaging stations.*

ILLINOIS RIVER.	Square miles.
Peoria.....	13,249
Lasalle.....	11,714
Minooka.....	6,476
Ottawa.....	10,094
Seneca.....	7,508

## DESPLAINES RIVER.

Jackson Creek .....	1,172
Kankakee Cut-off .....	1,489

## FOX RIVER.

Ottawa .....	2,492
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## SANGAMON RIVER AT SPRINGFIELD, ILL.

A station was established on Sangamon River at Springfield on the bridge of the Chicago, Peoria and St. Louis Railroad, which crosses the stream  $1\frac{1}{2}$  miles north of the State Fair Grounds. This bridge was not fully adapted for use as a measuring station, but was the best that could be found. It was found, however, that the station was poorer than expected and was finally abandoned. The drainage area at this point is 2,860 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Sangamon River at Springfield, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 11 .....	E. H. Heilbron .....	+3.05	4,790
July 4 .....	do .....	-3.90	543

*Mean daily gage height, in feet, of Sangamon River at Springfield, Ill., for 1903.*

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1 .....		-1.50		-2.45		17 .....	(a)	-1.93			-1.65
2 .....		-1.50		-2.55	-4.34	18 .....	(a)	-2.30			-1.63
3 .....				-2.90	-4.05	19 .....		-2.75			-1.90
4 .....				-3.90	-4.05	20 .....		-3.13			-2.60
5 .....				-2.55	-4.05	21 .....		-2.58			-3.10
6 .....				-2.55	-4.05	22 .....		-2.05			-4.40
7 .....				-2.57	-4.05	23 .....		-2.08			
8 .....				-2.60	-4.05	24 .....		-2.58			
9 .....				-2.60	-4.10	25 .....		-3.03			
10 .....				-2.60	-4.10	26 .....	-1.45	-3.15			
11 .....	3.05			-2.65	-4.10	27 .....	-1.45	-3.30			
12 .....	5.61				-4.05	28 .....	-1.45		-2.45		
13 .....	5.51				-4.05	29 .....	-1.50		-2.35		
14 .....	6.21	-.75			-4.15	30 .....	-1.50		-2.20		
15 .....	6.76	-1.05			-4.15	31 .....					
16 .....	6.76	-1.38			-1.90						

a Water over gage.

## ILLINOIS RIVER NEAR PEORIA, ILL.

This station was originally established by Jacob Harmon. It was reestablished March 10, 1903, by E. H. Heilbron. It is located on the

Peoria and Pekin Union Railroad bridge over the Illinois River,  $1\frac{1}{2}$  miles southwest of Peoria, Ill., and can be reached by street cars. The gage is a plain staff graduated to feet and inches and fastened to the central pier of the bridge. It is read twice daily by the draw tender of the bridge, P. A. Blumb. The measurements are taken from the bridge, and the initial point for sounding is on the right bank. The river is straight for 3,000 feet above and 2,000 feet below the station and has a width of about 1,000 feet, broken by six piers. The section is deep and the flow sluggish. The bed of the stream is composed of gravel and silt. The right bank is high, and the railroad embankment is along this shore. The left bank is low and liable to overflow.

The bench mark is the southwest corner of the top stone of the west abutment of the bridge; elevation, 125.722 feet below the Chicago datum. The gage at this point has for its zero a point 153.814 feet below the Chicago city datum. The gage reads up from this point, and in order to obtain the height of the river, referred to the Chicago datum, it is necessary to subtract the gage reading from 153.814 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Illinois River near Peoria, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 18.....	E. H. Heilbron.....	17.58	41,219
April 3.....	do.....	15.23	25,839
April 29.....	do.....	15.50	26,079
May 13.....	do.....	12.67	15,357
July 5.....	do.....	9.33	9,424
August 22.....	E. Johnson, jr.....	8.40	8,713
September 25.....	Johnson and Hanna.....	11.92	15,154
October 23.....	F. W. Hanna.....	10.83	13,686
November 12.....	do.....	9.00	9,135

*Mean daily gage height, in feet, of Illinois River near Peoria, Ill., for 1903.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		15.50	15.00	11.17	9.00		9.00	11.25	10.08	8.58
2.....		15.08	14.75	11.59	9.08		8.92	11.21	10.08	8.58
3.....		15.17	15.08	11.75	9.00		8.83	11.00	10.00	8.58
4.....		14.92	14.75	10.25	8.92		8.83	11.04	9.92	8.58
5.....		14.42	14.67	10.33	8.75		8.83	11.08	9.92	8.50
6.....		14.50	14.33	10.58	8.67		8.75	10.92	9.88	8.50
7.....		14.58	14.17	10.33	8.58		8.67	10.92	9.71	8.42

*Mean daily gage height, in feet, of Illinois River, etc.—Continued.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8.....		14.67	14.00	10.17	8.67		8.58	11.12	9.50	8.42
9.....		14.58	13.83	9.83	(a)		8.51	11.25	9.33	8.46
10.....	18.16	14.58	13.50	9.67			9.00	11.37	9.33	8.50
11.....	18.33	14.50	13.58	9.58			9.08	11.42	9.25	8.58
12.....	18.50	14.92	13.33	9.58			9.17	11.42	9.17	8.67
13.....	18.42	15.17	12.92	9.33			9.42	11.42	9.33	8.92
14.....	18.42	16.58	12.75	9.25			9.53	11.37	9.33	8.83
15.....	18.25	16.25	12.67	9.17			10.17	11.29	9.33	8.75
16.....	18.08	17.25	12.42	9.08			10.42	11.21	9.33	8.67
17.....	17.83	17.67	12.25	8.08			10.33	11.21	9.17	8.75
18.....	17.50	17.92	12.17	8.25			11.67	11.12	9.08	8.75
19.....	17.33	18.00	11.83	8.25			11.92	11.00	9.00	8.88
20.....	17.58	17.92	11.50	8.25			12.17	11.00	8.88	8.96
21.....	17.42	17.83	11.33	8.67			12.25	10.87	8.79	9.04
22.....	17.58	17.50	11.25	8.67		8.93	12.25	10.83	8.75	9.25
23.....	17.58	17.33	11.08	8.67		8.25	12.25	10.83	8.79	9.37
24.....	17.42	17.00	11.00	8.50		8.25	12.17	10.62	8.83	9.46
25.....	17.33	16.67	10.92	8.33		8.17	11.92	10.58	8.92	9.46
26.....	17.17	16.33	10.83	8.50		8.17	11.67	10.58	8.00	9.83
27.....	16.92	16.00	10.83	8.42		8.33	11.80	10.42	8.17	9.96
28.....	16.58	15.75	10.75	8.50		8.67	11.62	10.33	8.25	10.00
29.....	16.33	15.42	10.58	8.92		8.92	11.46	10.25	8.75	10.08
30.....	13.00	15.33	10.75	9.00		9.00	11.37	10.21	8.67	10.08
31.....	15.67		10.00			9.00		10.17		10.08

<sup>a</sup>Readings from July 9 to August 21 not taken.

*Rating table for Illinois River near Peoria, Ill., from March 10 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
8.0	7,850	9.3	9,955	11.2	13,645	13.8	20,415
8.1	8,000	9.4	10,130	11.4	14,080	14.0	21,060
8.2	8,150	9.5	10,310	11.6	14,525	14.5	22,830
8.3	8,305	9.6	10,490	11.8	14,985	15.0	24,900
8.4	8,460	9.7	10,670	12.0	15,455	15.5	27,450
8.5	8,620	9.8	10,855	12.2	15,940	16.0	30,690
8.6	8,780	9.9	11,040	12.4	16,440	16.5	34,040
8.7	8,940	10.0	11,230	12.6	16,955	17.0	37,390
8.8	9,105	10.2	11,610	12.8	17,490	17.5	40,740
8.9	9,270	10.4	12,000	13.0	18,035	18.0	44,090
9.0	9,440	10.6	12,400	13.2	18,600	19.0	50,790
9.1	9,610	10.8	12,805	13.4	19,185		
9.2	9,780	11.0	13,220	13.6	19,790		



*Estimated monthly discharge of Illinois River near Peoria, Ill., for 1903.*

[Drainage area, 13,249 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 10-31			40,589	3.06	2.50
April	44,090	22,830	31,169	2.35	2.62
May	25,360	11,230	17,332	1.31	1.51
June	14,870	8,000	10,152	.77	.86
July 1-8 <sup>a</sup>			9,160	.69	.21
August 22-31 <sup>a</sup>			8,637	.65	.24
September	16,065	8,620	12,127	.92	1.03
October	14,080	11,565	13,129	.99	1.14
November	11,420	7,850	9,790	.74	.83
December	11,420	8,460	9,500	.72	.83

<sup>a</sup> Readings July 9 to August 21 not taken.

## ILLINOIS RIVER NEAR LASALLE, ILL.

This station was established November 13, 1902, by E. H. Heilbron. It is located on the highway bridge at Shipping Sport,  $1\frac{1}{2}$  miles south-east of the Chicago, Rock Island and Pacific Railroad depot, Lasalle, Ill., 3,000 feet below the Chicago, Burlington and Quincy Railroad bridge, 1 mile below Big Vermilion River, 3,500 feet below Little Vermilion River, and 1 mile above Peru, Ill.

There is a plain staff graduated to feet and tenths and fastened to the southwest corner of the south pier of the bridge. A standard chain gage was installed May 12, 1903, reading the same as the original vertical gage. Gage heights are read twice daily by James Desper. Discharge measurements are made from the floor of the bridge. The initial point for soundings is a cross cut on the truss at the south end of the bridge on the east side of the railing. The width of the channel is about 750 feet, broken by five piers, and the maximum depth at ordinary stages is 14 to 26 feet. The bed is mostly of a firm material and the flow is sluggish at low stages. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below the station. The right bank is low and is overflowed at extreme high water. The left bank is high.

Bench mark No. 1 is at the east end of the north abutment on the third stone step from the east wing wall. It is a square marked "U. S." cut in the stone; elevation, 114.704 feet below the Chicago datum. Bench mark No. 2 is at the east end of the south pier and is a square marked "U. S." cut in the stone; elevation, 113.243 feet below the Chicago datum. The gage is set with its zero at the same

elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Mean daily gage height, in feet, of Illinois River near Lasalle, Ill., for 1903.*

Day.	Mar.	Apr.	May.	July.	Aug.	Sept.
1		-133.03	-133.75		-139.50	-139.20
2		-133.28	-133.85		-139.58	-139.30
3		-133.45	-133.95		-139.68	-139.30
4		-133.60	-134.30		-139.73	-139.50
5		-132.20	-134.87		-139.35	-139.60
6		-133.77	-135.15		-139.05	-139.60
7		-133.65	-135.45		-138.85	-139.80
8		-133.86	-135.75	-139.80	-138.70	-139.80
9		-133.28	-135.95	-139.80	-139.00	-139.80
10		-132.72	-136.18	-139.80	-139.20	-139.00
11		-132.50	-136.30	-139.40	-139.30	-138.40
12		-130.25	-136.25	-139.28	-139.50	-138.20
13		-129.72	-136.65	-139.32	-139.70	-138.50
14		-128.87	-136.85	-139.48	-139.70	-138.30
15		-129.55	-137.03	-139.58	-139.70	
16		-127.50	-137.14	-139.68	-139.20	
17		-127.70	-137.45	-139.78	-139.40	
18		-128.15	-137.55	-139.00	-139.60	
19		-128.50	-137.65	-138.30	-139.80	
20		-129.00	-137.90	-138.20	-139.80	
21		-129.54	-138.05	-138.75	-139.90	
22		-130.25	-137.97	-139.10	-139.90	
23		-130.28	-138.04	-139.30	-140.03	
24		-131.10		-139.50	-140.03	
25		-131.70		-139.60	-139.90	
26		-131.90		-139.80	-140.10	
27		-132.20		-139.90	-139.70	
28		-132.50		-139.90	-139.00	-137.10
29	-131.90	-132.85		-139.50	-138.70	-137.20
30		-133.30		-139.60	-138.90	-137.40
31				-139.60	-139.08	

*Discharge measurements of Illinois River near Lasalle, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 17	E. H. Heilbron	-129.70	32,006
April 4	do	-133.60	17,638
April 28	do	-132.55	17,884
May 12	do	-136.50	11,110
July 7	do	-139.85	7,221
July 15	E. C. Murphy	-139.55	8,123
August 23	E. Johnson, jr.	-140.03	7,448

*Rating table for Illinois River near Lasalle, Ill., from April 1 to September 30, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
-140.0	7,400	-138.7	8,320	-136.8	10,570	-134.2	15,290
-139.9	7,465	-138.6	8,405	-136.6	10,850	-134.0	15,750
-139.8	7,530	-138.5	8,495	-136.4	11,140	-133.5	16,940
-139.7	7,595	-138.4	8,590	-136.2	11,440	-133.0	18,400
-139.6	7,660	-138.3	8,690	-136.0	11,750	-132.5	20,180
-139.5	7,725	-138.2	8,795	-135.8	12,070	-132.0	22,060
-139.4	7,795	-138.1	8,905	-135.6	12,410	-131.5	24,000
-139.3	7,865	-138.0	9,020	-135.4	12,760	-131.0	26,190
-139.2	7,935	-137.8	9,260	-135.2	13,140	-130.0	30,790
-139.1	8,010	-137.6	9,500	-135.0	13,550	-129.5	33,090
-139.0	8,085	-137.4	9,760	-134.8	13,970	-129.0	35,390
-138.9	8,160	-137.2	10,020	-134.6	14,410		
-138.8	8,240	-137.0	10,290	-134.4	14,850		

*Estimated monthly discharge of Illinois River near Lasalle, Ill., for 1903.*

[Drainage area, 11,714 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April <sup>a</sup> .....	42,290	16,095	25,527	2.18	2.43
May 1 to 23 <sup>b</sup> .....			11,636	.99	.85
July 8 to 31 .....			7,786	.66	.59
August 1-31 .....	8,320	7,370	7,759	.66	.76
September, 17 days <sup>c</sup> .....			8,346	.71	.45

<sup>a</sup> April 27, 28, and 30, discharge estimated.

<sup>b</sup> May 2 and 18, discharge estimated.

<sup>c</sup> September 15 to 27, missing.

#### ILLINOIS RIVER AT OTTAWA, ILL.

This station was established November 11, 1902, by E. H. Heilbron. It is located at the Chicago, Burlington and Quincy Railroad bridge, 2,500 feet below the mouth of Fox River and 200 feet below the highway bridge leading to the main street of Ottawa, Ill. A vertical gage graduated to feet and tenths is fastened to the west end of the first pier from the north abutment of the railroad bridge. A standard

chain gage was established November 1, 1903, to replace the old vertical gage and was made to read the same as the original gage. The length of chain from the end of the weight to the marker was 37.42 feet. The gage was read twice each day by D. C. Woods. Discharge measurements were made from the east side of the railroad bridge, to which the gage is attached. The initial point for soundings was the center one of the group of nails driven into the cap at the south end of the trestlework, south of the main bridge structure. The channel is straight for about 2,000 feet above and below the station and has a width between abutments of 650 feet, broken by four piers. The depth at ordinary stages is about 13 feet. The railroad embankments form part of the banks of this river. The bed of the stream is composed of gravel, which is somewhat shifting. The flow is somewhat sluggish at low stages.

Bench mark No. 1 is the top of the coping stone at the east end of the first pier from the north end of the railroad bridge. The point is marked "U. S." Its elevation is 48.638 feet below the Hennepin datum and 103.156 feet below the Chicago datum. Bench mark No. 2 is a cut in the batter on the coign, 3 feet above ground, at the west end of the south pier of the railroad bridge. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Illinois River at Ottawa, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 18.....	E. H. Heilbron.....	-122.98	30,885
April 5.....	do.....	-126.25	17,573
April 28.....	do.....	-126.07	18,340
May 12.....	do.....	-128.42	11,616
July 8.....	do.....	-129.54	7,541
August 23.....	E. Johnson, jr.....	-129.57	7,668
September 25.....	Johnson and Hanna.....	-128.35	11,592
October 12.....	Johnson and Hanna.....	-127.88	13,543
November 12.....	F. W. Hanna.....	-129.01	8,898
December 12.....	do.....	-126.42	a 6,822

<sup>a</sup> Ice jam.

*Mean daily gage height, in feet, of Illinois River at Ottawa, Ill., for 1903.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		(a)	-126.90	-127.58	-129.62	-129.00	-128.90	-128.60	-128.63	-129.05
2.....		(a)	-127.22	-127.65	-129.62	-129.03	-129.00	-128.60	-128.68	-129.05
3.....			-126.65	-127.32	-128.03	-129.60	-129.16	-129.20	-128.60	-128.77
4.....			-126.61	-127.47	-128.03	-129.56	-129.10	-129.20	-127.93	-128.82
5.....			-126.10	-127.58	-127.55	-129.55	-128.80	-129.30	-128.10	-128.85
6.....			-125.47	-127.77	-126.50	-129.55	-128.55	-129.35	-128.12	-128.88
7.....			-125.28	-128.07	-126.50	-129.50	-128.39	-129.38	-127.77	-128.95
8.....			-125.75	-128.20	-126.80	-129.54	-128.54	-129.98	-127.67	-129.09
9.....			-125.82	-128.30	-127.20	-129.45	-128.80	-129.44	-127.70	-129.13
10.....			-126.65	-128.30	-127.64	-129.35	-128.90	-128.68	-127.77	-129.15
11.....	-120.35	-124.60	-128.32	-128.00	-129.00	-129.00	-128.00	-127.89	-129.13	-127.00
12.....	-120.90	-121.98	-128.42	-128.33	-129.00	-129.10	-128.35	-127.97	-129.10	-126.35
13.....	-121.68	-121.58	-128.49	-128.52	-129.10	-129.20	-128.58	-128.05	-129.18	-126.52
14.....	-121.70	-120.48	-128.60	-128.75	-129.20	-129.30	-123.35	-128.10	-129.28	-126.75
15.....	-121.92	-119.08	-128.74	-129.00	-129.20	-129.10	-125.45	-128.12	-129.33	-126.45
16.....	-122.50	-119.42	-128.85	-129.25	-129.26	-128.65	-124.08	-128.16	-129.40	-126.32
17.....	-122.95	-120.38	-129.03	-129.40	-129.31	-128.80	-124.75	-128.20	-129.40	-126.75
18.....	-123.25	-122.02	-129.05	-129.10	-128.20	-129.10	-125.85	-128.26	-129.39	-127.08
19.....	-123.50	-122.02	-129.10	-129.00	-127.90	-129.20	-126.48	-128.33	-129.34	-127.10
20.....	-121.45	-122.65	-129.17	-129.03	-128.10	-129.30	-126.84	-128.33	-129.30	-127.12
21.....	-120.72	-123.37	-129.15	-129.10	-128.50	-129.30	-127.38	-128.25	-129.29	-126.80
22.....	-122.15	-124.05	-129.93	-129.25	-128.50	-129.50	-127.58	-128.28	-129.13	-127.40
23.....	-122.75	-124.57	-128.95	-129.13	-129.10	-129.50	-127.80	-128.39	-128.70	-126.78
24.....	-123.37	-125.10	-128.85	-129.22	-129.20	-129.60	-128.04	-128.43	-128.73	-126.60
25.....	-124.20	-125.45	-128.82	-129.33	-129.30	-129.50	-128.03	-128.49	-129.00	-126.75
26.....	-124.68	-125.75	-128.68	-129.48	-129.30	-129.40	-128.50	-128.50	-129.48	-126.98
27.....	-125.02	-125.95	-128.50	-129.46	-129.40	-129.20	-128.40	-128.50	-129.28	-127.05
28.....	-125.25	-126.10	-128.30	-129.57	-129.40	-128.60	-128.50	-128.52	-129.21	-127.22
29.....	-125.62	-126.37	-128.02	-129.65	-129.30	-128.70	-128.40	-128.58	-129.12	-127.20
30.....	-126.52	-126.65	-128.05	-129.66	-129.00	-128.70	-128.47	-128.60	-129.20	-127.28
31.....	-126.82		-127.78		-129.00	-128.80		-128.61		-127.22

a Gage out.

*Rating table for Illinois River at Ottawa, Ill., from March 11 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
-130.0	6,740	-128.7	9,730	-126.8	15,620	-124.2	25,990
-129.9	6,940	-128.6	9,995	-126.6	16,340	-124.0	26,810
-129.8	7,145	-128.5	10,265	-126.4	17,080	-123.5	28,860
-129.7	7,355	-128.4	10,540	-126.2	17,840	-123.0	30,910
-129.6	7,570	-128.3	10,820	-126.0	18,620	-122.5	32,960
-129.5	7,790	-128.2	11,105	-125.8	19,430	-122.0	35,010
-129.4	8,015	-128.1	11,395	-125.6	20,250	-121.5	37,060
-129.3	8,245	-128.0	11,690	-125.4	21,070	-121.0	39,110
-129.2	8,480	-127.8	12,295	-125.2	21,890	-120.5	41,160
-129.1	8,720	-127.6	12,920	-125.0	22,710	-120.0	43,210
-129.0	8,965	-127.4	13,565	-124.8	23,530	-119.0	47,310
-128.9	9,215	-127.2	14,230	-124.6	24,350		
-128.8	9,470	-127.0	14,920	-124.4	25,170		

*Estimated monthly discharge of Illinois River at Ottawa, Ill., for 1903.*

[Drainage area, 10,094 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 11-31 .....	41,775	15,620	30,111	2.98	2.33
April .....	46,900	15,800	25,589	2.54	2.83
May .....	15,270	6,840	10,700	1.06	1.22
June .....	16,710	7,465	10,419	1.03	1.15
July .....	11,990	7,570	8,657	.86	.99
August .....	10,540	7,570	8,922	.88	1.01
September .....	26,400	6,740	12,106	1.20	1.34
October .....	12,760	9,995	11,015	1.09	1.26
November .....	9,860	7,790	8,722	.86	.96
December .....	17,460	8,600	13,563	1.34	1.54

## FOX RIVER AT OTTAWA, ILL.

This station was established November 10, 1902, by E. H. Heilbron. It was located at the Main street highway bridge over Fox River at Ottawa, Ill. The gage is a plain staff fastened to the abutment of the bridge, graduated to feet and tenths, and was read twice daily by D. C. Woods. The measurements were taken from the bridge. The channel is straight for 300 feet above and 600 feet below the station. The banks are both high. The bed of the stream is rock and gravel. The bench mark is the top step of the east concrete abutment of the street railway bridge over Fox River at Main street, Ottawa, Ill. It is on the south wing wall at the south end of the parapet wall. Elevation 99.940 feet below the Chicago city datum, and 51.854 feet above the Hennepin datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was discontinued in May, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Fox River at Ottawa, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 17 .....	E. H. Heilbron .....	—122.85	3,519
April 5 .....	do .....	—125.65	3,488

*Mean daily gage height, in feet, of Fox River at Ottawa, Ill., for 1903.*

Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.
1		(a)	9		-125.82	17	-122.95		25	-123.75	
2		(a)	10		-126.25	18	-123.25		26	-124.28	
3		-126.00	11	-119.50	-124.10	19	-123.50		27	-124.60	
4		-126.01	12	-120.50		20	-121.45		28	-124.88	
5		-125.62	13	-120.90		21	-120.68		29	-125.25	
6		-125.10	14	-121.49		22	-121.62		30	-125.95	
7		-124.92	15	-121.92		23	-122.25		31	-126.35	
8		-125.35	16	-122.50		24	-122.93				

<sup>a</sup> Gage out of order.

## ILLINOIS RIVER NEAR SENECA, ILL.

This station was established November 9, 1902, by E. H. Heilbron. It is located at the Kansas and Southern Railroad bridge, 2 miles from Seneca, Ill. The gage is a vertical staff graduated to feet and tenths and fastened to the center pier of the bridge. It was read twice daily by Augusta Ebeling. The measurements are taken from the bridge. The initial point for sounding is on the left bank. The channel is straight both above and below the station and has a width of about 360 feet at low water and 560 feet at high water. The maximum depth at ordinary stages is 20 feet, and the flow is moderately rapid. Both banks of the stream are high. The bed of the stream is composed of gravel and silt. The bench mark is a cut in the southwest corner of the south abutment of the Kansas and Southern Railroad bridge marked  $\odot$  S. D. B. M. Elevation, 77.220 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established to show the discharge of Mazon River, which enters the Illinois a short distance above the station. It was discontinued August 22, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following discharge measurement was made by E. H. Heilbron.

March 16: Gage height, 94.23 feet; discharge, 24,372 second-feet.

*Mean daily gage height, in feet, of Illinois River near Seneca, Ill., for 1903.*

Day.	Mar.	Apr.	May	June	July	Aug.
1		-97.72	-98.10	-98.38	-99.91	-99.60
2		-97.90	-98.21	-98.54	-99.87	-99.95
3		-98.00	-98.19	-98.53	-99.90	-99.78
4		-97.76	-98.39	-98.46	-99.87	-99.43
5		-96.96	-98.50	-98.11	-99.80	-99.40
6		-96.25	-98.60	-97.24	-99.80	-99.25
7		-96.18	-98.80	-97.05	-99.90	-99.00
8		-96.68	-98.87	-97.48	-99.90	-99.20
9		-96.98	-98.90	-97.78	-99.90	-99.35

*Mean daily gage height, in feet, of Illinois River, etc.—Continued.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.
10.....	-91.20	-97.32	-98.90	-98.18	-99.70	-99.53
11.....	-91.70	-96.53	-98.97	-98.48	-99.30	-99.63
12.....	-92.20	-93.25	-99.04	-98.73	-99.46	-99.76
13.....	-93.62	-93.15	-99.11	-98.95	-99.62	-99.91
14.....	-93.10	-92.05	-99.16	-99.09	-99.63	-99.85
15.....	-93.64	-90.35	-99.27	-99.18	-99.68	-99.93
16.....	-94.30	-90.40	-99.42	-99.34	-99.76	-99.93
17.....	-94.72	-91.55	-99.50	-99.50	-99.81	-99.99
18.....	-95.15	-92.22	-99.55	-99.56	-99.40	-100.05
19.....	-95.46	-93.63	-99.62	-99.58	-98.75	-100.20
20.....	-95.47	-94.06	-99.64	-99.48	-99.04	-100.10
21.....	-93.70	-94.96	-99.63	-99.47	-99.33	-100.55
22.....	-99.05	-95.55	-99.42	-99.51	-99.54	-100.50
23.....	-94.55	-95.59	-99.45	-99.50	-99.65	-101.00
24.....	-95.20	-96.51	-99.31	-99.60	-99.73	-101.00
25.....	-95.70	-96.70	-99.26	-99.68	-99.82	-101.00
26.....	-96.20	-96.95	-99.03	-99.78	-99.87	-101.50
27.....	-96.50	-97.68	-98.96	-99.81	-99.90	-----
28.....	-96.83	-97.20	-98.60	-99.85	-99.86	-----
29.....	-99.05	-97.57	-98.55	-99.90	-99.92	-----
30.....	-97.22	-97.77	-98.67	-99.91	-99.83	-----
31.....	-97.43	-----	-98.50	-----	-99.56	-----

#### ILLINOIS RIVER NEAR MINOOKA, ILL.

This station was established November 7, 1902, by E. H. Heilbron, to determine the flow of Kankakee River. It is 1 mile northwest of Devine, Ill., 6 miles south of Minooka, Ill., and  $2\frac{1}{2}$  miles west of the mouth of Kankakee River. The gage is a vertical rod fastened to the center pier of the bridge. It is read twice daily by J. A. Lyons. Discharge measurements are made from the bridge and from a boat and cable about 25 feet above the bridge. The initial point for soundings is an oak hub about 4 feet north of the north side of the railroad pumping station. The channel is straight for 1,000 feet above the station and 2,000 feet below. The width at ordinary stages is 560 feet, with a maximum depth of 12 feet. The flow is moderately rapid, but is sluggish at low stages. The width at high water is about 1,000 feet. The right bank is low and liable to overflow; the left bank is high. The bed of the stream is of gravel and is shifting on the north side.

The bench mark is a cut in the stone on the south abutment of the Elgin, Joliet and Eastern Railroad bridge. It is marked S. D.  $\square$  P. B. M. Its elevation is 85.030 feet above the Hennepin datum and 66.764 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.



*Discharge measurements of Illinois River near Minooka, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 15.....	E. H. Heilbron.....	-86.84	25,689
April 19.....	do.....	-91.12	13,482
May 10.....	do.....	-94.10	7,393
July 12.....	do.....	-93.83	7,465
August 31.....	do.....	-93.99	7,044
September 26.....	Johnson and Hanna.....	-94.10	7,319
October 24.....	do.....	-94.10	7,673
November 11.....	F. W. Hanna.....	-94.15	7,596

*Mean daily gage height, in feet, of Illinois River near Minooka, Ill., for 1903.*

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	-90.62		-91.86	-91.77	-92.63	-94.48	-93.12	-94.29	-94.20	-93.92	-93.98
2.....	-89.87		-92.05	-91.96	-92.69	-94.34	-93.98	-94.40	-94.17	-93.85	-93.83
3.....	-89.65		-92.13	-92.02	-92.91	-94.30	-94.13	-94.32	-94.25	-94.09	-93.78
4.....	-89.72		-91.91	-92.23	-92.78	-94.34	-94.07	-94.44	-94.12	-94.14	-93.71
5.....	-89.25		-90.85	-92.36	-92.19		-93.63	-94.45	-93.90	-94.21	-94.30
6.....	-89.38		-89.90	-92.60	-91.04	-94.30	-93.24	-94.67	-93.87	-94.18	-93.60
7.....	-87.45		-89.85	-92.95	-91.07	-94.36	-93.08	-94.63	-93.83	-94.22	-93.58
8.....			-90.62	-93.00	-91.36	-94.32	-93.55	-94.64	-93.61	-94.25	-93.68
9.....	-82.98		-91.05	-92.99	-91.83	-94.20	-92.70	-94.60	-93.36	-94.25	-93.88
10.....	-83.58		-91.36		-92.33	-93.69	-93.84	-94.09	-93.37	-94.15	-93.92
11.....	-84.18		-87.80	-93.12	-92.67	-93.58	-94.00	-93.39		-94.13	-93.79
12.....	-84.69		-86.13		-93.04	-93.86	-94.23	-94.11		-94.20	-93.72
13.....	-85.20		-85.78	-93.31	-93.26	-93.90	-94.30	-94.26		-94.23	-92.42
14.....	-85.64		-84.02	-93.46	-93.43	-93.97	-94.30	-94.00	-93.75	-94.27	-92.20
15.....		-86.62	-82.89	-93.55	-93.48	-94.05	-94.18	-92.79	-93.83	-94.88	-91.84
16.....		-87.33	-83.31	-93.76	-93.79	-94.17	-94.45	-90.36	-93.78	-94.22	-92.94
17.....		-88.03	-83.87	-93.85	-93.98	-94.26	-94.53	-90.99	-93.88	-94.20	-92.68
18.....		-88.37	-84.75	-93.84	-93.98	-92.85	-94.65	-91.78	-93.83	-94.43	-92.86
19.....		-88.78	-85.84	-93.94	-94.03	-92.80	-94.65	-92.12	-93.98	-94.45	-92.68
20.....		-88.35	-86.77	-93.95	-94.00	-93.47	-94.55	-92.53	-93.93	-94.20	-90.84
21.....		-86.95	-87.55	-93.97	-94.11	-94.04	-94.58	-93.01	-93.83	-94.41	-90.93
22.....		-87.22	-88.75	-93.78	-94.05		-94.61	-93.32	-93.91	-93.52	-90.84
23.....		-87.72	-89.26	-93.79	-94.05	-94.05	-94.56	-93.56	-93.93	-93.36	-91.00
24.....		-88.45	-89.73	-93.62	-94.13	-94.12	-94.51	-93.73	-93.97	-93.42	-90.84
25.....		-89.25	-90.10	-93.43	-94.22	-94.32	-94.53	-93.89	-94.06	-94.20	-90.83
26.....		-89.89	-90.41	-93.19	-94.27	-94.38	-94.64	-94.03	-93.98	-94.23	-91.31
27.....		-90.30	-90.46	-93.52	-94.34	-94.29	-94.48	-94.00	-93.95	-94.05	-91.18
28.....		-90.72	-90.63	-92.47	-94.37	-94.33	-93.94	-94.10	-93.98	-94.10	-91.13
29.....		-91.00	-91.18	-92.57	-94.39	-94.30	-94.05	-94.10	-94.05	-94.33	-91.10
30.....		-91.27	-91.42	-92.71	-94.40	-94.21	-94.30	-94.20	-94.01	-93.98	-91.30
31.....		-91.50		-92.78		-93.65	-94.23		-93.99		-91.04

*Rating table for Illinois River near Minooka, Ill., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
—95.0	6,020	—93.7	7,840	—91.8	11,765	—88.0	22,275
—94.9	6,135	—93.6	8,010	—91.6	12,260	—87.5	23,700
—94.8	6,250	—93.5	8,185	—91.4	12,765	—87.0	25,125
—94.7	6,370	—93.4	8,335	—91.2	13,280	—86.5	26,550
—94.6	6,495	—93.3	8,550	—91.0	13,810	—86.0	27,975
—94.5	6,625	—93.2	8,740	—90.8	14,350	—85.5	29,400
—94.4	6,760	—93.1	8,930	—90.6	14,895	—85.0	30,825
—94.3	6,900	—93.0	9,125	—90.4	15,450	—84.5	32,250
—94.2	7,045	—92.8	9,525	—90.2	16,010	—84.0	33,675
—94.1	7,195	—92.6	9,940	—90.0	16,575	—83.0	36,525
—94.0	7,350	—92.4	10,375	—89.5	18,000	—82.0	39,375
—93.9	7,510	—92.2	10,820	—89.0	19,425		
—93.8	7,675	—92.0	11,285	—88.5	20,850		

Above —90 feet gage height the curve becomes a tangent, with difference of 285 second-feet per tenth gage height.

*Estimated monthly discharge of Illinois River near Minooka, Ill., for 1903.*

[Drainage area, 6,476 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 1–14 <sup>a</sup>	36,525	14,895	25,238	3.90	2.03
February					
March 15–31			19,670	3.04	1.92
April	36,810	10,935	20,244	3.13	3.49
May <sup>b</sup>	11,885	7,430	8,979	1.39	1.60
June	13,675	6,760	8,754	1.35	1.51
July <sup>c</sup>	9,525	6,625	7,323	1.13	1.30
August	9,730	6,430	7,219	1.11	1.28
September	15,590	6,430	8,190	1.26	1.41
October <sup>d</sup>	8,445	6,970	7,572	1.17	1.35
November	8,445	6,135	7,161	1.10	1.23
December	14,215	6,900	10,557	1.63	1.88

<sup>a</sup> January 8, discharge estimated.

<sup>b</sup> May 10 and 12, discharge estimated.

<sup>c</sup> July 5 and 22, discharge estimated.

<sup>d</sup> October 11, 12, and 13, discharge estimated.

