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

WATER-SUPPLY PAPER 261

FACE WATER SUPPLY OF THE UNITED STATES

1909

PART I. NORTH ATLANTIC COAST

PARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

H. K. BARROWS, C. C. COVERT
AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
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SURFACE WATER SUPPLY OF THE NORTH ATLANTIC COAST, 1909.

By H. K. Barrows, C. C. Covert, and R. H. Bolster.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

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

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30,1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

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

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

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

SCOPE OF INVESTIGATIONS.

These investigations of stream flow are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited by the appropriations available. The field covered is the widest and the character of the work is believed to be the best possible under the controlling conditions. The work would undoubtedly have greater scientific importance and ultimately be of more practical value if the money now expended for wide areas were concentrated on a few small drainage basins; but such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be kept during a period of years long enough to determine within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum. The length of such a period manifestly differs for different streams. Experience has shown that the records for some streams should cover from five to ten years, and for other streams twenty years or even more, the limit being determined by the relative importance of the stream and the interdependence of the results with other long-time records on adjacent streams.

In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of time and a judicious expenditure of a small amount of money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-flow measurements. It is confidently believed that the stream-flow data presented in the publications of the Survey are in general sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of stations. All persons are cautioned to exercise the greatest care in using such incomplete records.

Records have been obtained at more than 1,550 different points in the United States, and in addition the surface-water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1909 regular gaging stations were maintained by the survey and cooperating organizations at about 850 points in the United States, and many miscellaneous measurements were made at other points. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular surface-water supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

The results contained in this volume are requisite to meet the immediate demands of many public interests, including navigation, irrigation, domestic water supply, water power, swamp and overflow land drainage, and flood prevention.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation, and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $51,000,000 on Federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system depends absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are not only of first importance in the redemption of the lands, but constitute an insurance of Federal and private investments.

Domestic water supply.—The highest use of water is for domestic supply, and although this branch of the subject is of less direct Federal interest than the branches already named, it nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The development of the water power of the country is an economic necessity. Our stock of coal is being rapidly depleted and the cost of steam power is increasing accordingly. Industrial growth and, as a consequence, the progress of the United States as a nation will cease if cheap power is not available. Water power affords the only avenue now open. When the electric transmission of power was accomplished the relation of our water powers to national economy changed entirely. Before the day of electric transmission water power was important only at the locality at which it was generated, but it has now become a public utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available depends on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worthless or of precarious value by reason of overflow and swamp conditions. When this land is drained it becomes exceedingly productive and its value increases many fold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the first consideration in connection with drainage projects. If by the drainage of a large area into any particular channel that channel becomes so gorged with water which it had not hitherto been called upon to convey that overflow conditions are created in places where previously the land was not subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States probably exceeds on the average $100,000,000 annually, and in the year 1908, according to estimates based on reliable data, the aggregate damage approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications has varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1909. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1909.

Part.	No.	Title.	Part.	No.	Title.
I	261	North Atlantic coast.	VI	266	Missouri River Basin.
II	262	South Atlantic coast and eastern Gulf of Mexico.	VII	267	Lower Mississippi River Basin.
			VIII	268	Western Gulf of Mexico.
III	263	Ohio River Basin.	IX	269	Colorado River Basin.
IV	264	St. Lawrence River Basin.	X	270	Great Basin.
V	265	Upper Mississippi River and Hudson Bay Basin.	XI	271	California.
			XII	272	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the

United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive and dates also are inclusive so far as the data are available.

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

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

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, Eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	do	1903.
W. S. 124 to 135	do	1904.
W. S. 165 to 178	do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.
W. S. 261 to 272	do	1909.

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

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1909. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1909.

	1899 [a]	1900 [b]	1901	1902	1903	1904	1905	1906	1907–8	1909
Atlantic coast and eastern Gulf of Mexico:										
New England rivers	35	47	65,75	82	97	124	165	201	241	261
Hudson River to Delaware River, inclusive	35	47,(48)	65,75	82	97	125	166	202	241	261
Susquehanna River to York River, inclusive	35	48	65,75	82	97	126	167	203	241	261
James River to Yadkin River, inclusive	(35),36	48	65,75	(82),83	(97),98	126	167	203	242	262
Santee River to Pearl River, inclusive	36	48	65,75	83	98	127	168	204	242	262
St. Lawrence River	36	49	65,75	(82),83	97	129	170	206	244	264
Hudson Bay	....	....	66,75	85	100	130	171	207	245	265
Mississippi River:										
Ohio River	36	48,(49)	65,75	83	98	128	169	205	243	263
Upper Mississippi River	36	49	65,75	83	98,(99)	128, (130)	171	207	245	265
Missouri River	(36),37	49,(50)	66,75	84	99	130, (131)	172	208	246	266
Lower Mississippi River	37	50	(65), 65,75	(83),84	(98),99	(128), 131	(169), 173	(205), 209	247	267
Western Gulf of Mexico	37	50	66,75	84	99	132	174	210	248	268
Pacific coast and Great Basin:										
Colorado River	(37),38	50	66,75	85	100	133, (134)	175, (177)	211, (213)	249, (251)	269, (271)
Great Basin	38,(39)	51	66,75	85	100	133, (134)	176, (177)	212, (213)	250, (251)	270, (271)
South Pacific coast to Klamath River, inclusive	(38),39	51	66,75	85	100	134	177	213	251	271
North Pacific coast	38	51	66,75	85	100	135	(177), 178	214	252	272

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basins.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	Yuma and Salton Sea stations repeated.
271	Great Basin	Owens River basin.

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the month of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

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

DEFINITION OF TERMS.

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

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

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

CONVENIENT EQUIVALENTS.

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

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches equals 96 Colorado miner's inches
100 California miner's inches for 1 day equals 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches equals 104 California miner's inches.
100 Colorado miner's inches for 1 day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for 1 day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.

1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

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

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, table of daily discharges, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with suitable footnotes. The rating is not appliable for such periods unless the proper correction to the gage heights is known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report but can be determined from the daily gage heights and daily discharges for the purposes of verifying the published results as follows:

First plot the discharge measurements for the current and earlier years on cross-section paper with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant. except for known backwater periods.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the period when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 13, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir or dam; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the vaule for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions. It is seldom used by the United States Geological Survey.[1]

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of sharp-crested and broad-crested weirs within the limits for which accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, crest which is not level, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current-meter gaging stations under unobstructed channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.[2]

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently, but which do not cause a variation of more than about 5 per cent of the discharge curves from year to year; and (4) those with constantly shifting beds. In determining the daily flow different office methods are necessary for

[1] Full information regarding this method is given in the various textbooks on hydraulics.

[2] The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200) and in the various textbooks on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The edition of the latter water-supply paper is nearly exhausted. It can, however, be consulted at most of the larger libraries of the country or it can be obtained from the superintendent of documents, Washington, D. C., at a cost of 20 cents.

each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

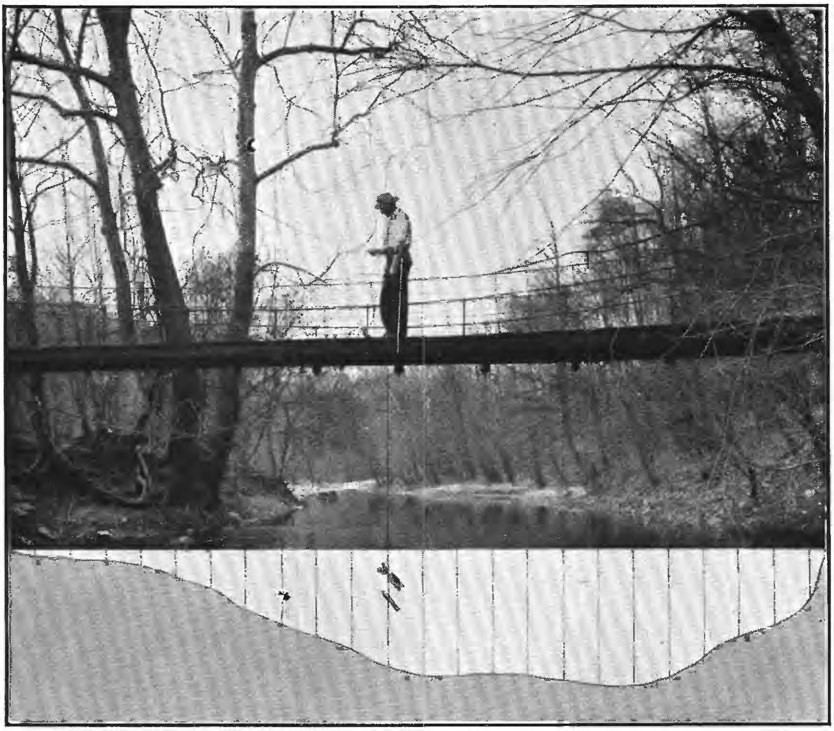
Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years unless funds are available to cover all changes in conditions of flow. A straight, smooth section without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the cost of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 2 to 5 per cent or less of the total width, will, within reasonable limits, yield better results for a given outlay of money than semi-permanent or shifting sections with smooth, uniform current. So far as possible stations are located where the banks are high and not subject to overflow at high stages and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

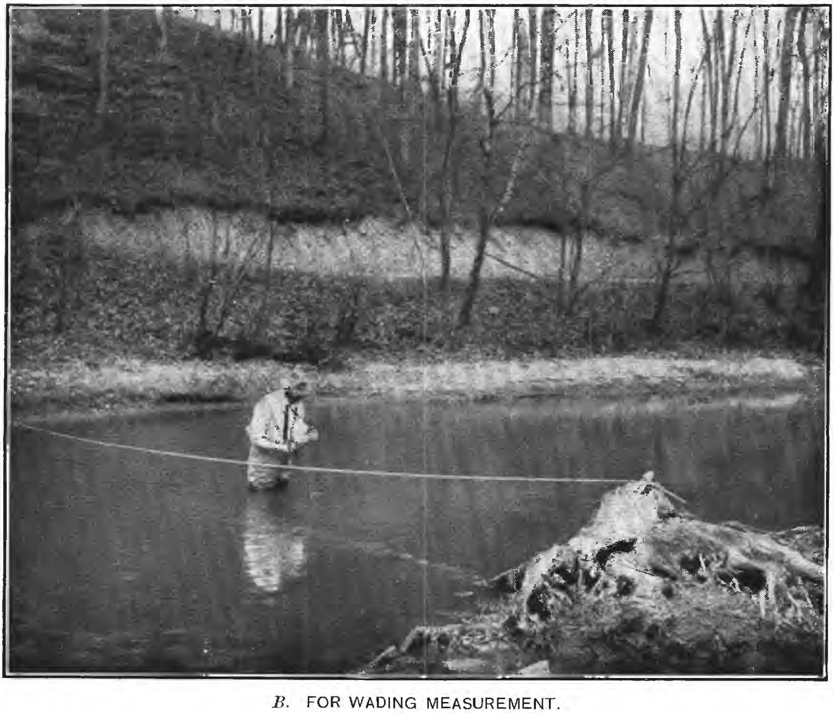
The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

In making a measurement with a current meter a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *A*.) These points are spaced equally for those parts of the section where the flow is uniform and smooth and are spaced unequally for other parts according to the discretion and judgment of the engineer. In general the points should not be spaced farther apart than 5 per cent of the channel width nor farther apart than the approximate mean depth of the section at the time of measurement.