DESPLAINES RIVER ABOVE THE MOUTH OF KANKAKEE RIVER NEAR  
CHANNAHON, ILL.

This station was established October 24, 1902, by E. H. Heilbron. It is located just above the mouth of the Kankakee cut-off, and 2 miles below the mouth of Dupage River, near Channahon, Ill. The gage is a plain staff graduated to feet and tenths and nailed to a tree. It is read twice daily by E. A. Hines. The measurements are taken from a cable and boat. The initial point for sounding is on the left bank. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below, and has a width of 360 feet, and maximum depth of 20 feet at ordinary stage. The flow is moderately rapid. The right bank is high and rocky, and the Illinois and Michigan Canal runs along the bank. The left bank is high, and the Kankakee cut-off enters the river just below the gaging station. The bed of the stream is gravel and silt.

Bench mark No. 1 is a nail driven into the north side of an elm tree about 2 inches in diameter, on the Illinois and Michigan Canal tow-path, 150 feet north of the Kankakee cut-off. Elevation, 81.501 feet above the Hennepin datum and 70.293 feet below the Chicago city datum. Bench mark No. 2 is a nail in the east root of an elm tree on the east bank of Desplaines River, 50 feet east of the water edge and 200 feet north of the Kankakee cut off, opposite the point where the Illinois and Michigan Canal and Desplaines River are separated. Elevation, 74.204 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established in order to determine the flow of Dupage River.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Desplaines River above mouth of Kankakee River near Channahon, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 14.....	E. H. Heilbron.....	—83.59	8,649
April 9.....	do.....	—86.61	5,483
April 26.....	do.....	—86.10	6,139
May 9.....	do.....	—86.93	5,078
July 11.....	do.....	—86.75	5,713
August 30.....	do.....	—86.75	5,753
September 26.....	do.....	—86.55	5,621
October 28.....	F. W. Hanna.....	—86.70	5,790
November 25.....	do.....	—86.95	5,138
December 17.....	E. H. Heilbron.....	—85.60	a 6,956

a Partly frozen.

*Mean daily gage height, in feet, of Desplaines River above mouth of Kankakee River near Channahon, Ill., for 1903.*

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	-80.20		-86.12	-86.95	-86.65	-87.05	-86.79	-86.84	-86.84	-86.75	-86.45
2.	-85.20		-86.30	-86.95	-86.73	-86.84	-86.88	-86.78	-86.78	-86.56	-86.50
3.	-85.18		-86.35	-86.80	-86.78	-86.82	-86.89	-86.86	-86.88	-86.81	-86.40
4.	-85.18		-86.53	-86.95	-86.70	-86.98	-86.66	-86.76	-86.67	-86.95	-83.58
5.	-85.15		-86.35	-86.95	-86.48	-87.01	-86.68	-86.83	-86.56	-86.97	-87.05
6.	-85.15		-86.02	-86.95	-86.40	-86.98	-86.97	-87.25	-86.73	-86.88	-87.12
7.			-86.05	-87.08	-86.56	-86.95	-86.37	-87.04	-86.55	-86.92	-87.12
8.			-86.33	-86.97	-86.51	-86.95	-87.07	-87.00	-86.57	-87.00	-87.12
9.			-86.62	-87.02	-86.77	-87.04	-87.04	-87.02	-86.29	-86.86	-87.12
10.	-80.65		-86.46	-86.99	-86.68	-86.88	-86.73	-86.60	-86.35	-86.88	-87.18
11.	-81.30		-86.50	-86.88	-86.68	-86.77	-86.90	-86.08	-86.44	-86.93	-87.11
12.	-81.80		-83.20	-86.89	-86.82	-86.89	-86.84	-86.68	-86.47	-86.84	-87.09
13.	-82.25		-82.80	-86.80	-86.85	-86.87	-86.93	-86.76	-86.66	-86.83	-87.12
14.	-82.72		-81.20	-87.01	-86.87	-86.83	-86.94	-86.61	-86.77	-86.98	-87.12
15.		-83.70	-80.38	-87.01	-86.80	-86.72	-86.97	-84.31	-86.57		-87.12
16.		-84.14	-80.90	-87.08	-86.84	-86.85	-87.08	-84.06	-86.69	-86.95	-87.12
17.		-84.58	-81.41	-87.25	-86.96	-86.87	-87.16	-84.86	-86.74	-86.93	-87.18
18.		-84.90	-82.15	-87.14	-86.93	-86.01	-87.25	-84.84	-86.64	-87.09	-87.11
19.		-84.92	-83.50	-87.10	-86.81	-86.35	-87.13	-85.14	-86.78	-87.05	-87.09
20.		-84.16	-83.72	-87.06	-86.91	-86.65	-86.99	-85.38	-86.69	-86.91	-87.15
21.		-82.85	-84.50	-87.05	-86.92	-86.71	-87.03	-85.66	-86.71	-87.00	
22.		-82.75	-85.00	-86.83	-86.92	-86.64	-87.16	-85.95	-86.66	-86.93	
23.		-83.21	-85.45	-86.88	-86.94	-86.11	-87.13	-86.11	-86.75	-86.98	
24.		-84.05	-85.90	-86.77	-86.90	-86.87	-86.89	-86.40	-86.81	-85.97	
25.		-84.38	-85.70	-86.84	-87.06	-86.85	-87.01	-86.66	-86.85	-86.83	
26.		-84.98	-86.10	-86.93	-86.93	-86.90	-87.03	-86.60	-86.75	-86.56	
27.		-85.20	-86.17	-86.88	-87.00	-86.81	-86.80	-86.67	-86.79	-86.90	-87.10
28.		-85.50	-86.27	-86.81	-86.98	-86.80	-86.24	-86.70	-86.80	-86.75	
29.		-85.75	-86.70	-86.74	-86.98	-86.79	-86.58	-86.75	-86.86	-86.80	
30.		-85.89	-86.82	-86.71	-87.03	-86.80	-86.82	-86.92	-86.87	-86.55	
31.		-85.98		-86.79		-87.80	-86.84		-86.79		

DESPLAINES RIVER ABOVE THE MOUTH OF JACKSON CREEK NEAR CHANNAHON, ILL.

This station was established October 23, 1902, by E. H. Heilbron. It is located just above the mouth of Jackson Creek,  $2\frac{1}{2}$  miles southwest of Millsdale, Ill. The gage is a vertical staff graduated to feet and tenths, and is read daily by Ruth Alexander. The measurements are taken from a cable and boat. The initial point for sounding is a red hub driven in the ground on the left bank near the end of the cable. The channel is straight for about 3,000 feet both above and below the station and has a width of 360 feet and a maximum depth of 16 feet at ordinary stages. Its flow is moderately rapid. Both banks of the stream are low and liable to overflow, but a few feet from the top of the banks on either side are high ridges, which never overflow. Measurements can be made at all stages. The bed of the stream is gravel.

The bench mark is the top of a red oak hub (the initial point for sounding) driven in the bluff between Jackson Creek and the south

bank of the Desplaines River. It is about 300 feet west of the west line of sec. 15, T. 37 N., R. 9 E., third principal meridian, and is on the farm owned by George Alexander. Elevation, 64.262 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum. This station was located to give the discharge of the upper Desplaines River.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Desplaines River above mouth of Jackson Creek near Channahon, Ill., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 14 .....	E. H. Heilbron .....	-80.45	8,031
April 18 .....	do .....	-82.90	4,584
April 25 .....	do .....	-82.32	6,114
May 8 .....	do .....	-83.15	5,003
July 11 .....	do .....	-82.90	5,447
August 30 .....	do .....	-82.90	5,086
September 26 .....	do .....	-82.80	5,892
October 28 .....	F. W. Hanna .....	-82.78	5,666
November 25 .....	do .....	-83.05	5,307
December 16 .....	E. H. Heilbron .....	-82.90	a 4,380

a Partly frozen.

*Mean daily gage height, in feet, of Desplaines River above mouth of Jackson Creek near Channahon, Ill., for 1903.*

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	-82.32		-82.54	-83.25	-82.83	-83.11	-82.89	-82.91	-82.99	-82.80	-82.52
2.....	-82.42		-82.55	-83.12	-82.90	-82.90	-82.95	-82.94	-82.93	-82.65	-82.36
3.....	-82.35		-82.58	-83.10	-82.98	-82.88	-82.91	-82.94	-83.03	-83.05	-82.42
4.....	-82.30		-82.80	-83.14	-82.93	-83.10	-82.71	-82.97	-82.82	-83.03	-82.36
5.....	-82.25		-82.82	-83.11	-82.80	-83.00	-82.75	-82.90	-82.70	-83.00	-82.45
6.....	-82.30		-82.65	-83.15	-82.80	-83.10	-83.18	-83.15	-82.91	-83.05	-82.50
7.....	-82.20		-82.74	-83.24	-82.93	-83.00	-83.15	-83.10	-82.87	-83.10	-82.38
8.....	-82.20		-82.91	-83.19	-82.83	-83.00	-83.23	-83.16	-82.70	-83.19	-82.39
9.....	-78.17		-83.05	-83.17	-82.85	-83.00	-83.18	-83.15	-82.58	-83.16	-82.51
10.....	-78.63		-82.74	-83.07	-82.95	-83.00	-82.90	-82.46	-82.55	-83.00	-82.54
11.....	-79.05		-81.05	-83.00	-82.83	-82.90	-82.91	-82.25	-82.57	-83.05	-83.28
12.....	-79.60		-80.94	-83.00	-82.90	-83.00	-83.03	-82.90	-82.69	-83.13	-83.31
13.....	-80.00		-80.72	-83.00	-82.95	-83.00	-82.98	-82.93	-82.78	-83.00	-83.62
14.....	-80.35		-79.25	-83.13	-82.88	-82.90	-82.95	-82.68	-82.78	-83.15	-83.28
15.....		-81.12	-79.00	-83.20	-82.85	-82.90	-83.10	-81.25	-82.79	-84.50	-81.88
16.....		-81.31	-79.30	-83.24	-82.92	-82.90	-83.23	-80.75	-82.84	-83.05	-82.05
17.....		-81.69	-79.96	-83.31	-82.94	-82.90	-83.35	-81.45	-82.95	-83.15	(a)

a Missing.

*Mean daily gage height, in feet, of Desplaines River, etc.—Continued.*

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18.....		-81.78	-80.35	-83.22	-82.92	-82.20	-83.20	-81.34	-82.87	-83.20	-82.17
19.....		-81.72	-80.95	-83.24	-82.94	-82.60	-83.20	-81.40	-82.93	-83.15	-82.79
20.....		-80.96	-81.26	-83.14	-82.94	-82.80	-83.20	-81.68	-82.86	-83.12	-81.34
21.....		-79.90	-81.72	-83.20	-83.05	-82.30	-83.13	-81.65	-82.80	-82.13	-81.70
22.....		-79.50	-81.97	-83.05	-82.90	-82.10	-83.28	-82.30	-82.84	-82.13	-81.35
23.....		-80.01	-82.10	-83.09	-83.03	-82.90	-83.02	-82.35	-82.82	-82.10	-81.72
24.....		-80.65	-82.20	-83.10	-82.98	-82.90	-83.00	-82.50	-82.99	-82.11	-81.88
25.....		-80.85	-82.25	-83.05	-83.05	-83.00	-83.04	-82.72	-82.73	-82.50	-81.86
26.....		-81.30	-82.61	-83.13	-83.00	-82.98	-83.11	-82.76	-82.85	-82.70	-81.40
27.....		-81.65	-82.65	-83.07	-83.07	-82.92	-82.93	-82.80	-82.93	-82.82	-81.40
28.....		-81.92	-82.75	-83.02	-83.15	-82.92	-82.60	-82.85	-82.82	-82.68	-81.45
29.....		-82.06	-83.20	-83.02	-83.07	-82.87	-82.65	-82.80	-82.93	-83.32	-81.30
30.....		-82.18	-83.25	-82.82	-83.10	-82.87	-83.00	-82.97	-82.88	-82.38	-81.00
31.....		-82.30		-82.89		-82.90	-83.00		-82.83		-80.56

### WABASH RIVER DRAINAGE BASIN.

The drainage basin of the Wabash embraces an area of about 33,000 square miles, distributed as follows: In Ohio, 400 square miles; in Indiana, 24,350 square miles; in Illinois, 8,250 square miles. It drains, therefore, slightly more than two-thirds of Indiana, the area of the State being 35,910 square miles. Of the portion of Indiana, about one-half is embraced in the drainage areas of the East and West White rivers. By including these drainage areas with the Wabash, the entire basin has a nearly symmetrical, broadly ovate form. Not including the White River system, the Wabash Basin is an unsymmetrical, elongated tract, curving around White River.

The length of the valley occupied by the Wabash is about 450 miles, but the length of the stream is fully 500 miles, for the river in its lower course makes several oxbow curves within the valley. The source of the river is about 1,000 feet above tide, while its mouth at low water is but 311 feet. The average fall, if we estimate the stream to have a length of 500 miles, is therefore about 16.5 inches per mile. The rate of descent is far from uniform, being much more rapid in the upper portion than in the lower. There are also many rapids, separated by pools or sluggish portions of the stream. The elevation of the stream is accurately determined at many points, but in the absence of a careful measurement of the length of the stream the rate of fall is only approximately known. The section above the point where the river enters the old lake outlet, estimated to have a length of 100 miles, has a fall of about 300 feet, or 3 feet per mile. Railway levels and canal surveys at the point where the river joins the old lake outlet show its elevation to be nearly 700 feet above sea level, the altitudes reported varying between 696 and 699 feet.

The following table gives the elevation and fall at various points in this basin:

*Table of altitudes and distances along Wabash River.*

Location.	Estimated distance.	Altitude.	Fall per mile.
	Miles.	Feet.	Feet.
Source .....	0.0	1,003.0	0.00
Huntington .....	100.0	699.0	36.03
Mouth of Salamonie River .....	15.0	667.0	25.56
Mouth of Mississinewa River .....	20.0	633.0	20.40
Logansport .....	20.0	583.0	30.00
Lafayette .....	50.0	506.0	18.48
Attica .....	25.0	487.0	9.12
Covington .....	20.0	470.0	10.20
Terre Haute .....	55.0	447.7	4.80
State line .....	14.6	440.6	5.80
Hutsonville, Ill. ....	29.0	424.6	6.60
Vincennes .....	46.4	398.8	6.60
Mouth on White River .....	32.5	376.5	8.30
Grayville, Ill. ....	28.0	365.0	5.00
Mouth of Little Wabash .....	46.0	323.0	11.00
Mouth of Wabash River .....	16.0	311.0	9.00

During 1903 the United States Geological Survey maintained stations in this basin at Logansport, Delphi, Shoals, Cataract, Terra Haute, and Lafayette, Ind. The following are the drainage areas of the several streams at these points.

*Drainage areas in Wabash River basin.*

	Sq. miles.
Wabash River at Logansport .....	3,163
Upper Eel River at Logansport .....	887
Tippecanoe River at Delphi .....	1,890
Lower Eel River at Cataract .....	255
White River (East Branch) at Shoals .....	4,900
White River (West Branch) at Indianapolis .....	1,520

## WHITE RIVER (EAST BRANCH) AT SHOALS, IND.

This station was established June 25, 1903, by A. C. Lootz. It is located at the highway bridge, in the village of Shoals, Ind., 400 feet above the Baltimore and Ohio Southwestern Railroad bridge. There are rapids just below this station and also about  $5\frac{1}{2}$  miles below. The gage is read once each day by O. H. Greist. The standard chain gage is fastened to the railing and metal posts of the downstream side of the first span on the left end of the highway bridge. The length of the chain from the end of the weight to the marker is 46.41 feet. This gage was established to take the place of the original vertical gage, which was fastened to one of the piers. Discharge measurements are made from the 3-span highway bridge to which the gage is attached. The initial point for soundings is the face of the left abut-

ment. The channel is straight above and below the station and the current is swift. The right bank is a high rocky road embankment and never overflows; the left bank is a steep rocky bluff and does not overflow. The bed of the stream is rocky, and the channel is divided into three parts by the bridge piers. Bench mark No. 1 is the stone cap on the downstream end of the first pier from the left bank. Its elevation is 100 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of White River (East Branch) at Shoals, Ind., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 22 .....	A. C. Lootz .....		<sup>a</sup> 2,000
August 4 .....	L. R. Stockman .....	65.07	3,392
September 24 .....	do .....	63.40	511

<sup>a</sup>Float measurement.

*Mean daily gage height, in feet, of White River (East Branch) at Shoals, Ind., for 1903.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		64.50	63.60	63.50	63.40	63.50	63.70
2.....		64.40	64.70	63.50	63.40	63.50	63.70
3.....		64.30	64.80	63.50	63.40	63.50	63.70
4.....		64.10	65.30	63.50	63.50	63.50	63.60
5.....		64.00	66.10	63.50	63.50	63.50	63.60
6.....		64.20	66.90	63.50	63.50	63.50	63.50
7.....		64.20	66.80	63.50	63.60	63.50	63.50
8.....		64.10	66.00	63.50	63.70	63.50	63.50
9.....		64.10	65.50	63.50	63.80	63.50	63.60
10.....		64.10	65.10	63.50	63.90	63.50	63.60
11.....		64.00	64.90	63.50	63.90	63.50	63.50
12.....		64.00	64.60	63.50	63.90	63.50	63.50
13.....		63.90	64.40	63.50	64.00	63.50	63.50
14.....		63.90	64.10	63.50	64.00	63.50	63.50
15.....		63.80	64.10	63.50	63.90	63.50	63.50
16.....		63.80	64.00	63.40	63.90	63.50	63.50
17.....		63.80	64.00	63.40	63.80	63.50	63.50
18.....		63.90	64.00	63.40	63.70	63.70	63.50
19.....		63.80	63.90	63.40	63.70	63.70	63.50
20.....		63.70	63.90	63.40	63.60	63.70	63.60
21.....		63.70	63.90	63.40	63.60	63.80	64.10
22.....		63.50	63.80	63.40	63.50	63.90	64.20
23.....		63.50	63.80	63.40	63.50	64.00	64.20
24.....		63.50	63.70	63.40	63.50	63.90	64.50
25.....		63.50	63.70	63.40	63.50	63.80	64.60
26.....		63.50	63.70	63.40	63.50	63.70	64.90
27.....	64.30	63.50	63.60	63.40	63.50	63.70	65.20
28.....	64.30	63.60	63.60	63.40	63.50	63.60	65.00
29.....	64.40	63.60	63.60	63.40	63.50	63.60	65.00
30.....	64.50	63.60	63.50	63.40	63.50	63.70	64.80
31.....		63.60	63.50		63.50		64.60



*Rating table for White River (East Branch) at Shoals, Ind., from June 22 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
63.4	510	64.7	2,600	67.0	6,970	69.6	11,910
63.5	640	64.8	2,790	67.2	7,350	69.8	12,290
63.6	770	64.9	2,980	67.4	7,730	70.0	12,670
63.7	910	65.0	3,170	67.6	8,110	70.5	13,620
63.8	1,050	65.2	3,550	67.8	8,490	71.0	14,570
63.9	1,200	65.4	3,930	68.0	8,870	71.5	15,520
64.0	1,350	65.6	4,310	68.2	9,250	72.0	16,470
64.1	1,510	65.8	4,690	68.4	9,630	72.5	17,420
64.2	1,680	66.0	5,070	68.6	10,010	73.0	18,370
64.3	1,860	66.2	5,450	68.8	10,390	73.5	19,320
64.4	2,045	66.4	5,730	69.0	10,770	74.0	20,270
64.5	2,230	66.6	6,210	69.2	11,150		
64.6	2,415	66.8	6,590	69.4	11,530		

Table made from measurements of August 4 and September 24, 1903, and January 24, 1904. Table should be accurate to limiting height in 1903.

*Estimated monthly discharge of White River (East Branch) at Shoals, Ind., for 1903.*

[Drainage area, 4,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
June 27-30	2,230	1,860	1,999	0.41	0.06
July	2,230	640	1,165	.24	.28
August	6,780	640	2,181	.45	.52
September	640	510	575	.12	.13
October	1,350	510	829	.17	.20
November	1,350	640	791	.16	.18
December	3,550	640	1,350	.28	.32

#### LOWER EEL RIVER AT CATARACT, IND.

This station was established by E. Johnson, jr., assisted by L. R. Stockman. It is located 6 miles from Cloverdale, Ind., and one-half mile southwest of Cataract, Ind. It is 300 feet above a dam below which there is a fall of 35 feet. The gage is a 3 by 6 inch oak timber, securely fastened to the west abutment on the downstream face. It is marked by brass-headed nails and reads from zero to 10 feet.

The gage is read once each day by Joe Steiner. Discharge measurements are made from the upstream side of the single-span, covered highway bridge, which has a length between abutments of 128 feet. The initial point for soundings is the face of the left or west abutment at the top of the coping on the upstream side. Distances are marked by wire nails and painted figures on the guard rail on the upstream side of the bridge. The channel is straight for about 500 feet above and 300 feet below the bridge. The current varies from swift to rather sluggish. Both banks are high and rocky and will not overflow. The bed of the stream is a smooth rock ledge, nearly level between the bridge abutments.

Bench mark No. 1 is a wire nail in the root of a small elm tree in a stone wall on the north side of the road approaching the bridge on the west side of the river about 50 feet from the bridge. Its elevation above the zero of the gage is 12.60 feet. Bench mark No. 2 is a wire nail in the root of a large oak tree in the pasture on the west side of the river 300 feet from the bridge and 20 feet from the fence which bounds the south side of the road approaching the bridge. The elevation of this bench mark is 27.20 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of lower Eel River at Cataract, Ind., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
August 6.....	E. Johnson, jr.....	2. 60	1, 479
August 12.....	do.....	1. 30	127
September 25.....	L. R. Stockman.....	1. 04	14

*Mean daily gage height, in feet, of lower Eel River at Cataract, Ind., for 1903.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	.....	1.20	1.10	1.20	1.30	17.....	1.15	1.35	1.20	1.30	1.30
2.....	.....	1.15	1.10	1.20	1.25	18.....	1.20	1.30	1.20	1.30	1.30
3.....	.....	1.15	1.10	1.20	1.30	19.....	1.10	1.30	1.15	1.30	1.40
4.....	.....	1.20	1.30	1.20	1.30	20.....	1.10	1.15	1.20	1.30	1.60
5.....	.....	1.15	1.20	1.20	1.30	21.....	1.10	1.15	1.30	1.30	1.60
6.....	2.60	1.00	1.30	1.20	1.30	22.....	1.10	1.25	1.20	1.20	1.60
7.....	2.00	1.00	2.50	1.20	1.35	23.....	1.10	1.20	1.20	1.25	1.60
8.....	1.55	1.00	2.70	1.20	1.35	24.....	1.10	1.20	1.20	1.20	1.60
9.....	1.50	1.00	2.20	1.20	1.35	25.....	1.10	1.15	1.20	1.30	1.60
10.....	1.40	1.00	2.10	1.20	1.35	26.....	1.10	1.15	1.20	1.30	1.60
11.....	1.35	1.00	1.20	1.20	1.40	27.....	1.10	1.10	1.20	1.25	1.40
12.....	1.30	1.00	1.15	1.30	1.40	28.....	1.05	1.15	1.20	1.20	1.40
13.....	1.20	1.10	1.15	1.40	1.30	29.....	1.20	1.10	1.15	1.30	1.40
14.....	1.20	1.10	1.15	1.30	1.30	30.....	1.15	1.05	1.20	1.30	1.40
15.....	1.20	1.15	1.60	1.30	1.30	31.....	1.20	.....	1.20	.....	1.40
16.....	1.15	1.30	1.30	1.30	1.30						

## WABASH RIVER AT TERRE HAUTE, IND.

The gage is located at the pump house of the Terre Haute Water-Works Company, and is read once each day by D. M. Rambarger. It is a chain gage connecting through a horizontal pipe with a float in a well and operating a pointer on a vertical gage in the pump house. Gage readings were begun August 3, 1902. The records consist of gage heights only, as no station suitable for discharge measurements has been selected in this vicinity.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Mean daily gage height, in feet, of Wabash River at Terre Haute, Ind., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.90	14.65	15.15	3.10	5.20	5.50	1.90	1.40	1.60	-0.10	-0.50	-0.40
2.....	5.60	15.25	15.70	3.55	4.80	5.00	1.60	1.00	1.80	-.10	-.60	-.40
3.....	6.20	15.65	16.05	3.45	4.75	5.50	1.60	1.00	1.80	-.05	-.60	-.40
4.....	7.90	15.80	17.30	6.70	4.11	5.80	5.60	2.10	1.50	.00	-.70	-.50
5.....	8.15	15.95	18.30	9.20	3.11	5.80	9.65	5.20	1.00	.15	-.70	-.50
6.....	8.70	15.90	18.80	10.90	3.90	5.80	8.95	3.55	1.00	.20	-.60	-.50
7.....	8.50	15.10	17.65	12.70	3.40	8.00	7.05	2.55	1.00	.30	-.60	-.50
8.....	8.95	15.11	17.30	12.75	3.10	8.55	6.00	2.00	.80	.65	-.70	-.60
9.....	8.45	15.65	16.65	11.80	2.10	9.50	4.90	1.80	.80	.80	-.70	-.60
10.....	6.45	14.60	16.70	9.95	2.10	8.80	4.00	1.70	.50	1.00	-.70	-.60
11.....	3.40	13.50	16.80	9.40	2.85	7.45	3.70	1.50	.30	1.60	-.70	-.60
12.....	3.00	14.06	16.70	.....	2.70	6.30	3.80	1.40	.10	1.80	-.60	-.60
13.....	2.45	15.50	15.65	.....	2.60	5.50	3.85	1.30	.00	1.75	-.60	-.60
14.....	2.60	15.15	15.35	.....	2.55	4.00	3.30	1.10	.00	1.60	-.60	-.60
15.....	2.50	17.05	14.85	.....	2.40	3.60	2.00	.10	.00	1.00	-.50	-.60
16.....	3.40	17.90	13.50	.....	2.30	3.00	2.00	.90	.50	.80	-.50	-.20
17.....	3.05	17.40	13.45	.....	2.30	2.60	1.10	.80	.15	.70	-.20	1.00
18.....	4.50	16.20	12.25	.....	2.10	2.40	1.10	.60	.00	.40	.10	1.40
19.....	4.70	14.25	10.15	19.10	1.11	2.00	1.80	.50	.00	.30	.20	1.90
20.....	4.60	10.30	9.50	17.65	1.10	2.00	1.70	.45	.30	.20	.20	1.90
21.....	4.00	7.95	8.70	16.15	1.80	2.20	1.80	.40	.40	.10	.20	2.80
22.....	4.10	7.15	8.10	13.55	5.60	2.20	1.10	.20	.50	.00	-.10	3.00
23.....	3.60	6.85	7.45	10.75	7.80	2.40	1.10	.20	.50	.00	.00	3.75
24.....	3.55	6.10	6.65	8.80	4.00	2.30	1.85	.00	.40	-.10	.00	3.65
25.....	3.30	6.85	5.55	7.35	4.10	2.30	1.80	-.10	.30	-.10	-.10	3.75
26.....	3.10	6.70	5.30	7.30	4.40	2.30	1.70	-.10	.30	-.20	-.10	4.15
27.....	3.40	7.80	5.05	7.05	4.75	2.30	1.50	.25	.20	-.20	-.20	4.05
28.....	5.90	13.15	4.55	6.50	5.50	2.20	1.40	.65	.10	-.30	-.30	3.10
29.....	11.50	.....	4.10	6.30	5.75	2.00	1.40	2.10	.00	-.30	-.30	3.60
30.....	14.05	.....	4.50	5.50	5.90	1.10	1.40	1.80	.00	-.40	-.40	3.60
31.....	14.30	.....	4.20	.....	5.95	.....	1.40	1.60	.....	-.50	.....	3.60

## WABASH RIVER AT LAFAYETTE, IND.

This station was established May 2, 1901, by George E. Waesche, and is carried on in connection with the Civil Engineering College of Purdue University. It is about one-half mile above Brown Street Bridge, Lafayette, Ind., and about one-fourth mile below the West

Lafayette pumping station. The gage is on the left bank and is in two parts. The lower portion is a 2 by 4 inch white-pine plank, graduated to feet and hundredths, extending down into an 18-inch sewer pipe, into which the water from the river is admitted. The upper portion of the gage is graduated to feet and tenths and is nailed to a large sycamore tree.

The measurements are made by means of a boat held in place by a wire cable. The cable is adjustable, so that it can be placed at any height above the surface of the water. The initial point for sounding is a gas-pipe plug set firmly in the west bank 25 feet east of the pole which supports the west end of the cable. The channel is straight both above and below the station, has a width of 550 feet and a maximum depth of 3 feet at ordinary stages, and is unobstructed except for a small sand bar at the mouth of a small stream which enters the river 1,500 feet above the station. The current is uniform. The banks are low and overflow at high water. The bed of the stream is a gravelly mixture, comparatively smooth, and slightly shifting. The bench mark is the head of a brass rod embedded in a block of concrete placed about 150 feet upstream from the gage. Its elevation is 515.46 feet above sea level and 14.31 feet above the zero of the gage. The gage is read by the students of Purdue University.

*Discharge measurements of Wabash River at Lafayette, Ind.*

Date.	Hydrographer.	Gage height.	Discharge.
1902.		<i>Feet.</i>	<i>Second-feet.</i>
March 22.....	G. E. Waesche.....	3.50	5,245
April 5.....	do.....	4.15	6,313
June 4.....	do.....	7.35	11,693
Do.....	do.....	7.35	12,157
July 26.....	do.....	3.12	4,089
Do.....	do.....	3.12	3,953
1903.			
April 24.....	G. E. Waesche.....	1.40	1,822
May 3.....	do.....	2.00	2,496
May 13.....	do.....	2.18	2,198
May 15.....	do.....	2.30	1,637
May 16.....	do.....	2.30	2,232
June 2.....	do.....	7.35	12,157
June 18.....	do.....	2.02	1,984
June 19.....	do.....	1.88	1,686

*Mean daily gage height, in feet, of Wabash River at Lafayette, Ind., for 1902 and 1903.*

Day.	1902.		1903.				
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1.....		3.25	4.28	13.64	17.77	3.15	3.60
2.....		4.50	4.60	11.52	18.12	3.11	3.65
3.....		6.25	5.35	10.39	16.80	3.15	.....
4.....		8.00	6.91	14.17	14.78	10.00	.....
5.....		7.70	8.67	16.40	13.05	.....	.....
6.....		6.04	8.35	14.80	13.16	.....	.....
7.....		5.20	7.39	12.30	13.00	.....	.....
8.....		4.66	6.48	10.20	12.05	.....	.....
9.....		3.92	4.87	8.60	12.52	.....	.....
10.....	2.53	3.45	4.03	7.27	13.14	.....	.....
11.....	2.75	3.56	3.53	7.94	13.62	.....	.....
12.....	3.19	3.74	3.44	13.82	12.94	.....	.....
13.....	3.33	3.85	3.28	16.05	11.53	.....	.....
14.....	3.15	3.65	5.10	15.74	9.88	.....	.....
15.....	3.08	3.75	5.42	13.98	8.52	.....	.....
16.....	3.04	4.90	5.52	10.42	7.40	.....	.....
17.....	3.18	7.70	5.38	8.22	6.72	.....	.....
18.....	4.20	9.12	4.75	6.15	6.86	.....	.....
19.....	5.68	8.35	4.48	4.93	6.78	.....	.....
20.....	5.53	7.95	4.30	4.48	6.26	.....	.....
21.....	5.80	10.70	4.27	4.70	5.74	.....	.....
22.....	4.30	14.38	3.84	5.00	5.00	.....	.....
23.....	3.82	15.46	3.79	4.83	5.00	.....	.....
24.....	3.37	14.40	3.50	4.60	4.78	.....	.....
25.....	3.07	11.75	3.19	4.44	4.44	.....	.....
26.....	2.65	9.14	3.36	4.52	4.16	4.80	.....
27.....	2.84	7.90	4.50	5.10	3.72	4.80	.....
28.....	2.81	6.65	5.75	12.43	3.28	4.41	.....
29.....	2.90	6.08	11.40	.....	3.58	3.80	.....
30.....	3.12	5.37	15.68	.....	3.74	3.60	.....
31.....	.....	4.47	15.00	.....	3.35	.....	.....

#### TIPPECANOE RIVER AT SPRINGBORO, IND.

This station was established March 14, 1903, by George E. Waesche. The station is located at the highway bridge at Springboro, Ind. The nearest railroad station is Delphi, 5 miles east of Springboro. The standard chain gage is located on the second span from the east bank, one panel length beyond the center of the span. The length of the chain from the end of the weight to the marker is 25.66 feet. The gage is read once each day by Lois Imler. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is the face of the east abutment. The channel is straight for about 1,600 feet above and about 2,000 feet below the station. Its width at ordinary stages is 350 feet, broken by two piers, and at high water is 510 feet, broken by three piers. Both banks are high and can not overflow to any considerable extent. The bed of the stream is rocky and rough; the current is swift. The bench mark is the head of an anchor bolt in the east

abutment; it is the outside anchor of the downstream truss. Its elevation above the zero of the gage is 22.25 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Tippecanoe River at Springboro, Ind., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 16.....	G. E. Waesche.....	4. 73	3, 448
May 18.....	do.....	3. 00	747
June 22.....	do.....	2. 87	662
July 17.....	E. C. Murphy.....	3. 03	892
August 14.....	E. Johnson.....	2. 75	584
September 30.....	L. R. Stockman.....	3. 05	704
November 11.....	do.....	3. 03	653
December 29.....	E. Johnson, jr.....	4. 00	<sup>a</sup> 1, 083

<sup>a</sup>Partly frozen.

*Mean daily gage height, in feet, of Tippecanoe River at Springboro, Ind., for 1903.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3.50	3.82	3.42	2.78	2.99	2.94	3.10	3.08	3.10
2.....		3.50	3.80	3.42	4.20	3.00	3.53	3.20	3.06	3.09
3.....		3.72	3.73	3.28	7.03	3.03	3.40	3.40	3.09	3.08
4.....		4.94	3.65	3.16	7.07	3.11	3.32	3.50	3.10	3.10
5.....		5.54	3.57	3.50	7.18	2.99	3.28	3.47	3.09	3.12
6.....		5.37	3.52	4.15	6.40	3.16	3.02	3.54	3.08	3.18
7.....		5.00	3.49	4.59	5.54	3.07	2.90	3.70	3.06	3.22
8.....		4.64	3.43	4.63	5.05		2.88	3.90	3.05	3.28
9.....		4.18	3.36	4.12	4.50	2.96	2.70	4.17	3.04	3.26
10.....		4.21	3.32	3.77	4.10	2.98	2.81	4.07	3.02	3.24
11.....		5.25	3.24	3.67	3.88	2.99	2.87	4.00	3.03	3.21
12.....		6.69	3.20	3.26	3.76	3.00	2.94	3.93	3.10	3.20
13.....		8.55	3.18	3.28	3.56	2.80	2.80	3.87	3.09	3.29
14.....	5.18	9.65	3.16	3.16	3.40	2.77	2.90	3.81	3.05	3.95
15.....	4.90	9.30	3.13	3.09	3.27	2.73	3.20	3.74	(a)	4.15
16.....	4.75	8.53	3.10	3.04	3.15	2.84	3.60	3.67	(a)	(b)
17.....	4.58	7.86	3.09	3.02	3.07	2.85	3.70	3.63	(a)	(b)
18.....	4.58	7.10	3.04	3.00	3.10	2.82	3.79	3.58	(a)	(b)
19.....	4.52	6.02	2.99	2.93	3.66	2.81	3.83	3.40	(a)	(b)
20.....	4.35	4.89	2.95	2.96	4.00	2.84	3.60	3.39	(a)	4.20
21.....	4.54	5.30	2.93	2.98	3.87	2.86	3.50	3.38	(a)	4.18
22.....	4.40	4.85	2.99	2.87	3.45	2.85	(c)	3.36	3.02	4.16
23.....	4.22	4.62	3.10	2.93	3.30	2.83	(c)	3.35	3.05	4.14
24.....	3.97	4.47	3.28	2.96	3.14	2.81	(c)	3.34	3.08	4.15
25.....	3.87	4.33	3.72	2.92	3.10	3.01	(c)	3.31	3.07	4.13
26.....	3.88	4.47	4.05	2.87	3.05	2.94	(c)	3.25	3.05	4.17
27.....	3.82	4.38	4.08	2.93	2.97	2.96	(c)	3.24	3.04	4.16
28.....	3.78	4.14	3.80	2.86	2.93	2.97	(c)	3.20	3.07	4.15
29.....	3.70	4.05	3.70	2.83	2.91	2.98	(c)	3.19	3.09	4.14
30.....	3.60	3.90	3.54	2.82	2.94	3.01	3.05	3.14	3.11	4.13
31.....	3.50		3.38		2.96	2.97		3.09		4.13

<sup>a</sup>Gage reader absent.

<sup>b</sup>Frozen.

<sup>c</sup>Gage stolen.

*Rating table for Tippecanoe River at Springboro, Ind., from March 14 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.7	551	4.0	1,987	5.3	4,230	7.2	7,650
2.8	611	4.1	2,151	5.4	4,410	7.4	8,010
2.9	680	4.2	2,320	5.5	4,590	7.6	8,370
3.0	758	4.3	2,490	5.6	4,770	7.8	8,730
3.1	845	4.4	2,660	5.7	4,950	8.0	9,090
3.2	940	4.5	2,830	5.8	5,130	8.5	9,990
3.3	1,043	4.6	3,000	5.9	5,310	9.0	10,890
3.4	1,154	4.7	3,170	6.0	5,490	9.5	11,790
3.5	1,273	4.8	3,345	6.2	5,850	10.0	12,690
3.6	1,400	4.9	3,520	6.4	6,210	10.5	13,590
3.7	1,535	5.0	3,695	6.6	6,570	11.0	14,490
3.8	1,678	5.1	3,870	6.8	6,930		
3.9	1,829	5.2	4,050	7.0	7,290		

*Estimated monthly discharge of Tippecanoe River at Springboro, Ind., for 1903.*

[Drainage area, 1,890 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 14-31 .....	4,050	1,273	2,399	1.27	0.85
April .....	12,060	1,273	4,582	2.43	2.71
May .....	2,151	719	1,197	.63	.73
June .....	3,085	611	1,112	.59	.66
July .....	7,650	611	2,194	1.16	1.34
August <sup>a</sup> .....	892	581	710	.38	.44
September <sup>b</sup> .....	1,753	551	962	.51	.57
October .....	2,235	845	1,326	.70	.81
November <sup>c</sup> .....	845	758	812	.43	.48
December <sup>d</sup> .....	2,320	845	1,681	.89	1.03

<sup>a</sup> August 8 estimated.

<sup>b</sup> Gage stolen. Discharge estimated September 22-30.

<sup>c</sup> November 15-21 estimated.

<sup>d</sup> December 16-19 frozen. Discharge estimated.

## WABASH RIVER AT LOGANSFORT, IND.

This station was established April 27, 1903, by George E. Waesche. It is located at the Cicott street bridge, about 1 mile from the center of the city of Logansport,  $1\frac{3}{4}$  miles from the Wabash Railroad station,  $1\frac{1}{2}$  miles from the Pennsylvania station, four blocks from the street car line, and 1,000 feet below the mouth of Eel River. The standard chain gage is placed on the second span of the bridge, at the third panel from the second pier, and is supported by the bridge pins, and is between the lower chord bars. It is reached through a trap door in the floor planks of the bridge. The distance from the end of the weight to the marker is 20.78 feet. The gage is read once each day by C. B. Woodruff. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is the back wall of the bridge seat for the north abutment. The channel is nearly straight for 1,000 feet above and for 1,500 feet below the station. The distance between abutments is 550 feet, and the channel is broken by three bridge piers. The right bank is high, and is not subject to overflow at the bridge. The left bank is submerged only at extreme high water. The bed of the stream is covered with small bowlders and is rough. The stream is shallow and the current is never sluggish. Bench mark No. 1 is the top of the north abutment, under the fourth board of the downstream sidewalk. Its elevation above gage datum is 18.814 feet. From Pennsylvania Railroad levels its elevation above sea level has been found to be 591 feet. Bench mark No. 2 is the top of the third course of masonry from the top of the north abutment. Its elevation above the zero of the gage is 15.31 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Wabash River at Logansport, Ind., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
April 27 .....	Geo. E. Waesche .....	2.50	2,367
June 8 .....	do .....	4.55	7,180
June 16 .....	do .....	(?)	1,444
July 8 .....	do .....	2.30	1,358
July 16 .....	E. C. Murphy .....	1.54	719
August 15 .....	E. Johnson, jr. ....	1.35	418
September 30 .....	L. R. Stockman .....	1.30	349
November 10 .....	do .....	1.38	452
December 28 .....	E. Johnson, jr. ....	2.75	1,285



*Mean daily gage height, in feet, of Wabash River at Logansport, Ind., for 1903.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.15	2.30	1.55	1.70	1.70	-----	-----	1.30
2.....		2.10	2.25	10.15	1.60	1.70	-----	-----	1.30
3.....			2.70	7.25	1.50	1.70	(a)	-----	1.40
4.....		2.00	2.50	4.80	1.60	1.70	-----	-----	1.50
5.....		2.00	3.25	3.65	1.60	1.70	-----	-----	1.60
6.....		1.95	4.15	3.00	1.55	1.92	-----	-----	1.70
7.....		1.90	5.50	2.55	1.55	1.72	-----	-----	1.50
8.....		1.90		2.30	1.50	1.72	-----	-----	1.45
9.....		1.90	4.30	2.15	1.45	1.70	-----	-----	1.40
10.....			3.65	2.00	1.40	1.40	(a)	1.40	1.40
11.....		1.80	3.10	1.90	1.40	1.40	-----	1.40	1.85
12.....		1.80	2.65	1.95	1.35	1.35	-----	1.40	1.85
13.....		1.80	2.40	1.90	1.35	1.35	-----	1.40	2.40
14.....		1.75	2.25	1.25	1.35	1.40	-----	1.40	2.90
15.....		1.75	2.10	1.70	1.35	1.40	-----	1.40	2.90
16.....		1.75	1.95	1.60	1.45	1.40	-----	1.50	2.90
17.....			1.85	1.60	1.40	1.40	(a)	1.50	2.70
18.....		1.70	1.80	1.75	1.40	1.40	-----	1.80	2.40
19.....		1.65	1.80	1.85	1.30	1.40	-----	1.60	2.40
20.....		1.65	1.75	1.85	1.35	(a)	-----	1.40	2.40
21.....		1.60	1.70	1.80	1.35	-----	-----	1.50	2.70
22.....		1.65	1.80	1.70	1.30	-----	-----	1.50	2.90
23.....		1.70	2.05	1.80	1.30	-----	-----	1.40	2.80
24.....		2.15	2.20	1.75	1.30	-----	(a)	1.40	2.70
25.....		2.80	2.00	1.70	1.30	-----	-----	1.40	2.70
26.....		2.70	1.85	1.70	1.30	-----	-----	1.40	2.70
27.....	2.50	3.00	1.75	1.70	1.35	-----	-----	1.40	2.80
28.....	2.40	3.60	1.70	1.60	1.90	-----	-----	1.40	2.75
29.....	2.30	3.30	1.60	1.60	2.10	-----	-----	1.40	2.68
30.....	2.20	2.85	1.60	1.65	1.90	-----	-----	1.30	2.60
31.....		2.60		1.70	1.70	-----	-----		2.53

" Observer absent.

*Rating table for Wabash River at Logansport, Ind., from April 27 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.3	380	2.6	1,990	4.8	8,100	8.0	22,780
1.4	460	2.7	2,170	5.0	8,890	8.5	25,130
1.5	550	2.8	2,360	5.2	9,720	9.0	27,480
1.6	650	2.9	2,560	5.4	10,590	9.5	29,830
1.7	750	3.0	2,770	5.6	11,500	10.0	32,100
1.8	860	3.2	3,200	5.8	12,440	10.5	34,530
1.9	980	3.4	3,670	6.0	13,380	11.0	36,880
2.0	1,100	3.6	4,180	6.2	14,320	11.5	39,230
2.1	1,230	3.8	4,740	6.4	15,260	12.0	41,580
2.2	1,370	4.0	5,340	6.6	16,200	12.5	43,930
2.3	1,510	4.2	5,970	6.8	17,140	13.0	46,280
2.4	1,660	4.4	6,640	7.0	18,080		
2.5	1,820	4.6	7,350	7.5	20,430		

*Estimated monthly discharge of Wabash River at Logansport, Ind., for 1903.*

[Drainage area, 3,163 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April 27-30 .....	1,820	1,370	1,590	0.50	0.07
May <sup>a</sup> .....	4,180	650	1,337	.42	.48
June <sup>b</sup> .....	11,040	650	2,304	.73	.81
July .....	32,885	345	2,922	.92	1.06
August .....	1,230	380	549	.17	.20
September 1-19 <sup>c</sup> .....	980	420	605	.19	.13
October <sup>c</sup> .....					
November 10-30 <sup>c</sup> .....	860	380	501	.16	.12
December .....	2,560	380	1,541	.49	.56

<sup>a</sup> 3 days estimated.

<sup>b</sup> 1 day estimated.

<sup>c</sup> Observer left.

#### UPPER EEL RIVER AT LOGANSFORT, IND.

This station was established April 27, 1903, by George E. Waesche. It was located at Uhl's milldam, in the city of Logansport, just above the junction of the Eel and Wabash rivers. The dam is suitable for determining the discharge, considering it as a weir, but it is also necessary to compute the flow through the mill turbines by keeping a record of the head and gate openings under which the wheels are operated. The depth of water on the crest of the dam was recorded from April 27 to September 19, from November 10 to December 12, and from December 20 to 31, 1903. An accurate record of the amount of water passing through the turbines could not be obtained, and the station was discontinued for this reason. The amount of water passing over the crest of the dam was not computed, as the other records were lacking.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

#### MISCELLANEOUS MEASUREMENTS IN WABASH RIVER DRAINAGE BASIN.

*Discharge measurements of White (West Branch) River at Indianapolis, Ind., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 13 .....	George E. Waesche .....		1,444
August 14 .....	E. Johnson, jr. ....	3.60	279
September 26 .....	L. R. Stockman .....	3.20	171

## MUSKINGUM RIVER DRAINAGE BASIN.

Muskingum River is formed by the junction of Walhonding and Tuscarawas rivers in the east-central part of Ohio, flows south, and enters Ohio River at Marietta, Ohio. In this drainage basin the United States Geological Survey has two stations—one on Jonathan Creek, at Powells, Ohio, and the other on Licking River, at Pleasant Valley, Ohio. These two streams enter the main river near Zanesville.

## JONATHAN CREEK AT POWELLS, OHIO.

Jonathan Creek flows into Muskingum River a short distance below Zanesville, Ohio.

The gaging station at Powells was established November 15, 1902, by Benjamin H. Flynn, and was discontinued July 20, 1903. It was located on the railroad bridge, one-fourth of a mile north of the railroad station. The gage is a plain staff graduated to feet and tenths. The channel is straight both above and below the station. The river is confined to its channel by the railroad embankments. The bed of the stream is rocky. Low-water discharge measurements are made by wading; high-water measurements, from the bridge. The bench mark is a cut on the downstream side of the wing wall of the left abutment; elevation, 7 feet above the zero of the gage. The drainage area at this point is 189 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Jonathan Creek near Powells, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 12	E. Johnson, jr.	2.45	899
June 25	R. W. Pratt	.90	34

*Mean daily gage height, in feet, of Jonathan Creek near Powells, Ohio, for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	June.	July.
1	7.05	1.90	5.90	1.30		0.80	17	1.20	2.60	2.90	2.10		0.75
2	1.15	2.30	2.40	1.30		.80	18	1.90	2.10	1.90	1.80		.80
3	7.00	1.80	2.30	1.75		.90	19	1.50	1.90	1.75			.75
4	3.00	1.10	2.00	1.70		.80	20	1.40	1.70	1.60			.70
5	2.00	2.90	2.30	1.20		.80	21	1.75	1.70	1.30		1.20	.75
6	1.70	1.90	2.00	1.20		.90	22	1.50	1.60	1.80		.90	.90
7	1.40	1.80	1.90	1.20		.80	23	1.35	1.40	1.70		1.00	.90
8	1.20	1.90	6.10	1.50		.80	24	1.20	1.70	1.60		.90	.90
9	1.20	1.70	3.90	2.70		.80	25	1.05	1.70	1.40		.90	.90
10	1.30	1.40	2.60	1.80		.75	26	1.00	1.60	1.30		.90	
11	1.60	1.50	6.30	1.60		.80	27	1.80	1.85	1.25		.85	
12	1.80	2.10	2.60	2.70		.80	28	4.20	12.00	1.20		.90	
13	1.90	1.70	2.30	2.70		.80	29	3.00		1.10		.90	
14	2.30	1.60	1.90	3.90		.80	30	3.00		1.05		.90	
15	2.00	1.80	1.80	2.20		.80	31	1.60		1.60			
16	1.50	6.10	1.70	2.90		.80							

## LICKING RIVER AT PLEASANT VALLEY, OHIO.

Licking River flows into the Muskingum at Zanesville.

The gaging station at Pleasant Valley was established November 14, 1902, by Benjamin H. Flynn. It is located at the highway bridge, 300 feet north of the railroad station at Pleasant Valley, Ohio. The lower part of the gage is inclined and spiked to a post driven into the bank. The upper part is vertical and spiked to a tree. It is graduated to read direct to feet and tenths. The channel is straight for 200 feet above and 300 feet below the station. The banks are high and not liable to overflow, except in extreme floods. The bed of the stream is gravel and clay. The low-water measurements are made by wading and the high-water measurements from the highway bridge.

There are three bench marks. The first is a copper nail on the gage tree; elevation, 13 feet above the zero of the gage. The second is three copper nails on a walnut tree 200 feet west of the gage; elevation, 15, 16, and 17 feet above the zero of the gage. The third consists of four copper nails on a telephone pole north of the tree; elevation, 13, 14, 15, and 16 feet above the zero of the gage. The initial point for soundings is a cross on the top stone of the downstream side of the right abutment of the highway bridge.

The drainage area at Pleasant Valley is 696 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Licking River at Pleasant Valley, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	Second-feet.
March 13 .....	E. Johnson, jr .....	6.50	2,618
June 25 .....	R. W. Pratt .....	1.75	147
October 3 .....	do .....	1.25	76
November 30 .....	do .....	1.27	72

*Mean daily gage height, in feet, of Licking River at Pleasant Valley, Ohio, for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.50	6.40	14.50	3.20	2.60	2.10	2.00	1.40	1.30	1.20	1.20	1.30
2.....	2.50	5.20	8.60	3.00	2.60	2.10	2.00	1.40	1.30	1.20	1.20	1.30
3.....	2.60	6.60	5.90	3.00	2.70	2.00	1.90	1.40	1.30	1.20	1.20	1.20
4.....	12.10	12.10	5.10	3.70	2.60	2.00	1.70	1.40	1.30	1.20	1.20	1.20
5.....	8.20	12.00	5.00	3.90	2.60	1.90	1.60	1.40	1.30	1.20	1.20	1.20
6.....	6.20	5.80	5.40	3.50	2.50	1.90	1.70	1.40	1.30	1.20	1.20	1.20
7.....	5.50	4.70	5.50	3.90	2.40	2.00	1.70	1.40	1.30	1.20	1.20	1.20
8.....	5.00	4.80	13.35	3.10	2.30	2.10	1.60	1.40	1.20	1.40	1.20	1.20

*Mean daily gage height, in feet, of Licking River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9.....	4.70	4.70	14.10	5.50	2.20	2.10	1.60	1.40	1.20	1.60	1.20	1.30
10.....	4.50	4.20	9.00	4.70	2.20	2.00	1.80	1.40	1.20	1.50	1.20	1.30
11.....	6.40	3.80	13.10	3.90	2.20	2.00	2.20	1.40	1.20	1.40	1.20	1.30
12.....	5.50	6.00	10.10	4.80	2.10	2.00	2.10	1.40	1.30	1.30	1.20	1.30
13.....	5.40	5.00	6.60	7.00	2.10	2.10	1.90	1.40	1.30	1.30	1.30	1.30
14.....	5.20	4.10	5.60	10.00	2.00	2.00	1.70	1.30	1.30	1.30	1.40	1.30
15.....	5.00	4.00	5.00	8.20	2.00	2.00	1.70	1.30	1.20	1.20	1.40	1.30
16.....	4.60	9.00	4.60	7.90	2.00	1.90	1.60	1.30	1.20	1.20	1.80	1.30
17.....	4.30	7.20	5.10	6.80	2.00	1.80	1.60	1.30	1.20	1.20	1.90	1.30
18.....	4.50	5.70	5.40	5.10	2.00	1.80	1.60	1.30	1.20	1.20	1.90	1.30
19.....	3.70	4.50	4.70	4.40	2.00	1.80	1.60	1.30	1.20	1.20	1.80	1.30
20.....	3.20	4.00	4.20	4.10	1.90	1.90	1.50	1.30	1.20	1.20	1.80	4.90
21.....	3.80	3.80	5.10	3.70	1.90	2.00	1.50	1.30	1.20	1.20	1.70	4.70
22.....	3.90	3.30	4.70	3.80	1.90	2.00	1.50	1.30	1.20	1.20	1.60	4.20
23.....	3.60	3.00	4.20	3.60	2.10	2.00	1.50	1.30	1.20	1.20	1.60	3.80
24.....	2.80	3.30	3.90	3.20	2.20	1.90	1.50	1.30	1.20	1.20	1.50	3.60
25.....	2.70	3.40	3.70	3.10	2.20	1.80	1.40	1.30	1.20	1.20	1.50	3.50
26.....	2.60	3.50	3.50	3.20	2.90	1.70	1.40	1.30	1.20	1.20	1.50	3.40
27.....	3.00	3.90	3.30	3.60	3.30	1.70	1.40	1.30	1.20	1.20	1.50	3.30
28.....	7.20	14.00	3.20	2.90	3.30	1.70	1.40	1.30	1.20	1.20	1.40	3.20
29.....	10.60	-----	3.10	2.80	3.20	2.30	1.40	1.30	1.20	1.20	1.40	3.10
30.....	10.80	-----	3.00	2.70	2.40	2.20	1.40	1.30	1.20	1.20	1.30	3.00
31.....	7.60	-----	3.30	-----	2.30	-----	1.40	1.30	-----	1.20	-----	2.90

*Rating table for Licking River at Pleasant Valley, Ohio, from November 14, 1902, to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.2	72	2.5	375	3.8	935	5.1	1,660
1.3	77	2.6	412	3.9	985	5.2	1,725
1.4	86	2.7	450	4.0	1,035	5.3	1,790
1.5	99	2.8	490	4.1	1,085	5.4	1,855
1.6	116	2.9	530	4.2	1,140	5.5	1,920
1.7	136	3.0	570	4.3	1,195	5.6	1,985
1.8	159	3.1	610	4.4	1,250	5.7	2,050
1.9	184	3.2	655	4.5	1,305	5.8	2,120
2.0	211	3.3	700	4.6	1,360	5.9	2,190
2.1	240	3.4	745	4.7	1,420	6.0	2,260
2.2	271	3.5	790	4.8	1,480	6.1	2,330
2.3	304	3.6	835	4.9	1,540		
2.4	339	3.7	885	5.0	1,600		

Tangent at 6 feet. Differences above this point, 70 per tenth.

*Estimated monthly discharge of Licking River at Pleasant Valley, Ohio.*

[Drainage area, 696 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
November 14-30 .....	885	99	342	0.49	3.10
December .....	6,040	304	1,220	1.75	2.02
1903.					
January .....	6,530	375	1,839	2.64	3.04
February .....	7,860	570	2,127	3.06	3.18
March .....	8,210	570	2,496	3.58	4.13
April .....	5,060	450	1,347	1.94	2.16
May .....	700	184	330	.47	.54
June .....	304	136	202	.29	.32
July .....	271	86	131	.19	.22
August .....	86	77	81	.12	.14
September .....	77	72	74	.11	.12
October .....	116	72	76	.11	.13
November .....	184	72	99	.14	.16
December .....	1,540	72	384	.55	.63
The year .....	8,210	72	766	1.10	14.77

### LITTLE MIAMI RIVER DRAINAGE BASIN.

Little Miami River rises in the southeastern part of Clark County, flows southwest through Greene and Warren counties, and enters the Ohio River just above Cincinnati. The greater part of the drainage area lies to the east, as there is only a narrow piece of country between this and the Miami River. The Little Miami is the best power river in the State. The United States Geological Survey maintained a station on the Little Miami at Morrow in 1903, where its drainage area is 951 square miles. This station was discontinued owing to the location, which proved unsuitable at low water.

### LITTLE MIAMI RIVER NEAR MORROW, OHIO.

The station was established May 29, 1903, by R. Winthrop Pratt, and was discontinued July 27, 1903. It was located at Stubb's mills, 2 miles west of the railroad station at Morrow, at the highway bridge, 500 feet west of the mouth of Todds Fork. The gage consists of a

1 by 6 inch pine board 14 feet long on the downstream side of north abutment. The gage was read twice a day by T. J. Buchanan. Discharge measurements were made from the two-span covered bridge, which is about 225 feet in length between abutments. The initial point for soundings is a cut in the bridge rail on the downstream side, approximately over the face of the north abutment. Underneath it is painted "O U. S. G. S." The channel is straight for about 500 feet above and below the station. Both banks are high, but overflow at flood stages. The channel is divided by the center pier, and at low stages the current is sluggish with a slight reverse current on the south side of the river. The bench mark is an iron spike driven into the west side of the north abutment, about 2 feet from the south face and about 5 feet below the lowest bridge timber. Its elevation is 9 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following discharge measurement was made by R. W. Pratt in 1903:

July 6: Gage height, 2.00 feet; discharge, 170 second-feet.

*Mean daily gage height, in feet, of Little Miami River near Morrow, Ohio, for 1903.*

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1.....	3.10	2.60	1.60	1.30	17.....	5.30	3.20	1.55	.....
2.....	4.90	3.80	1.35	1.20	18.....	4.20	2.70	1.45	.....
3.....	5.70	4.70	1.50	1.15	19.....	3.50	2.55	1.40	.....
4.....	5.10	4.10	6.00	1.00	20.....	2.50	2.10	1.30	.....
5.....	3.10	3.40	4.15	1.05	21.....	2.40	3.30	1.40	.....
6.....	4.90	3.30	4.40	1.00	22.....	3.00	3.40	2.45	.....
7.....	5.70	2.90	4.85	1.00	23.....	4.00	3.20	1.55	.....
8.....	5.10	2.60	3.60	1.10	24.....	3.80	2.70	1.45	.....
9.....	4.70	3.80	3.80	1.00	25.....	3.90	2.20	1.30	.....
10.....	5.60	3.50	2.65	1.30	26.....	4.70	1.90	1.65	.....
11.....	5.90	3.30	2.15	1.15	27.....	3.20	1.55	2.05	.....
12.....	5.45	3.45	1.90	.....	28.....	2.80	2.25	1.70	.....
13.....	4.40	2.75	1.70	.....	29.....	2.50	3.40	1.55	.....
14.....	3.80	2.50	1.55	.....	30.....	2.60	2.20	1.40	.....
15.....	3.85	2.10	1.55	.....	31.....	.....	1.90	.....	.....
16.....	5.90	2.85	1.95	.....					

#### MISCELLANEOUS MEASUREMENTS IN LITTLE MIAMI RIVER DRAINAGE BASIN.

A measurement was made July 31, 1903, of the Little Miami River at Loveland, Ohio, by R. W. Pratt. The discharge was 105 second-feet. Water surface 21.3 feet below top of floor plank 10 feet west of intersection of top chord and floor, upstream side.

## SCIOTO RIVER DRAINAGE BASIN.

Scioto River rises in the eastern part of Auglaize County, Ohio, flows east for about 40 miles and then almost due south, entering the Ohio at Portsmouth. Below Columbus, where it is joined by the Olentangy, it is one of the largest and most important streams in the State. The United States Geological Survey maintained stations on both Scioto and Olentangy rivers at Columbus for the purpose of studying the water supply and sewage disposal of that city. The river has considerable fall and flows through a hilly basin, forming numerous good locations for water-power developments. Its drainage area at Columbus is 1,051 square miles.

## SCIOTO RIVER AT COLUMBUS, OHIO.

This station was originally established for the State board of health by B. F. Flynn, on the Grand View Avenue Bridge, 3 miles northwest of Columbus post-office, and was reestablished on the same bridge by R. W. Pratt, on November 21, 1903. This bridge is a two-span iron highway bridge, 250 feet between abutments. The initial point is the face of the easterly abutment on the downstream side, and the bridge is marked every 10 feet with double nails. The main channel is straight for about 100 feet above and 200 feet below, and there is a small island 150 feet above, which causes a side channel to enter the main channel at this point. The banks are high and only overflow in extreme floods. At low water the river is sluggish, but can be waded at several points below the bridge, where good measurements can be obtained. The following bench marks have been established:

Bench mark No. 1 is the upper side of the upper angle iron forming the lowest part of the hand rail above a point 1 foot east of the pulley. This point is 34.02 feet above the zero of the gage. Bench mark No. 2 is the extreme northeast corner of the north stone of the parapet wall of the east abutment. The elevation of this bench mark is 34.32 feet above the zero of the gage. Bench mark No. 3 is a nail in a telegraph pole 10 feet east of the east abutment at the north side. The elevation of this bench mark is 34.95 feet above the zero of the gage. The gage established by Mr. Pratt has its zero at the same elevation as the gage which was established by Mr. Flynn.

*Discharge measurements of Scioto River at Columbus, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
August 6.....	E. C. Murphy.....	9.40	32
November 21.....	R. W. Pratt.....	9.37	83



*Mean daily gage height, in feet, of Scioto River at Columbus, Ohio, for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Oct.	Nov.	Dec.
1.....	11.00	14.50	20.50	10.55	10.20	-----	9.00	9.20
2.....	11.20	14.05	17.85	10.45	10.15	-----	9.10	9.20
3.....	13.70	14.25	16.20	10.50	10.10	-----	9.10	9.20
4.....	13.60	18.00	14.65	13.15	10.00	-----	9.00	9.20
5.....	13.65	16.70	13.70	14.95	10.00	-----	9.15	9.20
6.....	12.95	15.10	12.90	14.35	9.95	-----	9.20	9.20
7.....	12.65	14.30	14.50	13.55	9.90	-----	9.00	9.10
8.....	12.40	13.70	17.00	12.85	9.90	9.45	9.00	9.10
9.....	12.05	13.25	16.70	12.40	9.80	9.50	9.00	9.10
10.....	12.30	12.70	16.95	11.75	9.80	9.25	9.15	9.10
11.....	11.75	12.35	17.25	11.30	9.70	9.35	9.20	9.20
12.....	11.60	12.90	15.55	11.55	9.70	9.25	9.15	9.10
13.....	11.55	13.50	14.35	12.50	9.65	9.25	9.05	9.20
14.....	11.40	13.15	13.45	14.45	9.60	9.20	9.20	9.20
15.....	11.40	13.80	12.90	14.40	9.55	9.25	9.20	9.20
16.....	11.35	13.40	12.75	13.70	9.50	9.20	9.20	9.20
17.....	11.10	12.25	13.65	13.35	9.50	9.20	9.60	9.20
18.....	10.80	12.70	12.85	12.45	9.50	9.10	9.70	9.20
19.....	10.80	13.20	12.30	11.75	9.50	9.10	9.50	11.60
20.....	10.80	13.00	11.95	11.30	9.50	9.10	9.40	11.40
21.....	10.80	12.45	13.05	10.95	9.50	9.10	9.40	11.15
22.....	10.60	12.00	12.60	10.75	9.50	9.10	9.30	11.50
23.....	10.55	11.25	11.95	10.55	9.50	9.00	9.20	10.10
24.....	10.40	11.05	11.40	10.50	9.55	9.00	9.20	10.30
25.....	10.45	10.95	11.15	10.40	9.70	9.00	9.20	10.10
26.....	10.50	11.10	11.05	10.40	9.80	9.10	9.20	10.25
27.....	10.50	12.95	10.85	10.40	9.75	9.10	9.20	10.25
28.....	12.10	19.85	10.65	10.40	9.95	9.10	9.10	10.10
29.....	15.50	-----	10.60	10.40	9.95	9.00	9.10	10.00
30.....	16.60	-----	10.60	10.30	9.85	9.00	9.10	10.00
31.....	15.45	-----	10.60	-----	-----	9.00	-----	9.85

#### OLENTANGY RIVER AT COLUMBUS, OHIO.

This station was established October 7, 1903, by R. Winthrop Pratt, in connection with the water supply and sewage disposal investigations of the city of Columbus. It is located 4 miles north of the Columbus, Ohio, post-office and one-fourth mile west of North High street at the Doddridge Street Bridge. The original station at Fifth Avenue Bridge, established by H. A. Pressey November 22, 1898, was abandoned August 18, 1903, on account of the sluggish flow and poor distribution of velocity. The boxed chain gage is bolted to the hand rail of the bridge on the upstream side. The observer is A. D. Winegardner. Discharge measurements are made from the two-span highway bridge and by wading below the bridge. The initial point for soundings is the east face of the west parapet wall. The channel is straight for 300 feet above and 500 feet below the station. The banks overflow only at high stages. The bed of the stream is of sand and clay. The drainage area at the station is 520 square miles.

Bench mark No. 1 is the northwest corner of the top stone of the north wing of the west abutment. Its elevation is 34.99 feet above gage datum. Bench mark No. 2 is a cut in the top of the hand rail

over the gage 31 feet from the initial point for soundings. Its elevation is 39.89 feet above the zero of the gage. Bench mark No. 3 is the center pin of the west end of the north truss; its elevation is 39.60 feet above the zero of the gage. The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Olentangy River at Doddridge Street Bridge, Columbus, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
October 7 .....	R. Winthrop Pratt .....	6.20	13
November 21 .....	do .....	6.56	51
December 23 .....	do .....	7.00	211

*Mean daily gage height, in feet, of Olentangy River at Fifth avenue, Columbus, Ohio, for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1 .....	2.20	3.50	9.05	1.80	1.70	17 .....	2.40	3.20	2.60	2.90	1.40
2 .....	2.20	2.85	6.05	1.80	1.70	18 .....	2.40	3.20	2.75	2.35	1.40
3 .....	4.35	4.00	3.35	1.90	1.70	19 .....	2.40	3.20	2.35	2.10	1.40
4 .....	5.35	7.40	3.05	4.50	1.70	20 .....	2.40	3.20	2.60	2.05	1.40
5 .....	4.20	6.00	2.85	4.20	1.70	21 .....	2.40	3.20	3.25	1.90	1.40
6 .....	3.80	4.30	3.15	3.40	1.70	22 .....	2.40	3.20	3.05	1.80	1.40
7 .....	2.40	2.65	3.45	2.50	1.70	23 .....	2.40	3.20	2.50	1.80	1.40
8 .....	2.40	2.50	5.80	2.45	1.70	24 .....	2.40	3.20	2.35	1.80	1.40
9 .....	2.40	2.75	5.20	2.60	1.60	25 .....	2.40	3.20	2.25	1.80	1.50
10 .....	2.40	2.40	5.80	2.35	1.50	26 .....	2.40	3.20	2.10	1.80	1.55
11 .....	2.40	2.40	5.60	2.10	1.50	27 .....	2.40	3.85	1.95	1.80	1.80
12 .....	2.40	3.40	5.10	2.55	1.50	28 .....	3.05	8.70	1.85	1.90	1.95
13 .....	2.40	3.25	3.65	2.90	1.50	29 .....	7.60	-----	1.80	1.75	2.00
14 .....	2.40	2.80	2.75	4.65	1.50	30 .....	5.60	-----	1.75	1.70	1.75
15 .....	2.40	2.75	2.40	5.05	1.50	31 .....	4.20	-----	1.80	-----	-----
16 .....	2.40	3.10	2.30	3.75	1.50						

*Mean daily gage height, in feet, of Olentangy River at Doddridge street, Columbus, Ohio, for 1903.*

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1 .....	6.10	6.10	6.30	12 .....	6.30	6.20	6.20	23 .....	6.20	6.50	7.00
2 .....	6.15	6.15	6.30	13 .....	6.50	6.20	6.30	24 .....	6.20	6.40	7.00
3 .....	6.20	6.20	6.30	14 .....	6.50	6.20	6.20	25 .....	6.20	6.40	7.20
4 .....	6.20	6.20	6.30	15 .....	6.30	6.20	6.10	26 .....	6.20	6.50	7.00
5 .....	6.20	6.20	6.30	16 .....	6.35	6.20	6.20	27 .....	6.20	6.30	7.80
6 .....	6.20	6.20	6.20	17 .....	6.40	6.30	6.20	28 .....	6.25	6.30	6.10
7 .....	6.20	6.20	6.20	18 .....	6.40	7.00	6.20	29 .....	6.20	6.30	6.70
8 .....	6.20	6.20	6.20	19 .....	6.30	6.70	6.20	30 .....	6.20	6.30	6.60
9 .....	6.40	6.10	6.20	20 .....	6.30	6.60	8.10	31 .....	6.10	-----	6.50
10 .....	6.40	6.20	6.20	21 .....	6.30	6.40	7.30				
11 .....	6.30	6.10	6.20	22 .....	6.20	6.30	7.20				

## McMAHON RIVER DRAINAGE BASIN.

McMahon River rises in the eastern part of Harrison County, Ohio, flows southeast, and in a short course of about 20 miles joins the Ohio at Bellaire. This stream flows through a rough country, and, though small, is of interest as a possible water supply for the city of Bellaire.