The measuring points divide the total cross section into elementary strips at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip



A. FOR BRIDGE MEASUREMENT.



B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.

times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total discharge of the stream.[1]

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method, with its various modifications of surface, subsurface, and tube or rod floats, is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity.[2]

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions.[3]

Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations; on the left the same type of meter is shown equipped for wading measurements, to record by the acoustic method; on the right the meter is shown equipped to record electrically. (See Pl. I, *B*.) Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The revolutions are indicated electrically. The rating, or relation between the velocity of moving water and the revolutions

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1 For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908

2 Further information regarding the float method is given in Water-Supply Paper 95 and the various textbooks on stream flow.

3 See Hoyt, J. C., and others, Use and care of the current meter as practiced by the United States Geological Survey: Trans. Am. Soc. C. E., vol. 66, 1910, p. 70.

of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

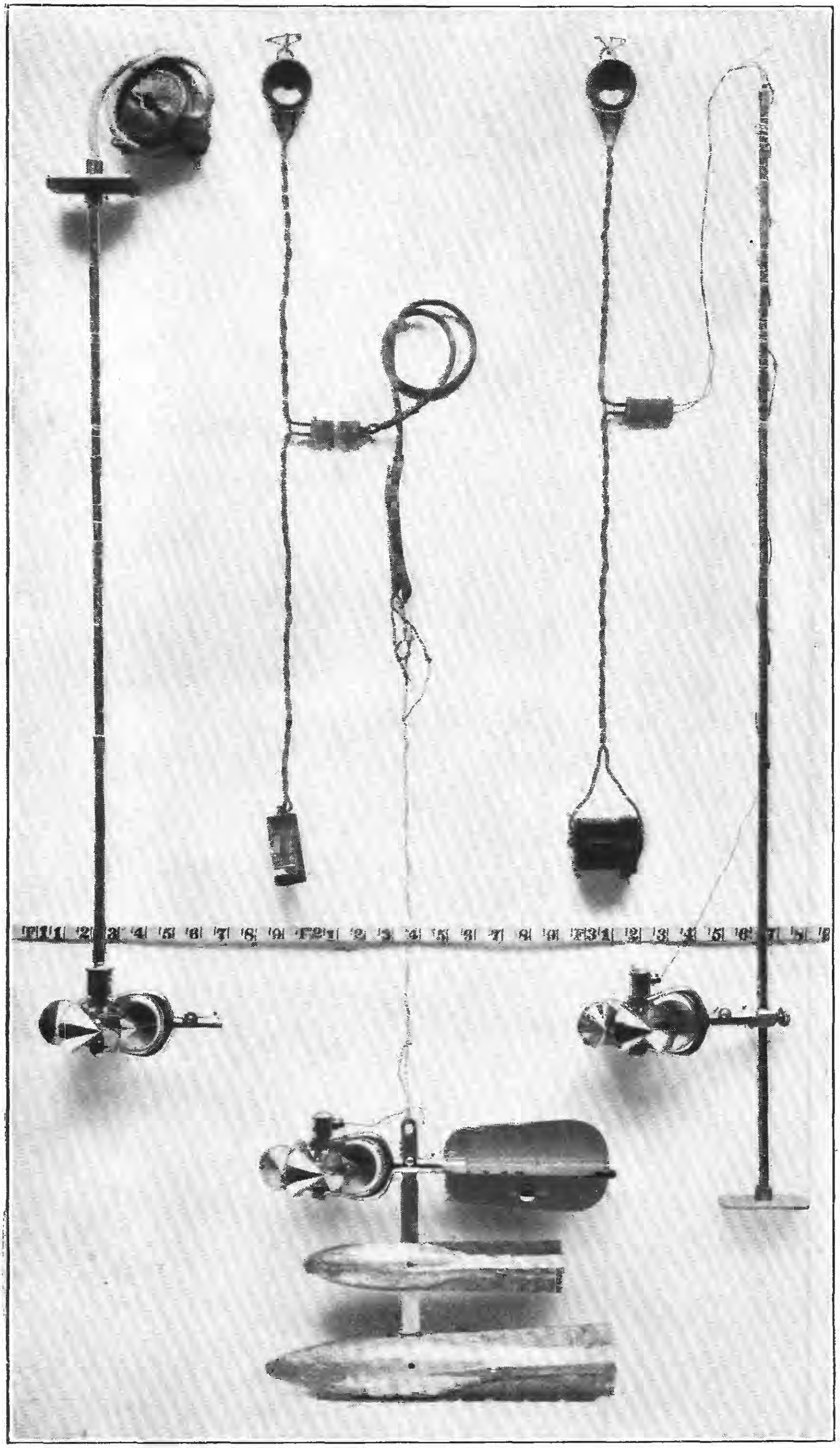
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I, *A*.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in



SMALL PRICE CURRENT METERS.

most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.[1]

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measure-

[1] For information in regard to flow under ice cover see Water-Supply Paper U. S. Geol. Survey No. 187.

ments, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 17.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are more or less generally parabolic in form. In many cases curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock, and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean discharge curve, and the rating developed from that curve represents a very high degree of accuracy. For illustrative example of a station of this type see Plate III and stations of the north Atlantic coast drainage basins.

Class 2 is confined mainly to stations on rough, mountainous streams with steep slopes. The beds of such streams are as a rule comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow. For illustrative examples of stations of this type see stations of the upper Missouri River basin.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class, results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to their ordinates or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is, of course, fundamentally due to change in the channel caused by cut or fill, or both, at and near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section, there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky controlling point, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class.

For illustrative example of a station of this type see stations of the south Atlantic coast drainage basins.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. For examples of stations of this type see stations in the Platte, Arkansas, Rio Grande, and lower Colorado drainage basins.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the daily and monthly discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions wherever available, daily records of temperature and precipitation obtained from the United States Weather Bureau climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all, and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are, as a rule, included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

The effort is made to visit every station at least once each year for the purpose of making a measurement to determine the constancy of conditions of flow since the last measurement made during the preceding year, and also to check the elevation of the gage. On account of lack of funds or for other causes, some stations were not visited during the current year. If conditions of flow have been reasonably permanent up to the time of the last preceding measurement, it is considered best to publish values of discharge on the basis of the latest verified rating curve rather than to omit them altogether, although it should be distinctly understood that such records are at times subject to considerable error. This is also true, although to a less degree, of the period of records since the date of the last measurement of the current year. As a rule the accuracy notes are based on the assumption that the rating curve used is strictly applicable to the current year.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the survey engineers. This is done to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for 5 or 10 year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates. This is particularly true of the maximum and minimum figures, which in the very nature of the method of collecting these data are liable to large errors. The maximum value should be increased considerably for many stations in considering designs for spillways, and the minimum value should be considered for a group of, say, seven days and not for one day.

The daily discharges are published to allow a more detailed study of the variation in flow and to determine the periods of deficient flow.

COOPERATIVE DATA.

Cooperative data of various kinds and also data regarding the run-off at many stations maintained wholly by private funds are incorporated in the surface water-supply reports of the United States Geological Survey.

Many stations throughout the country are maintained for specific purposes by private parties who supply the records gratuitously to the United States Geological Survey for publication. When such records are supplied by responsible parties and appear to be reasonably accurate they are verified, so far as possible, and estimated values of accuracy are given. Records clearly known to be worthless or misleading are not published. As it is, however, impossible to completely verify all such records furnished—because of lack of funds or for other causes—they are published for what they are worth, as they are of value as a matter of record and afford at least approximate information regarding stream flow at the particular localities. The Survey does not, however, assume any responsibility for inaccuracies found in such records, although most of them are believed to be reasonably good.

COOPERATION AND ACKNOWLEDGMENTS.

NEW ENGLAND.

Assistance has been rendered or records furnished in New England by the following, to whom special acknowledgment is due:

Maine State Survey Commission, F. C. Robinson, chairman, C. S. Hichborn, secretary and treasurer, and N. M. Jones; the State of Vermont, George H. Prouty, governor; the State of Massachusetts, Eben S. Draper, governor; Natural Resources Survey of Rhode Island, Prof. Charles W. Brown, superintendent; H. S. Ferguson, engineer of Great Northern Paper Co.; H. C. Lord; Fred Cort; F. E. Boston, manager, and James L. Dean and George H. Marr, engineers for Hollingsworth & Whitney Co.; C. S. Humphreys; Joseph A. Warren, of S. D. Warren & Co.; J. G. White & Co.; C. A. Mixer, engineer for Rumford Falls Power Co.; Walter H. Sawyer, agent of Union Water Power Co.; Sellers & Rippey; J. Brodie Smith, manager of Manchester Traction, Light & Power Co.; R. A. Hale, principal assistant engineer of Essex Co.; Arthur T. Safford, principal assistant engineer of Locks & Canals Co.; Dexter Brackett, chief engineer of Metropolitan Water and Sewerage Board; Charles Bigelow, treasurer of Haile & Frost Manufacturing Co.; Frederick S. Leonard, of Fisk Paper Co.; Charles Of, general superintendent, and H. M. Sumner, engineer for Vermont Copper Co.; International Paper Co.; Bellows Falls Canal, Co.; C. W. Hazelton, treasurer of Turners Falls Co.; H. I. Harriman, general manager of Connecticut River Power Co.; A. F. Sickman, hydraulic engineer, Holyoke Water Power Co.; Greenfield Electric Light & Power Co.; Otis Co.; George H. Gilbert Manufacturing Co.; E. E. Lochridge, engineer Springfield Water Board; Charles T. Main; Prof. George F. Swain; William D. Thompson, engineer, and A. W. Hubbard, manager of Orange Electric Light Co.; Hollis French; McElwain Co.; C. S. Taylor, of Taylor Manufacturing Co.; F. J. Pitts, of James Pitts & Sons; P. M. Churchill; and S. F. Dunlap, of East Providence Water Co.

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NEW JERSEY, PENNSYLVANIA, MARYLAND, AND VIRGINIA.

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DIVISION OF WORK.

The field data for New England were collected under the direction of H. K. Barrows, district engineer, assisted by T. W. Norcross, F. E. Pressey, and D. M. Wood, assistant engineers, and G. M. Brett and A. D. Butterfield.

The field data for New York were collected under the direction of C. C. Covert, district engineer, assisted by W. G. Hoyt, junior engineer, and E. F. Weeks.

The field data for the Middle Atlantic States were collected under the direction of R. H. Bolster, assistant engineer, assisted by G. C. Stevens, R. C. Rice, and J. G. Mathers, junior engineers.

Except as otherwise stated in the descriptions, computations of discharge for stations located at dams, and ratings, computations, ice estimates, and special studies, prepared in advance for the New York State Water Supply Commission, and some few other stations in New York, were made by C. C. Covert, assisted by W. G. Hoyt.

All other ratings, ice estimates, special estimates, studies of the completed data and computations for New England and New York were made and prepared for publication by R. H. Bolster and

T. W. Norcross assistant engineers, assisted by G. C. Stevens, H. D. Padgett, R. C. Rice, J. G. Mathers, and M. I. Walters.

The manuscript for Maine was reviewed by C. C. Babb, that for New England by T. W. Norcross, and that for New York by C. C. Covert. The complete manuscript was edited by Mrs. B. D. Wood.

GAGING STATIONS IN NORTH ATLANTIC COAST DRAINAGE BASINS.

The following is a list of gaging stations maintained in the north Atlantic coast drainage basins by the United States Geological Survey and cooperative parties. Data for these stations have appeared in the reports listed in tables on page 13. The stations are arranged by river basins and appear in downstream order, tributaries of main streams being shown by indention.

St. John River:
- St. John River at Fort Kent, Maine, 1905–1909.
  - Fish River at Wallagrass, Maine, 1903–1908.
  - Aroostook River at Fort Fairfield, Maine, 1903–1909.

St. Croix River:
- St. Croix River near Woodland, Maine, 1902–1909.

Machias River:
- Machias River at Whitneyville, Maine, 1903–1909.

Union River:
- West Branch of Union River at Amherst, Maine, 1909.
- West Branch of Union River near Mariaville, Maine, 1909.
- Union River at Ellsworth, Maine, 1909.
  - East Branch of Union River near Waltham, Maine, 1909.
  - Webbs Brook at Waltham, Maine, 1909.
  - Green Lake at Green Lake, Maine, 1909.
  - Green Lake Stream at Lakewood, Maine, 1909.
  - Branch Lake near Ellsworth, Maine, 1909.
  - Branch Lake Stream near Ellsworth, Maine, 1909.

Penobscot River:
- West Branch of Penobscot River at Millinocket, Maine, 1901–1909.
- Penobscot River at West Enfield Maine, 1901–1909.
- Penobscot River at Sunk Haze Rips, near Costigan, Maine, 1899–1900.
  - East Branch Penobscot River at Grindstone, Maine, 1902–1909.
  - Mattawamkeag River at Mattawamkeag, Maine, 1902–1909.
  - Piscataquis River near Foxcroft, Maine, 1902–1909.
  - Cold Stream at Enfield, Maine, 1904–1906.
  - Kenduskeag Stream near Bangor, Maine, 1908–9.
  - Phillips Lake Outlets at Holden and Dedham, Maine, 1904–1908.

Kennebec River:
- Moose River at Rockwood, Maine, 1902–1908.
- Moosehead Lake at Greenville, Maine, 1903–1908 (stage only).
- Moosehead Lake at East Outlet, Maine, 1895–1909 (stage only).
- Kennebec River at The Forks, Maine, 1901–1909.
- Kennebec River at Bingham, Maine, 1907–1909.
- Kennebec River at North Anson, Maine, 1901–1907.

Kennebec River—Continued.
- Kennebec River at Waterville, Maine, 1891–1909.
  - Roach River at Roach River, Maine, 1901–1908.
  - Dead River at The Forks, Maine, 1901–1907.
  - Carrabassett River at North Anson, Maine, 1901–1907.
  - Sandy River at Madison, Maine, 1904–1908.
  - Sebasticook River at Pittsfield, Maine, 1908–9.
  - Messalonskee Stream at Waterville, Maine, 1903–1905.
  - Cobbosseecontee Stream at Gardiner, Maine, 1890–1909.

Androscoggin River:
- Androscoggin River at Errol Dam, N. H., 1905–1909.
- Androscoggin River at Gorham, N. H., 1903 (fragmentary).
- Androscoggin River at Shelburne, N. H., 1903–1907.
- Androscoggin River at Rumford Falls, Maine, 1892–1909.
- Androscoggin River at Dixfield, Maine, 1902–1908.

Presumpscot River:
- Presumpscot River at outlet of Sebago Lake, Maine, 1887–1909.

Saco River:
- Saco River near Center Conway, N. H., 1903–1909.
- Saco River at West Buxton, Maine, 1907–1909.

Merrimac River:
- Pemigewasset River at Plymouth, N. H., 1886–1909.
- Merrimac River at Franklin Junction, N. H., 1903–1909.
- Merrimac River at Garvins Falls, N. H., 1904–1909.
- Merrimac River at Lawrence, Mass., 1890–1909.
  - Contoocook River at West Hopkinton, N. H., 1903–1907.
  - Suncook River at East Pembroke, N. H., 1904–5.
  - Souhegan River at Merrimac, N. H., 1909.
  - South Branch of Nashua River at Clinton, Mass., 1896–1909.
  - Sudbury River at Framingham, Mass., 1875–1909.
  - Lake Cochituate at Cochituate, Mass., 1863–1909.

Mystic River:
- Mystic Lake near Boston, Mass., 1878–1897.

Taunton River:
- Matfield River at Elmwood, Mass., 1909.
  - Satucket River near Elmwood, Mass., 1909.

Tenmile River drainage basin:
- Tenmile River near Rumford, R. I., 1909.

Blackstone River:
- Blackstone River at Woonsocket, R. I., 1904–5.
- Blackstone River at Berkeley, R. I., 1900–1.
  - Branch River at Branch Village, R. I., 1909.

Pawtuxet River:
- Pawtuxet River at Harris, R. I., 1909.

Pawcatuck River:
- Wood River at Hope Valley, R. I., 1909.

Thames River:
- Shetucket River at Willimantic, Conn., 1904–5.

Connecticut River:
- Connecticut River at Orford, N. H., 1900–1909.
- Connecticut River at Sunderland, Mass., 1904–1909.
- Connecticut River at Holyoke, Mass., 1880–1898.

Connecticut River—Continued.
- Connecticut River at Hartford, Conn, 1896-1908.
  - Israel River above South Branch at Jefferson Highlands, N. H., 1903-1906.
  - Israel River below South Branch at Jefferson Highlands, N. H., 1903-1907.
  - Passumpsic River at St. Johnsbury Center, Vt., 1903 and 1909.
  - Ammonoosuc River at Bretton Woods, N. H., 1903-1907.
    - Zeland River at Twin Mountain, N. H., 1903-1907.
    - Little River at Twin Mountain, N. H., 1904-5.
  - White River at Sharon, Vt., 1903-4 and 1909.
  - Ashuelot River at Winchester, N. H., 1903-4.
  - Ashuelot River at Hinsdale, N. H., 1907-1909.
  - Millers River at Wendell, Mass., 1909.
  - Deerfield River at Hoosac Tunnel, Mass., 1909.
  - Deerfield River at Shelburne Falls, Mass., 1907-1909.
  - Deerfield River at Deerfield, Mass., 1904-5.
  - Ware River at Ware, Mass., 1904-1908.
    - Burnshirt River near Templeton, Mass., 1909.
  - Quaboag River at West Warren, Mass., 1904-1907.
  - Quaboag River at West Brimfield, Mass., 1909.
  - Westfield River at Russell, Mass., 1904-5.
    - North Branch of Westfield River at Knightville, Mass., 1909.
    - Westfield Little River near Blandford, Mass., 1905-1909.
  - Salmon River at Leesville, Conn., 1905-6.

Housatonic River:
- Housatonic River at Gaylordsville, Conn., 1900-1908.
  - Tenmile River at Dover Plains, N. Y., 1901-1903.

Mianus River:
- Mianus River near Stamford, Conn., 1903.
- Mianus River at Bedford, N. Y., 1903.

Byram River:
- Byram River at Pemberwick, Conn., 1903.
  - West Branch of Byram River near Port Chester, N. Y., 1903.
  - East Branch of Byram River near Greenwich, Conn., 1903.
  - Middle Branch of Byram River near Riverville, Conn., 1903.