During part of 1903 the United States Geological Survey maintained a station at Steel, where its drainage area is 82 square miles.

## McMAHON RIVER AT STEEL, OHIO.

This station is located on the single 88-foot span railroad bridge on the main line of the Baltimore and Ohio Railroad 200 feet west of the station at St. Clairsville Junction, and was established by R. W. Pratt June 24, 1903.

A short distance below this bridge water is pumped for use of the railroad and the gage is placed in their well. At low water this stream is measured some distance below the bridge by wading. At the bridge the stream is prevented from overflowing by railroad embankments on both sides, and the bottom is fairly constant. This stream was found to have such a small discharge during the dry months that it did not warrant the expense incurred in carrying it on, and it was discontinued.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of McMahon River at Steel, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 24 .....	R. W. Pratt .....	4.20	65
March 11 .....	E. Johnson, jr. ....	5.50	525

*Mean daily gage height, in feet, of McMahon River at Steel, Ohio, for 1903.*

Day.	June. July.	Day.	June. July.	Day.	June. July.	Day.	June. July.
1 .....	3.80	9 .....	3.70	17 .....	3.60	25 .....	4.05 3.60
2 .....	3.80	10 .....	3.70	18 .....	3.60	26 .....	3.80 .....
3 .....	3.70	11 .....	3.80	19 .....	3.60	27 .....	3.65 .....
4 .....	3.70	12 .....	3.60	20 .....	3.70	28 .....	3.80 .....
5 .....	3.70	13 .....	3.10	21 .....	3.70	29 .....	3.90 .....
6 .....	4.15	14 .....	3.80	22 .....	3.80	30 .....	3.70 .....
7 .....	3.80	15 .....	3.80	23 .....	3.60	31 .....	.....
8 .....	3.75	16 .....	3.70	24 .....	3.60		

## CROSS CREEK DRAINAGE BASIN.

Cross Creek rises in the northeastern corner of Harrison County and flows east and joins Ohio River a few miles south of Steubenville, Ohio. This stream flows near the city of Steubenville and through

Mingo Junction, an important industrial settlement, and the measurements of its flow are of importance in determining the available water supply for these municipalities. This river drains a territory of 129 square miles.

CROSS CREEK NEAR MINGO JUNCTION, OHIO.

This station was established May 22, 1903, by R. Winthrop Pratt. It was discontinued September 23, 1903, on account of sluggish flow and poorly distributed velocity. It was located at the Pennsylvania Railroad bridge, a stone arch bridge  $1\frac{1}{2}$  miles west of Mingo Junction railroad station. The gage was a 1 by 6 inch pine board, spiked to the first pier at the east end of the bridge. The gage was read once each day by George Mayberry. Discharge measurements can be made from the railroad bridge or by wading at low water. The initial point for soundings is the downstream corner at the west end of stone bridge. The bed of the stream consists of gravel and small rocks, and probably changes during floods. The bench mark is a cut on the northeast corner of the east pier. Its elevation is 4.00 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Cross Creek near Mingo Junction, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
June 24 .....	R. W. Pratt .....	2.35	233
August 11 .....	do .....	1.20	10

*Mean daily gage height, in feet, of Cross Creek near Mingo Junction, Ohio, for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1 .....		1.40	1.50	1.20	1.10	17 .....		1.45	1.30	1.05	1.00
2 .....		1.35	1.50	1.20	1.10	18 .....		1.45	1.50	1.05	1.00
3 .....		1.35	1.50	1.20	1.10	19 .....		1.45	1.80	1.00	.95
4 .....		1.30	1.40	1.20	1.05	20 .....		1.93	1.60	1.00	.95
5 .....		1.30	1.80	1.10	1.05	21 .....		1.90	1.50	1.00	.95
6 .....		1.40	1.50	1.10	1.00	22 .....	1.40	1.75	1.40	1.00	.95
7 .....		1.45	1.40	1.30	1.00	23 .....	2.30	4.25	1.30	1.00	.95
8 .....		2.10	1.40	1.30	1.00	24 .....	1.70	2.40	1.30	1.00	.95
9 .....		1.50	1.30	1.25	1.00	25 .....	1.60	2.10	1.20	.95	.95
10 .....		1.40	1.30	1.25	1.00	26 .....	1.55	1.80	1.20	1.00	.95
11 .....		1.35	1.50	1.20	1.15	27 .....	1.55	1.75	1.20	1.05	.95
12 .....		1.30	1.50	1.20	1.10	28 .....	1.45	1.70	1.20	1.20	.90
13 .....		1.65	1.45	1.20	1.10	29 .....	1.40	1.65	1.20	1.60	.90
14 .....		2.00	1.40	1.10	1.05	30 .....	1.40	1.60	1.30	1.30	.90
15 .....		1.75	1.40	1.10	1.00	31 .....	1.40		1.30	1.20	
16 .....		1.55	1.40	1.05	1.00						

**MAHONING RIVER DRAINAGE BASIN.**

Mahoning River rises in the northwestern part of Columbiana County, Ohio, flows north, then turns southeast, entering Ohio River at Beaver, in Beaver County, Pa. This river flows through a hilly and important territory. There are numerous water-power developments on it, and it forms an important adjunct in the water supply and sewage disposal of numerous towns along its course. Among them is Youngstown, Ohio, where the United States Geological Survey station is maintained. Its drainage area at Youngstown is 958 square miles.

**MAHONING RIVER AT YOUNGSTOWN, OHIO.**

This station was established May 23, 1903, by R. Winthrop Pratt, and is located about 2 miles below the center of the city of Youngstown, at the highway bridge near the plant of the Hazelton Steel Company. The vertical gage, consisting of a 1-inch by 6-inch board nailed to stakes driven in the river bed 15 feet from the east abutment, was used up to September 23, 1903, at which time a standard chain gage was installed. The gage is read once each day by John McVean. Discharge measurements are made from the single-span highway bridge, to which the gage is attached. The initial point for soundings is the face of the parapet wall of the east abutment on the upstream side. The channel is straight for about 2,000 feet above and 1,000 feet below the bridge and is 200 feet wide between abutments. Both banks are high and are subject to overflow only at high water. The section is fairly regular and the bed of the stream is composed of gravel and small boulders, probably not subject to change.

Bench mark No. 1 is the top of the copper plate on the face of the east abutment near the upstream corner. It is 9.37 feet above gage datum. Bench mark No. 2 is the northwest corner of the bridge seat of the west abutment. It is 17.12 feet above gage datum. Bench mark No. 3 is a cut in the end stone of the second tier from the top of the north wing wall of the west abutment. It is 21.34 feet above gage datum. Bench mark No. 4 is a cut in the top hand rail at a point 35 feet from the east abutment on the upstream side. It is 25.88 feet above gage datum. The elevation of the center of the pulley on which the chain of the gage runs is 23.61 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

*Discharge measurements of Mahoning River at Youngstown, Ohio, in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 9	E. Johnson	10.80	14,095
July 16	R. W. Pratt	.65	151
August 7	E. C. Murphy	.90	216
September 23	R. W. Pratt	.62	149
October 27	do	.77	167
November 24	do	1.10	295
December 16	do	1.00	262

*Mean daily gage height, in feet, of Mahoning River at Youngstown, Ohio, for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		0.70	1.20	1.80	3.15	0.45	0.60	0.90
2.		.85	1.15	1.50	2.75	.55	.65	.90
3.		.70	1.00	1.50	2.30	.60	.70	.85
4.		.70	1.00	1.40	1.85	.50	.65	.75
5.		.70	.95	.90	1.35	.55	.95	.70
6.		.65	.80	1.00	1.20	.60	.75	.75
7.		.75	.70	.70	1.05	.45	.70	.85
8.		1.15	.75	1.10	1.00	1.50	.50	.75
9.		1.35	.70	.90	1.10	2.45	.65	.75
10.		1.15	.70	.70	1.20	2.25	.80	.90
11.		1.00	.70	.80	1.40	1.80	.75	.95
12.		.80	.50	.80	1.40	1.55	.70	.80
13.		.80	.60	.70	1.30	1.55	.75	.80
14.		1.10	.70	.70	1.10	1.35	.85	.75
15.		1.35	.60	.70	1.10	1.10	.70	.90
16.		1.35	.60	.70	.90	1.05	.75	.90
17.		1.00	.60	.60	.90	.85	2.35	.80
18.		1.00	1.30	.60	.80	.80	3.60	.70
19.		.90	1.00	.60	.70	.75	2.90	.90
20.		.85	1.70	.50	.70	.90	2.15	.90
21.		.60	1.90	.40	.70	.85	1.50	1.40
22.		.65	2.00	.40	.60	.85	1.10	2.65
23.		1.55	2.20	.30	.65	.85	1.15	2.05
24.	0.75	1.65	1.80	.30	.65	.80	1.05	1.85
25.	.80	1.55	1.40	.40	.65	.80	1.00	1.60
26.	.95	1.20	1.10	.40	.35	.75	1.05	1.50
27.	.80	1.00	.90	.70	.40	.75	1.00	1.40
28.	.80	.95	.70	6.70	.50	.65	.95	1.30
29.	.70	1.00	.70	8.00	.40	.65	1.00	1.15
30.	.70	1.10	1.00	6.30	.40	.45	.95	1.05
31.	.60		2.00	4.40		.50		1.00

## ALLEGHENY RIVER DRAINAGE BASIN.

Allegheny River rises in Potter County, Pa., and unites with Monongahela River at Pittsburgh to form the Ohio. Its sources are adjacent to those of Susquehanna and Genesee rivers. It flows west and north, entering New York State near the southeast corner of Cattaraugus County, and, making a bend across the county, it again enters Pennsylvania at a point near the southwest corner of Cattaraugus County.

The drainage basin is rugged and largely timber covered. On Allegheny River near the gaging station the banks rise abruptly several feet above the stream on either side closely adjacent to the river. The stream valley itself is broad and flat, varying from 1 to 2 miles in width, and the current, as a rule, is sluggish. The plateaus from which the stream receives its drainage are deeply dissected by tributaries and are very irregular in contour. The soil is, as a rule, impervious, and dry gulleys are numerous.

Chautauqua Lake extends in a northwesterly and southeasterly direction, having its head at a distance of 8 miles from Lake Erie. Its water surface is at an elevation of 1,308 feet above sea level or 735 feet above Lake Erie. Its outlet at the southeast end, near the city of Jamestown, is known as the Chadakoin River, and furnishes water power at numerous dams, entering Allegheny River in Pennsylvania through Conewango Creek. The drainage area above the foot of the lake is 190.6 square miles, of which 20.8 square miles comprise the lake surface, which represents 10.4 per cent of the drainage area. The land area tributary to the lake is very rolling and the soil impervious.

At Olean the wasteway from Cuba reservoir enters the Allegheny through Olean Creek. This reservoir is located on the divide between Oil Creek, tributary to Allegheny River, and Genesee River. The storage is commonly turned into Genesee River through the abandoned summit level of Genesee Valley Canal, but may be diverted into Oil Creek through the guard lock at the head of the canal.

### ALLEGHENY RIVER AT REDHOUSE, N. Y.

This station was established September 4, 1903, by R. E. Horton, assisted by C. C. Covert. It is located at the Redhouse bridge near the stations of the Erie and Pennsylvania railroads and about 5 miles below Salamanca, N. Y., and about 13 miles above the point where the river leaves New York State. The standard chain gage is fastened to the upstream side of the bridge near the middle of the left span. The length of the chain from the end of the weight to the marker is 24.16 feet. The gage is read twice each day by James H. Smith. Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the left end of the downstream side of the bridge. The channel is straight for 800 feet above and below the bridge. The current velocity is well distributed. The

right bank is high and does not overflow. The left bank overflows only at flood stages. The bed of the stream is of gravel, and is regular. The channel is 494 feet wide between abutments, broken by two piers. At extreme high water there is an additional flood channel on the left bank. The bench mark is a circle cut on the downstream side of the left abutment. Its elevation is 21.09 feet above the water surface when the gage reads zero.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

*Discharge measurements of Allegheny River at Redhouse, N. Y., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
September 4 .....	R. E. Horton .....	4.33	1,909
August 29 .....	C. C. Covert .....		<sup>a</sup> 6,844
September 3 .....	do .....		<sup>b</sup> 1,312

<sup>a</sup> High-water measurement at Union Street Bridge, Olean, N. Y.

<sup>b</sup> High-water measurement at highway bridge near Portville, N. Y.

*Mean daily gage height, in feet, of Allegheny River at Redhouse, N. Y., for 1903.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1 .....		3.35	3.70	4.05	17 .....	3.70	4.15	7.30	4.20
2 .....		3.70	3.70	4.00	18 .....	5.00	4.15	7.95	4.20
3 .....		3.85	3.60	3.85	19 .....	4.60	4.70	7.30	4.20
4 .....	4.35	3.70	3.60	3.75	20 .....	4.22	4.50	6.45	4.22
5 .....	4.15	4.28	3.60	3.65	21 .....	4.05	4.30	6.25	4.25
6 .....	4.00	4.60	3.70	3.60	22 .....	3.90	4.22	5.80	4.25
7 .....	3.88	4.32	3.90	3.60	23 .....	3.75	4.20	5.32	4.25
8 .....	3.82	5.00	3.70	3.60	24 .....	3.70	4.10	5.18	4.22
9 .....	3.78	7.05	3.65	3.60	25 .....	3.58	4.00	5.00	4.25
10 .....	3.70	6.35	3.60	3.60	26 .....	3.50	3.85	4.65	( <sup>a</sup> )
11 .....	4.40	5.75	3.60	3.55	27 .....	3.50	3.85	4.45	.....
12 .....	5.00	5.20	3.65	3.50	28 .....	3.40	3.65	4.35	.....
13 .....	4.25	4.82	3.70	3.50	29 .....	3.42	3.80	4.25	.....
14 .....	4.15	4.55	3.70	3.50	30 .....	3.35	3.80	4.20	.....
15 .....	3.85	4.35	3.60	3.50	31 .....		3.70		.....
16 .....	3.75	4.25	3.60	4.10					

<sup>a</sup> Stream frozen over.

#### MISCELLANEOUS MEASUREMENTS IN THE ALLEGHENY RIVER DRAINAGE BASIN.

The following measurements of the outflow from the lake in the unusually dry summer season of 1895 were made by E. C. Burns. The measurements of July, 1895, were made by means of floats; the later measurements were all by current meter. Some fall exists in the outlet from the foot of the lake to the first dam, the lake outflow being probably unregulated.



*Discharge of Chautauqua Lake Outlet, Jamestown, N. Y., 1895.*

[Drainage area, 190.6 square miles.]

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
July 18..	83.9	0.44	Sept. 2 ..	46.3	0.24
July 20..	135.3	.71	Sept. 3 ..	80.4	.42
July 21..	42.7	.22	Sept. 4 ..	64.2	.34
July 22..	68.8	.36	Sept. 5 ..	40.7	.21
July 23..	71.9	.38	Sept. 6 ..	43.8	.22
July 28..	53.6	.28	Sept. 10 ..	43.8	.22
July 30..	98.8	.52	Sept. 13 ..	62.0	.32
July 31..	105.3	.55	Sept. 18 ..	71.6	.38
Aug. 16..	106.1	.56	Sept. 20 ..	41.8	.22
Aug. 17..	78.2	.41	Sept. 24 ..	68.3	.36
Aug. 18..	87.9	.46	Sept. 26 ..	86.6	.45
Aug. 19..	93.0	.48	Oct. 9 ..	47.8	.25
Aug. 20..	88.5	.46	Oct. 10 ..	43.0	.22
Aug. 21..	82.8	.43	Oct. 11 ..	48.0	.25
Aug. 26..	92.3	.48	Oct. 12 ..	41.9	.22
Aug. 27..	96.0	.50	Oct. 13 ..	34.6	.18
Aug. 28..	78.5	.41	Oct. 14 ..	47.7	.25
Aug. 29..	62.4	.32	Oct. 15 ..	43.7	.22
Aug. 30..	88.2	.46	Oct. 16 ..	<sup>a</sup> 66.0	.34
Aug. 31..	113.1	.59	Oct. 17 ..	<sup>b</sup> 36.0	.18

<sup>a</sup> Strong wind down the lake.<sup>b</sup> Wind up the lake.

Stream measurements have been furnished by F. W. Dalrymple, C. E.

The following additional measurements have been made:

Date.	Second-feet.	Second-feet per square mile.
April 30, 1902 .....	466.0	2.45
September 6, 1903 <sup>a</sup> .....	130.6	.69

<sup>a</sup> By R. E. Horton. Steel Street Bridge. Water surface 12.54 feet below downstream corner right-hand abutment coping, on downstream side of bridge.

**MONONGAHELA RIVER DRAINAGE BASIN.**

Monongahela River rises in the central part of West Virginia and, flowing north, crosses into Pennsylvania. At Pittsburg it unites with the Allegheny, forming the Ohio. Its principal tributaries are the Youghiogheny, which flows into it about 15 miles above Pittsburg,

and the Cheat, which joins it just north of the Pennsylvania line. Under the direction of E. G. Paul the United States Geological Survey is maintaining a station on the Youghiogheny, at Friendsville, Md., and one on the Cheat, at Uneva, near Morgantown, W. Va.

#### YOUGHIOGHENY RIVER AT FRIENDSVILLE, MD.

Youghiogheny River rises in Garrett County, Md., and flows in a northwesterly direction into Pennsylvania, where it empties into Monongahela River 15 miles above Pittsburg. Its source is on the western slope of the Allegheny Mountains, at an elevation of about 2,900 feet. The average fall of the stream for 19 miles above its mouth is about 2 feet per mile, but above this point it soon increases to an average fall of nearly 5 feet per mile. The bank height above low water ranges between 15 and 28 feet, and the average width between banks from the mouth to West Newton, Pa., is 546 feet. The following heights of the high water of February, 1897, above low-water stage, at various points in Pennsylvania, were furnished by George M. Lehman: Whikett, 13 feet; Jacobs Creek, 10 feet; Smith-ton, 14 feet; Port Royal, 17 feet; Snyder, 16 feet; West Newton, 20 feet; Suterville, 22 feet; Buena Vista, 26.5 feet; Coulterville, 28.5 feet; Boston, 29 feet; McKeesport, 28.5 feet.

A measurement of Youghiogheny River was made October 13, 1892, with surface floats, at Ohiopyle, Pa., by Kenneth Allen, in connection with an investigation of a water supply for the works of the H. C. Frick Coke Company. It was during a period of extreme drought, and the discharge was found to be 106 second-feet.

The station at Friendsville, Md., was established by E. G. Paul on August 17, 1898. The standard chain gage is located on the upstream side of the right span of the bridge and is nailed to the guard rail. The length of the chain from the end of the weight to the marker is 20 feet. The initial point for soundings is a point 15 feet back from the face of the right abutment on the upstream side of the bridge. Measurements are made from the iron highway bridge connecting the east and the west portions of the village. The channel is straight for several hundred feet above and below the bridge. The bed is rocky and the banks are high and not subject to overflow. The observer is J. H. Cuppet, a merchant residing within a short distance of the gage.

Bench mark No. 1 is a United States Geological Survey bench mark consisting of an aluminum tablet disk marked "1501," in the foundation corner stone of the southeast corner of Friend's store. The elevation of this bench mark is 33.17 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurement was made by E. G. Paul:

September 3: Gage height, 4.10 feet; discharge, 124 second-feet.

*Mean daily gage height, in feet, of Youghiogheny River at Friendsville, Md., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.00	7.80	7.50	5.20	4.80	5.20	6.20	4.40	4.20	3.70	3.90	4.30
2.....	6.00	7.50	7.00	5.30	4.90	5.20	5.80	4.50	4.10	3.70	3.90	4.30
3.....	6.80	7.40	6.50	5.20	4.90	5.20	5.50	4.30	4.10	3.70	4.00	4.30
4.....	7.80	8.00	6.10	5.20	4.90	5.30	5.50	4.20	4.10	4.00	4.00	4.30
5.....	6.90	8.00	5.80	5.20	4.90	5.30	5.50	4.30	4.00	4.20	4.00	4.30
6.....	6.30	7.00	5.80	5.30	4.80	5.40	5.40	4.30	4.00	4.30	4.00	4.20
7.....	5.90	6.20	5.80	5.50	4.70	5.50	5.30	4.30	4.00	4.50	4.00	4.30
8.....	5.40	6.00	5.90	5.80	4.70	5.50	5.20	4.20	4.10	4.50	4.00	4.30
9.....	5.00	6.00	6.00	7.00	4.50	5.10	5.30	4.20	4.10	4.80	4.00	4.30
10.....	5.20	5.80	6.00	6.80	4.50	4.80	5.40	4.10	4.10	4.60	4.00	4.30
11.....	5.80	5.20	6.20	6.40	4.40	5.00	5.50	4.10	4.00	4.50	4.00	4.30
12.....	5.70	5.20	7.00	6.00	4.40	5.20	5.60	4.10	4.00	4.30	4.20	4.30
13.....	5.50	6.00	7.50	5.60	4.40	6.00	5.50	4.10	4.00	4.30	4.60	4.30
14.....	5.40	5.80	6.90	5.60	4.40	6.60	5.50	4.10	4.00	4.20	4.70	4.30
15.....	5.20	6.50	6.00	5.60	4.30	6.80	5.40	4.00	4.00	4.20	4.90	4.20
16.....	5.10	9.00	5.20	5.50	4.30	6.70	5.20	4.10	3.90	4.20	5.00	4.30
17.....	5.00	8.50	5.20	5.50	4.30	6.40	5.10	4.10	3.90	4.30	5.60	4.30
18.....	5.00	6.50	5.20	5.50	4.20	6.40	5.20	4.20	3.90	4.20	5.20	4.30
19.....	5.00	6.20	5.20	5.50	4.20	6.20	5.10	4.30	3.90	4.10	4.90	4.30
20.....	4.90	5.90	5.10	5.40	4.20	6.10	5.30	4.30	3.90	4.10	4.70	4.30
21.....	4.70	5.50	5.10	5.30	4.60	6.20	5.20	4.20	3.80	4.10	4.60	4.30
22.....	4.70	5.50	5.80	5.30	4.80	6.00	5.20	4.30	3.80	4.10	4.50	4.30
23.....	4.80	5.30	6.20	5.20	5.00	6.30	5.10	4.20	3.80	4.10	4.50	4.30
24.....	4.80	5.10	8.20	5.00	5.20	6.40	4.90	4.10	3.80	4.00	4.40	4.30
25.....	4.90	5.00	8.00	5.00	5.30	6.40	4.70	4.20	3.80	4.00	4.40	4.30
26.....	5.00	5.20	6.00	4.90	5.40	6.20	4.60	4.30	3.80	4.00	4.40	4.30
27.....	5.30	5.90	5.80	4.80	5.50	7.10	4.50	4.40	3.80	4.00	4.30	4.30
28.....	5.70	8.00	5.50	4.80	5.30	7.40	4.30	4.50	3.80	4.00	4.30	4.30
29.....	7.20	.....	5.40	4.80	5.40	8.50	4.20	4.40	3.70	4.00	4.30	4.30
30.....	8.30	.....	5.40	4.70	5.30	7.90	4.20	4.30	3.70	4.00	a 4.30	4.30
31.....	8.00	.....	5.30	.....	5.20	.....	4.30	4.20	.....	3.50	.....	4.30

a To top of ice remainder of year.

*Rating table for Youghiogheny River at Friendsville, Md., for 1902 and 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.6	12	4.6	340	5.6	1,150	7.5	3,310
3.8	45	4.8	464	5.8	1,372	8.0	3,880
4.0	90	5.0	600	6.0	1,600	9.0	5,020
4.2	150	5.2	770	6.5	2,170		
4.4	230	5.4	955	7.0	2,740		

*Estimated monthly discharge of Youghiogheny River at Friendsville, Md., for 1903.*

[Drainage area, 295 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	4,222	400	1,330	4.51	5.20
February .....	5,020	690	2,110	7.16	7.46
March .....	4,108	685	1,718	5.82	6.71
April .....	2,740	400	1,025	3.47	3.87
May .....	1,070	150	478	1.62	1.87
June .....	4,450	464	1,725	5.85	6.53
July .....	1,828	150	781	2.65	3.06
August .....	280	90	167	.57	.66
September .....	150	25	78	.26	.29
October .....	464	25	148	.50	.58
November <sup>a</sup> .....	1,150	65	271	.92	1.03

<sup>a</sup> River frozen November 30 to January 1.

#### CHEAT RIVER NEAR MORGANTOWN, W. VA.

A cable station was established July 8, 1899, by E. G. Paul, at Uneva, near Morgantown, W. Va. The cable was moved about 1 mile downstream, to secure a more satisfactory cross section and better facilities for observing gage heights, on July 26, 1901. An inclined timber gage was established at the present station August 21, 1902. It is located 275 feet below the cable and is inclined up to 6.5 feet, above which point readings are taken on a vertical timber spiked to an ash tree. The station is located 7 miles from Morgantown and 1 mile below Ices' ferry bridge. Discharge measurements are made from the cable secured to a sycamore tree on the right bank and timber supports on the left bank. The channel is straight for about 800 feet above and 1,200 feet below the station. The right bank is low and liable to overflow; the left bank is high. The bed of the stream is of rocks and gravel and the current is sluggish. The bench mark is a mark on the face of a sandstone rock at the edge of the road, 20 feet downstream and 30 feet back from the gage. Its elevation above gage datum is 21.13 feet.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurement was made by E. G. Paul:

September 1: Gage height, 2.30 feet; discharge, 682 second-feet.

*Mean daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.95	6.15	10.55	3.70	3.15	3.25	5.65	2.25	2.25	1.40	1.50	1.85
2.....	3.75	6.40	6.95	3.80	3.05	2.95	5.25	2.80	2.20	1.40	1.50	1.85
3.....	10.10	7.35	5.60	3.80	3.00	3.00	4.10	2.70	2.15	1.40	1.50	1.90
4.....	8.90	9.20	4.90	4.05	3.30	2.70	3.65	2.50	2.00	1.40	1.50	1.90
5.....	6.70	8.80	4.55	5.35	3.25	2.50	3.85	2.35	1.80	1.55	1.55	1.80
6.....	5.50	6.35	4.50	4.60	3.05	2.50	4.60	2.10	1.80	1.85	1.75	1.80
7.....	4.80	5.35	4.75	4.45	2.90	3.50	3.95	2.30	1.70	1.85	1.90	1.80
8.....	4.35	4.80	7.10	6.65	2.75	5.65	3.70	2.10	1.70	1.70	2.15	1.75
9.....	3.60	4.60	8.25	8.35	2.70	4.65	3.20	2.10	1.70	3.05	2.05	1.70
10.....	3.30	4.10	6.65	6.45	2.55	3.95	2.95	2.00	1.80	3.10	1.90	1.75
11.....	3.40	3.95	5.70	5.45	2.50	3.60	3.45	1.95	1.80	2.65	1.85	1.80
12.....	5.95	5.05	5.30	5.05	2.50	4.60	3.95	1.90	1.75	2.25	1.80	1.65
13.....	4.90	5.75	4.95	4.95	2.35	6.80	4.75	1.90	1.65	2.10	1.75	1.80
14.....	5.35	4.95	4.35	4.75	2.30	7.00	5.30	1.75	1.60	2.25	1.70	2.25
15.....	5.60	5.75	4.05	4.60	2.25	7.20	4.40	1.75	1.50	2.10	1.70	2.25
16.....	4.10	11.10	3.90	5.50	2.45	5.85	3.70	1.70	1.50	2.00	1.70	2.40
17.....	3.85	8.25	3.80	5.50	2.25	4.75	3.25	1.70	1.50	1.90	2.20	2.20
18.....	3.55	6.10	3.60	5.50	2.25	4.10	3.25	1.70	1.50	1.90	5.25	2.20
19.....	3.20	4.85	3.40	4.95	2.20	3.70	3.20	1.80	2.00	2.05	4.15	2.00
20.....	3.00	4.75	3.25	4.40	2.10	3.50	4.05	1.85	2.55	2.35	3.25	2.10
21.....	3.40	4.15	4.35	4.05	2.05	4.85	4.30	1.80	2.05	2.20	2.75	4.00
22.....	3.80	4.00	5.20	3.90	1.95	4.65	3.45	2.50	1.85	2.10	2.50	3.60
23.....	3.65	3.60	7.80	3.65	2.30	4.65	3.05	2.15	1.70	2.00	2.50	3.45
24.....	3.40	3.80	9.50	3.45	3.50	5.30	2.75	1.95	1.65	1.90	2.40	3.00
25.....	3.30	3.85	6.50	3.55	4.25	4.40	2.50	1.75	1.60	1.80	2.25	4.45
26.....	3.15	3.70	5.35	3.55	5.30	3.70	2.30	1.70	1.50	1.65	2.25	5.35
27.....	3.20	3.95	4.60	4.05	6.40	3.30	2.20	1.70	1.50	1.70	2.05	4.05
28.....	6.15	11.30	4.20	3.80	5.05	3.75	2.00	1.75	1.50	1.70	2.05	3.50
29.....	8.50	-----	3.80	3.55	4.30	8.50	2.00	1.75	1.50	1.70	1.90	3.15
30.....	8.65	-----	3.70	3.30	3.85	7.35	2.05	1.75	1.40	1.60	1.90	3.15
31.....	8.16	-----	3.70	-----	3.60	-----	2.00	2.25	-----	1.60	-----	2.85

### KANAWHA RIVER DRAINAGE BASIN.

Kanawha River flows north through West Virginia, joining the Ohio River at Point Pleasant, W. Va. In its upper course it is known as New River, which rises in Watauga, Ashe, and Alleghany counties, N. C. The area of the latter two counties is comprised wholly within the drainage basin of New River; their boundaries, being along the mountain ridges, form the divides between the drainage basin of this river and Yadkin River on the east and of Holston River on the west. The general direction of the river is northwesterly. At first the upper tributaries have a general northeasterly and southwesterly direction, draining narrow valleys of the Greater Appalachian Valley in Virginia. The main river cuts the Alleghany fronts just below Pearisburg, Va., and the remainder of the drainage area is confined to the State of West Virginia. For some distance the basin divide follows the State line between Virginia and West Virginia, both north and south of the point where the river pierces the Alleghany

front. The basin of New River is as beautiful and picturesque a section of country as any in the eastern part of the United States. The river itself is rapid. The country on its lower courses, through which the Chesapeake and Ohio Railway passes, is noted for its scenic beauty.

The principal tributaries of New River are Little River, which empties near Radford, Va., and the Greenbrier, which rises in the eastern part of West Virginia and joins the New at Hinton, W. Va. The following is a list of the stations maintained in this drainage basin by the United States Geological Survey, under the supervision of E. G. Paul: New River at Fayette, W. Va.; Greenbrier River at Alderson, W. Va.; New River at Radford, Va.; New River near Oldtown, Va.

#### NEW RIVER AT FAYETTE, W. VA.

This station, established by C. C. Babb and D. C. Humphreys July 29, 1895, is located just below the mouth of Wolf Creek, on the highway bridge of one span at Fayette, W. Va. The wire gage was located on the guard rail on the upper side of the bridge, about the middle of the span, the scale being graduated to feet and tenths. The gage is referred to four bench marks: First, the top of the bottom plate of the lower plate girder at the end of the first panel from the right bank, downstream side, 55.13 feet above the zero of the gage; second, the top of the lower end of the coping on the main pier, right bank, downstream side, 52.13 feet above the zero of the gage; third, the bridge seat on the right bank, downstream side, 54.58 feet above the zero of the gage; fourth, the west corner of the abutment stone by the Chesapeake and Ohio Railway station, 58.62 feet above the zero of the gage. A temporary bench mark, established when the chain gage was installed, is the top of the bottom plate of the plate girder 0.5 foot south of the gage box. Its elevation is 52.63 feet above gage datum. The channel is straight above and below the station. The current is swift and without obstructions, except for immense boulders in the bottom. The banks are high, rocky, and not subject to overflow. The bed is constant in section. The observer is J. R. Durrett, a clerk in the store at Fayette, W. Va. The station was discontinued May 22, 1901. On August 11, 1902, it was reestablished. On November 20, 1903, a standard chain gage was installed by W. C. Sawyer. It occupies the same position as the old wire gage, which it replaced, and it has the same datum. The length of the chain from the end of the weight to the marker is 59 feet.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurements were made by E. G. Paul and W. C. Sawyer:

September 21: Gage height, 3.20 feet; discharge, 3,968 second-feet.