Hudson River:
- Hudson River at North Creek, N. Y., 1907-1909.
- Hudson River at Thurman, N. Y., 1907-1909.
- Hudson River at Fort Edward, N. Y., 1895-1908.
- Hudson River at Mechanicville, N. Y., 1888-1909.
  - Indian Lake Reservoir at Indian Lake, N. Y., 1900-1909.
  - Schroon Lake at Pottersville, N. Y., 1908-9.
  - Schroon River at Riverbank, N. Y., 1907-1909.
  - Schroon River at Warrensburg, N. Y., 1895-1902.
  - Sacandaga River at Wells, N. Y., 1907-1909.
  - Sacandaga River at Northville, N. Y., 1907-1909.
  - Sacandaga River near Hadley, N. Y., 1907-1909.
  - Sacandaga River at Union Bag & Paper Co.'s Mill, at Hadley, N. Y., 1909.
  - Battenkill River at Battenville, N. Y., 1908.
  - Fish Creek at Burgoyne, N. Y., 1904-5 and 1908.
  - Hoosic River at Buskirk, N. Y., 1903-1909.
  - Mohawk River at Ridge Mills near Rome, N. Y., 1898-1900.
  - Mohawk River at Utica, N. Y., 1901-1903.
  - Mohawk River at Little Falls, N. Y., 1898-1909.
  - Mohawk River at Rocky Rift Dam near Indian Castle, N. Y., 1901.

Hudson River—Continued.
  Hudson River at Mechanicville, N. Y., 1888–1909—Continued.
    Mohawk River at Schenectady, N. Y., 1899–1901.
    Mohawk River at Rexford Flats, N. Y., 1898–1901.
    Mohawk River at Dunsbach Ferry, N. Y., 1898–1909.
      Ninemile Creek at Stittville, N. Y., 1898–9.
      Oriskany Creek at Coleman, N. Y., 1904–1906.
      Oriskany Creek at Wood Road Bridge near Oriskany, N. Y., 1901–1904.
      Oriskany Creek at Oriskany State Dam near Oriskany, N. Y., 1898–1906.
      Saquoit Creek at New York Mills, N. Y., 1898–1900.
      Nail Creek at Utica, N. Y., 1904.
      Reels Creek at Deerfield, N. Y., 1901–1904.
      Reels Creek at Utica, N. Y., 1901–2.
        Johnston Brook at Deerfield, N. Y., 1903–1905.
      Starch Factory Creek at New Hartford, N. Y., 1903–1906.
        Graefenberg Creek at New Hartford, N. Y., 1903–1906.
        Sylvan Glen Creek at New Hartford, N. Y., 1900–1906.
      West Canada Creek at Twin Rock Bridge near Trenton Falls, N. Y., 1900–1909.
      West Canada Creek at Middleville, N. Y., 1898–1901.
      West Canada Creek at Kast Bridge, N. Y., 1905–1909.
      East Canada Creek at Dolgeville, N. Y., 1898–1909.
      Garoga Creek 3 miles above junction with Mohawk, 1898–9.
      Cayadutta Creek at Johnstown, N. Y., 1898–1900.
      Schoharie Creek at Prattsville, N. Y., 1902–1909.
      Schoharie Creek at Schoharie Falls above Mill Point, 1900–1.
      Schoharie Creek at Mill Point, N. Y., 1900–1903.
      Schoharie Creek at Fort Hunter, 1898–1901.
      Schoharie Creek at Erie Canal Aqueduct below Fort Hunter, N. Y., 1900.
    Quackenkill at Quackenkill, N. Y., 1894.
    Normanskill at French's Mill, N. Y., 1891.
    Kinderhook Creek at Wilson's Dam near Garfield, N. Y., 1893–4.
    Kinderhook Creek at East Nassau, N. Y., 1892–1894.
    Kinderhook Creek at Rossman, N. Y., 1906–1909.
    Catskill Creek at South Cairo, N. Y., 1901–1907.
    Esopus Creek at Olivebridge, N. Y., 1903–1904.
    Esopus Creek near Olivebridge, N. Y. (weir station), 1906–1909.
    Esopus Creek at Kingston, N. Y., 1901–1909.
    Esopus Creek at Mount Marion, N. Y., 1907–1909.
    Rondout Creek at Rosendale, 1901–1903, 1905–1909.
      Diversion to Delaware and Hudson Canal at Rosendale, 1901–1907.
      Wallkill River at Newpaltz, N. Y., 1901–1903.
    Wappinger Creek at Wappinger Falls, N. Y., 1903–1905.
    Fishkill Creek at Glenham, N. Y., 1901–1903.
    Foundry Brook at Coldspring, N. Y., 1902–3.
    Croton River at Croton Dam, near Croton Lake, N. Y., 1868–1903.
Passaic River:
  Passaic River at Millington, N. J., 1903–1906.
  Passaic River near Chatham, N. J., 1902–1909.
  Passaic River at Two Bridges (Mountain View), N. J., 1901–1903.
    Rockaway River, at Boonton, N. J., 1903–4.
    Pompton River at Pompton Plains, N. J., 1903–4.
    Pompton River at Two Bridges (Mountain View), N. J., 1901–1903.
      Ramapo River near Mahwah, N. J., 1903–1908.
        Wanaque River at Wanaque, N. J., 1903–1905.

Raritan River:
- Raritan River at Stanton, N. J., 1903–1906.
- Raritan River at Finderne, N. J., 1903–1907.
- Raritan River at Boundbrook, N. J., 1903–1909.
  - North Branch Raritan River at Pluckemin, N. J., 1903–1906.
  - Millstone River at Millstone, N. J., 1903–4.

Delaware River:
- East Branch Delaware River at Hancock, N. Y., 1902–1909.
- Delaware River at Port Jervis, N. Y., 1904–1909.
- Delaware River at Rieglesville, N. J., 1906–1909.
- Delaware River at Lambertville, N. J., 1897–1908.
  - West Branch Delaware River at Hancock, N. Y., 1902–1909.
  - Mongaup River near Rio, N. Y., 1909.
  - Neversink River at Godeffroy, N. Y., 1903, 1909.
  - Neversink River at Port Jervis, N. Y., 1902–1903.
  - Paulins Kill at Columbia, N. J., 1908–9.
  - Lehigh River at South Bethlehem, Pa., 1902–1905; 1909.
  - Lehigh River at Easton, Pa., 1909.
  - Musconetcong River at Asbury, N. J., 1903.
  - Musconetong River near Bloomsbury, N. J., 1903–1907.
  - Tohickon Creek at Point Pleasant, Pa., 1883–1909.
  - Neshaminy Creek below Forks, Pa., 1884–1909.
  - Schuylkill River near Philadelphia, Pa., 1898–1909.
    - Perkiomen Creek near Frederick, Pa., 1884–1909.
    - Wissahickon Creek at Philadelphia, Pa., 1897–1906.

Susquehanna River:
- Susquehanna River at Colliersville, N. Y., 1907–8.
- Susquehanna River at Binghamton, N. Y., 1901–1909.
- Susquehanna River at Wysox, Pa., 1908–9.
- Susquehanna River at Wilkesbarre, Pa., 1899–1909.
- Susquehanna River at Danville, Pa., 1899–1909.
- Susquehanna River at Harrisburg, Pa., 1891–1909.
- Susquehanna River at McCalls Ferry, Pa., 1902–1909.
  - Chenango River at South Oxford, N. Y., 1903.
  - Chenango River near Greene, N. Y., 1908.
  - Chenango River at Binghamton, N. Y., 1901–1909.
    - Eaton Brook, Madison County, N. Y., 1835.
    - Madison Brook, Madison County, N. Y., 1835.
    - Tioughnioga River at Chenango Forks, N. Y., 1903.
  - Cayuta Creek at Waverly, N. Y., 1898–1902.
  - Chemung River at Chemung, N. Y., 1903–1909.
  - West branch Susquehanna River at Williamsport, Pa., 1895–1909.
  - West branch Susquehanna River at Allenwood, Pa., 1899–1902.
  - Juniata River at Newport, Pa., 1899–1909.
  - Broad Creek at Mill Green, Md., 1904–1909.
  - Octararo Creek at Rowlandsville, Md., 1896–1899.
  - Deer Creek near Churchville, Md., 1904–1909.

Gunpowder River:
- Gunpowder Falls at Glencoe, Md., 1904–1909.
  - Little Gunpowder Falls, near Belair, Md., 1904–1909.

Patapsco River:
- Patapsco River at Woodstock, Md., 1896–1909.

Patuxent River:
- Patuxent River at Laurel, Md., 1896–1898.

Potomac River:
- North Branch of Potomac River at Piedmont, W. Va., 1899–1906.
- North Branch of Potomac River at Cumberland, Md., 1894–1897.
- Potomac River at Great Cacapon, W. Va., 1894–1896.
- Potomac River at Point of Rocks, Md., 1895–1909.
  - Savage River at Bloomington, Md., 1905–6.
  - Georges Creek at Westernport, Md., 1905–6.
  - Wills Creek near Cumberland, Md., 1905–6.
  - South Branch of Potomac River near Springfield, W. Va., 1894–1896, 1899–1906.
  - Opequan Creek near Martinsburg, W. Va., 1905–6.
  - Tuscarora Creek at Martinsburg, W. Va., 1905.
  - Antietam Creek near Sharpsburg, Md., 1897–1905.
  - South River at Basic City, Va., 1905–6.
  - South River at Port Republic, Va., 1895–1899.
  - South Fork of Shenandoah River near Front Royal, Va., 1899–1906.
  - Shenandoah River at Millville, W. Va., 1895–1909.
    - North River at Port Republic, Va., 1895–1899.
      - Lewis Creek near Staunton, Va., 1905–6.
      - Cooks Creek at Mount Crawford, Va., 1905–6.
    - Elk Run at Elkton, Va., 1905–6.
    - Hawksbill Creek near Luray, Va., 1905–6.
    - North Fork of Shenandoah River near Riverton, Va., 1899–1906.
      - Passage Creek at Buckton, Va., 1905–6.
  - Monocacy River near Frederick, Md., 1896–1909.
  - Goose Creek near Leesburg, Va., 1909.
  - Rock Creek at Zoological Park, D. C., 1897–1900.
  - Rock Creek at Lyons Mill, D. C., 1892–1894.

Rappahannock River:
- Rappahannock River near Fredericksburg, Va., 1907–1909.

STORM OF SEPTEMBER 26 TO 29, 1909, IN MAINE.

A general deficiency in precipitation existed in the State of Maine from about June, 1908, to September, 1909. Although the precipitation for the first four months of 1909 was above the normal it was mostly in the form of snow which, because of the frozen ground, passed off without materially increasing the ground-water supply. During the summer of 1909 the rivers fell to a low pitch and the prospects during early September were for very low water during the fall and winter.

The drought was brought to an end on September 26 by a general rain which lasted three days and was heaviest on the third day. The rainfall was unusually heavy in the central and eastern parts of the State and the rivers were at flood stage for several days.

The rainfall was perhaps the heaviest in the upper Kennebec drainage (see Greenville), but the effect of storage in Moosehead Lake prevented very high water. Thus at The Forks there was a rise of stage of only 1.7 feet due to this entire storm. The permanency of conditions at the gaging stations was not materially affected by the flood.

Damage resulted from washouts and log jams which carried away bridges. A locomotive was derailed by a culvert washout near West Seboois and the engineer was killed. Shipping was delayed for several days.

The flood was most destructive on the Piscataquis River and its branch, Pleasant River. These streams have practically no storage facilities and are very quick spilling. The flood on the main Penobscot River was occasioned to a large extent by that on the Piscataquis. The East Branch also showed a high rate of run-off, probably owing to the fact that the gates at the storage dams were open.

The following table gives the rainfall as observed at several stations during the storm:

Rainfall in inches in Maine during storm of September 26-29, 1909.

Date.	Greenville.	Eastport.	Portland.	Danforth.	Soldier Pond.	The Forks.
Sept. 26	1.00	0.68	0.74	1.00		
Sept. 27	1.40	1.12	.25	1.50		
Sept. 28	3.87	.19	1.50	1.30		[a] 4.25
Sept. 29	.71	1.97	.00	1.20	[a] 3.80	
	6.98	3.96	2.49	5.00	3.80	[a] 4.25

[a] Total for storm; amounts not observed for each day.

The following stages were reached at several of the river stations of the United States Geological Survey:

River stages.

Station.	Drainage area.	Flood discharge.			Discharge previous to storm.		Ratio of low water to flood discharge.
		Maximum gage height.	Maximum discharge.	Per square mile.	Gage heights.	Discharge.	
	Sq. miles.	*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	
St. John at Fort Kent	5,280	14.5	46,800	8.9	4.2	3,130	1 : 15
St. Croix at Woodland [a]	1,420	14.8	20,300	14.3	7.6	2,090	1 : 10
Machias at Whitneyville [a]	465	14.7	11,100	23.9	3.4	211	1 : 53
Penobscot at West Enfield [a]	6,600	17.8	84,500	12.8	2.4	4,160	1 : 20
Mattawamkeag at Mattawamkeag [a]	1,500	10.3	13,400	8.9	4.0	660	1 : 20
East Branch of Penobscot at Grindstone [a]	1,100	14.3	24,500	22.3	4.7	455	1 : 54
Piscataquis at Foxcroft [a]	286	14.9	23,100	80.8	1.7	31	1 : 742
Kennebec at The Forks	1,570	3.9	3,810	2.4	2.2	1,530	1 : 2.5

[a] Gage heights are the highest observed since the establishment of the station.

ST. JOHN RIVER DRAINAGE BASIN.

DESCRIPTION.

St. John River drains the largest basin between St. Lawrence and Susquehanna rivers. Its extreme headwaters lie in the mountainous region between Maine and Canada, adjacent to those of the Penobscot. From the junction of the northwest and southwest branches, where the river first takes its name, to its junction with St. Francis River, a distance of 90 miles, its course is in general northeastward and lies wholly in Maine, although a portion of the tributary drainage area lies wholly in Canada. In this distance it receives Allagash River, its second largest tributary. From its junction with the St. Francis the St. John flows eastward, forming the northern boundary of Maine for 70 miles and receiving in this stretch two important tributaries—Fish River, from the south, at Fort Kent, and Madawaska River, from the north, at Madawaska. At the point where the St. John leaves the State line its drainage area measures 8,765 square miles, of which 4,670 square miles are in Maine and 4,095 square miles are in Canada. Beyond this point it flows southward and receives the waters of Aroostook, Presque Isle, and Meduxnekeag rivers, the basins of which are almost entirely in Maine. From source to mouth its length is about 450 miles, and its total drainage area measures about 26,000 square miles.

In the eastern or lower portion of the basin the country is almost level near the river, but at a distance from the stream it becomes undulating and moderately hilly, finally subsiding and merging into the flat country bordering Aroostook River. Above the mouths of St. Francis and Allagash rivers the aspect of the basin is diversified by highlands.

The basin of the St. John is higher than that of any other river in the State, but as its elevation is fairly uniform the fall of the stream and the opportunities for the development of water power are less than on the other great rivers. Allagash River, which drains about 1,500 square miles of entirely wild and forest country, has considerable fall and affords excellent storage facilities, all unutilized.

The area as a whole is well forested. Large tracts have never been touched by the ax, and other portions have been lumbered for pine only. Probably 90 per cent of the whole basin tributary to the St. John at the eastern boundary of Maine is in forest.

The prevailing rocks in the eastern part of the area are limestones and slate, with patches of sandstone, coarse rock, and granite. Clays and slates are found over about 75 per cent of the total area.

According to Wells,[1] the ponds and lakes in the St. John basin have an aggregate area of 314 square miles, the largest of these lakes being tributary to Allagash and Fish rivers. On some of the lakes rough timber crib dams are used to store water for log driving, but no attempt is made to store water after the driving season is over. Previous to 1845 a canal was cut from Telos Lake, in the Allagash basin, to Webster Lake, in the Penobscot basin, and a dam was

[1] Wells, Walter, Water powers of Maine, 1869.

constructed between Chamberlain and Eagle lakes. In this way Chamberlain Lake, with its drainage area of 270 square miles, was rendered in part tributary to the Penobscot. This diversion continues at the present time. Its general effect is to supply most of the water to the Penobscot during the log-driving season, but after the gates at the dams are opened more water flows toward the St. John, as the gate sills are 0.6 foot lower than those at Telos Lake.

Precipitation records in the basin of the St. John are very meager, but from the best information available it seems probable that the mean annual rainfall is not over 30 to 35 inches.

The river and its tributaries are completely frozen over during the winter season, which usually extends from the 1st of November until after the middle of April, and provides a large amount of snow storage.

ST. JOHN RIVER AT FORT KENT, MAINE.

This station, which is located at the footbridge that crosses the St. John near Fort Kent post office a short distance above the confluence of Fish River with the St. John, was established October 13, 1905, to obtain data regarding the daily distribution of flow. It is about 15 miles below the mouth of St. Francis River and about 50 miles above Grand Falls, which is an important undeveloped power. Many power sites exist along the river.

Discharge measurements are made from the footbridge. The inclined staff gage is attached to a pier of the bridge. Its datum has remained the same during the maintenance of the station. During the winter months the discharge is affected by ice. The discharge is also at times affected by log jams, which form in the river in the vicinity of the station, especially on the bridge piers.

Conditions for obtaining accurate free-flow results are fair, and a fairly good rating curve has been developed. (See fig. 1.)

Discharge measurements of St. John River at Fort Kent, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 13[a]	F. E. Pressey	715	11,800	19.40	75,000
June 24	.....do	654	3,110	6.38	9,560

[a] Rough gaging based on current meter observations in right span and surface velocity of logs in left span; bridge partially wrecked and unsafe.

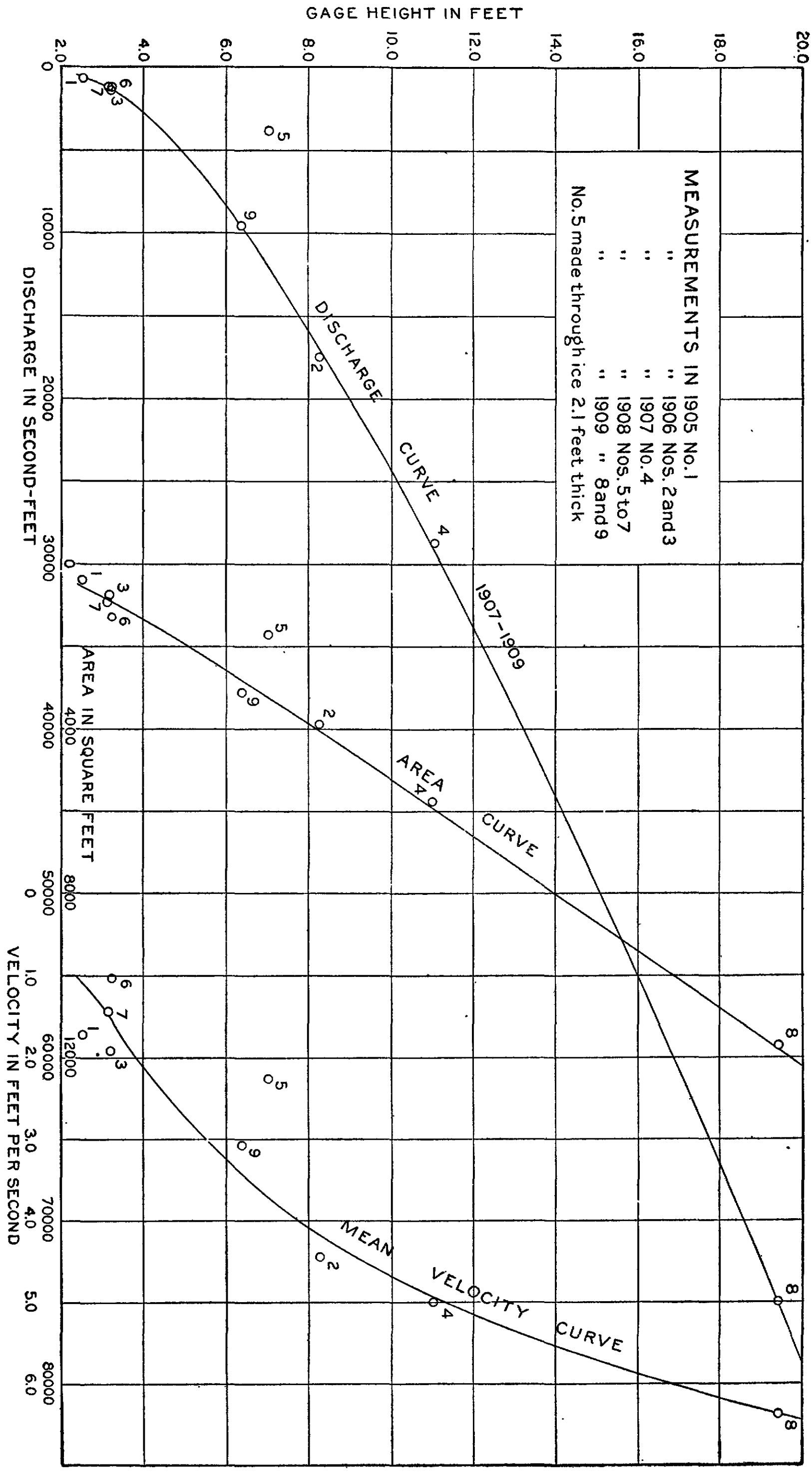


FIGURE 1.—Discharge, area, and mean velocity curve for St. John River at Fort Kent, Maine.