*Mean daily gage height, in feet, of New River at Fayette, W. Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	8.02	21.60	9.90	11.20	5.70	7.70	6.70	1.75	1.35	1.30	0.20
2	8.40	7.03	15.00	9.70	9.85	6.10	6.40	7.70	1.75	1.25	1.45	.10
3	17.20	7.45	12.10	9.50	9.80	5.65	5.55	7.40	1.80	1.25	1.55	.00
4	15.10	11.60	9.00	8.00	9.15	5.30	5.75	5.90	2.85	1.35	1.45	.90
5	7.60	17.70	8.00	6.50	9.10	5.80	5.65	6.30	1.80	1.25	1.55	1.00
6	4.30	11.10	6.70	5.80	10.25	6.20	5.30	6.50	1.75	1.25	1.45	.95
7	4.80	9.30	6.30	7.10	9.10	9.50	5.05	6.80	1.85	1.35	1.85	.90
8	4.10	8.00	8.10	10.10	9.20	9.00	5.00	6.60	1.95	1.45	1.55	1.00
9	4.00	7.20	9.00	12.90	9.81	7.95	4.80	5.80	2.15	1.55	2.05	1.10
10	3.75	6.40	11.30	9.80	9.90	7.70	4.80	5.50	2.05	3.65	1.50	.90
11	3.60	5.40	11.00	8.70	9.70	6.80	4.85	3.30	2.95	3.05	1.25	.75
12	3.10	8.30	10.80	6.60	9.20	6.45	6.20	3.05	1.85	2.75	1.55	.55
13	3.15	11.00	10.30	5.50	9.05	6.35	8.65	2.95	2.15	2.65	1.45	.30
14	2.90	9.20	9.50	9.60	8.75	6.75	9.85	2.85	2.05	2.45	1.40	.15
15	2.80	10.20	9.30	11.20	8.00	6.65	10.70	2.95	1.95	2.05	1.65	.10
16	2.85	11.40	8.00	10.10	7.95	5.85	10.00	2.35	1.80	1.75	1.55	.10
17	3.40	12.20	7.00	8.70	7.75	5.85	9.30	2.15	2.05	1.55	.95	.05
18	3.55	17.20	7.50	8.10	7.90	4.50	7.10	2.05	2.20	1.20		.00
19	3.80	10.60	6.00	7.60	6.70	4.80	5.70	2.00	2.15	1.45	1.40	.00
20	4.45	9.10	5.20	7.20	5.90	4.90	5.40	2.00	.80	2.00	1.40	.00
21	5.05	8.70	4.80	7.10	5.80	4.85	5.20	1.95	1.95	1.50	2.25	.20
22	4.20	8.60	5.00	7.70	5.80	4.75	5.05	1.90	2.55	1.35	1.60	1.20
23	4.35	7.00	22.40	7.00	5.80	5.00	4.85	1.95	1.65	1.65	1.25	1.20
24	7.80	6.50	31.80	6.70	5.70	5.65	3.75	1.90	1.55	.95	.95	1.30
25	4.60	5.30	19.70	7.80	5.00	5.40	3.70	1.90	1.45	.70	.95	1.30
26	6.00	4.60	11.70	9.85	4.75	5.60	3.70	2.05	1.50	1.25	.85	1.20
27	8.40	7.00	9.70	18.00	4.10	5.70	3.20	2.10	1.55	1.45	.75	1.20
28	9.30	9.60	8.80	12.85	3.80	7.10	3.20	2.05	1.45	1.45	.65	1.30
29	10.04		8.10	11.90	3.75	11.40	3.80	2.00	1.35	1.35	.25	1.45
30	13.01		8.70	12.10	3.80	8.35	5.00	2.90	1.25	1.15	.20	1.60
31	12.04		10.10		5.30		6.30	1.80		1.35		1.60

#### GREENBRIER RIVER AT ALDERSON, W. VA.

Greenbrier River rises on the western slope of the Allegheny Mountains, in Pocahontas County, W. Va., and flows in a southwesterly direction, emptying into New River near Hinton, Summers County, W. Va. The station was established by C. C. Babb and D. C. Humphreys, at Alderson, W. Va., 21 miles above Hinton, August 1, 1895. Greenbrier River receives many short tributaries from the Allegheny Range, and flows for the most part through a broken, hilly, and mountainous country well covered with forests. The station is located one-half mile above the mouth of Muddy Creek, on the county bridge at Alderson. The wire gage was located in the third panel of the second span, downstream side of the bridge. This gage was referred to three bench marks: The first, on the upper end of the coping of the first pier from the left bank, 21.75 feet above gage datum; the second, on the upper end of the bridge seat of the left-bank abutment, 21.61 feet above gage datum; the third, on the stone foundation of the water tank of the Chesapeake and Ohio Railway, 23.48 feet above gage

datum. A temporary bench mark has been established on the lower end of the third floor beam, in the second span from the left bank. Its elevation is 22.47 feet above gage datum. On November 20, 1903, a standard chain gage was installed by W. C. Sawyer. It occupies the same position as the wire gage which it replaced and its datum is the same. The length of the chain from the end of the weight to the marker is 27.81 feet. A new bench mark, to which this gage is referred, is the top of the water table at the northwest corner of the Merchants' Grocery Company building. Its elevation is 21.71 feet above gage datum. The bridge consists of four spans 435 feet long. At ordinary stages the water flows in two channels, between which is an island 600 feet long and 75 feet wide. The initial point for soundings is the center of the pin on the downstream side of the bridge, on the left bank. The banks are high and not subject to overflow. The bed is of rock and gravel and fairly constant. The observer is W. J. Hancock, merchant at Alderson, W. Va.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

*Discharge measurements of Greenbrier River at Alderson, W. Va., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
September 21 .....	Paul and Sawyer .....	2.03	373
November 16 .....	W. C. Sawyer .....	1.73	130

*Mean daily gage height, in feet, of Greenbrier River at Alderson, W. Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. ....	2.28	4.92	10.00	3.55	3.40	2.50	3.33	1.95	1.93	1.65	1.70	1.60
2. ....	2.39	4.10	5.88	3.30	3.15	3.10	2.90	2.25	1.75	1.70	1.65	1.65
3. ....	9.94	4.50	4.46	3.17	2.95	2.70	2.65	2.45	1.73	1.65	1.65	1.70
4. ....	7.22	7.45	3.93	3.17	2.80	2.50	2.47	2.33	1.73	1.65	1.65	1.68
5. ....	5.60	8.94	3.50	3.33	2.75	2.38	2.30	2.05	1.73	1.60	1.65	1.65
6. ....	4.43	5.32	3.25	3.33	2.65	2.30	2.50	1.98	1.68	1.60	1.70	1.68
7. ....	3.82	4.35	3.10	3.20	2.55	3.30	2.65	1.92	1.63	1.65	1.70	1.65
8. ....	3.50	3.65	3.40	3.82	2.55	5.70	2.80	1.87	1.58	1.65	1.70	1.60
9. ....	3.15	3.50	5.12	5.65	2.50	4.15	2.55	1.82	1.83	1.65	1.70	1.65
10. ....	3.00	3.25	5.45	5.00	2.45	3.50	2.38	1.80	1.68	1.65	1.65	1.65
11. ....	2.55	3.00	4.50	4.25	2.40	3.45	2.20	1.73	1.63	1.65	1.65	1.68
12. ....	2.87	4.10	4.85	3.60	2.35	3.98	2.15	1.45	1.63	1.70	1.65	1.70
13. ....	2.93	4.83	4.60	3.40	2.30	3.50	2.75	2.28	1.58	1.90	1.65	1.60
14. ....	2.98	4.10	4.18	3.35	2.25	3.10	3.25	2.13	1.58	1.80	1.75	1.68
15. ....	2.55	3.75	3.75	3.50	2.25	2.92	3.10	1.93	1.53	1.80	1.65	1.68
16. ....	2.45	9.15	3.45	3.53	2.20	2.75	2.70	1.73	1.58	1.80	1.65	1.60
17. ....	2.63	10.32	3.20	3.50	2.17	2.70	2.45	1.73	1.71	1.70	1.70	1.68
18. ....	2.65	5.90	3.00	3.30	2.15	2.50	2.30	1.65	1.93	1.75	1.75	1.70
19. ....	2.68	4.65	2.90	3.30	2.07	2.40	2.20	1.63	1.98	1.75	1.80	1.65



*Mean daily gage height, in feet, of Greenbrier River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20. ....	2.52	3.90	2.75	3.15	2.10	2.30	2.10	1.73	1.96	1.75	1.80	1.60
21. ....	2.50	3.50	2.70	3.15	2.05	2.22	2.05	1.68	1.93	1.80	1.90	1.70
22. ....	2.68	3.40	3.38	3.30	2.05	2.12	1.80	1.65	1.90	1.80	1.85	1.80
23. ....	2.78	3.20	11.10	3.25	2.02	2.10	1.95	1.68	1.85	1.75	1.85	1.88
24. ....	2.75	3.20	11.90	3.15	2.00	2.10	1.90	1.68	1.80	1.75	1.80	1.88
25. ....	2.65	3.20	6.28	3.10	2.02	2.10	1.85	1.65	1.70	1.75	1.80	1.87
26. ....	2.60	3.16	4.62	3.90	2.10	2.25	1.80	1.65	1.68	1.75	1.78	2.00
27. ....	2.58	3.10	4.00	6.10	2.10	2.18	1.76	1.48	1.65	1.75	1.75	2.10
28. ....	3.38	9.15	3.55	4.90	3.30	2.35	1.75	1.45	1.65	1.70	1.75	2.07
29. ....	6.50	-----	3.30	4.10	2.90	3.25	1.67	1.45	1.65	1.70	1.65	2.00
30. ....	6.92	-----	3.05	3.65	2.65	4.00	1.75	1.88	1.65	1.65	1.50	2.00
31. ....	6.50	-----	3.45	-----	2.50	-----	1.95	1.93	-----	1.70	-----	2.20

#### NEW RIVER AT RADFORD, VA.

New River rises in Watauga, Ashe, and Alleghany counties, N. C., and flows in a northwesterly direction into West Virginia, where, after meeting the Gauley, near Kanawha Falls, it is known as the Kanawha. The station at Radford is located at the highway bridge close to the Norfolk and Western Railway station. It was established by D. C. Humphreys August 1, 1898. The gage used was erected by the United States Weather Bureau. It consists of a vertical board graduated to feet and tenths, and is attached to the iron framework connecting the pair of iron concrete cylinders which form the first pier from the right bank. On account of the inaccessibility of the Weather Bureau gage, a wire gage was put in February 23, 1900, the datum being the same as that of the old gage. On December 1, 1903, the old wire gage was replaced by a standard chain gage which was installed by W. C. Sawyer. At this time the gage datum was lowered 3.41 feet. The length of the chain from the end of the weight to the marker is 87 feet. The observer is T. M. Brady, saddler and harness dealer. The channel is straight for several hundred feet above and below the station and has a width of 580 feet at ordinary stages, broken by five piers. At high water its width is about 1,200 feet. The bottom is of solid rock and gravel and is smooth and regular. On the left bank there is a steep, rocky bluff. The right bank is low and subject to overflow for about 100 yards, but all the water must pass under the bridge, which is about 85 feet above low water. The discharge measurements are made from the upstream side of the bridge. The initial point for soundings is on the right bank of the river 50 feet from the first pier.

Bench mark No. 1 is the bottom of the lowest horizontal brace connecting the two cylinders, the elevation being 3.88 feet above the gage datum. Bench mark No. 2 is the top of the lowest horizontal brace on the west side of the bridge 2.5 feet south of the northwest

post of the bent nearest the river on the right bank. Its elevation is 22.65 feet above the new gage datum. Bench mark No. 3 is the northwest corner of the top of the stone under the seventh post from the right bank. Its elevation is 18.54 feet above the new gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

*Discharge measurements of New River at Radford, Va., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 21	E. C. Murphy	1.45	5,214
September 23	Paul and Sawyer	.13	2,106
November 30	W. C. Sawyer	<sup>a</sup> 3.21	1,212

<sup>a</sup> Gage datum lowered.

*Mean daily gage height, in feet, of New River at Radford, Va., for 1903.<sup>a</sup>*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.50	0.90	6.30	3.10	1.40	1.60	1.80	1.20	1.30	-0.10	0.20	0.50
2	.60	.90	4.50	2.40	1.20	1.50	1.40	2.40	1.10	-.10	.30	<sup>b</sup> 3.50
3	4.70	.90	3.20	1.90	1.20	1.50	1.00	1.80	.90	-.10	.30	3.40
4	3.40	.90	2.30	2.90	1.20	1.40	.80	1.50	.70	-.10	.30	3.40
5	2.80	2.50	1.50	4.00	1.10	1.40	.80	1.30	.70	.00	.40	3.50
6	2.40	2.00	1.30	3.00	1.10	1.30	2.00	1.00	.70	.00	.80	3.50
7	1.90	1.80	1.20	3.50	1.00	2.00	1.60	.80	.60	.10	.50	3.50
8	1.60	1.60	1.20	3.20	1.00	1.90	1.30	.70	.60	1.35	.50	3.40
9	1.40	1.40	1.00	3.40	1.00	1.90	1.00	.50	.60	1.50	.40	3.40
10	1.20	1.30	1.50	3.00	1.00	1.80	1.00	.50	1.10	.80	.30	3.30
11	1.00	1.20	1.80	2.40	1.60	1.60	.80	.50	.70	.60	.20	3.10
12	.80	2.80	2.00	2.00	1.00	1.60	1.50	.40	.60	.50	.30	3.00
13	.80	2.40	1.90	1.50	.90	1.50	1.40	.40	.60	.40	.30	3.10
14	.60	1.60	1.80	2.40	.90	1.50	1.40	.80	.50	.20	.20	3.20
15	.60	1.50	1.60	2.80	.80	1.40	2.00	1.10	.50	.10	.20	3.10
16	.50	1.30	1.60	2.90	.80	1.30	1.40	1.00	.50	.00	.30	3.00
17	.50	8.50	1.40	2.00	.80	1.20	1.20	.90	3.40	.10	.30	3.00
18	.50	4.30	1.20	1.60	.70	1.00	1.00	.90	1.80	1.00	.40	3.00
19	.50	3.20	1.00	1.60	.70	.90	1.00	.70	1.20	.70	.70	2.90
20	.40	2.00	1.00	1.50	.60	.80	.80	.80	1.00	.40	.70	3.00
21	.60	1.50	.90	1.50	.60	.60	.70	.70	.80	.30	.60	3.20
22	1.40	1.30	2.00	1.40	.50	.50	.60	.60	.70	.20	.40	3.40
23	1.20	1.30	9.00	1.40	.50	.70	.50	.60	.60	.10	.30	3.70
24	1.00	1.20	9.10	1.40	.60	.60	.40	.50	.10	.10	.20	3.70
25	1.00	1.00	4.20	1.50	.60	.60	.40	.50	.10	.10	.40	3.60
26	.90	1.00	2.90	1.50	.80	.50	.40	.40	.00	.00	.30	3.60
27	.90	1.00	2.50	2.30	.90	1.40	.40	.30	.00	.00	.20	3.60
28	.90	2.40	1.80	1.90	1.00	4.30	.30	.30	.00	.00	-.10	3.40
29	1.00	-----	2.00	1.60	1.00	3.00	.30	.20	.00	.00	-.10	3.30
30	1.40	-----	7.00	1.50	1.20	2.50	.30	.30	-.10	.10	.00	3.30
31	1.20	-----	4.00	-----	1.60	-----	.60	.70	-----	.20	-----	3.30

<sup>a</sup> These gage heights are in error from 0.1 to 0.2 owing to stretch in the gage wire.

<sup>b</sup> Gage datum lowered 3.41'.

## NEW RIVER NEAR OLDTOWN, VA.

This station, like those on the North and South forks of New River, was established to aid in the hydrographic investigations undertaken by the United States Geological Survey in the southern Appalachian area. It was established July 31, 1900, and is located about 2 miles west of Oldtown. Oldtown is 30 miles from the railroad at Mount Airy, N. C., and 9 miles from a branch of the Norfolk and Western Railway, and can only be reached by private conveyance.

The gaging station was located at Austin's ferry. The wire gage is fixed in an overhanging tree on the left bank, about 50 yards upstream from the ferry. The scale is so placed that the zero mark is next the bank, the distance from the index on the wire to the end of the weight being 16.1 feet. The initial point for soundings is on the right bank and the measurements of discharge are made from the ferryboat. The channel above and below the station is straight and the current swift. The right bank is high and rocky and is never submerged, but the left bank is lower, and at times floods cover it for a considerable distance.

Since the gage rod at this station is so placed that the zero mark is next to the bank the gage readings were reversed, a rise in the water surface being indicated by a decrease in the gage reading, and vice versa. This is true of all figures for gage heights for this station published in Water Supply Papers Nos. 48 and 65.

This rectification was made by subtracting all observed gage heights from 7.3 feet, this being the length of the gage, and also the gage height which corresponded to the lowest stage of the stream. Gage heights, as printed herewith, above 7.3 feet are estimated by the observer. The only exception to this rule is the height of the flood of May 22, 1901, which was determined directly by leveling. This was the greatest flood since 1878, when the river rose some 4 or 5 feet higher. Owing to the inaccessibility of this station, no measurements of the flow were made during 1902, though daily records of the stage of the surface have been maintained. The station was discontinued March 31, 1903.

The observations at this station during 1903 have been made under the direction of E. W. Myers, district hydrographer.

In 1903 the following discharge measurement was made by E. W. Myers:

February 6: Gage height, 1.70 feet; discharge, 3,533 second-feet.

*Mean daily gage height, in feet, of New River near Oldtown, Va., for 1903.*

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1.....	1.60	1.20	4.10	12.....	0.90	2.80	2.10	23.....	0.90	1.40	4.70
2.....	2.90	1.10	2.60	13.....	.90	2.40	2.00	24.....	.90	1.20	4.80
3.....	3.90	1.20	2.10	14.....	.90	1.90	1.80	25.....	.90	1.10	3.00
4.....	2.40	1.40	1.80	15.....	.90	1.60	1.60	26.....	1.00	1.10	2.40
5.....	1.90	3.00	1.60	16.....	.90	1.50	1.50	27.....	1.10	1.20	2.00
6.....	1.50	1.80	1.50	17.....	.90	5.40	1.50	28.....	1.30	2.90	1.60
7.....	1.30	1.50	1.50	18.....	.90	3.20	1.40	29.....	1.40	.....	5.60
8.....	1.10	1.90	1.60	19.....	.90	2.20	1.20	30.....	1.50	.....	3.10
9.....	.90	1.90	1.70	20.....	.90	2.10	1.20	31.....	1.30	.....	2.20
10.....	.90	1.80	1.80	21.....	.90	1.80	1.40				
11.....	.90	1.70	2.40	22.....	.90	1.50	1.70				

### CUMBERLAND RIVER DRAINAGE BASIN.

Cumberland River rises in the eastern part of Kentucky and flows west till it meets the South Fork, which rises in northern Tennessee and flows northward. After this junction the Cumberland turns toward the southwest into Tennessee, and, after flowing through the north-central part, again enters Kentucky in Trigg County, flows across the State, and enters the Ohio River at Smithland, about 15 miles above the mouth of Tennessee River. The gaging station on this river is located at Nashville, Tenn.

#### CUMBERLAND RIVER AT NASHVILLE, TENN.

The gage, which belongs to the United States Engineer Corps, is at the foot of Broad street. It is in three sections, two of which are upright and one inclined. The lowest section, extending from  $-0.2$  foot to  $+46$  feet, is on the slope of the bank and consists of timbers embedded in the ground, bearing an iron strap, into which the markings are cut. The section extending from gage height 46 to 53 feet is fastened to a small building at the top of the bank, and consists of a timber painted white with black markings. The top section of the gage, extending from 52 feet to 55.3 feet, is on the corner of Temperance Hall, painted on the stones in white with black markings. In addition there is a vertical section reading from  $-1.2$  feet to  $+2$  feet. The datum of the gage corresponds to elevation 110.3 feet of the city levels. A cross, cut on the upper face of the corner stone in the southeast corner of Temperance Hall, on Broad street, near Front street, is 52 feet above the zero of the gage, and 366.6 feet above mean sea level. The highest observed water was 55.3 feet on January 22, 1882. The lowest occurred on October 15 and 16, 1878, at a gage height of  $-0.4$  foot. The danger line is at 40 feet.

Records have been kept for a number of years by the United States Weather Bureau, from which readings previous to those here published may be obtained.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Mean daily gage height, in feet, of Cumberland River at Nashville, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	12.80	10.50	28.40	13.70	12.30	14.30	3.60	2.30	2.10	0.80	0.70	2.30
2.....	12.40	10.40	30.80	15.30	11.20	16.00	3.20	2.20	2.50	.80	1.40	2.10
3.....	15.20	10.20	34.20	16.20	10.30	17.30	3.90	2.10	2.30	.80	1.50	1.90
4.....	16.30	14.40	36.40	16.70	9.50	18.20	4.60	2.40	2.00	.70	1.30	1.90
5.....	16.60	21.40	36.90	16.40	8.80	25.80	5.00	3.20	2.00	.70	2.80	1.90
6.....	17.30	24.80	37.90	15.30	8.10	25.30	4.50	3.40	1.90	.80	2.80	1.80
7.....	17.80	28.30	38.90	14.50	7.60	22.70	3.80	4.40	1.90	1.10	2.70	1.70
8.....	17.60	29.90	39.80	18.70	7.00	22.00	3.40	4.90	2.10	1.40	2.40	1.70
9.....	16.20	30.50	40.70	26.30	6.60	20.00	3.40	5.10	2.00	1.70	2.20	1.60
10.....	14.40	29.00	39.20	29.20	6.20	16.80	3.60	5.40	1.90	1.70	2.00	1.60
11.....	12.90	25.90	38.60	32.40	6.00	14.30	3.20	5.60	1.80	1.70	1.80	1.50
12.....	13.60	23.60	38.40	33.90	5.50	12.80	4.00	5.60	1.70	1.50	1.60	1.40
13.....	13.70	21.50	37.40	34.20	5.20	11.00	5.20	5.20	1.60	1.70	1.50	1.40
14.....	14.10	21.70	36.00	33.60	5.10	9.80	6.10	4.30	1.60	1.70	1.50	1.40
15.....	15.60	23.40	33.80	31.70	5.00	8.60	4.50	3.80	1.50	1.60	1.40	1.40
16.....	17.00	25.90	30.90	31.10	4.80	7.40	4.40	3.90	1.50	1.60	1.40	1.40
17.....	16.60	29.50	27.10	32.00	4.50	6.40	4.00	4.50	1.40	1.60	2.30	1.40
18.....	14.80	31.50	23.90	32.80	4.30	5.60	3.80	5.60	1.40	1.50	6.00	1.40
19.....	13.80	34.80	21.60	32.60	4.00	5.00	3.50	5.10	1.30	1.40	5.50	1.40
20.....	10.90	36.40	19.30	30.50	3.80	4.60	5.50	4.40	1.30	1.40	6.30	6.70
21.....	9.40	37.50	17.40	26.80	3.80	4.30	4.60	3.90	1.20	1.30	6.20	16.80
22.....	8.80	37.20	16.30	23.70	3.60	3.90	4.70	3.80	1.20	1.30	5.70	15.50
23.....	7.60	34.70	16.10	21.70	3.60	3.80	4.30	3.70	1.10	1.20	5.90	15.90
24.....	7.50	29.00	15.90	21.00	3.20	3.90	3.90	3.40	1.00	1.00	5.30	16.50
25.....	6.00	22.10	16.30	20.20	3.10	3.70	4.00	3.30	1.00	1.00	4.50	16.10
26.....	7.00	18.20	17.30	18.90	3.00	3.60	3.80	3.30	.90	.90	4.40	16.40
27.....	7.20	16.40	19.60	17.30	2.90	3.70	3.40	3.00	.90	.80	3.50	15.30
28.....	7.70	21.20	20.50	15.70	2.90	4.00	3.00	2.80	.80	.80	3.00	14.30
29.....	9.70	-----	19.20	14.30	3.70	4.50	2.90	2.50	.80	.80	2.70	14.10
30.....	10.40	-----	16.60	13.30	8.30	3.70	2.60	2.50	.80	.90	2.40	14.80
31.....	10.60	-----	14.30	-----	11.50	-----	2.40	2.20	-----	.80	-----	13.80

#### MISCELLANEOUS MEASUREMENTS IN CUMBERLAND RIVER DRAINAGE BASIN DURING 1903.

Cumberland River was measured 500 feet above wagon bridge near Williamsburg, Tenn. The bench mark is top of upstream end of third crossbeam from left-bank end of main center span of bridge. On October 23 the water surface was 38.18 feet below the bench mark and the discharge was 44 second-feet.

#### TENNESSEE RIVER DRAINAGE BASIN.

Tennessee River is formed by the junction of the French Broad and the Holston about 4 miles above Knoxville, Tenn. It flows southwest, crossing into Alabama about 40 miles below Chattanooga, Tenn., and, after crossing the northern part of Alabama, again enters Tennessee in Harding County. It then flows north, crossing Tennessee and Ken-

tucky, and enters the Ohio River at Paducah, about 40 miles above Cairo. Its principal tributary on the north is Clinch River, which enters it near Kingston, Roan County, Tenn. The principal tributaries on the south are Hiwassee and Little Tennessee rivers. Hiwassee rises in the northern part of Georgia and flows into the Tennessee about 30 miles above Chattanooga. Its principal tributaries are the Okoee and the Nottely. Little Tennessee River rises in the northern part of Georgia, flows across the southwestern part of North Carolina, and enters the Tennessee near Loudon, Tenn. Its principal tributary is the Tuckasegee. French Broad River rises in the western part of North Carolina. Its principal tributaries are the Pigeon and the Nolichucky. Holston River rises in the western part of Virginia. Its principal tributary is Watauga River, into which stream Roan Creek enters. During 1903 the United States Geological Survey maintained the following stations in this basin under the supervision of M. R. Hall, district hydrographer for this section: On the Tennessee at Chattanooga, Tenn.; on the Toccoa (Okoe) near Blue Ridge, Ga.; on the Okoe at McCays, Tenn.; on the Hiwassee at Reliance, Tenn.; on the Nottely at Ranger, N. C.; on the Hiwassee at Murphy, N. C.; on the Little Tennessee at Judson, N. C.; on the Tuckasegee at Bryson, N. C.; on the Tennessee at Knoxville, Tenn.; on the French Broad at Oldtown, near Newport, Tenn.; on the Pigeon at Newport, Tenn.; on Nolichucky River near Greenville, Tenn.; on the Holston (S. F.) at Bluff City, Tenn.; on the Watauga near Elizabethton, Tenn.

#### TENNESSEE RIVER AT CHATTANOOGA, TENN.

This station was established in 1879, at the foot of Lookout street, just below Chattanooga Island, by the Signal Corps of the United States Army; but since July 1, 1891, it has been in charge of the Weather Bureau. During the year 1900 a new gage was established. It is a vertical metal scale bolted to the south side of the third stone pier from the south end of the Hamilton County highway bridge. During the present year the self-registering gage invented by Professor Fulton, of Tennessee University, has been in use at this station. The gage is connected by wire with the Weather Bureau office, and a continuous electrical record of river height is made in the same manner as the record of wind, sunshine, etc. Gage heights are furnished to the Geological Survey through L. M. Pindell.

Discharge measurements are made from the steel highway bridge in six spans and an approach about 1,000 feet long on the right bank. The floor of the bridge is about 125 feet above low water. The initial point for soundings is the outside corner of the iron post of the downstream hand rail on the left bank. The channel is curved for 3,000 feet above and 2,000 feet below the station. The right bank is high and overflows at flood stages, but all water passes under the bridge or its approach. The left bank is a high, rocky bluff, and will not

overflow. The bed is composed of loose rock, sand, and gravel, and is fairly constant. The bench mark is the top of the water table on the southeast corner of the post-office on Eleventh street. Its elevation is 74.4 feet above the zero of the gage, and 705 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Tennessee River at Chattanooga, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 26.....	O. P. Hall.....	28.85	190,279
July 21.....	M. R. Hall.....	3.85	20,936
September 5.....	J. M. Giles.....	1.60	10,472
October 21.....	M. R. Hall.....	1.10	8,063

*Mean daily gage height, in feet, of Tennessee River at Chattanooga, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.70	4.80	26.50	17.40	9.00	6.50	4.10	2.80	1.70	0.60	0.80	1.10
2.....	4.50	4.90	31.00	16.60	8.30	8.20	3.80	2.60	1.60	.60	.90	1.10
3.....	5.30	5.10	29.20	14.80	7.80	11.60	3.70	2.90	1.40	.60	1.10	1.10
4.....	6.10	7.60	23.60	13.00	7.30	11.50	3.60	3.80	1.40	.60	1.20	1.00
5.....	6.90	15.40	16.50	12.30	7.00	10.10	3.60	3.80	1.30	.60	1.80	1.00
6.....	6.80	19.60	13.10	12.40	6.70	9.30	3.80	4.20	1.30	.60	1.80	.90
7.....	8.20	17.50	12.30	11.90	6.60	9.80	3.90	4.90	1.30	.60	1.50	1.00
8.....	7.60	18.00	14.60	15.50	6.30	11.20	3.80	4.20	1.30	.80	1.40	.90
9.....	6.70	17.20	20.70	24.50	6.00	10.50	4.00	3.60	1.30	1.00	1.30	1.00
10.....	6.00	15.30	24.40	30.30	5.80	9.00	4.00	3.00	1.20	1.50	1.30	.90
11.....	5.50	14.40	23.90	31.80	5.60	8.70	3.90	2.60	1.20	1.40	1.30	.90
12.....	6.20	16.00	21.00	28.00	5.40	7.80	3.80	2.70	1.10	1.30	1.30	.90
13.....	7.10	16.30	18.30	19.70	5.20	8.00	4.10	3.30	1.10	1.20	1.30	1.00
14.....	7.20	14.80	16.20	17.50	5.00	7.10	5.70	2.90	1.10	1.20	1.30	.90
15.....	6.50	13.60	14.90	20.40	4.90	6.30	5.50	3.20	1.20	1.00	1.20	.90
16.....	6.00	12.30	13.60	21.90	4.80	5.60	5.40	3.80	1.10	.90	1.20	1.00
17.....	5.80	18.40	11.90	21.20	4.70	5.10	5.60	4.10	1.00	1.00	1.50	1.20
18.....	5.40	25.90	10.70	18.80	4.60	4.70	5.10	3.80	1.20	1.00	3.60	1.10
19.....	5.10	29.30	9.80	16.10	4.50	4.40	4.70	3.40	1.30	1.00	6.10	1.00
20.....	4.80	29.00	9.00	14.20	4.30	4.30	4.10	3.80	1.30	.90	5.80	1.40
21.....	4.50	24.40	9.00	13.20	4.20	4.30	3.80	3.30	1.10	.90	4.60	3.00
22.....	4.40	15.40	9.00	13.00	4.10	4.30	4.00	3.00	1.20	.90	3.80	4.70
23.....	4.20	11.30	10.00	13.00	4.00	4.30	3.60	2.90	1.20	.90	3.10	4.40
24.....	4.00	9.90	16.70	11.80	4.00	4.30	3.20	2.50	1.10	.80	2.50	3.70
25.....	4.00	8.80	25.80	10.80	3.80	4.20	2.90	2.20	1.00	.80	2.10	3.70
26.....	4.20	8.00	28.80	10.10	3.80	4.10	2.70	2.00	1.00	.70	1.80	3.40
27.....	4.30	7.50	27.30	9.60	3.60	4.10	2.60	1.80	.80	.70	1.60	3.10
28.....	4.40	12.70	20.10	9.20	3.50	4.50	2.40	1.70	.70	.60	1.50	3.70
29.....	4.50	-----	13.80	9.20	3.50	4.70	2.30	1.60	.70	.60	1.30	3.80
30.....	4.70	-----	13.10	9.60	3.80	4.50	2.30	1.60	.60	.60	1.20	3.80
31.....	4.80	-----	16.00	-----	4.70	-----	2.20	1.80	-----	.70	-----	3.70

*Rating table for Tennessee River at Chattanooga, Tenn., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.6	6,100	2.3	13,240	5.0	27,220	14.0	85,200
.7	6,490	2.4	13,700	5.2	28,400	15.0	91,700
.8	6,880	2.5	14,160	5.4	29,600	16.0	98,200
.9	7,280	2.6	14,620	5.6	30,820	17.0	104,700
1.0	7,680	2.7	15,090	5.8	32,050	18.0	111,200
1.1	8,080	2.8	15,560	6.0	33,290	19.0	117,700
1.2	8,490	2.9	16,040	6.5	36,460	20.0	124,200
1.3	8,900	3.0	16,520	7.0	39,700	21.0	130,700
1.4	9,320	3.2	17,500	7.5	42,950	22.0	137,200
1.5	9,740	3.4	18,500	8.0	46,200	23.0	143,700
1.6	10,160	3.6	19,520	8.5	49,450	24.0	150,200
1.7	10,590	3.8	20,560	9.0	52,700	25.0	156,700
1.8	11,020	4.0	21,620	9.5	55,950	26.0	163,200
1.9	11,460	4.2	22,700	10.0	59,200	27.0	169,700
2.0	11,900	4.4	23,800	11.0	65,700	28.0	176,200
2.1	12,340	4.6	24,920	12.0	72,200	29.0	182,700
2.2	12,790	4.8	26,060	13.0	78,700	30.0	189,200

Above 6.60 feet gage height, table is same as 1902.

*Estimated monthly discharge of Tennessee River at Chattanooga, Tenn., for 1903.*

[Drainage area, 21,418 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	47,500	21,620	30,435	1.42	1.64
February	184,650	26,060	90,229	4.21	4.38
March	195,700	52,700	109,690	5.12	5.90
April	200,900	54,000	99,890	4.66	5.20
May	52,700	19,010	29,098	1.36	1.57
June	69,600	22,160	38,661	1.81	2.02
July	31,430	12,790	20,855	.97	1.12
August	26,640	10,160	16,818	.79	.91
September	10,590	6,100	8,337	.39	.44
October	9,740	6,100	7,124	.33	.38
November	37,100	6,880	12,597	.59	.66
December	25,490	7,280	12,176	.57	.66
The year	200,900	6,100	39,659	1.85	24.88



## TOCCOA (OKOEE) RIVER NEAR BLUERIDGE, GA.

This stream, called Toccoa River in Georgia and Okoee River in Tennessee, has its source on the northern slopes of the Blue Ridge Mountains in Georgia and flows northwest into Hiwassee River. The area is covered with a fine growth of oak, hickory, and other hard woods. The station, established by B. M. Hall on November 25, 1898, is located at the Morganton bridge, about 4 miles east of the town of Blueridge, Ga. The gage is a 14-foot rod, in two 7-foot sections, nailed to a tree on the right bank just below the bridge. It is graduated to feet and tenths and is set to conform to bench marks which were established October 15, 1896, and October 26, 1898. The measurements during 1896 were made at the railroad bridge about 3 miles below, but are referred to the present gage by comparison of the bench marks at the two bridges. The bench mark at Morganton bridge is on the top of the bridge floor, on the downstream side, 50 feet from the initial point, and is 18 feet above the zero of the gage. The bridge was a wooden, queen-post, open bridge, in three spans, with a total length between abutments of 153 feet, but it has been remodeled and changed into a closed bridge, not suitable for use in making discharge measurements at such an irregular section. Measurements are now made at a ferry about  $2\frac{1}{2}$  miles below, but the gage at the bridge is still maintained. The observer was W. E. Rogers, a farmer living about a quarter of a mile east of the gage. The station was discontinued March 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Mean daily gage height, in feet, of Toccoa River near Blueridge, Ga., for 1903.*

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1.....	3.00	3.00	6.00	12.....	2.80	3.80	4.00	23.....	3.00	3.80	4.00
2.....	3.00	3.00	5.00	13.....	2.80	3.60	4.00	24.....	3.00	3.80	4.00
3.....	3.50	4.00	5.00	14.....	2.80	3.60	4.00	25.....	3.00	3.80	4.00
4.....	3.00	5.00	5.00	15.....	2.80	4.00	4.00	26.....	3.00	3.60	4.00
5.....	3.00	4.00	4.80	16.....	2.80	4.00	4.60	27.....	3.00	3.60	3.80
6.....	2.80	4.00	4.80	17.....	2.80	4.00	4.00	28.....	3.00	10.00	3.80
7.....	2.80	4.00	4.60	18.....	2.80	4.00	4.00	29.....	3.00	-----	4.00
8.....	2.80	3.00	4.50	19.....	2.80	3.80	4.00	30.....	3.60	-----	7.00
9.....	2.80	4.00	4.50	20.....	3.00	3.80	4.00	31.....	3.00	-----	6.00
10.....	2.80	4.00	4.20	21.....	3.00	3.80	4.60				
11.....	2.80	3.80	4.20	22.....	3.00	3.80	4.00				

*Rating table for Toccoa (Okoe) River near Blairidge, Ga., from January 1, 1902, to March 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.2	270	3.6	1,162	5.0	2,660	6.8	4,586
2.3	312	3.7	1,269	5.1	2,767	7.0	4,800
2.4	355	3.8	1,376	5.2	2,874	7.2	5,014
2.5	400	3.9	1,483	5.3	2,981	7.4	5,228
2.6	447	4.0	1,590	5.4	3,088	7.6	5,442
2.7	497	4.1	1,697	5.5	3,195	7.8	5,656
2.8	550	4.2	1,804	5.6	3,302	8.0	5,870
2.9	606	4.3	1,911	5.7	3,409	9.0	6,940
3.0	666	4.4	2,018	5.8	3,516	10.0	8,010
3.1	732	4.5	2,125	5.9	3,623	11.0	9,080
3.2	804	4.6	2,232	6.0	3,730	12.0	10,150
3.3	883	4.7	2,339	6.2	3,944	13.0	11,220
3.4	969	4.8	2,446	6.4	4,158	14.0	12,290
3.5	1,062	4.9	2,553	6.6	4,372		

*Estimated monthly discharge of Toccoa River near Blairidge, Ga., for 1903.*

[Drainage area, 231 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	1,062	550	626	2.71	3.12
February .....	8,010	666	1,629	7.05	7.24
March .....	4,800	1,376	2,046	8.86	10.21

#### OKOEE RIVER AT M'CAYS, TENN.

This station was established March 21, 1903, by O. P. Hall, and was permanently equipped by M. R. Hall, on May 13, 1903. It is located at a suspension footbridge just below McCays's ferry at McCays, Tenn., near the Georgia-Tennessee boundary and one-half mile below the railroad bridge of the Atlanta, Knoxville and Northern Railroad. The gage is in two sections, the inclined section reading from -0.3 to 8.5 feet, and consists of double 2 by 6 inch timbers, spiked and bolted together, set in a trench and held in place by 2 by 6 inch posts driven into the ground and bolted or spiked to the gage.