Daily gage height, in feet, of St. John River at Fort Kent, Maine, for 1909.

[Alice M. Currie, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					9.8	8.4		5.1	6.25	13.95	5.15	6.1
2				5.6	9.6	7.9		4.95	6.65	12.4	5.1	6.05
3					10.05	7.4		4.2	7.15	10.8	4.95	6.0
4					10.05	6.85		3.85	7.25	9.95	5.15	5.85
5		4.1	5.4		10.2	6.7		3.65	7.15	9.4	5.4	5.75
6					10.65	6.5		3.55	7.05	8.65	5.35	5.65
7					11.55	6.1		3.4	7.6	8.05		5.55
8	9.9				12.4	5.75		3.4	7.5	7.6	5.3	5.5
9				6.3	13.4	5.6		3.7	7.0	6.95	5.2	5.4
10					14.65	5.55		4.45	6.6	6.65	5.25	5.3
11		4.2			16.55	5.4	6.8	5.5	6.2	6.45	5.3	5.3
12			5.8		19.1	5.25	6.55	5.9	6.0	6.25	5.2	
13				8.2	19.5	5.05	6.35	5.8	5.95	6.05	5.2	
14				8.5	18.85	4.75	6.25	5.5	5.75	5.85		
15	5.8			8.1	17.75	4.6	6.35	5.25	5.45	5.7	5.3	
16				8.05	17.4	4.45	6.4	5.05	5.2	5.7	5.4	
17			5.0	8.3	17.1	4.35	6.5	4.75	5.2	5.55	5.6	
18					16.5	4.25	6.55	4.55	5.0	5.4	5.5	
19				8.4	15.95	4.15	6.55	4.35	4.85	5.3	5.35	
20		4.5		9.45	15.3	4.1	6.5	4.25	4.65	5.25	5.1	
21	4.4			9.3	14.45		6.75	4.2	4.5	5.2	4.95	
22				9.7	13.55		6.7	3.95	4.5	5.15	4.95	
23				9.95	12.95		6.15	3.8	4.4	5.1	5.25	
24				10.55	12.35		5.85	3.7	4.3	5.2	5.35	
25				10.65	11.95		5.95	3.7	4.2	5.45	5.6	
26				12.25	11.35		5.85	3.85	4.2	5.6	5.8	
27		5.0	5.4	10.4	10.7		5.65	5.75	4.4	5.5	5.95	
28				10.4	10.1		5.4	7.05	6.25	5.4		
29	4.4			10.4	9.65		5.2	7.5	10.5	5.35	6.1	
30				10.15	9.15		5.2	7.1	14.25	5.25	6.1	
31					8.85		5.15	6.4		5.2		

NOTE.—Ice existed from Jan. 1 to about Apr. 26 and Dec. 6 to 31. From January to April ice thickness varied from 0.8 foot to 2.4 feet. River only partially frozen over during December. Gage heights during ice periods are to water surface.

Daily discharge, in second-feet, of St. John River at Fort Kent, Maine, for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		23,600	17,500		5,380	9,100	43,900	5,520	8,570
2		22,800	15,400		4,960	10,600	36,000	5,380	8,400
3		24,800	13,400		3,130	12,400	28,300	4,960	8,220
4		24,800	11,300		2,400	12,800	24,300	5,520	7,710
5		25,500	10,700		2,020	12,400	21,900	6,270	7,380
6		27,600	10,000		1,840	12,100	18,600	6,120	
7		31,800	8,570		1,600	14,200	16,100	6,040	
8		36,000	7,380		1,600	13,800	14,200	5,970	
9		41,100	6,890		2,110	11,900	11,700	5,670	
10		47,600	6,740		3,700	10,400	10,600	5,820	
11		58,100	6,270	11,100	6,580	8,920	9,820	5,970	
12		73,200	5,820	10,200	7,880	8,220	9,100	5,670	
13		75,600	5,240	9,460	7,540	8,050	8,400	5,670	
14		71,700	4,440	9,100	6,580	7,380	7,710	5,820	
15		65,100	4,060	9,460	5,820	6,420	7,210	5,970	
16		63,000	3,700	9,640	5,240	5,670	7,210	6,270	
17		61,300	3,460	10,000	4,440	5,670	6,740	6,890	
18		57,800	3,240	10,200	3,940	5,100	6,270	6,580	
19		54,700	3,020	10,200	3,460	4,700	5,970	6,120	
20		51,100	2,910	10,000	3,240	4,180	5,820	5,380	
21	21,400	46,600		10,900	3,130	3,820	5,670	4,960	
22	23,200	41,800		10,700	2,600	3,820	5,520	4,960	
23	24,300	38,700		8,740	2,300	3,580	5,380	5,820	
24	27,100	35,200		7,710	2,110	3,350	5,670	6,120	
25	27,600	33,800		8,050	2,110	3,130	6,420	6,890	
26	35,200	30,900		7,710	2,400	3,130	6,890	7,540	
27	26,400	27,800		7,050	7,380	3,580	6,580	8,050	
28	26,400	25,000		6,270	12,100	9,100	6,270	8,310	
29	26,400	23,000		5,670	13,800	26,800	6,120	8,570	
30	25,200	20,800		5,670	12,200	45,500	5,820	8,570	
31		19,500		5,520	9,640		5,670		

NOTE.—The above daily discharges are based upon a well-defined rating curve. Discharge interpolated for days of missing gage heights in November. Discharge assumed unaffected by ice Apr. 21 to 26.

Monthly discharge of St. John River at Fort Kent, Maine, for 1909.

[Drainage area, 5,280 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			4,290	0.812	0.94	D.
February			1,980	.375	.39	D.
March			3,150	.597	.69	D.
April	35,200		14,800	2.80	3.12	C.
May	75,600	19,500	41,300	7.82	9.02	A.
June	17,500	2,910	7,150	1.35	1.51	B.
July			8,620	1.63	1.88	B.
August	13,800	1,600	4,940	.936	1.08	A.
September	45,500	3,130	9,660	1.83	2.04	A.
October	43,900	5,380	11,800	2.23	2.57	A.
November	8,570	4,960	6,250	1.18	1.32	A.
December	8,570		4,370	.828	.95	D.
The year	75,600		9,860	1.87	25.51	

NOTE.—Discharge for periods of ice conditions and for period June 21 to July 10 estimated from study of climatological data and comparisons with the discharge from adjacent drainage areas.

Mean discharge: Apr. 1 to 20, estimated 9,030 second-feet; June 21–30, estimated 6,460 second-feet; July 1–10, estimated 8,400 second-feet; Dec. 6–31, estimated 3,660 second-feet.

FISH RIVER AT WALLAGRASS, MAINE.

The station on the Fish River at Wallagrass, Maine, was discontinued June 30, 1909. The gage heights were observed up to that date, but as they are liable to considerable error on account of settling of gage, due to caving banks, they are unreliable and are omitted. The station was not visited during 1909.

AROOSTOOK RIVER AT FORT FAIRFIELD, MAINE.

The sources of Aroostook River lie adjacent to those of the Mattawamkeag and the East Branch of the Penobscot. Although its drainage area is large—2,350 square miles, nearly all in Maine—its flow is quite variable, because of lack of storage facilities. During the low-water season, which frequently occurs in both the fall and midwinter, its flow has been known to reach a minimum of 0.06 second-foot per square mile, a remarkably low figure for so large a stream in the East. Considerable fall is available, and during 1907 a light and power plant was constructed at Aroostook Falls, just across the boundary line in New Brunswick, developing a head of about 75 feet.

The gaging station, which was established July 31, 1903, to obtain general statistical data regarding the daily distribution of flow of the river, is located at the steel highway bridge in the village of Fort Fairfield, about 3 miles from the international boundary line and about 8 miles below the mouth of Little Madawaska Stream. The nearest dam is that at Aroostook Falls.

The datum of the chain gage, attached to the bridge, has remained unchanged during the maintenance of the station. Discharge measurements are made from the bridge or by wading. During the winter months the discharge is affected by ice, and gage-height observations are made weekly. Conditions for accurate determinations of discharge during periods of free flow are good, and an excellent rating curve has been developed.

The following discharge measurement was made by F. E. Pressey:

May 11, 1909: Width, 492 feet; area, 4,680 square feet; gage height, 13.15 feet; discharge, 25,700 second-feet.

Daily gage height, in feet, of Aroostook River at Fort Fairfield, Maine, for 1909.

[F. E. Peterson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					9.45	5.5			6.95	13.75	5.7	8.0
2	3.9				9.5	5.4			7.05	12.3	5.35	7.85
3				6.9	9.6	5.7			7.15	11.0	5.2	7.8
4					9.7	5.6			7.35	9.9	5.45	7.4
5					9.95	5.35			7.55	8.85	6.95	6.7
6	4.3	5.0	5.6		10.0	5.45			7.8	8.35	6.9	6.55
7					10.6	5.65			8.65	7.35	6.55	6.6
8						5.3			8.0	7.0	6.35	6.45
9						5.2			6.95	6.65	6.15	6.1
10						5.3			6.4	6.15	6.0	5.85
11					13.15	4.85			6.05	6.0	5.85	5.4
12				9.05	14.4	4.8			5.8	5.6	5.8	5.2
13		4.9	5.7	9.45	14.65	4.6			5.55	5.55	5.7	5.0
14				12.0	14.0	4.25			5.35	5.5	5.7	4.7
15				10.05	13.0	4.4			5.2	5.5	5.6	4.8
16	5.1			11.05	12.15	4.1			5.05	5.5	5.45	5.05
17				11.05	11.35	4.05			4.95	5.5	5.5	5.2
18				11.1	10.7	4.1				5.25	5.35	5.15
19				11.3	10.3	4.2		4.85	4.7	5.2	5.1	5.2
20		5.1		11.3	9.75	4.9		4.9	4.6	5.1	5.0	5.2
21				11.35	9.15	5.4		4.9	4.5	5.2	5.05	5.4
22				12.3	8.5	4.85		4.85	4.4	5.2	5.0	9.7
23	5.2			12.15	8.2	4.55		4.7	4.4	5.2	5.0	
24				12.0	7.95	4.4		4.65	4.4	5.25	5.05	
25				11.7	7.65	4.5		4.5		5.2	5.35	
26				11.0	7.35	4.6		4.5	4.4	5.35	7.25	
27		5.6			7.55	4.6		5.65	5.05	5.5	7.75	
28				10.7	7.1	4.55		7.9	7.75	5.6	8.3	
29				10.25	6.5	4.35		7.45	10.4	5.85	8.5	
30	5.3			9.9	6.2	4.2		6.95	13.7	5.9	8.25	
31					5.9			6.9		5.5		

NOTE.—Ice conditions existed from Jan. 1 to Apr. 13 and from about Dec. 16 to 31. Ice thickness January to April varied from 1.4 to 2.6 feet. Readings are to water surface during periods of ice conditions.

Daily discharge, in second-feet, of Aroostook River at Fort Fairfield, Maine, for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		14,100	3,620			6,750	29,600	4,020	9,500
2		14,200	3,420			6,980	24,100	3,330	9,060
3		14,600	4,020			7,220	19,400	3,040	8,910
4		14,900	3,820			7,720	15,600	3,520	7,840
5		15,700	3,330			8,230	12,100	6,750	6,160
6		15,900	3,520			8,910	10,600	6,630	5,830
7		18,000	3,920			11,500	7,720	5,830	5,940
8		20,800	3,230			9,500	6,860	5,380	5,600
9		23,600	3,040			6,750	6,050	4,950	4,840
10		26,400	3,230			5,500	4,950	4,640	4,320
11		27,300	2,410			4,740	4,640	4,320	3,420
12		32,000	2,320			4,220	3,820	4,220	3,040
13		33,000	1,980			3,720	3,720	4,020	2,670
14	23,000	30,500	1,440			3,330	3,620	4,020	2,150
15	16,100	26,700	1,660			3,040	3,620	3,820	

Daily discharge, in second-feet, of Aroostook River at Fort Fairfield, Maine, for 1909—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	19,600	23,600	1,220	....	....	2,760	3,620	3,520	....
17	19,600	20,700	1,140	....	....	2,580	3,620	3,620	....
18	19,800	18,400	1,220	....	....	2,360	3,140	3,330	....
19	20,500	17,000	1,360	....	2,410	2,150	3,040	2,850	....
20	20,500	15,100	2,490	....	2,490	1,980	2,850	2,670	....
21	20,700	13,100	3,420	....	2,490	1,820	3,040	2,760	....
22	24,100	11,000	2,410	....	2,410	1,660	3,040	2,670	....
23	23,600	10,100	1,900	....	2,150	1,660	3,040	2,670	....
24	23,000	9,350	1,660	....	2,070	1,660	3,140	2,760	....
25	21,900	8,500	1,820	....	1,820	1,660	3,040	3,330	....
26	19,400	7,720	1,980	....	1,820	1,660	3,330	7,470	....
27	18,900	8,230	1,980	....	3,920	2,760	3,620	8,770	....
28	18,400	7,100	1,900	....	9,200	8,770	3,820	10,400	....
29	16,800	5,720	1,590	....	7,970	17,300	4,320	11,000	....
30	15,600	5,060	1,360	....	6,750	29,400	4,430	10,200	....
31	....	4,430	....	....	6,630	....	3,620	....	....

NOTE.—The above daily discharges for free-flow conditions are based on a well-defined rating curve. Discharge interpolated for Apr. 27, May 8 to 10, and Sept. 18 and 25.

Monthly discharge of Aroostook River at Fort Fairfield, Maine, for 1909.

[Drainage area, 2,230 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	....	....	1,070	0.480	0.55	D.
February	....	....	900	.404	.42	D.
March	....	....	1,710	.767	.88	D.
April	24,100	....	14,100	6.32	7.05	B.
May	33,000	4,430	16,500	7.40	8.53	A.
June	4,020	1,140	2,410	1.08	1.20	A.
July	....	....	3,630	1.63	1.88	D.
August	9,200	....	2,730	1.23	1.42	C.
September	29,400	1,660	5,940	2.66	2.97	A.
October	29,600	2,850	6,810	3.05	3.52	A.
November	11,000	2,670	4,880	2.19	2.44	A.
December	9,500	....	3,400	1.52	1.75	C.
The year	33,000	....	5,340	2.39	32.61	

NOTE.—Discharges for periods of ice conditions based on study of climatological data and knowledge of ice conditions. Discharge July 1 to Aug. 18 based on Fort Kent records.

Mean discharge Apr. 1 to 13, estimated, 6,260 second-feet; Aug. 1 to 18, estimated, 1,800 second-feet; Dec. 16 to 31, estimated, 1,540 second-feet.

ST. CROIX RIVER DRAINAGE BASIN.

DESCRIPTION.

St. Croix River is formed by two principal branches. The East Branch, also known as the Upper St. Croix, is the outlet of the Schoodic Lake system, including Grand and Spednic lakes; the West Branch is formed by the Grand Lake system, including Sysladobsis, Grand, and Big lakes. The St. Croix, including the East Branch, forms nearly half of the eastern boundary of Maine, and its total length is about 100 miles. Tributaries are small and unimportant. The total drainage area is 1,630 square miles, the East or principal branch having 690 square miles, and the West Branch 670 square miles at their junction. The river discharges into Passamaquoddy Bay.

The basin is in general lower than that of any other of the larger streams of the State flowing into the Atlantic, its headwaters having an elevation of about 540 feet.

A large part of the drainage basin is still covered with timber, and above Vanceboro and Princeton, at the foot of the two systems of lakes, the region is for the most part wild and inaccessible.

The mean annual precipitation is probably about 41 inches, ranging from 44 inches at Eastport, on the coast, to 38 inches in the northern portions. The river is generally frozen over during the winter, although more subject to thaws during this season than basins that are farther inland.

The lake system of the St. Croix is the largest in the State in proportion to the drainage basin, except that of the Presumpscot, which is, however, a much smaller stream. The lake surface of the Upper St. Croix aggregates approximately 50 square miles, that of the West Branch 70 square miles, taking into account only the principal lakes and ponds. In fact, above Vanceboro and Princeton each branch of the river is simply a succession of lakes almost to the extreme headwaters. The total lake surface of the St. Croix is probably not less than 150 square miles, or nearly one-tenth the total drainage area.

The St. Croix is a valuable stream for water power, owing to its very uniform flow. Power has been developed at Calais, Baring, and Woodland, principally for the manufacture of pulp, paper, and lumber. Opportunities for increased storage are excellent, and a systematic regulation of water areas easily controlled by dams would make this one of the best power streams in the country.

The river is navigable as far as Calais, except for the two or three months in the year when it is frozen.

ST. CROIX RIVER NEAR WOODLAND, MAINE.

This station, which has been maintained to obtain general data regarding the daily distribution of flow of the river, was originally established December 4, 1902, at a point a short distance above Sprague Falls, now called Woodland, near Baring, Maine. On June 8, 1905, it was moved about 1½ miles downstream to avoid backwater effect from a paper mill and dam constructed at Sprague Falls. It is about 10 miles below the junction of the West with the East Branch, and about 14 miles above the mouth of the St. Croix. Power plants are numerous along the river, the nearest being at Woodland above, and at Baring, 5 miles below. Backwater from the lower dam extends about 2 miles, and does not affect the flow at the station.

There is no determined relation between the gauge datums at the original and final locations of the station. A vertical staff gage is attached to a bowlder on the left bank about 1 mile below the dam at Sprague Falls. A chain gage for use in high water is located on the left bank about 300 feet above the staff gage. The cable from which discharge measurements are made is at a point about 400 feet below the staff gage. During the winter months the discharge is usually not affected by ice, because the effect of the mill above is to keep the channel open. In the log-driving season the discharge is sometimes materially affected by log jams. On Sundays and holidays and occasionally at other times the mill is shut down and water stored, which usually greatly reduces the discharge on such days, when the natural discharge is relatively low. Conditions for obtaining accurate discharge at the present station location under open-channel conditions are good, and a very good rating curve has been developed.

Discharge measurements of St. Croix River near Woodland, Maine, in 1909.

Date.	Hydroghapher.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 27	F. E. Pressey	293	1,710	9.96	6,500
July 16	do	302	1,290	*a* 8.50	2,240
Oct. 26	T. W. Norcross	301	1,120	7.77	2,340

a Backwater from log jam causes 0.8 foot increase in gage height.

Daily gage height, in feet, of St. Croix River near Woodland, Maine, for 1909.