The vertical section, reading from 8 to 16 feet, is attached to the bridge posts on the right bank. Discharge measurements are made from the suspension footbridge, consisting of four wire cables and a plank footway. Its span is about 230 feet and it is 23 feet above the water surface at the end supports and 17 feet above the water surface at the middle. The initial point for soundings is the center of the high bent supporting the bridge on the left bank. The channel is practically straight for about 800 feet above and below the station. The right bank will overflow at about 14 feet gage height for about 500 feet; the left bank will overflow at gage height 12 to 20 feet for about 400 feet. The water is confined to one channel and the bed is probably constant. The current is good and the section is excellent.

Bench mark No. 1 is a cut on a walnut tree on the downstream side of the road, about 50 feet from the left-bank landing of McCays's ferry; its elevation is 12.59 feet above the zero of the gage. Bench mark No. 2 is the head of a large nail in the center of a post at the right-bank end of the footbridge, on the downstream side; its elevation is 16.10 feet above the zero of the gage. This post is an anchor post for the cable of the suspension bridge and may be pulled out of place. Bench mark No. 3 is a copper plug set in solid rock at the outer edge of the side ditch of the railroad bed, about 800 feet west of the railroad station at McCays. It is 11 feet north of the center of the track and is slightly higher than the railroad. Its elevation is 20.98 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Okoee River at McCays, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 21.....	O. P. Hall.....	3.42	2,063
May 12.....	M. R. Hall.....	1.87	992
May 14.....	do.....	1.86	990
July 24.....	O. P. Hall.....	1.37	727
August 21.....	do.....	1.17	584
October 8.....	do.....	1.22	624
October 9.....	do.....	.85	429
December 7.....	do.....	.53	307

*Mean daily gage height, in feet, of Okeech River at McCays, Tenn., 1903.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3.70	2.30	2.70	1.60	1.40	0.80	0.60	0.70	0.60
2.....		3.50	2.50	3.90	1.60	1.50	.80	.60	.70	.60
3.....		3.50	2.20	2.80	1.60	1.60	.90	.60	.90	.50
4.....		3.60	2.20	2.70	1.70	1.20	.90	.60	.90	.50
5.....		3.10	2.10	4.30	1.50	1.40	.90	.60	1.20	.60
6.....		3.10	2.10	4.10	1.50	1.30	.80	.60	.90	.60
7.....		3.00	2.10	3.10	1.60	1.20	.80	.60	.80	.50
8.....		4.40	2.00	2.60	1.60	1.10	.80	1.50	.70	.50
9.....		3.20	2.00	2.40	1.50	1.10	.90	.90	.70	.50
10.....		3.10	2.00	2.30	1.60	1.10	.90	.70	.60	.60
11.....		2.90	2.00	2.80	2.30	1.60	.80	.70	.60	.60
12.....		2.80	1.90	2.30	1.80	1.10	.80	.70	.90	.50
13.....		3.30	1.90	2.20	6.30	1.10	.70	.60	.70	.70
14.....		3.10	1.90	2.10	2.60	1.00	.70	.60	.70	.80
15.....		3.50	1.90	2.00	1.90	1.80	1.00	.60	.70	.60
16.....		3.20	1.80	2.00	1.70	1.90	1.30	.60	.70	.50
17.....		3.10	1.70	1.80	1.80	1.30	1.00	.90	1.20	.50
18.....		3.10	1.70	1.80	1.60	1.90	.90	.90	1.20	.50
19.....		2.90	1.70	1.70	1.50	1.20	.80	.70	.80	.50
20.....		3.10	1.70	1.70	1.50	2.40	.80	.70	.80	.90
21.....		2.90	1.70	1.70	1.40	1.20	.80	.60	.70	.90
22.....	4.30	2.70	1.60	1.70	1.40	1.10	.80	.60	.70	.80
23.....	5.00	2.60	1.60	1.70	1.40	1.10	.70	.60	.70	.60
24.....	4.60	2.50	1.60	1.60	1.40	1.00	.70	.60	.70	.60
25.....	3.70	2.50	1.50	1.60	1.30	1.00	.70	.60	.60	.60
26.....	3.50	2.60	1.50	1.80	1.30	1.00	.70	.60	.60	.70
27.....	3.30	2.50	1.50	2.20	1.30	.90	.70	.60	.60	.70
28.....	3.20	2.40	1.50	2.60	1.30	.90	.70	.60	.60	.60
29.....	3.40	2.30	1.50	1.80	1.20	.90	.70	.60	.60	.70
30.....	6.40	2.30	1.80	1.60	1.40	.90	.60	.60	.60	.70
31.....	4.30		1.90		1.70	.90		.70		.60

*Rating table for Okeech River at McCays, Tenn., from March 20 to December 31, 1903.*

Gage height.	Discharge	Gage height.	Discharge.	Gage height	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.5	297	1.7	887	2.9	1,690	4.1	2,575
.6	332	1.8	950	3.0	1,760	4.2	2,650
.7	370	1.9	1,015	3.1	1,830	4.3	2,725
.8	411	2.0	1,080	3.2	1,900	4.4	2,800
.9	455	2.1	1,145	3.3	1,975	4.5	2,875
1.0	502	2.2	1,210	3.4	2,050	4.6	2,950
1.1	551	2.3	1,275	3.5	2,125	4.7	3,025
1.2	602	2.4	1,340	3.6	2,200	4.8	3,100
1.3	655	2.5	1,410	3.7	2,275	4.9	3,175
1.4	710	2.6	1,480	3.8	2,350	5.0	3,250
1.5	767	2.7	1,550	3.9	2,425		
1.6	826	2.8	1,620	4.0	2,500		

Table well determined to 3.50 feet gage height. Curve reached tangent at 5 feet. Differences thereafter, 80 per tenth.

*Estimated monthly discharge of Okoce River at McCays, Tenn., for 1903.*

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 22-31 .....	4,370	1,900	2,634
April .....	2,800	1,275	1,772
May .....	1,275	767	982
June .....	2,725	826	1,306
July .....	4,290	602	936
August .....	1,340	455	642
September .....	655	332	419
October .....	767	332	365
November .....	602	332	398
December .....	455	297	340

#### HIWASSEE RIVER AT RELIANCE, TENN.

This station was established August 17, 1900, by O. P. Hall. It is located at the Atlanta, Knoxville and Northern Railroad bridge, near the ferry landing. The gage consists of a vertical rod, reading from zero to 10 feet, fastened to an oak tree on the right bank, 150 feet above the railroad bridge and 40 feet below the ferry landing, and a 5-foot section, reading from 10 to 15 feet, attached to a sycamore tree on the downstream side of the road leading to the ferry, about 400 feet from the river. The gage is read once each day by C. V. Higdon. Discharge measurements are made from the railroad bridge and from the wooden trestles on both banks. The railroad track is about 34 feet above low water. The initial point for soundings is the center of the heavy bolt or bridge pin, about 1 foot from the end of the bridge on the right bank, downstream side. This point is also at the center of the pier on the right bank. Above the station the channel makes a sharp bend to the east for a distance of 800 feet. Below the station the channel makes a sharp bend to the west for about 1,000 feet. At ordinary stages the river is about 350 feet wide at this point, and the section is a fairly good one. The water is held back by a ledge of rock below and is rather sluggish at low stages. Discharge measurements at low stages can be made at a ferry near Wetmore, 6 miles below. Both banks overflow, but all water passes beneath the bridge and its approaches.

Bench mark No. 1 is a cut in a hickory tree on the right bank of the river, about 75 feet upstream from the bridge. Its elevation is 5.82 feet above the zero of the gage. Bench mark No. 2 is the top of the downstream iron girder under the cross-ties at a point about 40

feet from the end of the bridge on the right bank. Its elevation is 23.90 feet above the zero of the gage. Bench mark No. 3 is the top of the capstone of the right-bank pier on the upstream side of the bridge. Its elevation is 19.26 feet above the zero of the gage. Bench mark No. 4 is a copper plug set in a stone post flush with the surface of the ground at the south end of C. V. Higdon's house, under the south window. This house stands on the right bank, about 50 feet up from the foot of the hill, 600 feet north of the right-bank end of the bridge and opposite a point on the river about 300 feet above the bridge. Its elevation is 27.16 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Hiwassee River at Reliance, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 23.....	O. P. Hall .....	7.60	24,527
May 15.....	M. R. Hall .....	1.90	2,335
July 25.....	O. P. Hall .....	1.40	1,440
August 22.....	do .....	1.28	1,155
October 7.....	do .....	.92	615
December 8.....	do .....	.98	663

*Mean daily gage height, in feet, of Hiwassee River at Reliance, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.80	1.60	6.70	3.60	2.30	2.50	1.70	1.60	1.10	0.90	1.10	1.00
2.....	1.70	1.60	4.00	3.20	2.20	3.40	1.60	2.10	1.10	.90	1.00	1.00
3.....	2.30	1.70	3.40	3.10	2.20	2.50	1.60	1.70	1.10	.90	1.10	1.00
4.....	3.30	2.90	3.00	3.40	2.20	2.30	1.80	1.60	1.10	.90	1.00	1.00
5.....	2.10	4.00	2.80	3.00	2.10	2.70	1.60	1.60	1.10	.90	1.20	1.00
6.....	2.00	2.80	3.10	2.90	2.10	3.60	1.60	1.60	1.10	.90	1.30	1.00
7.....	1.90	2.60	2.90	2.70	2.10	2.80	1.60	1.60	1.00	.90	1.20	1.00
8.....	1.80	4.30	4.30	4.70	2.00	2.40	1.70	1.50	1.00	1.20	1.10	1.00
9.....	1.70	3.50	4.40	3.90	2.00	2.20	1.80	1.40	1.10	1.60	1.10	1.00
10.....	1.60	2.90	4.00	3.10	2.00	3.40	1.70	1.40	1.20	1.10	1.00	1.00
11.....	1.70	3.40	4.00	2.90	1.90	2.60	1.80	1.30	1.10	1.00	1.00	1.00
12.....	2.70	4.70	4.70	2.80	1.90	2.30	1.70	1.40	1.10	1.00	1.20	1.00
13.....	2.00	3.30	3.70	3.20	1.90	2.10	2.80	1.30	1.00	1.00	1.30	1.00
14.....	1.90	2.80	3.40	5.20	1.90	2.00	3.00	1.40	1.00	1.00	1.10	1.10
15.....	1.80	2.60	3.10	4.00	1.90	1.90	2.20	1.30	1.00	1.90	1.10	1.20
16.....	1.70	2.70	2.90	3.50	1.90	1.80	1.90	1.50	1.30	1.00	1.10	1.10
17.....	1.70	7.70	2.80	3.00	1.80	1.80	2.00	1.60	1.50	1.00	1.10	1.00
18.....	1.70	4.10	2.60	2.80	1.80	1.70	1.90	1.50	1.20	1.10	2.10	1.00
19.....	1.60	3.30	2.50	2.90	1.80	1.70	1.70	1.40	1.10	1.00	1.50	.90

*a* Mean.

*Mean daily gage height, in feet, of Hiwassee River, etc.—Continue 1.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20.....	1.50	2.90	2.50	2.90	1.70	1.70	1.60	1.30	1.10	1.00	1.20	1.20
21.....	1.50	2.70	2.60	2.90	1.70	1.70	1.60	1.50	1.00	1.10	1.20	1.50
22.....	1.50	2.50	2.90	2.80	1.80	1.70	1.50	1.30	1.00	1.00	1.10	1.40
23.....	1.50	2.40	8.10	2.60	1.70	1.80	1.50	1.20	1.00	1.00	1.10	1.20
24.....	1.50	2.20	6.00	2.50	1.70	1.60	1.50	1.30	1.00	.90	1.10	1.10
25.....	1.50	2.20	4.10	2.50	1.60	1.60	1.40	1.20	1.00	.90	1.10	1.10
26.....	1.50	2.10	3.50	2.60	1.60	1.90	1.40	1.20	1.00	.90	1.10	1.20
27.....	1.50	2.00	3.20	2.50	1.60	2.20	1.40	1.10	1.00	.90	1.00	1.50
28.....	1.60	9.30	3.00	2.30	1.60	2.00	1.30	1.10	1.00	.90	1.00	1.30
29.....	1.60	-----	2.90	2.30	1.70	1.90	1.40	1.10	.90	.90	1.00	1.20
30.....	1.70	-----	5.00	2.20	1.80	1.80	1.50	1.20	.90	1.00	1.00	1.10
31.....	1.60	-----	4.60	-----	2.50	-----	1.80	1.10	-----	1.10	-----	1.10

*Rating table for Hiwassee River at Reliance, Tenn., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.9	590	3.1	5,790	5.3	14,890	7.5	24,350
1.0	735	3.2	6,140	5.4	15,320	7.6	24,780
1.1	885	3.3	6,500	5.5	15,750	7.7	25,210
1.2	1,040	3.4	6,870	5.6	16,180	7.8	25,640
1.3	1,200	3.5	7,250	5.7	16,610	7.9	26,070
1.4	1,370	3.6	7,640	5.8	17,040	8.0	26,500
1.5	1,550	3.7	8,040	5.9	17,470	8.1	26,930
1.6	1,740	3.8	8,450	6.0	17,900	8.2	27,360
1.7	1,940	3.9	8,870	6.1	18,330	8.3	27,790
1.8	2,150	4.0	9,300	6.2	18,760	8.4	28,220
1.9	2,370	4.1	9,730	6.3	19,190	8.5	28,650
2.0	2,600	4.2	10,160	6.4	19,620	8.6	29,080
2.1	2,840	4.3	10,590	6.5	20,050	8.7	29,510
2.2	3,090	4.4	11,020	6.6	20,480	8.8	29,940
2.3	3,350	4.5	11,450	6.7	20,910	8.9	30,370
2.4	3,620	4.6	11,880	6.8	21,340	9.0	30,800
2.5	3,900	4.7	12,310	6.9	21,770	9.1	31,230
2.6	4,190	4.8	12,740	7.0	22,200	9.2	31,660
2.7	4,490	4.9	13,170	7.1	22,630	9.3	32,090
2.8	4,800	5.0	13,600	7.2	23,060		
2.9	5,120	5.1	14,030	7.3	23,490		
3.0	5,450	5.2	14,460	7.4	23,920		

*Estimated monthly discharge of Hiwassee River at Reliance, Tenn., for 1903.*

[Drainage area. 1,180 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	6,500	1,550	2,202	1.87	2.16
February .....	32,090	1,740	6,901	5.85	6.09
March .....	26,930	3,900	8,603	7.29	8.40
April .....	14,460	3,090	5,861	4.97	5.55
May .....	3,900	1,740	2,402	2.04	2.35
June .....	7,640	1,740	3,203	2.72	3.03
July .....	5,450	1,200	2,066	1.75	2.02
August .....	2,840	885	1,393	1.18	1.36
September .....	1,550	590	843	.71	.79
October .....	2,370	590	789	.67	.77
November .....	2,840	735	979	.83	.93
December .....	1,550	590	893	.76	.88
The year .....	32,090	590	3,011	2.55	34.33

#### NOTTELY RIVER AT RANGER, N. C.

This station was established February 16, 1901, by O. P. Hall. It is located at the wooden wagon bridge one-half mile from the railroad station at Ranger, N. C., and one-fourth mile below the Atlanta, Knoxville and Northern Railroad bridge. The vertical gage is a 1-inch by 3-inch pine board in two sections, each 8 feet long, fastened to the left-hand side of the first wooden pier from the right bank. The gage is read once each day by A. D. Kilpatrick. Discharge measurements are made from the wagon bridge, a wooden structure of three spans supported by two wooden piers and two stone abutments; the center span is 55 feet long and the end spans are each 36 feet long. The floor of the bridge is about 20 feet above low water. The initial point for soundings is the inside face of the stone abutment on the right bank. The bridge is at a flat bend in the river, the channel curving slightly above and below the station for 600 feet. The right bank is high, rocky, and is somewhat wooded, and will overflow around the end of the bridge for about 50 feet only. The left bank is low and will overflow for a distance of 700 feet at a gage height of from 15 to 18 feet. The bed of the stream is of gravel and sand and probably shifts considerably. The current is somewhat broken and irregular, caused mostly by the piers. There is a moderate velocity and a depth of from 2 to 5 feet at low stages.

Bench mark No. 1 consists of the heads of large wire nails driven in the top of the downstream end of the wooden cap on the left bent of the wooden pier nearest the right bank of the river. Its elevation is 20.05 feet above the zero of the gage. Bench mark No. 2 is a cut on



a maple tree 18 inches in diameter, 25 feet from the upstream side of the bridge on the right bank, 25 feet from the edge of the water. Its elevation is 15 feet above the zero of the gage. Bench mark No. 3 is a cut on a red oak tree about 15 inches in diameter on the left bank of the river, 35 feet from the end of the bridge near the downstream side of the road. Its elevation is 17.27 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Nottely River at Ranger, N. C., in 1903.*

Date.	Hydrographer.	Gage height. <i>Feet.</i>	Discharge. <i>Second-feet.</i>
March 19.-----	O. P. Hall.-----	4.75	833
May 15.-----	M. R. Hall.-----	3.95	551
July 30.-----	O. P. Hall.-----	3.42	372
August 28.-----	do.-----	2.88	267
October 2.-----	do.-----	2.62	183
December 5.-----	do.-----	2.68	204

*Mean daily gage height, in feet, of Nottely River at Ranger, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.-----	3.20	3.20	8.80	6.40	4.20	6.00	3.80	7.00	2.80	2.60	2.70	2.50
2.-----	3.20	3.50	6.30	6.10	4.40	7.00	3.70	4.40	2.80	2.50	2.70	2.50
3.-----	3.00	3.60	5.80	5.70	4.30	6.00	3.60	3.70	2.70	2.50	2.80	2.50
4.-----	4.00	9.60	5.40	5.80	4.20	6.40	3.90	3.60	2.70	2.50	2.90	2.50
5.-----	3.80	6.00	5.00	5.30	4.20	7.40	3.60	3.50	2.70	2.60	2.90	2.60
6.-----	3.70	4.80	4.90	5.20	4.10	7.00	3.60	3.40	2.90	2.60	2.90	2.60
7.-----	3.70	6.00	5.00	5.10	4.00	7.50	3.70	3.30	2.80	2.60	2.90	2.60
8.-----	3.60	7.60	5.20	5.00	4.00	5.00	3.70	3.20	2.80	4.00	2.90	2.50
9.-----	3.60	5.40	6.70	7.00	4.00	5.00	3.80	3.00	3.20	2.80	2.80	2.50
10.-----	3.80	4.90	6.20	6.50	4.90	4.90	4.00	3.10	2.90	2.70	2.80	2.50
11.-----	3.80	7.60	11.00	5.80	3.90	5.20	3.90	3.40	2.80	2.70	2.70	2.50
12.-----	4.80	7.00	7.60	5.00	3.90	5.20	5.00	3.30	2.80	2.70	3.00	2.50
13.-----	3.80	5.40	6.20	8.60	3.90	5.00	5.80	3.20	2.70	2.60	2.80	2.50
14.-----	3.80	5.00	5.00	8.00	3.90	4.00	5.00	4.00	2.70	2.60	2.70	2.50
15.-----	3.70	4.70	5.40	6.60	3.90	4.00	4.00	4.00	2.70	2.80	2.60	2.50
16.-----	3.60	4.70	5.10	5.80	3.90	4.00	3.90	3.70	2.70	2.80	2.60	2.50
17.-----	3.50	8.00	5.10	5.70	3.80	3.80	4.40	3.30	4.00	2.90	2.80	2.60
18.-----	3.60	5.60	5.00	5.50	3.80	3.80	3.70	3.40	3.20	2.80	4.00	2.60
19.-----	3.50	5.20	4.90	5.40	3.80	3.80	3.60	3.40	2.90	2.70	3.00	2.70
20.-----	3.40	5.00	4.70	5.20	3.80	3.70	4.70	3.30	2.80	2.70	2.80	3.50
21.-----	3.40	4.70	7.00	5.00	4.00	3.70	4.00	3.00	2.90	2.70	2.80	3.40
22.-----	3.30	4.70	8.00	5.20	3.70	3.60	3.50	3.00	2.80	2.70	2.80	3.40
23.-----	3.50	4.60	14.80	4.80	3.50	3.50	3.40	3.20	2.80	2.60	2.70	3.80
24.-----	3.30	4.40	8.00	4.70	3.50	3.50	3.30	3.00	2.70	2.60	2.70	3.70
25.-----	3.40	4.40	6.20	4.60	3.60	3.50	3.00	3.00	2.70	2.60	2.70	3.60
26.-----	3.40	4.30	6.10	4.70	3.60	5.00	3.10	2.90	2.70	2.60	2.60	3.50
27.-----	3.30	4.50	5.60	4.70	3.60	5.00	3.10	2.90	2.70	2.60	2.60	3.40
28.-----	3.40	17.50	5.20	4.60	3.70	4.70	3.10	2.90	2.70	2.50	2.60	3.20
29.-----	3.60	-----	5.00	4.50	3.90	4.00	3.00	2.90	2.60	2.50	2.60	3.10
30.-----	3.70	-----	6.40	4.30	5.50	3.80	3.00	2.90	2.60	2.70	2.50	3.00
31.-----	3.60	-----	7.70	-----	5.70	-----	4.00	2.80	-----	2.70	-----	2.80

*Rating table for Nottely River at Ranger, N. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.4	155	5.2	920	8.0	1,760	12.0	2,960
2.6	190	5.4	980	8.2	1,820	12.5	3,110
2.8	229	5.6	1,040	8.4	1,880	13.0	3,260
3.0	272	5.8	1,100	8.6	1,940	13.5	3,410
3.2	322	6.0	1,160	8.8	2,000	14.0	3,560
3.4	380	6.2	1,220	9.0	2,060	14.5	3,710
3.6	440	6.4	1,280	9.2	2,120	15.0	3,860
3.8	500	6.6	1,340	9.4	2,180	15.5	4,010
4.0	560	6.8	1,400	9.6	2,240	16.0	4,160
4.2	620	7.0	1,460	9.8	2,300	17.0	4,460
4.4	680	7.2	1,520	10.0	2,360	18.0	4,760
4.6	740	7.4	1,580	10.5	2,510	19.0	5,060
4.8	800	7.6	1,640	11.0	2,660	20.0	5,360
5.0	860	7.8	1,700	11.5	2,910	21.0	5,660

*Estimated monthly discharge of Nottely River at Ranger, N. C., for 1903.*

[Drainage area. 272 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January.....	800	272	433	1.59	1.83
February.....	4,610	322	1,095	4.03	4.20
March.....	3,800	770	1,289	4.74	5.46
April.....	1,940	650	1,028	3.78	4.22
May.....	1,070	410	572	2.10	2.42
June.....	1,610	410	810	2.98	3.32
July.....	1,100	272	503	1.85	2.13
August.....	1,460	229	389	1.43	1.65
September.....	560	190	238	.88	.98
October.....	560	172	212	.78	.90
November.....	560	172	232	.85	.95
December.....	500	172	254	.93	1.07
The year.....	4,610	172	588	2.16	29.13

## HIWASSEE RIVER AT MURPHY, N. C.

The station was established July 26, 1896, by E. W. Myers. It is located at the highway bridge, about 80 feet above the Atlanta, Knoxville and Northern Railroad bridge and one-half mile above the mouth of Valley River. The standard chain gage, with 24-inch box, is clamped to the top of the downstream end of the first iron crossbeam from the right bank in the space between the bridge floor and the lower chords. The length of the chain from the bottom of the weight to the index is 27.05 feet. The gage is read once each day by William Mingus. Discharge measurements are made from the sidewalk on the upstream side of the single-span highway bridge. The bridge is 195 feet long, supported by stone abutments. The initial point for soundings is the end of the iron hand rail on the right bank, upstream side of the bridge. The channel is straight for about 500 feet above and below the station. The right bank is high and rocky and will not overflow. The left bank will overflow for a short distance around the abutment. The bed of the stream is rocky and rough and makes soundings uncertain. The bed is permanent and the flow is rapid.

Bench mark No. 1 is the downstream side of the top of the stone pier at the right bank, 22.55 feet above gage datum. Bench mark No. 2 is the top of the downstream end of the first iron crossbeam from the right end of the bridge under the bridge floor; its elevation is 25.05 feet above gage datum. Bench mark No. 3 is a cut on a large white-oak tree in the grounds of the Atlanta, Knoxville and Northern Railroad station, on the left side of the street leading from the highway bridge to the town and 325 feet from the end of the bridge. Its elevation is 31.57 feet above gage datum. Bench mark No. 4 is a copper plug set in the solid rock on the right side of the river, 100 feet from the water's edge, 10 feet uphill from the foot of the hill and 500 feet up the river from the bridge. Its elevation is 21.31 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Hiwassee River at Murphy, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 6 .....	M. R. Hall .....	6.60	1,747
March 28 .....	B. S. Craue .....	6.75	2,226
April 28 .....	E. C. Murphy .....	6.04	1,302
July 29 .....	O. P. Hall .....	5.16	435
August 17 .....	M. R. Hall .....	5.19	437
August 27 .....	O. P. Hall .....	5.00	315
October 2 .....	do .....	4.88	217
October 3 .....	do .....	4.88	220
December 3 .....	do .....	4.83	233

*Mean daily gage height, in feet, of Hiwassee River at Murphy, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.05	5.40	8.55	7.10	6.00	6.20	5.40	5.25	4.95	4.85	4.95	4.90
2	5.05	5.40	7.35	6.85	5.95	6.25	5.50	6.50	4.95	4.85	4.90	4.90
3	5.65	5.50	6.95	6.70	5.90	5.90	5.45	5.70	5.00	4.85	4.90	4.90
4	5.85	6.60	6.75	6.95	6.30	5.75	5.40	5.30	5.00	4.90	4.95	4.90
5	5.80	6.90	6.55	6.55	5.85	6.40	5.35	6.15	5.00	4.85	5.40	4.90
6	5.70	6.25	6.60	6.45	5.85	6.75	5.45	5.40	4.95	4.85	5.05	4.90
7	5.60	6.25	6.45	6.40	5.80	6.35	5.65	5.30	4.90	4.85	4.95	4.75
8	5.60	7.60	7.95	6.70	5.80	6.50	5.45	5.20	4.90	5.90	4.95	4.85
9	5.50	6.90	7.75	6.80	5.75	5.90	5.40	5.15	5.05	5.05	4.90	4.85
10	5.50	6.45	7.35	6.55	5.75	5.85	5.65	5.10	4.95	4.90	4.90	4.90
11	5.55	7.20	9.95	6.45	5.70	6.30	5.50	5.20	4.90	4.85	4.90	4.90
12	5.95	7.35	8.20	6.30	5.70	5.90	6.15	5.10	4.90	4.85	5.15	4.90
13	5.70	6.75	7.50	6.50	5.75	5.75	6.10	5.00	4.90	4.85	5.00	4.95
14	5.70	6.45	7.10	7.65	5.70	5.65	6.10	5.00	4.90	4.85	4.95	5.05
15	5.60	6.25	6.85	7.25	5.70	5.65	5.70	5.10	5.15	4.85	5.00	4.95
16	5.55	6.20	6.70	6.90	5.65	5.60	5.55	5.15	5.45	4.85	4.95	4.90
17	5.60	9.15	6.55	6.70	5.60	5.55	5.75	5.20	5.10	4.95	5.00	4.85
18	5.90	7.30	6.45	6.55	5.60	5.50	5.50	5.20	5.05	5.05	5.45	4.85
19	5.40	6.75	6.95	6.45	5.55	5.30	5.45	5.10	4.95	4.90	5.00	4.85
20	5.35	6.50	6.25	6.40	5.55	5.50	5.45	5.20	4.95	4.90	5.00	5.05
21	5.40	6.35	6.90	6.45	6.10	5.65	5.35	5.10	4.95	4.90	5.00	5.25
22	5.35	6.20	7.10	6.25	5.55	5.45	5.35	5.10	4.95	4.85	4.95	5.00
23	5.35	6.05	11.80	6.20	5.50	5.50	5.35	5.05	4.90	4.85	4.95	5.00
24	5.35	6.00	8.75	6.15	5.50	5.45	5.30	5.05	4.90	4.90	4.75	4.95
25	5.40	5.95	7.65	6.10	5.45	5.40	5.25	5.05	4.90	4.85	4.95	4.95
26	5.35	5.85	7.15	6.25	5.45	5.45	5.25	5.00	4.85	4.85	4.95	5.00
27	5.50	5.80	6.90	6.10	5.45	5.75	5.25	5.00	4.90	4.85	4.95	4.95
28	5.35	12.00	6.75	6.05	5.45	5.85	5.25	5.00	4.90	4.85	4.90	5.05
29	5.55	-----	6.65	6.00	5.95	5.55	5.30	4.95	4.90	4.85	4.90	5.00
30	5.45	-----	7.85	5.95	5.60	5.45	5.35	4.95	4.85	4.90	4.90	4.95
31	5.40	-----	7.55	-----	5.80	-----	5.40	4.95	-----	4.95	-----	4.95

*Rating table for Hiwassee River at Murphy, N. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
4.8	205	5.8	940	6.8	2,640	7.8	4,440
4.9	265	5.9	1,070	6.9	2,820	7.9	4,620
5.0	325	6.0	1,200	7.0	3,000	8.0	4,800
5.1	385	6.1	1,380	7.1	3,180	8.5	5,700
5.2	450	6.2	1,560	7.2	3,360	9.0	6,600
5.3	520	6.3	1,740	7.3	3,540	9.5	7,500
5.4	590	6.4	1,920	7.4	3,720	10.0	8,400
5.5	670	6.5	2,100	7.5	3,900	10.5	9,300
5.6	750	6.6	2,280	7.6	4,080	11.0	10,200
5.7	845	6.7	2,460	7.7	4,260	12.0	12,000

Rating table for 1903 same as 1902.

*Estimated monthly discharge of Hiwassee River at Murphy, N. C., for 1903.*

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	1,135	355	698	1.70	1.96
February .....	12,000	590	2,498	6.09	6.34
March .....	11,640	1,650	3,708	9.04	10.42
April .....	4,170	1,135	2,143	5.23	5.83
May .....	1,740	630	890	2.17	2.50
June .....	2,550	590	1,053	2.57	2.87
July .....	1,470	485	695	1.70	1.96
August .....	2,100	295	500	1.22	1.41
September .....	630	235	304	.74	.83
October .....	1,070	235	280	.68	.78
November .....	630	265	320	.78	.87
December .....	485	235	290	.71	.82
The year .....	12,000	235	1,115	2.72	36.59

## LITTLE TENNESSEE RIVER AT JUDSON, N. C.

This river rises in northern Georgia, with tributaries from the mountains between North Carolina and Georgia, and flows in a north-westerly direction, emptying into the Tennessee River at Lenoir, Tenn. Measurements of flow are made at Judson, N. C., below the mouth of Sawyer Branch. The area drained is mountainous and covered with forest growth. The station was established by E. W. Myers in June, 1896. It is located on the Southern Railway bridge, about one-fourth of a mile from Judson, N. C. The standard chain gage with inclosed scale is located on the downstream side of the first span from the left end of the bridge. The length of the chain from the end of the weight to the marker is 26.29 feet. The observer is R. C. Sawyer, a farmer living at Judson, N. C. The river is straight for several hundred yards above and below the station; the bottom rocky and very rough on the west side and sandy on the east side. The current is swift and considerably obstructed by two wide timber piers. The section is constant, but not a good one for measurements.

Bench mark No. 1 is the top of the angle block on the lower chord at the middle of the first span from the left end of the bridge, on the downstream side. Its elevation is 23.36 feet above gage datum. Bench mark No. 2 is a standard copper bolt set in the rock near the end of the tunnel, on the right bank, 130 feet from the end of the

bridge and 8 feet from the center of the track. Its elevation is 28.14 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Little Tennessee River at Judson, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 30	B. S. Drane	6.91	10,494
April 26	E. W. Myers	4.35	3,033
June 28	do	3.56	1,796
October 10	B. S. Drane	2.48	565
Do	do	2.46	559
August 20	do	2.86	1,097

*Mean daily gage height, in feet, of Little Tennessee River at Judson, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.41	3.54	9.63	7.10	4.00	4.60	3.25	2.80	2.55	2.32	2.38	2.38
2	3.55	3.60	6.92	7.15	3.95	4.55	3.25	4.35	2.95	2.32	2.40	2.30
3	4.02	3.66	5.93	6.90	3.90	4.55	3.25	3.90	2.55	2.31	2.65	2.25
4	4.08	5.82	4.98	6.75	4.15	4.50	3.50	3.10	2.50	2.35	2.60	2.28
5	3.90	4.73	4.65	6.65	3.95	5.70	3.25	3.10	2.60	2.30	2.98	2.40
6	3.70	4.73	5.39	8.70	3.85	5.65	3.35	3.00	2.50	2.32	2.75	2.42
7	3.65	5.41	5.52	7.55	3.85	4.72	3.35	2.90	2.45	2.33	2.52	2.30
8	3.62	4.89	7.27	7.20	3.80	3.90	3.40	2.80	2.40	2.40	2.48	2.28
9	3.30	4.82	6.53	6.50	3.75	3.85	3.30	2.75	2.45	2.35	2.45	2.40
10	3.35	4.90	7.39	5.90	3.70	3.85	3.25	2.75	2.50	2.33	2.40	2.42
11	3.45	5.41	6.80	4.75	3.70	4.95	3.60	2.80	2.40	2.35	2.42	2.22
12	4.35	6.40	6.72	4.65	3.70	4.36	3.80	2.85	2.45	2.37	2.53	2.22
13	3.00	5.29	5.93	5.85	3.65	4.20	3.75	2.75	2.40	2.36	2.55	2.62
14	3.65	4.96	5.71	6.55	3.60	4.10	3.60	2.70	2.40	2.40	2.52	2.70
15	3.55	4.31	6.42	5.50	3.60	3.90	3.25	2.80	2.75	2.32	2.50	2.50
16	3.50	4.30	5.18	5.45	3.60	3.80	3.20	3.50	3.60	2.33	2.45	2.38
17	3.48	5.73	4.98	4.95	3.70	3.65	3.35	3.95	2.60	2.48	3.25	2.35
18	3.45	4.98	4.93	4.75	3.70	3.60	3.25	3.00	2.55	2.72	3.35	2.22
19	3.43	4.81	4.80	4.53	3.70	3.55	3.15	2.80	2.50	2.50	3.32	2.25
20	3.40	4.72	4.73	4.53	3.60	3.55	3.10	2.80	2.50	2.40	2.60	2.82
21	3.42	4.36	5.29	4.45	3.55	3.55	3.00	2.70	2.45	2.35	2.52	3.65
22	3.40	4.31	6.03	4.44	3.55	3.45	3.50	2.65	2.45	2.32	2.50	2.75
23	3.41	4.22	10.28	4.44	3.50	3.40	3.00	2.65	2.40	2.33	2.48	2.68
24	3.49	4.22	8.92	4.44	3.45	3.35	2.95	2.60	2.40	2.33	2.45	2.55
25	3.60	5.46	6.29	4.43	3.45	3.35	2.90	2.60	2.38	2.38	2.42	2.60
26	3.61	5.72	6.20	4.47	3.30	4.25	2.85	2.55	2.39	2.30	2.42	3.00
27	3.54	6.23	5.64	4.46	3.20	4.15	2.85	2.55	2.36	2.30	2.38	2.45
28	3.58	10.63	5.10	4.20	3.20	3.50	2.80	2.50	2.37	2.38	2.23	2.68
29	3.57		5.60	4.10	3.80	3.30	3.00	2.50	2.35	2.34	2.50	2.56
30	3.58		5.60	4.00	3.90	3.20	2.95	2.55	2.33	2.35	2.42	2.50
31	3.59		6.65		3.90		3.10	2.50		2.36		2.43

*Rating table for Little Tennessee River at Judson, N. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
2.2	335	3.9	2,300	5.6	5,700	7.3	9,864
2.3	405	4.0	2,460	5.7	5,920	7.4	10,142
2.4	485	4.1	2,620	5.8	6,140	7.5	10,420
2.5	575	4.2	2,800	5.9	6,360	7.6	10,776
2.6	675	4.3	2,980	6.0	6,580	7.7	11,132
2.7	775	4.4	3,180	6.1	6,825	7.8	11,488
2.8	875	4.5	3,380	6.2	7,070	7.9	11,844
2.9	985	4.6	3,580	6.3	7,315	8.0	12,200
3.0	1,100	4.7	3,780	6.4	7,560	8.5	14,200
3.1	1,220	4.8	3,980	6.5	7,805	9.0	16,200
3.2	1,340	4.9	4,180	6.6	8,050	9.5	18,450
3.3	1,460	5.0	4,380	6.7	8,295	10.0	20,700
3.4	1,580	5.1	4,600	6.8	8,540	10.5	23,100
3.5	1,720	5.2	4,820	6.9	8,785	11.0	25,500
3.6	1,860	5.3	5,040	7.0	9,030		
3.7	2,000	5.4	5,260	7.1	9,308		
3.8	2,140	5.5	5,480	7.2	9,586		

*Estimated monthly discharge of Little Tennessee River at Judson, N. C., for 1903.*

[Drainage area, 675 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	3,080	1,100	1,830	2.71	3.12
February	23,820	1,790	4,908	7.27	7.57
March	22,140	3,680	7,521	11.14	12.84
April	15,000	2,460	5,782	8.57	9.56
May	2,710	1,340	1,991	2.95	3.40
June	5,920	1,340	2,631	3.90	4.35
July	2,140	875	1,389	2.06	2.37
August	3,080	575	1,023	1.52	1.75
September	1,860	445	605	.90	1.00
October	775	405	459	.68	.78
November	1,520	370	669	.99	1.10
December	1,160	335	575	.85	.98
The year	23,820	335	2,449	3.63	48.82

## TUCKASEGEE RIVER AT BRYSON, N. C.

Tuckasegee River rises in the southwestern part of North Carolina, at the base of Tennessee Ridge, which separates Jackson and Transylvania counties. It flows in a northwesterly direction, emptying into Little Tennessee River at Bushnell, N. C. Measurements of discharge are made at Bryson, 2 miles below the mouth of Newton Mill Creek. The drainage area is largely rough and mountainous, and covered with forest growth.

This station was originally established by E. W. Myers, June, 1896, at the Southern Railroad bridge, about 3 miles above Bryson, N. C., just below Governor Island post-office. This station was abandoned March 25, 1897, on account of the poor section. The present station was established November 7, 1897, by A. P. Davis, at the highway bridge in the town of Bryson, N. C., 2 miles below the mouth of Newton Mill Creek. The gage is a vertical rod bolted to the north pier on the right bank at the downstream side of the bridge. It is read once daily by J. M. Welch. Discharge measurements are made from the sidewalk on the downstream side of the single-span steel highway bridge. The initial point for soundings is the end of the hand rail at the left bank on the downstream side of the bridge. The channel is straight for about 600 feet above and below the station. The water is moderately swift, but the current is obstructed by the remnants of two old bridge piers. The right bank is low at the bridge and overflows to a slight extent, but all water passes beneath the bridge and its approach. The right bank is high and rocky and does not overflow. The bed is of gravel and sand and is fairly constant. Bench mark No. 1 is a copper bolt set in the stonesill beneath the large window in the northwest corner of D. K. Collins's brick store, about 80 feet east of the northeast corner of the county court-house. The window is on the side of the store nearest the court-house. The elevation of the bench mark is 22.32 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.



*Discharge measurements of Tuckasegee River at Bryson, N. C., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 19.....	E. W. Myers.....	2.50	2,471
Do.....	do.....	2.50	2,484
March 27.....	B. S. Drane.....	4.35	4,435
April 23.....	do.....	2.78	2,932
April 24.....	do.....	2.63	2,748
April 25.....	E. W. Myers.....	2.70	2,928
June 26.....	do.....	1.73	1,299
June 27.....	do.....	1.70	1,225
August 17.....	B. S. Drane.....	1.25	659
August 18.....	do.....	1.49	955
Do.....	do.....	1.41	794
October 9.....	do.....	1.16	607
October 12.....	do.....	.95	419

*Mean daily gage height, in feet, of Tuckasegee River at Bryson, N. C., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.80	1.60	4.00	3.30	2.25	2.50	1.50	1.30	1.10	0.95	1.00	0.90
2.....	1.90	1.75	3.40	3.10	2.20	2.65	1.50	1.70	1.10	.95	1.00	.90
3.....	2.50	2.00	3.10	2.90	2.20	2.20	1.50	1.50	1.10	.95	1.00	.90
4.....	2.10	5.75	2.80	3.30	2.20	2.10	1.50	1.40	1.20	.95	1.10	.90
5.....	1.90	3.15	3.00	2.90	2.10	3.05	1.65	1.59	1.10	.90	1.35	1.00
6.....	1.85	2.65	3.00	2.80	2.05	3.30	1.60	1.35	1.10	.90	1.10	1.00
7.....	1.70	2.95	2.90	3.30	2.00	2.70	1.55	1.25	1.05	1.00	1.00	.90
8.....	1.70	3.85	4.35	6.50	2.00	2.30	1.50	1.20	1.10	1.60	1.00	1.00
9.....	1.60	3.00	3.50	3.60	2.00	2.20	1.50	1.20	1.10	1.05	1.00	1.00
10.....	1.70	2.70	3.60	3.40	1.95	3.30	1.80	1.20	1.10	1.00	1.00	.95
11.....	2.30	4.20	4.20	3.30	1.90	2.20	1.70	1.50	1.05	1.00	1.00	.90
12.....	1.90	3.50	3.70	3.10	1.90	2.10	1.70	1.30	1.00	.95	1.05	1.00
13.....	1.75	3.00	3.30	4.75	1.90	1.95	1.95	1.25	1.00	.95	1.10	1.30
14.....	1.80	2.80	3.10	4.00	1.90	1.90	1.60	1.30	1.00	.95	1.10	1.10
15.....	1.70	2.70	3.00	3.60	1.85	1.80	1.50	1.40	1.50	.95	1.10	1.10
16.....	1.60	5.00	2.80	3.40	1.80	1.75	1.50	1.50	1.40	.95	1.00	.95
17.....	1.60	4.90	2.70	3.20	1.80	1.70	1.70	1.25	1.20	1.30	4.00	.90
18.....	1.60	3.50	2.60	3.10	1.75	1.75	1.45	1.40	1.10	1.10	1.75	.90
19.....	1.55	3.10	2.50	3.00	1.75	1.65	1.50	1.40	1.05	1.05	1.20	1.00
20.....	1.55	3.00	2.40	3.30	1.70	1.85	1.40	1.30	1.05	1.00	1.10	1.80
21.....	1.60	2.80	2.80	3.10	1.75	1.70	1.40	1.20	1.05	1.00	1.10	1.30
22.....	1.55	2.50	4.45	2.90	1.75	1.65	1.35	1.20	1.00	1.00	1.10	1.15
23.....	1.50	2.30	8.20	2.75	1.70	1.65	1.35	1.20	1.00	.95	1.10	1.10
24.....	1.60	2.25	5.15	2.60	1.70	1.55	1.30	1.15	1.00	.95	1.05	1.10
25.....	1.55	2.20	4.00	2.70	1.65	1.55	1.30	1.15	1.00	.95	1.00	1.40
26.....	1.50	2.10	3.60	2.60	1.60	1.75	1.25	1.10	1.00	.95	1.00	1.40
27.....	1.55	2.50	3.30	2.50	1.60	1.65	1.25	1.10	1.00	.95	.90	1.10
28.....	1.80	7.80	3.10	2.40	1.65	1.60	1.60	1.10	.95	.95	.90	1.30
29.....	1.80	-----	3.20	2.35	1.95	1.55	1.40	1.10	.95	.95	.95	1.10
30.....	1.80	-----	4.30	2.30	2.20	1.50	1.40	1.25	.95	.95	1.00	1.10
31.....	1.70	-----	3.60	-----	2.10	-----	1.35	1.10	-----	1.00	-----	1.00

*Rating table for Tuckasegee River at Bryson, N. C., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.9	380	2.7	2,850	4.5	7,220	6.3	14,940
1.0	460	2.8	3,050	4.6	7,530	6.4	15,520
1.1	550	2.9	3,250	4.7	7,840	6.5	16,100
1.2	640	3.0	3,460	4.8	8,160	6.6	16,680
1.3	730	3.1	3,670	4.9	8,480	6.7	17,260
1.4	830	3.2	3,890	5.0	8,800	6.8	17,840
1.5	940	3.3	4,110	5.1	9,125	6.9	18,420
1.6	1,060	3.4	4,330	5.2	9,475	7.0	19,000
1.7	1,180	3.5	4,560	5.3	9,850	7.2	20,160
1.8	1,310	3.6	4,800	5.4	10,250	7.4	21,320
1.9	1,450	3.7	5,040	5.5	10,675	7.6	22,480
2.0	1,600	3.8	5,290	5.6	11,125	7.8	23,640
2.1	1,760	3.9	5,540	5.7	11,600	8.0	24,800
2.2	1,930	4.0	5,800	5.8	12,100	8.2	25,960
2.3	2,100	4.1	6,070	5.9	12,625	8.4	27,120
2.4	2,280	4.2	6,350	6.0	13,200	8.6	28,280
2.5	2,470	4.3	6,630	6.1	13,780	8.8	29,440
2.6	2,660	4.4	6,920	6.2	14,360	9.0	30,600

Table well determined to 3 feet gage height. Above 5 feet 1901, 1902, and 1903 rating tables are the same.

*Estimated monthly discharge of Tuckasegee River at Bryson, N. C., in 1903.*

[Drainage area, 662 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,470	940	1,258	1.90	2.19
February	23,640	1,060	4,502	6.80	7.08
March	25,960	2,280	5,102	7.71	8.89
April	16,100	2,100	4,123	6.23	6.95
May	2,015	1,060	1,467	2.22	2.56
June	4,110	940	1,683	2.54	2.83
July	1,525	685	952	1.44	1.66
August	1,180	550	725	1.10	1.27
September	940	420	531	.80	.89
October	1,060	380	467	.71	.82
November	5,800	380	704	1.06	1.18
December	1,310	380	539	.81	.93
The year	25,960	380	1,838	2.78	37.25

## TENNESSEE RIVER AT KNOXVILLE, TENN.

This station was originally established by the United States Weather Bureau at the old county highway bridge, which has been torn down and replaced by a new bridge. Instead of placing the gage at the new bridge, it was decided to move it down the river in order to get below some shoals and wing dams which have been put in for boating. A temporary gage was put in at the Knoxville and Augusta Railroad bridge, a half mile below the highway bridge, and was used during the greater part of the year 1899. In the latter part of that year a new permanent gage was established, and readings from it began on November 1, 1899. The new gage is on the right bank of the river, just below the mouth of West Knoxville Bayou, and about 1,000 feet below the temporary gage at the Knoxville and Augusta Railroad bridge. The gage, which is graduated to feet and tenths, is in two sections—the first, a sloping section, made of a 2 by 4 inch pine timber spiked on top of an 8 by 8 inch oak sill well bolted to piles and embedded in crushed stone, reading from  $-2$  to  $+12$  feet; the second, a vertical section, attached to one of the bents of the railroad trestle across West Knoxville Bayou, about 50 feet from the bank of the river and from the sloping gage, reading from 12 to 36.5 feet. The gage is fastened to the upstream post of the bent, facing away from the river. The zero of the gage is 804.3 feet above sea level. The gage was located for the United States Weather Bureau by the United States Engineer Corps. Daily records are kept by the United States Weather Bureau and are furnished to the Geological Survey. Until recently discharge measurements have been made from the Cherokee Bridge, about  $2\frac{1}{2}$  miles downstream from the Gay street or county bridge, at which measurements are now made, and which is one-half mile above the Knoxville and Augusta railroad bridge. The Gay Street Bridge has seven spans, with a total length of 1,570 feet. The floor of the bridge is about 100 feet above low water. The initial point for soundings is the end of the bridge on the right-bank, downstream side. The channel is straight for one-half mile above and for 1,000 feet below the station. The right bank will overflow for about 400 feet and the left bank for 200 feet, beyond which points a steep high bluff begins on both sides of the river. The bed is of rocks and gravel, and is rough and probably permanent. The current is swift and somewhat broken by the rough bed and by the remains of old piers. The bench mark is a cross in the stone on the east corner of the base of the right-bank pier of the Knoxville and Augusta Railroad bridge. Its elevation is 2.4 feet above the zero of the gage and 807 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Tennessee River at Knoxville, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
March 24.....	O. P. Hall.....	24.30	126,376
July 27.....	do.....	.86	4,759
August 25.....	do.....	.70	4,366
Do.....	do.....	.70	4,344
October 5.....	do.....	.01	2,584
October 22.....	M. R. Hall.....	.27	3,135

*Mean daily gage height, in feet, of Tennessee River at Knoxville, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.80	2.40	14.60	10.90	5.00	3.10	1.90	1.20	0.60	-0.20	0.00	0.20
2.....	1.80	2.30	13.40	9.20	4.60	2.90	1.70	1.20	.50	-.20	.00	.20
3.....	2.00	2.30	9.70	7.60	4.30	4.70	1.50	2.00	.40	-.20	.10	.20
4.....	2.70	3.90	7.30	7.50	4.10	3.80	1.60	1.80	.40	-.10	.10	.10
5.....	5.20	9.40	5.70	8.50	4.10	3.20	1.80	2.70	.60	.00	.20	.10
6.....	4.40	9.50	6.00	8.20	4.00	3.50	2.10	2.00	.70	.00	.20	.10
7.....	3.80	6.80	6.10	6.80	3.60	5.90	2.20	2.00	.40	.00	.50	.10
8.....	3.20	6.00	7.80	14.80	3.40	6.20	-----	1.50	.50	-.10	.70	.10
9.....	2.90	7.60	11.20	24.10	3.20	5.50	1.90	1.20	.30	.10	.60	.10
10.....	2.50	6.70	9.90	17.80	3.10	4.40	1.60	1.00	.30	.10	.40	.10
11.....	2.20	6.00	8.20	12.00	3.00	4.60	1.40	1.10	.30	.80	.30	.10
12.....	2.30	7.00	8.10	8.90	2.80	4.70	1.70	1.60	.60	.70	.20	.10
13.....	2.90	8.60	8.80	9.20	2.60	4.20	2.20	1.50	.30	.30	.20	.20
14.....	2.70	7.70	8.30	13.90	2.60	3.40	3.00	1.30	.20	.20	.30	.10
15.....	2.20	6.00	5.80	12.80	2.60	3.00	4.30	1.80	.30	.20	.30	.10
16.....	2.20	6.70	5.80	11.70	2.60	2.60	3.00	1.20	.20	.20	.30	.20
17.....	2.30	15.60	5.20	10.60	2.60	2.40	2.20	1.10	.20	.10	1.00	.30
18.....	2.20	19.90	4.70	9.80	2.40	2.20	1.90	1.80	.20	.10	1.80	.20
19.....	2.00	15.80	4.30	8.40	2.30	2.10	1.90	1.70	.70	.20	2.50	.20
20.....	1.90	8.90	3.90	7.40	2.10	2.10	2.20	1.70	.60	.20	2.20	.20
21.....	1.80	6.90	4.00	8.00	2.00	2.00	1.70	1.60	.50	.20	1.60	.50
22.....	1.60	5.80	4.30	7.60	2.00	2.10	1.50	1.20	.40	.20	1.00	1.00
23.....	1.70	5.00	10.90	6.70	2.00	2.00	1.20	1.00	.20	.20	.90	1.40
24.....	1.80	4.50	24.00	6.50	2.00	2.30	1.20	.90	.20	.10	.80	1.20
25.....	1.80	4.00	20.40	5.90	1.90	2.10	1.10	.70	.20	.10	.70	1.00
26.....	1.80	3.70	13.20	5.80	1.80	1.80	.90	.70	.10	.00	.60	1.00
27.....	1.80	3.40	9.40	5.80	1.80	1.70	.90	.60	.00	.00	.40	1.30
28.....	1.80	8.00	7.40	7.70	1.70	2.00	.80	.60	.00	.00	.30	1.40
29.....	1.80	-----	6.40	6.70	1.90	1.90	.80	.50	-.10	-.10	.20	1.50
30.....	2.00	-----	6.90	5.70	2.50	1.90	.80	.60	-.10	-.10	.20	1.00
31.....	2.20	-----	9.90	-----	3.30	-----	1.20	.50	-----	-.10	-----	.90

*Rating table for Tennessee River at Knoxville, Tenn., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
—0.2	2,180	2.3	9,620	5.6	22,620	14.5	68,390
— .1	2,370	2.4	9,980	5.8	23,480	15.0	71,290
+ .0	2,570	2.5	10,340	6.0	24,340	15.5	74,190
.1	2,780	2.6	10,710	6.2	25,220	16.0	77,090
.2	3,000	2.7	11,080	6.4	26,100	16.5	79,990
.3	3,230	2.8	11,450	6.6	26,990	17.0	82,890
.4	3,470	2.9	11,820	6.8	27,890	17.5	85,790
.5	3,730	3.0	12,190	7.0	28,790	18.0	88,690
.6	4,000	3.1	12,570	7.2	29,710	18.5	91,590
.7	4,280	3.2	12,950	7.4	30,630	19.0	94,490
.8	4,570	3.3	13,330	7.6	31,560	19.5	97,390
.9	4,870	3.4	13,710	7.8	32,500	20.0	100,290
1.0	5,180	3.5	14,090	8.0	33,440	20.5	103,190
1.1	5,500	3.6	14,480	8.5	35,840	21.0	106,090
1.2	5,820	3.7	14,870	9.0	38,290	21.5	108,990
1.3	6,150	3.8	15,260	9.5	40,790	22.0	111,890
1.4	6,480	3.9	15,650	10.0	43,340	22.5	114,790
1.5	6,820	4.0	16,040	10.5	45,940	23.0	117,690
1.6	7,160	4.2	16,840	11.0	48,590	23.5	120,590
1.7	7,500	4.4	17,640	11.5	51,290	24.0	123,490
1.8	7,850	4.6	18,450	12.0	54,040	24.5	126,390
1.9	8,200	4.8	19,270	12.5	56,840	25.0	129,290
2.0	8,550	5.0	20,900	13.0	59,690		
2.1	8,900	5.2	20,930	13.5	62,590		
2.2	9,260	5.4	21,770	14.0	65,490		

*Estimated monthly discharge of Tennessee River at Knoxville, Tenn., for 1903.*

[Drainage area, 8,990 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-foot per square mile.	Depth in inches.
January .....	20,930	7,160	9,923	1.10	1.27
February .....	99,710	9,620	30,952	3.44	3.58
March .....	123,490	15,650	38,605	4.29	4.95
April .....	124,070	23,050	42,133	4.69	5.24
May .....	20,090	7,500	11,664	1.30	1.50
June .....	25,220	7,500	12,904	1.44	1.60
July .....	17,240	4,570	7,757	.86	.99
August .....	11,080	3,730	6,217	.69	.79
September .....	4,280	2,370	3,298	.37	.41
October .....	4,570	2,180	2,793	.31	.36
November .....	10,340	2,570	4,216	.47	.52
December .....	6,820	2,780	3,867	.43	.50
The year .....	124,070	2,180	14,527	1.62	21.71

#### FRENCH BROAD RIVER AT OLDTOWN, NEAR NEWPORT, TENN.

This was originally one of the temporary stations established in connection with the general hydrographic study of the southern Appalachian region.

The original gage put in at this station was carried away with the old bridge by flood early in the spring of 1902.

The wire gage was established on the new bridge October 27, 1902, by B. S. Drane. The distance from the zero of the scale to the outer rim of the pulley was 2.80 feet; the length of the wire from the end of the weight to the marker was 30.38 feet. The zero of the scale was placed directly opposite the center of the first intermediate post on the second span from the southwest end. This gage was referred to the top of the hexagonal nut on the center bolt in the lower chord of the bridge below and slightly downstream from the zero of the gage. It was 26.60 feet above gage datum. The wire gage was replaced April 29, 1903, by a standard chain gage, with inclosed scale, with its zero 133 feet from initial point for soundings. This gage was made to read the same as the one which it replaced. The length of the chain from the end of the weight to the marker is 28 feet. Discharge measurements are made from the downstream side of the steel highway bridge, in four spans, to which the gage is attached. The initial point for soundings is the end of the guard rail at the left end of the bridge, on the downstream side. The channel is straight for about 600 feet above and below the station. The velocity is moderately swift,

well distributed, and can be measured at all stages. Both banks are high and wooded, and all water passes beneath the bridge at all stages. The section is smooth and regular, and the bed is of gravel and sand, not subject to much change.

Bench mark No. 1 is a point marked in white paint on the sharp, rectangular corner of the angle iron connection between the floor beam and the first strut on the downstream side in the second span from the left end of the bridge. This point is toward the right bank and is 25.84 feet above gage datum. Bench mark No. 2 is the top of the copper bolt set in a bowlder projecting from the hillside on the left bank 175 feet downstream from the center line of the bridge, 8 feet from the center of the road, and about 4 feet above ground. This rock is the first smooth-faced ledge of limestone outcropping close to the road. The face next the road is nearly vertical for a length of 4 feet. The elevation of the bench mark is 29.52 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of French Broad River at Oldtown, near Newport, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second feet.</i>
February 12 .....	E. W. Myers .....	4.32	12,874
March 17 .....	do .....	2.87	5,059
April 2 .....	B. S. Drane .....	4.11	10,660
April 30 .....	E. C. Murphy .....	2.58	4,611
June 30 .....	B. S. Drane .....	2.25	3,532
Do .....	do .....	2.24	3,268
August 12 .....	do .....	1.80	2,279
Do .....	M. R. Hall .....	1.82	2,246
September 2 .....	B. S. Drane .....	1.45	1,167
October 14 .....	do .....	1.31	986
Do .....	do .....	1.31	992

*Mean daily gage height, in feet, of French Broad River at Oldtown, near Newport, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.10	2.00	5.50	4.80	2.50	2.40	2.20	2.00	1.50	1.20	1.20	1.20
2.....	2.20	1.90	4.40	4.00	2.50	3.30	2.10	2.00	1.50	1.20	1.20	1.30
3.....	2.40	2.00	3.90	3.60	2.40	3.20	2.00	2.10	1.40	1.20	1.20	1.30
4.....	2.50	3.80	3.20	4.30	2.80	2.80	2.20	2.00	1.40	1.20	1.50	1.30
5.....	2.50	3.70	3.00	3.70	2.60	2.50	2.00	2.10	1.50	1.20	1.60	1.30
6.....	2.40	3.00	3.50	3.40	2.50	4.50	2.40	2.00	1.50	1.30	1.70	1.30
7.....	2.30	2.70	3.80	3.20	2.40	4.70	2.30	1.90	1.40	1.30	1.60	1.30

*Mean daily gage height, in feet, of French Broad River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8.....	2.20	4.60	3.80	12.00	2.30	4.60	2.20	1.80	1.40	1.40	1.50	1.20
9.....	2.10	4.00	4.80	5.90	2.30	4.20	2.10	1.60	1.40	1.50	1.40	1.20
10.....	2.00	3.30	4.00	4.60	2.30	4.00	2.00	1.70	1.30	1.60	1.30	1.20
11.....	1.90	3.20	4.20	3.80	2.30	4.10	2.10	1.90	1.40	1.50	1.30	1.20
12.....	2.10	4.40	4.60	3.40	2.20	3.70	2.40	1.80	1.30	1.40	1.30	1.20
13.....	2.40	3.80	4.50	4.40	2.20	3.20	2.70	1.70	1.30	1.40	1.30	1.20
14.....	2.20	3.20	3.80	5.80	2.20	2.80	2.60	1.60	1.30	1.30	1.30	1.30
15.....	2.20	2.90	3.20	5.20	2.10	2.60	2.20	1.70	1.40	1.30	1.30	1.30
16.....	2.20	3.90	3.00	4.70	2.10	2.50	2.00	1.80	1.40	1.30	1.20	1.30
17.....	2.10	6.50	2.90	4.20	2.10	2.40	2.20	1.90	1.50	1.40	1.50	1.20
18.....	2.00	4.70	2.80	3.80	2.10	2.30	2.00	2.00	1.50	1.40	2.10	1.20
19.....	2.00	3.60	2.70	3.50	2.10	2.30	1.90	1.90	1.50	1.40	1.80	1.20
20.....	1.90	3.10	2.60	3.40	2.00	2.30	1.90	1.80	1.40	1.30	1.60	1.20
21.....	2.00	3.00	2.70	3.50	2.00	2.40	1.80	1.70	1.40	1.30	1.50	1.50
22.....	2.10	2.80	3.30	3.30	2.10	2.20	1.80	1.70	1.30	1.30	1.50	1.70
23.....	2.00	2.70	11.80	3.40	2.00	2.50	1.80	1.60	1.30	1.20	1.50	1.50
24.....	1.90	2.60	7.50	3.10	2.00	2.30	1.70	1.60	1.30	1.20	1.40	1.40
25.....	1.90	2.50	6.40	3.00	2.00	2.10	1.70	1.60	1.30	1.20	1.40	1.50
26.....	1.90	2.40	4.90	2.90	1.90	2.20	1.70	1.50	1.30	1.20	1.30	1.60
27.....	2.00	2.30	3.90	2.80	1.90	2.30	1.60	1.50	1.20	1.30	1.30	1.50
28.....	1.90	6.50	3.40	2.70	2.00	2.50	1.60	1.50	1.30	1.30	1.30	1.50
29.....	2.00	-----	3.20	2.60	2.10	2.40	1.60	1.40	1.30	1.20	1.20	1.40
30.....	2.10	-----	5.60	2.60	2.40	2.30	1.90	1.70	1.20	1.20	1.20	1.40
31.....	2.00	-----	5.30	-----	2.90	-----	1.80	1.60	-----	1.20	-----	1.40

*Rating table for French Broad River at Oldtown, near Newport, Tenn., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.2	735	2.9	5,440	4.6	14,050	6.3	25,100
1.3	965	3.0	5,820	4.7	14,700	6.4	25,750
1.4	1,200	3.1	6,220	4.8	15,350	6.5	26,400
1.5	1,440	3.2	6,630	4.9	16,000	6.6	27,050
1.6	1,685	3.3	7,060	5.0	16,650	6.7	27,700
1.7	1,935	3.4	7,510	5.1	17,300	6.8	28,350
1.8	2,190	3.5	7,980	5.2	17,950	6.9	29,000
1.9	2,450	3.6	8,460	5.3	18,600	7.0	29,650
2.0	2,715	3.7	8,950	5.4	19,250	7.5	32,900
2.1	2,985	3.8	9,460	5.5	19,900	8.0	36,150
2.2	3,265	3.9	9,980	5.6	20,550	9.0	42,650
2.3	3,545	4.0	10,520	5.7	21,200	10.0	49,150
2.4	3,830	4.1	11,070	5.8	21,850	11.0	55,650
2.5	4,120	4.2	11,640	5.9	22,500	12.0	62,150
2.6	4,420	4.3	12,220	6.0	23,150		
2.7	4,740	4.4	12,810	6.1	23,800		
2.8	5,080	4.5	13,420	6.2	24,450		



*Estimated monthly discharge of French Broad River at Oldtown, near Newport, Tenn., for 1903.*

[Drainage area, 1,737 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	4,120	2,450	3,030	1.74	2.01
February .....	26,400	2,450	8,327	4.79	4.99
March .....	60,850	4,420	12,877	7.41	8.54
April .....	62,150	4,420	11,597	6.68	7.45
May .....	5,440	2,450	3,382	1.95	2.25
June .....	14,700	2,985	6,061	3.49	3.89
July .....	4,740	1,685	2,780	1.60	1.84
August .....	2,985	1,200	2,108	1.21	1.39
September .....	1,440	735	1,139	.66	.74
October .....	1,685	735	975	.56	.65
November .....	2,985	735	1,250	.72	.80
December .....	1,935	735	1,045	.60	.69
The year .....	62,150	735	4,548	2.62	35.24

#### PIGEON RIVER AT NEWPORT, TENN.

The station was established September 4, 1900, by E. W. Myers. It is located at the highway bridge in the eastern part of Newport, Tenn., 1 mile from the railroad station and 1 mile above the dam of the Newport Flouring Mill, out of reach of backwater. On April 30, 1903, the old wire gage was replaced by a standard chain gage with inclosed scale fastened to the lower chord of the bridge on the downstream side, approximately at the same location as the old gage. The new gage was made to read the same as the one which it replaced. The gage is read once each day by S. R. McSween. Since it was first established the gage has been damaged several times, and the records are continuous only from December 14, 1902. Discharge measurements are made from the lower side of the single-span steel highway bridge to which the gage is attached. The initial point for soundings is the end of the hand rail over the left bank on the downstream side of the bridge. The channel is straight for about 300 feet above and 200 feet below the station. The section is deep, rough, and irregular in shape; the velocity is poorly distributed and about 50 feet of the total width at low stages is backwater or has a negative velocity. The right bank is low and overflows to some extent, but all water passes beneath the bridge and its approach. The left bank is a high vertical rock

cliff. The bed of the stream is rocky near the left bank and sandy near the right bank.

Bench mark No. 1 is the top surface of the outer left corner of the plate at the bottom of the floor-beam hanger to the left of the zero of the gage. When the gage reads zero the water surface is 26.87 feet below this bench mark. Bench mark No. 2 is the top of a copper plug set in cement on the top of a limestone outcrop about 5 feet upstream and 3 feet to the left of the end of the upstream hand rail on the left bank. When the gage reads zero the water surface is 32.61 feet below the top of the bolt.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Pigeon River at Newport, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 12 .....	E. W. Myers .....	3.98	3,450
February 18 .....	do .....	4.12	4,862
March 17 .....	do .....	2.58	2,031
April 2 .....	B. S. Drane .....	3.50	3,586
April 30 .....	E. C. Murphy .....	2.46	1,912
June 29 .....	B. S. Drane .....	1.59	620
June 30 .....	do .....	1.51	649
August 12 .....	do .....	1.41	773
September 2 .....	do .....	.97	367
Do .....	do .....	.97	349
October 13 .....	do .....	.82	249
Do .....	do .....	.82	272
November 20 .....	do .....	1.12	424

*Mean daily gage height, in feet, of Pigeon River at Newport, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	2.85	2.85	(a)	3.90	2.40	2.20	1.70	1.50	1.00	0.70	0.80	0.85
2 .....	2.87	2.85		3.50	2.30	2.10	1.60	1.50	1.00	.70	.85	.80
3 .....	2.85	2.85	3.20	3.40	2.30	2.30	1.70	1.50	1.00	.70	.85	.80
4 .....	2.87	5.82	3.30	4.90	2.20	2.30	1.60	1.40	1.00	.70	.85	.85
5 .....	2.77	3.67	3.20	3.70	2.10	2.90	1.60	1.40	.95	.75	.90	.85
6 .....	2.84	3.07	3.10	3.10	2.10	5.50	1.50	1.30	.90	.75	.90	.85
7 .....	2.85	(a)	3.00	4.90	2.10	3.40	1.60	1.30	.90	.70	.85	.85
8 .....	2.84		4.30	11.00	2.00	3.30	1.50	1.20	.90	.85	.85	.90
9 .....	2.85		3.50	6.70	2.00	3.00	1.50	1.20	.90	1.55	.85	.90
10 .....	2.84		3.20	4.30	1.90	2.70	1.60	1.20	.95	1.00	.85	.80
11 .....	(a)		3.20	3.70	1.90	2.50	1.50	1.60	.95	.80	.90	.75

<sup>a</sup>No record.

*Mean daily gage height, in feet, of Pigeon River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12.....			3.10	4.20	1.80	2.40	1.60	1.50	0.85	0.80	0.90	0.70
13.....			3.10	5.70	1.80	2.30	1.50	1.20	.80	.80	.90	1.15
14.....			3.00	4.80	1.80	2.20	1.50	1.10	.80	.80	.90	1.15
15.....			2.80	4.10	1.70	2.10	1.50	2.00	.80	.80	.95	1.00
16.....			2.70	3.90	1.70	2.10	1.60	2.60	.85	.80	.95	.95
17.....			2.70	3.70	1.70	2.10	1.90	2.40	1.45	.85	1.70	.85
18.....	2.85		2.60	3.50	1.80	2.00	1.70	2.00	1.30	1.20	1.80	.65
19.....	2.85		2.60	3.50	1.70	2.00	1.80	1.50	1.00	.85	1.40	1.55
20.....	2.85		2.50	3.40	1.70	1.90	1.70	1.40	.95	.80	1.10	1.55
21.....	2.85		2.40	3.20	1.70	1.90	1.50	1.30	.90	.80	1.00	1.45
22.....	2.85		2.50	3.20	1.70	1.90	1.40	1.30	.85	.80	1.00	1.35
23.....	2.85		10.50	3.10	1.80	1.90	1.40	1.20	.80	.80	1.00	1.20
24.....	2.85		5.80	3.10	1.80	1.80	1.40	1.20	.80	.80	.95	1.10
25.....	2.85		5.00	3.10	1.70	1.80	1.30	1.10	.80	.80	.95	1.15
26.....	2.87		3.90	3.00	1.80	1.80	1.20	1.00	.80	.75	.95	1.20
27.....	2.88		3.30	2.90	1.80	1.70	1.20	1.00	.85	.75	1.00	1.20
28.....	2.87		3.10	2.80	1.80	1.80	1.20	1.00	.80	.75	1.00	1.10
29.....	2.88		3.50	2.60	1.90	1.70	1.20	1.10	.70	.75	1.00	1.05
30.....	2.87		6.20	2.40	2.00	1.70	1.40	1.00	.70	.80	.95	1.00
31.....	2.85		4.20		2.20		1.60	1.00		.80		.90

*Rating table for Pigeon River at Newport, Tenn., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.6	160	1.6	756	2.6	2,090	3.6	3,805
.7	210	1.7	854	2.7	2,240	3.7	4,000
.8	260	1.8	962	2.8	2,390	3.8	4,195
.9	312	1.9	1,080	2.9	2,550	3.9	4,390
1.0	366	2.0	1,210	3.0	2,710	4.0	4,590
1.1	420	2.1	1,350	3.1	2,870	4.1	4,790
1.2	478	2.2	1,490	3.2	3,050	4.2	4,995
1.3	538	2.3	1,640	3.3	3,235	4.4	5,420
1.4	600	2.4	1,790	3.4	3,425	4.6	5,860
1.5	670	2.5	1,940	3.5	3,615	4.8	6,310

Table uncertain above 4 feet gage height. Differences from 4.8 feet, 225 per tenth.

*Estimated monthly discharge of Pigeon River at Newport, Tenn., for 1903.*

[Drainage area, 655 square miles.]

Month.	Discharge in second feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-foot per square mile.	Depth in inches.
January 1-10 and 18-31 <sup>a</sup>			2.470	3.77	3.36
February 1-6 <sup>a</sup>			3.962	6.05	1.35
March 3-31 <sup>a</sup>			4.076	6.22	6.71
April	20.260	1.790	4.704	7.18	8.01
May	1.790	854	1.112	1.70	1.96
June	7.885	854	1.741	2.66	2.97
July	1.080	478	701	1.07	1.23
August	2.090	366	655	1.00	1.15
September	635	210	319	.49	.55
October	713	210	275	.42	.48
November	962	260	373	.57	.64
December	713	185	380	.58	.67

<sup>a</sup> No record for missing days.

#### NOLICHUCKY RIVER NEAR GREENEVILLE, TENN.

This station was established May 7, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at Jones's bridge, 5 miles southeast of Greeneville, Tenn., which is the nearest railroad station. The standard chain gage, with inclosed scale, is nailed to wooden blocks bolted to the lower chord of the bridge on the upstream side midway between the second and third struts from the right bank. The length of the chain from the end of the weight to the marker is 33.63 feet. The gage is read once each day by G. H. Jones. Discharge measurements are made from the downstream side of the two-span steel highway bridge to which the gage is attached. The initial point for soundings is the left end of the top bar of the downstream hand rail. The channel is straight for about 700 feet above and below the station. The right bank is high, but at flood stages part of the water will pass around the end of the bridge. The left bank is high and can never overflow. The section is regular, and the bed is composed of pebbles and small stones and is not subject to change. The velocity is uniform and well distributed except at extreme low water (below gage height 0.50 foot), when the middle pier and a small bar of gravel and small stones throw the current toward both banks.

Bench mark No. 1 is a standard iron bench-mark post of the United States Geological Survey set on the left bank just below the bridge. It is 5.5 feet downstream from the left end of the bridge, and is said to be above high-water mark. Its elevation above gage datum is 26.80 feet. Bench mark No. 2 is the upper outer edge of the outer

eyebars of the lower chord of the bridge, 3.6 feet to the right of the center of the third strut from the bank. The point is marked by a spot of white paint and the letters "B. M." Its elevation above gage datum is 32.03 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Nolichucky River near Greeneville, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 7.....	E. W. Meyers.....	1.48	2,358
Do.....	do.....	1.48	2,351
July 1.....	B. S. Drane.....	.61	866
August 13.....	M. R. Hall.....	.47	866
September 3.....	B. S. Drane.....	.19	588
October 15.....	do.....	.01	400
Do.....	do.....	.00	383

*Mean daily gage height, in feet, of Nolichucky River near Greeneville, Tenn., for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.00	0.60	0.70	0.20	0.00	0.00	0.10
2.....		3.00	.50	.70	.20	.00	.00	.04
3.....		1.80	.50	.80	.20	.00	.00	.08
4.....		1.70	.70	1.00	.20	.00	.01	.03
5.....		1.30	.60	.90	.20	.00	.16	.04
6.....		1.80	.70	.80	.10	.00	.15	.17
7.....		2.80	.80	.60	.10	.05	.01	.00
8.....		2.10	.70	.50	.10	.10	.00	.01
9.....	1.40	1.60	.60	.40	.10	.20	.08	.05
10.....	1.30	1.40	.50	.30	.10	.50	.05	.14
11.....	1.30	1.90	.60	.60	.30	.30	.01	.10
12.....	1.20	1.50	.60	.70	.20	.10	.06	-.01
13.....	1.30	1.30	1.00	.50	.20	.20	.05	.10
14.....	1.30	1.10	1.70	.40	.10	.05	.10	.30
15.....	1.40	1.00	1.10	.40	.10	.06	.09	.06
16.....	1.30	1.00	.70	.50	.00	.00	.10	.09
17.....	1.10	.90	.70	.60	.10	.00	.50	-.09
18.....	1.10	.90	.70	1.00	.80	.00	1.60	.00
19.....	1.00	.80	.70	.70	.40	.10	.80	-.01
20.....	1.00	.80	.60	.70	.20	.13	.50	.70
21.....	1.00	.80	.50	.50	.20	.00	.20	.90
22.....	.90	1.00	.50	.40	.10	.01	.20	.60
23.....	.90	.80	.40	.40	.10	.00	.20	.40
24.....	.90	1.10	.40	.30	.10	.00	.20	.19
25.....	.80	.80	.40	.30	.10	-.01	.01	.30
26.....	.80	.70	.50	.30	.10	-.03	.12	.50
27.....	.70	.70	.40	.20	.00	.00	.10	.40
28.....	.70	.80	.30	.20	.00	-.01	.04	.30
29.....	.70	.80	.30	.20	.00	-.05	.06	.30
30.....	.90	.80	.50	.20	.00	-.05	.05	.30
31.....	1.10		1.00	.20		.00		.19

*Rating table for Nolichucky River near Greeneville, Tenn., from May 9 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
—0.1	312	.7	1,075	1.5	2,395	2.3	4,030
.0	388	.8	1,200	1.6	2,595	2.4	4,235
+ .1	469	.9	1,335	1.7	2,800	2.5	4,440
.2	557	1.0	1,485	1.8	3,005	2.6	4,645
.3	649	1.1	1,645	1.9	3,210	2.7	4,850
.4	746	1.2	1,815	2.0	3,415	2.8	5,055
.5	850	1.3	2,000	2.1	3,620	2.9	5,260
.6	960	1.4	2,195	2.2	3,825	3.0	5,465

*Estimated monthly discharge of Nolichucky River near Greeneville, Tenn., for 1903.*

[Drainage area, 1,099 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 9-31.....	2,195	1,075	1,590	1.45	1.24
June.....	5,465	1,075	2,033	1.85	2.06
July.....	2,800	649	1,037	.94	1.09
August.....	1,485	557	886	.81	.93
September.....	1,200	388	521	.47	.53
October.....	850	350	434	.40	.46
November.....	2,595	388	576	.52	.58
December.....	1,335	312	571	.52	.60

#### HOLSTON RIVER (SOUTH FORK) AT BLUFF CITY, TENN.

This station was originally established by the United States Weather Bureau at the highway bridge at Bluff City, Tenn. Readings were begun July 17, 1900, by the United States Geological Survey in connection with the general hydrographic investigation of the Southern Appalachian region. The gage, which is the property of the United States Weather Bureau, is a 4 by 8 inch timber bolted to the downstream side of the first channel pier from the right bank. It is read once each day by B. N. Edwards. Discharge measurements are made from the lower side of the four-span highway bridge to which the gage is attached. This bridge is a short distance below the Virginia and Southwestern Railroad bridge. The initial point for soundings is the end of the guard rail on the downstream side of the bridge over the left abutment. The channel is straight above the bridge for a distance of 300 feet, to the bridge of the Virginia and Southwestern Railroad. The channel is straight for about 100 feet below the bridge.

The bed is rocky and permanent. The bottom is very rough and rocky ledges just above and below the bridge cause back currents, eddies, and sudden variations in the velocity. Both banks are high, wooded, and do not overflow. The gage is referred to a United States Geological Survey bronze bench-mark tablet set in the upstream side of the capstone of the left abutment. When the gage reads zero this bench mark is 20.44 feet above the water surface. Its elevation above sea level is 1,389 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of South Fork of Holston River at Bluff City, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
February 9	B. S. Drane	2.10	1,604
March 18	do	1.55	1,432
April 1	do	3.50	3,522
May 9	E. W. Myers	1.50	1,310
Do	do	1.50	1,292
July 2	B. S. Drane	.40	375
Do	do	.40	420
August 14	do	.36	406
Do	M. R. Hall	.37	310
September 4	B. S. Drane	.09	241
Do	do	.16	229
Do	do	.11	225
October 16	do	.05	204
Do	do	.08	250
Do	do	.07	192
November 21	do	.40	316

*Mean daily gage height, in feet, of South Fork of Holston River at Bluff City, Tenn., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	0.90	1.04	5.00	3.50	3.40	0.80	0.60	0.50	0.40	0.10	0.10	0.00
2.	1.00	1.04	3.30	3.10	3.10	.80	.60	.70	.30	.10	.10	.10
3.	2.00	1.03	2.80	2.90	1.90	.80	.50	.50	.20	.10	.10	.00
4.	3.00	3.02	2.40	4.10	2.10	.70	.50	.50	.10	.10	.10	.10
5.	2.80	4.01	2.10	3.70	1.80	.70	.50	.50	.20	.10	.20	.30
6.	2.00	3.90	2.00	3.00	1.80	.70	.50	.40	.20	.10	.20	.20
7.	1.80	2.30	1.90	2.90	1.60	.70	.90	.40	.10	.10	.20	.00
8.	1.30	2.40	2.00	3.80	1.50	.70	.50	.40	.10	.10	.20	.00
9.	1.10	2.10	2.10	4.50	1.50	.60	.40	.30	.10	.30	.10	.30
10.	1.10	1.90	2.00	3.70	1.50	.60	.40	.30	.10	.30	.10	.20
11.	1.40	2.60	2.00	3.00	1.40	.90	.50	.40	.20	.10	.00	.00
12.	1.80	4.10	2.40	2.60	1.30	.60	.60	.60	.20	.10	.10	.00
13.	1.60	3.30	2.40	2.50	1.40	.60	3.00	.60	.20	.10	.10	.30
14.	1.40	2.80	2.10	2.70	1.30	.60	2.10	.50	.20	.10	.10	.30
15.	1.40	2.30	2.00	3.00	1.20	.60	1.30	.50	.20	.10	.10	.30
16.	1.60	2.50	1.90	3.40	1.10	.60	1.00	.40	.10	.10	.10	.10

*Mean daily gage height, in feet, of South Fork of Holston River, etc.—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17.....	1.30	9.40	1.70	3.10	1.10	.60	.80	.30	.20	.10	1.30	.10
18.....	1.10	5.30	1.60	2.80	1.10	.60	.70	.70	.20	.10	2.00	.10
19.....	1.10	3.80	1.50	2.60	1.10	.60	.60	.40	.20	.10	1.20	.60
20.....	.90	3.00	1.20	2.50	1.00	.60	.60	.40	.20	.10	.70	.70
21.....	1.00	2.70	1.30	2.50	1.00	.50	.60	.40	.10	.10	.50	1.50
22.....	1.00	2.40	2.30	2.20	1.00	.50	.60	.40	.10	.10	.30	1.00
23.....	.90	2.20	7.50	2.10	.90	.50	.50	.40	.10	.00	.30	.60
24.....	.90	2.00	6.80	2.00	.90	.40	.40	.30	.10	.00	.30	.00
25.....	1.00	1.80	4.20	2.10	.80	.40	.40	.20	.10	.00	.20	.00
26.....	.90	1.60	3.30	4.20	.80	.40	.40	.10	.10	.00	.30	1.50
27.....	.90	1.60	2.80	4.40	.80	.60	.20	.10	.10	.00	.30	1.50
28.....	.50	3.00	2.50	4.40	.70	.60	.20	.10	.10	.00	.00	1.00
29.....	1.30	-----	2.30	3.60	.70	.70	.10	.10	.10	.00	.10	.90
30.....	1.60	-----	2.20	3.50	.80	.70	.10	.20	.10	.00	.20	.80
31.....	1.60	-----	4.10	-----	.80	-----	.40	.40	-----	.10	-----	.60

*Rating table for South Fork of Holston River at Bluff City, Tenn., from January 1, to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.0	176	2.4	2,235	4.8	5,760	7.2	15,140
.1	213	2.5	2,345	4.9	6,030	7.3	15,560
.2	253	2.6	2,455	5.0	6,320	7.4	15,980
.3	304	2.7	2,570	5.1	6,630	7.5	16,400
.4	366	2.8	2,685	5.2	6,950	7.6	16,820
.5	433	2.9	2,800	5.3	7,290	7.7	17,240
.6	503	3.0	2,915	5.4	7,650	7.8	17,660
.7	576	3.1	3,030	5.5	8,030	7.9	18,080
.8	654	3.2	3,145	5.6	8,430	8.0	18,500
.9	737	3.3	3,260	5.7	8,840	8.1	18,920
1.0	825	3.4	3,375	5.8	9,260	8.2	19,340
1.1	915	3.5	3,490	5.9	9,680	8.3	19,760
1.2	1,010	3.6	3,605	6.0	10,100	8.4	20,180
1.3	1,105	3.7	3,720	6.1	10,520	8.5	20,600
1.4	1,200	3.8	3,840	6.2	10,940	8.6	21,020
1.5	1,300	3.9	3,970	6.3	11,360	8.7	21,440
1.6	1,400	4.0	4,110	6.4	11,780	8.8	21,860
1.7	1,500	4.1	4,270	6.5	12,200	8.9	22,280
1.8	1,600	4.2	4,440	6.6	12,620	9.0	22,700
1.9	1,700	4.3	4,620	6.7	13,040	9.1	23,120
2.0	1,800	4.4	4,810	6.8	13,460	9.2	23,540
2.1	1,905	4.5	5,020	6.9	13,880	9.3	23,960
2.2	2,015	4.6	5,250	7.0	14,300	9.4	24,380
2.3	2,125	4.7	5,500	7.1	14,720		

Above 5.70 feet gage height rating table same as 1900-1902.



*Estimated monthly discharge of South Fork of Holston River at Bluff City, Tenn., for 1903.*

[Drainage area, 828 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January .....	2,915	737	1,195	1.44	1.66
February .....	24,380	825	3,319	4.01	4.18
March .....	16,400	1,010	3,110	3.76	4.33
April .....	5,020	1,800	3,127	3.78	4.22
May .....	3,375	576	1,166	1.41	1.63
June .....	737	366	522	.63	.70
July .....	2,915	213	593	.72	.83
August .....	576	213	366	.44	.51
September .....	366	213	237	.29	.32
October .....	304	176	209	.25	.29
November .....	1,800	176	364	.44	.49
December .....	1,300	176	447	.54	.62
The year .....	24,380	176	1,221	1.48	19.78

WATAUGA RIVER NEAR ELIZABETHTON, TENN.

This station was established May 11, 1903, by E. W. Myers, assisted by B. S. Drane. The station is located on the Virginia and South-western Railroad bridge at Siam, about 4 miles from Elizabethton, Tenn. The standard inclosed chain gage is located on the downstream side of the middle span on the inside of the guard rail. The zero of the scale is opposite a point 142 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 22.66 feet. It is read once each day by J. B. Nave. Discharge measurements are made on the lower side of the bridge, to which the gage is attached. This bridge crosses the river at an angle of  $14^{\circ}$  with the normal to the direction of the current. The initial point for soundings is the top of the first bolt on the downstream guard rail over the middle of the left abutment. The channel is straight for 1,000 feet above and below the station. The right bank is high and will overflow only at flood stages. All water will, however, pass under the bridge and the trestle approach. The left bank is a perpendicular masonry abutment and will not overflow. The section underneath the bridge is smooth and consists of sand, silt, and some small rocks, and does not appear to be shifting. At ordinary stages the channel is divided into three parts by the bridge piers. At flood stages there is an additional flood channel on the right bank. A shallow stretch 1,000 feet below the bridge makes the current under the bridge sluggish at low stages. Bench mark No. 1 is a standard

copper bolt set in the cap of the abutment on the left bank, upstream side of the bridge. When the gage reads zero its elevation is 21.11 feet above the water surface. Bench mark No. 2 is the upper edge of the plate connecting the lower bracing system with the lower chord and floor beam opposite the middle of the gage box on the downstream side of the bridge. This floor beam is the fourth from the left end of the middle span. When the gage reads zero its elevation is 19.60 feet above the water surface. During the summer and fall of 1902 a line of levels was run from Carter's station, Tennessee, near the mouth of the river, to a point near Shulls mill, in North Carolina, near the head of the river, locating the water powers of this stream. These powers are numerous and of considerable magnitude, but at present are comparatively inaccessible and hence not commercially available.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Watauga River near Elizabethton, Tenn., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
May 11.....	E. W. Myers.....	2.00	665
July 3.....	B. S. Drane.....	1.61	234
August 15.....	M. R. Hall.....	1.38	328
Do.....	B. S. Drane.....	1.38	205
September 5.....	do.....	1.25	247
Do.....	do.....	1.25	226
October 17.....	do.....	1.20	204
November 23.....	do.....	1.26	214
February 10.....	E. W. Myers.....	2.80	1,095

*Mean daily gage height, in feet, of Watauga River near Elizabethton, Tenn., for 1903.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.80	1.75	1.55	1.30	1.15	1.15	1.20
2.....		1.90	1.65	1.75	1.25	1.15	1.15	1.20
3.....		1.80	1.65	2.20	1.25	1.10	1.20	1.20
4.....		1.85	1.75	1.75	1.30	1.10	1.25	1.20
5.....		1.80	1.75	2.20	1.25	1.10	1.45	1.25
6.....		2.45	1.75	1.90	1.20	1.10	1.45	1.20
7.....		2.70	1.85	1.70	1.20	1.10	1.35	1.20
8.....		2.30	1.70	1.60	1.20	1.20	1.20	1.20
9.....		2.05	1.55	1.50	1.20	1.70	1.20	1.20
10.....		2.00	1.55	1.45	1.20	1.30	1.20	1.20
11.....	1.95	1.90	1.65	1.50	1.60	1.25	1.20	1.20
12.....	1.95	2.00	1.60	1.55	1.40	1.20	1.20	1.15
13.....	1.90	1.85	3.00	1.50	1.25	1.20	1.15	1.20
14.....	2.00	1.80	3.00	1.40	1.20	1.15	1.20	1.40
15.....	1.95	1.75	2.10	1.40	1.20	1.15	1.20	1.25

*Mean daily gage height, in feet, of Watauga River, etc.—Continued.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16.....	1.95	1.75	1.80	1.35	1.20	1.15	1.20	1.15
17.....	1.85	1.70	1.75	1.40	1.85	1.20	1.20	1.15
18.....	1.80	1.65	1.70	1.40	1.60	1.30	2.20	1.15
19.....	1.85	1.60	1.60	1.35	1.35	1.30	1.50	1.15
20.....	1.80	1.60	1.65	1.35	1.25	1.25	1.30	1.30
21.....	1.80	1.65	1.55	1.35	1.25	1.20	1.30	2.00
22.....	1.80	1.65	1.55	1.30	1.25	1.20	1.25	1.60
23.....	1.75	1.65	1.50	1.30	1.20	1.20	1.25	1.40
24.....	1.70	1.70	1.50	1.30	1.20	1.15	1.25	1.40
25.....	1.70	1.60	1.45	1.25	1.20	1.15	1.25	1.40
26.....	1.70	1.50	1.40	1.25	1.20	1.15	1.25	2.10
27.....	1.65	1.85	1.40	1.25	1.20	1.15	1.20	1.40
28.....	1.65	1.80	1.40	1.25	1.20	1.10	1.15	1.70
29.....	1.65	2.10	1.35	1.20	1.20	1.10	1.20	1.50
30.....	1.75	1.95	1.40	1.25	1.15	1.15	1.20	1.50
31.....	1.80	.....	1.50	1.30	.....	1.20	.....	1.30

*Rating table for Watauga River near Elizabethton, Tenn., from May 11 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.1	200	1.6	430	2.1	708	2.6	993
1.2	231	1.7	485	2.2	765	2.7	1,050
1.3	273	1.8	540	2.3	822	2.8	1,107
1.4	323	1.9	596	2.4	879	2.9	1,164
1.5	376	2.0	652	2.5	936	3.0	1,221

Lower part of curve is uncertain on account of low velocity of stream.

*Estimated monthly discharge of Watauga River near Elizabethton, Tenn., for 1903.*

[Drainage area, 408 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 11-31.....	652	457	544	1.33	1.04
June.....	1,050	376	573	1.40	1.57
July.....	1,221	298	489	1.20	1.38
August.....	765	231	368	.90	1.04
September.....	568	216	268	.66	.73
October.....	485	200	233	.57	.66
November.....	765	216	270	.66	.74
December.....	708	216	300	.74	.85

MISCELLANEOUS MEASUREMENTS IN TENNESSEE RIVER DRAINAGE  
BASIN.

*Valley River.*—The following discharge measurements were made on this stream:

*Discharge measurements of Valley River at Murphy, N. C.*

Date.	Gage height, Hiwassee gage.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
August 27 .....	5.0	63
Do .....	5.0	84
December 4 .....	4.9	58

*Fightingtown Creek.*—This stream was measured at wagon bridge 7 miles northwest of Blueridge, Ga. The bench mark is top of bridge floor at right-bank pier, downstream side of bridge.

*Discharge measurements of Fightingtown Creek at wagon bridge 7 miles northwest of Blueridge, Ga., 1903.*

Date.	Height of bench mark above water.	Discharge.
	<i>Feet.</i>	<i>Second-feet.</i>
July 16 .....	9.60 below B. M. ....	132
July 19 .....	9.80 below B. M. ....	114
August 13 .....	.....	79
December 7 .....	Measured at mouth of creek, G. H. McCays, 0.53.	61

*Little Tennessee River.*—At wagon bridge at McGhee, Tenn., this stream was discharging 2,103 second-feet on August 24, 1903, when the water surface was 38.48 feet below top of upstream end of first crossbeam from left-bank pier.

*Other streams.*—The following miscellaneous measurements have been made in the Tennessee River drainage basin:

*Miscellaneous measurements in Tennessee River drainage basin.*

Date.	Stream.	Locality.	Discharge.
			<i>Second-feet.</i>
July 20	Big Spring .....	Tuscumbia, Ala .....	177.0
Aug. 11	Hampton Creek .....	Mineralbluff, Ga .....	73.0
Aug. 12	Charley Creek .....	Green's mill, near Blueridge, Ga. ....	14.0
Dec. 2	do .....	do .....	3.5
Do	do .....	One-half mile below Green's mill, near Blue Ridge, Ga. ....	3.2
Aug. 27	Hanging Dog Creek .....	Murphy, N. C. ....	48.0
Dec. 2	do .....	do .....	26.0
Do	Weaver Creek .....	Near Blueridge, Ga .....	3.7
Dec. 5	Martins Creek .....	Murphy, N. C. ....	4.0
Dec. 9	Ellijay River .....	Ellijay, Ga. ....	6.07

## YAZOO RIVER DRAINAGE BASIN.

Yazoo River rises in the northwestern part of Mississippi. It flows south just west of the central portion of the State and enters the Mississippi River just above Vicksburg. The United States Geological Survey is maintaining a station on this river at Yazoo City under the direction of M. R. Hall.

## YAZOO RIVER AT YAZOO CITY, MISS.

A gage has been maintained at this point by the Engineer Corps of the Army. It was replaced in 1901 by a new gage rod in three sections, marked with brass figures and brass tacks, the sections being placed as follows: The lowest, marked from  $-3$  to  $+4.5$  feet, is attached to the protecting work of the bridge; the middle section, marked from  $4.5$  to  $18.5$  feet, is attached to the piling that protects the bridge pier; the uppermost section, continuing the graduation up to  $32.3$  feet, is on a post under the approach to the bridge. The highest known water occurred in 1882, reaching a gage height of  $36.5$  feet; the lowest occurred on October 15 to 17 and 20 to 22, 1896, with a gage height of  $-2.8$  feet. The danger line is at  $25$  feet.

Discharge measurements are made from the highway bridge consisting of one span of  $85$  feet, a turn-span of  $190$  feet, an approach on the right bank of about  $100$  feet, and on the left bank of about  $1,200$  feet. This is the bridge to which the gage is attached, and is located one-half mile northwest from the Illinois Central Railroad station in Yazoo City. The initial point for soundings is the end of the iron bridge on the left bank, downstream side. The channel is straight for about  $3,000$  feet above the station and is curved for about  $2,000$  feet below. The current is moderately rapid. As this stream is connected with the Mississippi River both above and below the station, it is influenced by the stage of that stream to the extent that high-water measurements are of no value. The bed is of sand and mud and is subject to some change. The right bank is high, but overflows for several hundred miles at extreme floods; the left bank is high and overflows to the foot of the hill about one-half mile from the river. There are trees along both banks.

A bench mark was established on the top of the upstream cylinder of the second pier from the left bank, at a distance of  $85$  feet from the initial point for soundings, which is on the downstream end of iron bridge on the left bank. The elevation of the mark is  $35.85$  feet above the zero of the gage. Other important bench marks in Yazoo City are the following: P. B. M. 12, Yazoo City, is a copper bolt in stone under ground, surmounted by an iron pipe and cap, in the north corner of the county court-house yard. It is  $44.1$  feet above the zero of the gage and  $116.2$  feet above mean sea level. P. B. M. 13, Yazoo City, is a copper bolt in stone under ground, surmounted

by an iron pipe and cap, in the north corner of the public school yard, near Washington and Main streets. It is 29.2 feet above the zero of the gage and 101.3 feet above mean sea level. The observer is P. C. Battaille. Daily gage heights are furnished by the Weather Bureau.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

*Discharge measurements of Yazoo River at Yazoo City, Miss., in 1903.*

Date.	Hydrographer.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Second-feet.</i>
July 13 .....	J. M. Giles .....	5.80	4,755
September 23 .....	do .....	-2.00	1,633

*Mean daily gage height, in feet, of Yazoo River at Yazoo City, Miss., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	16.40	17.30	24.10	28.60	22.00	6.70	16.90	-0.00	0.50	-2.20	-2.50	-2.20
2.....	18.00	17.20	24.20	28.60	21.80	6.50	16.80	-.60	.40	-2.20	-2.50	-2.10
3.....	18.00	19.00	24.40	28.60	21.40	6.70	16.50	-.50	.20	-2.20	-2.50	-2.10
4.....	18.10	19.00	24.60	28.60	21.00	7.40	16.00	-.50	-.40	-2.20	-2.50	-2.10
5.....	18.40	18.50	24.70	28.70	20.70	8.30	15.50	-.50	-.60	-2.50	-2.50	-2.20
6.....	18.70	18.20	24.80	28.70	20.30	9.20	14.80	-.40	-.90	-2.30	-2.50	-2.30
7.....	18.90	19.70	24.10	28.70	20.00	10.00	13.90	-.30	-1.00	-2.30	-2.50	-2.30
8.....	19.00	22.40	25.20	28.70	19.80	10.90	12.50	-.20	-1.20	-2.30	-2.50	-2.30
9.....	19.00	21.90	25.30	28.60	19.50	11.50	11.00	-.10	-1.30	-2.30	-2.50	-2.30
10.....	19.00	21.80	25.40	28.50	19.20	12.40	9.60	-.10	-1.40	-2.30	-2.50	-2.30
11.....	19.40	22.40	25.80	28.40	19.00	13.00	8.20	1.00	-1.50	-2.30	-2.50	-2.30
12.....	19.40	22.00	25.90	28.30	18.40	13.50	6.90	1.00	-1.60	-2.40	-2.40	-2.40
13.....	19.30	21.90	26.00	28.20	18.50	14.10	6.00	.90	-1.70	-2.40	-2.30	-2.30
14.....	19.30	21.90	26.20	28.00	18.00	14.70	5.00	.90	-1.70	-2.40	-2.20	-2.20
15.....	19.30	22.00	26.40	27.80	17.50	15.00	4.00	1.40	-1.70	-2.40	-2.10	-2.20
16.....	19.20	23.10	26.50	27.50	16.90	15.50	3.50	1.60	-1.80	-2.40	-2.00	-2.20
17.....	19.00	23.40	26.60	27.20	16.20	15.80	2.80	1.80	-1.80	-2.40	-1.90	-2.20
18.....	19.00	23.30	26.80	26.90	15.50	16.00	2.40	1.80	-1.80	-2.40	-1.90	-2.10
19.....	18.90	23.30	26.90	26.60	14.50	16.20	2.00	2.00	-1.80	-2.40	-2.10	-2.00
20.....	18.80	23.30	27.00	26.30	13.40	16.30	1.80	2.50	-2.00	-2.40	-2.10	-1.80
21.....	18.60	23.30	27.20	25.90	12.00	16.40	1.50	1.80	-2.00	-2.40	-2.20	-1.60
22.....	18.40	23.40	27.50	25.50	10.80	16.50	1.20	1.50	-2.10	-2.40	-2.30	-1.40
23.....	18.10	23.50	27.60	25.00	9.50	16.60	1.00	1.50	-2.20	-2.40	-2.30	-1.20
24.....	18.00	23.60	27.80	24.70	8.80	16.70	.80	1.50	-2.20	-2.40	-2.30	-.20
25.....	17.80	23.60	27.90	24.30	8.20	16.90	.50	1.50	-2.20	-2.40	-2.30	.80
26.....	17.60	23.70	28.00	23.90	7.80	17.00	.50	1.50	-2.20	-2.40	-2.30	1.60
27.....	17.50	23.80	28.20	23.50	7.60	17.10	.40	1.40	-2.20	-2.40	-2.30	1.90
28.....	17.80	24.10	28.30	23.00	7.50	17.10	.00	1.30	-2.20	-2.40	-2.30	2.10
29.....	17.60	.....	28.40	22.80	7.40	17.10	-.20	1.20	-2.20	-2.40	-2.30	2.30
30.....	17.50	.....	28.50	22.50	7.20	17.10	-.40	1.00	-2.20	-2.40	-2.30	2.50
31.....	17.40	.....	28.60	.....	6.90	.....	-.50	.80	.....	-2.40	.....	2.50

*Rating table for Yazoo River at Yazoo City, Miss., from January 1 to December 31, 1903.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
-2.5	1,730	.4	2,440	5.0	4,440	15.0	14,000
-2.4	1,750	.6	2,500	5.2	4,580	15.5	14,500
-2.3	1,770	.8	2,560	5.4	4,720	16.0	15,000
-2.2	1,790	1.0	2,620	5.6	4,860	16.5	15,500
-2.1	1,810	1.2	2,690	5.8	5,000	17.0	16,000
-2.0	1,830	1.4	2,760	6.0	5,150	17.5	16,500
-1.9	1,850	1.6	2,830	6.5	5,550	18.0	17,000
-1.8	1,870	1.8	2,900	7.0	6,000	18.5	17,500
-1.6	1,915	2.0	2,970	7.5	6,500	19.0	18,000
-1.5	1,940	2.2	3,050	8.0	7,000	19.5	18,500
-1.4	1,965	2.4	3,130	8.5	7,500	20.0	19,000
-1.3	1,990	2.6	3,210	9.0	8,000	20.5	19,500
-1.2	2,015	2.8	3,300	9.5	8,500	21.0	20,000
-1.1	2,040	3.0	3,390	10.0	9,000	22.0	21,000
-1.0	2,065	3.2	3,480	10.5	9,500	23.0	22,000
— .9	2,090	3.4	3,570	11.0	10,000	24.0	23,000
— .8	2,115	3.6	3,660	11.5	10,500	25.0	24,000
— .7	2,140	3.8	3,760	12.0	11,000	26.0	25,000
— .6	2,165	4.0	3,870	12.5	11,500	27.0	26,000
— .4	2,215	4.2	3,980	13.0	12,000	28.0	27,000
— .2	2,265	4.4	4,090	13.5	12,500	29.0	28,000
+ .0	2,320	4.6	4,200	14.0	13,000		
.2	2,380	4.8	4,320	14.5	13,500		

Rating table for 1903 same as 1902.

*Estimated monthly discharge of Yazoo River at Yazoo City, Miss., for 1903.*

[Drainage area, 8,580 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second feet per square mile.	Depth in inches.
January .....	18,400	15,400	17,432	2.03	2.34
February .....	23,100	16,200	20,807	2.43	2.53
March .....	27,600	23,100	25,442	2.97	3.42
April .....	27,700	21,700	25,753	3.00	3.35
May .....	21,000	5,910	14,075	1.64	1.89
June .....	16,100	5,550	12,610	1.47	1.64
July .....	15,900	2,190	6,549	.76	.88
August .....	3,170	2,165	2,593	.30	.35
September .....	2,470	1,790	1,953	.23	.26
October .....	1,790	1,750	1,760	.21	.24
November .....	1,850	1,770	1,767	.21	.23
December .....	3,170	1,750	2,089	.24	.28
The year .....	27,700	1,730	11,068	1.29	17.41

## BIG BLACK RIVER DRAINAGE BASIN.

### MISCELLANEOUS MEASUREMENTS.

Big Black River was measured at the Illinois Central Railroad trestle at Morey, Miss., on July 13, when it had a discharge of 491 second-feet. The bench mark is the downstream end of cap, 110 feet from left-bank end of trestle, and the water surface was 25.25 feet below bench mark.

On July 14 the same stream was measured at Illinois Central Railroad trestle, 1 mile north of Way, Miss. The bench mark is downstream end of cap, 240 feet from north end of trestle. Water surface was 15.75 feet below bench mark, and the discharge was 1,391 second-feet.





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