[Simeon Phinney observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.7				10.0	8.4	7.7	(*a*)	8.2	14.3	7.9	7.9
2	6.7	7.4	7.3		(*a*)	8.3	7.7	8.4	8.2	13.8	7.9	7.9
3	(*a*)			9.1	9.9	8.3		8.4	8.2	(*a*)	7.9	7.9
4		7.3		(*a*)	9.8	8.2	(*a*)	8.5	8.1	12.3	8.0	
5	9.2	7.3	7.3	9.1	9.8	8.2	4.5	8.5	(*a*)	10.4	8.0	(*a*)
6				9.1	9.7	*a* 6.0	4.5	8.5		9.5		7.8
7	8.8	(*a*)	(*a*)		9.7	8.0	7.7	8.5		8.5	(*a*)	7.8
8			8.2	9.0	9.6	8.0	7.7	(*a*)	8.2	8.4	7.9	7.8
9		7.3		9.0	(*a*)	8.0	7.7	8.5	8.3	8.4	7.9	7.7
10	(*a*)				9.5		7.7	8.5	8.3	(*a*)	7.8	
11				(*a*)	9.5	7.9	(*a*)	8.5	8.4	8.3	7.8	
12	8.4	7.3		9.0	9.4	7.8	7.8	8.4	(*a*)	8.2	7.8	(*a*)
13				9.1	9.2	(*a*)	7.8	8.4	8.4	8.1	7.8	7.7
14	8.0	(*a*)	(*a*)		9.1	7.8	7.7	8.4	8.4	8.0	(*a*)	8.0
15			8.1	10.0	9.0	7.8	8.5	(*a*)	8.3	8.0	7.9	8.0
16				12.3	(*a*)	7.8		8.4	8.3	8.0	7.9	7.9
17	(*a*)	7.3	8.1	13.2	9.0	7.8	8.5	8.4	8.3	(*a*)	7.9	7.9
18				(*a*)	9.0		(*a*)	8.5	8.3	8.0	7.8	7.8
19	8.0	7.3		12.9	8.9	7.9	8.5	8.5	(*a*)	8.0	7.8	(*a*)
20				12.2	8.9	(*a*)	8.5	8.4	8.0	8.0	7.8	7.9
21		(*a*)	(*a*)	12.5	8.8	7.9	8.5	8.4	8.0	7.9	(*a*)	7.8
22	7.7		8.2	11.0	8.8	7.9	8.4	(*a*)	7.7	7.9	7.9	7.8
23		7.4		11.0	(*a*)	7.9	8.5	8.4	7.7	7.9	7.9	7.9
24	(*a*)				8.6	7.9	8.5	8.4	7.6	(*a*)	7.9	7.8
25				(*a*)	8.6	7.8	(*a*)	8.4	7.6	8.0		
26			8.2	10.5		7.8	8.5	8.4	(*a*)	7.9	9.7	(*a*)
27	7.7	7.4		10.2	8.5	*a* 7.6	8.4	8.3	13.4	7.9	9.6	7.8
28		(*a*)	(*a*)	10.1		7.6	8.4	8.3	14.5	7.9	(*a*)	7.8
29	7.6		9.3		8.4	7.6	8.5	(*a*)	14.8	8.0	8.9	7.7
30				10.0	(*a*)	7.6	8.5	8.3	14.6	8.0	8.4	7.7
31	(*a*)							8.3		(*a*)		

a Sunday.

NOTE.—Ice conditions existed along the shores from Jan. 1 to latter part of March. There were no ice conditions in December. Gage heights were affected by backwater from a log jam, July 15 to Sept. 21. Paper mills shut down June 6, 13, and 20, July 4 to 6 and 13, and Sundays January, February, March, October, November, December.

Daily discharge, in second-feet, of St. Croix River near Woodland, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,050	2,090	1,710	4,750	6,550	3,300	2,230			18,700	2,510	2,510
2	1,050	1,830	1,710	4,670	6,450	3,130	2,230			17,100	2,510	2,510
3	500	1,830	1,710	4,590	6,320	3,130	2,230			14,800	2,510	2,510
4	1,050	1,710	1,710	4,590	6,090	2,970	50			12,600	2,660	2,510
5	4,790	1,710	1,710	4,590	6,090	2,970	50			7,500	2,660	500
6	4,390	1,710	1,710	4,590	5,860	480	50			5,420	2,660	2,370
7	4,010	500	500	4,490	5,860	2,660	2,230			3,470	500	2,370
8	4,010	1,710	2,970	4,390	5,640	2,660	2,230			3,300	2,510	2,370
9	3,650	1,710	2,970	4,390	5,530	2,580	2,230			3,300	2,510	2,230
10	500	1,710	2,970	4,390	5,420	2,510	2,230			500	2,370	2,230
11	3,300	1,710	2,970	4,390	5,420	2,370	500			3,130	2,370	2,230
12	3,300	1,710	2,810	4,390	5,210	2,370	2,370			2,970	2,370	500
13	2,980	1,710	2,810	4,590	4,790	500	2,370			2,810	2,370	2,230
14	2,660	500	500	5,570	4,590	2,370	2,230			2,660	500	2,660
15	2,660	1,710	2,810	6,550	4,390	2,370				2,660	2,510	2,660
16	2,660	1,710	2,810	12,600	4,390	2,370				2,660	2,510	2,510
17	500	1,710	2,810	15,300	4,390	2,370				500	2,510	2,510
18	2,660	1,710	2,810	14,800	4,390	2,440				2,660	2,370	2,370
19	2,660	1,710	2,810	14,400	4,200	2,510				2,660	2,370	500
20	2,660	1,710	2,970	12,300	4,200	500				2,660	2,370	2,510
21	2,660	500	500	13,200	4,010	2,510				2,510	500	2,370
22	2,230	1,830	2,970	9,030	4,010	2,510			2,230	2,510	2,510	2,370
23	2,230	1,830	2,970	9,030	3,830	2,510			2,230	2,510	2,510	2,510
24	500	1,830	2,970	8,600	3,650	2,510			2,090	500	2,510	2,370
25	2,230	1,830	2,970	8,180	3,650	2,370			2,090	2,660	4,180	2,370
26	2,230	1,830	2,970	7,750	3,560	2,370			2,000	2,510	5,860	500
27	2,230	1,830	2,970	7,020	3,470	2,090			15,900	2,510	5,640	2,370
28	2,230	500	500	6,780	3,380	2,090			19,300	2,510	500	2,370
29	2,090		5,000	6,660	3,300	2,090			20,300	2,660	4,200	2,230
30	2,090		5,000	6,550	3,300	2,090			19,600	2,660	3,300	2,230
31	500		5,000		3,300					500		2,230

NOTE.—The above daily discharges are based upon a rating curve which is well defined below discharge 10,000 second-feet. July 4 to 6 have been estimated as 50 second-feet; this value is very uncertain, however. Discharge assumed unaffected by ice during the winter periods.

Monthly discharge of St. Croix River near Woodland, Maine, for 1909.

[Drainage area, 1,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	4,790	500	2,330	1.64	1.89	B.
February	2,090	500	1,580	1.11	1.16	B.
March	5,000	500	2,570	1.81	2.09	B.
April	15,300	4,390	7,440	5.24	5.85	A.
May	6,550	3,300	4,680	3.30	3.80	A.
June	3,300	480	2,320	1.63	1.82	A.
July		50	1,960	1.38	1.59	B.
August			1,990	1.40	1.61	C.
September	20,300		4,120	2.90	3.24	C.
October	18,700	500	4,390	3.09	3.56	A.
November	5,860	500	2,580	1.82	2.03	A.
December	2,660	500	2,150	1.51	1.74	B.
The year	20,300	50	3,180	2.24	30.38	

NOTE.—Discharge during the winter periods are probably slightly in excess of the true values due to anchor ice conditions and shore ice. Discharge estimated July 15 to Sept. 21 account of backwater from log jam.

Mean discharge—	Second-feet.
July 15 to 31, estimated	2,200
September 1 to 21, estimated	1,800

MACHIAS RIVER DRAINAGE BASIN.

DESCRIPTION.

Machias River is fairly representative of several of the smaller streams in Maine that discharge their waters into the ocean and are commonly referred to as "coastal rivers." It rises in the Machias Lakes, in the near vicinity of the Grand Lake system of the St. Croix, flows in a generally southeasterly direction to tidewater at Machias, a distance of some 50 miles, and its drainage area measures 495 square miles. At East Machias, near the mouth, it is joined by East Machias River, a stream of similar characteristics rising in Pocamoonshine Lake, near Princeton, and draining about 345 square miles.

The Machias drainage basin is considerably broken with hills and low mountains, and attains an altitude in its northwestern portion of about 400 feet above sea level. Near the coast the prevailing rock is quartzite; farther inland granite is found; and near the headwaters mica schists prevail. The basin is generally forested.

The mean annual rainfall is probably about 42 inches, or a little greater than that of the St. Croix basin, and winter conditions are similar to those of the St. Croix.

In the whole Machias basin there are about 70 square miles of lake surface which are, however, largely near the headwaters. They are utilized to a small extent for log driving.

There are good water-power sites on the Machias and its principal branch, and developments have been made at Machias, East Machias, and Whitneyville.

MACHIAS RIVER AT WHITNEYVILLE, MAINE.

This station was established October 17, 1903, and was originally located at the bridge of the Washington County R. R., near Whitneyville, about 8 miles above the mouth of the river.

A chain gage is attached to the railroad bridge. On October 3, 1905, a vertical-staff gage was placed on a pier of the wooden highway bridge, about one-half mile upstream from the railroad bridge. Published gage heights beginning with 1906 refer to the staff gage. This station has been maintained to obtain general information concerning the daily distribution of flow of the Machias River. A short distance above the station is a storage dam which causes considerable fluctuations in the gage heights at low-water periods. At the original location backwater from the dam at Machias, about 4 miles below, or from accumulation of logs, occurred during a considerable portion of the time, and some of the gage heights previous to October 3, 1905, are liable to very considerable errors. Discharge measurements are made from the railroad bridge.

During the winter months the discharge is often affected by ice, although operation of the dam above tends to prevent the formation of ice except during severe winters. Conditions for obtaining accurate discharge at the new location are fair, and a fair rating curve has been developed, except at low stages, which are somewhat uncertain.

The discharge prior to 1909 has been computed for all years since the establishment of the station, and republished in Water-Supply Paper 241. The 1903–4 values as published in Water-Supply Paper 124 were revised on the basis of new and more accurate rating curves. The discharge is materially affected at times during the driving season by log jams.

Discharge measurements of Machias River at Whitneyville, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 26[a]	F. E. Pressey	124.5	1,210	8.40	3,840
July 15	.....do	124	618	4.03	273
Oct. 25[b]	T. W. Norcross	174	335	4.45	891

[a] Partial measurement, logs preventing many observations. Logs from 600 feet below gage to dam at Machias.
[b] From highway bridge; poor measurement.

Daily gage height, in feet, of Machias River at Whitneyville, Maine, for 1909.

[Ira S. Albee, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	......	7.3	10.0	7.8	6.0	4.4	3.6	3.3	13.3	4.4	5.6
2	3.5	4.0	7.6	9.0	7.8	6.2	4.4	3.5	3.25	10.3	4.3	5.4
3	3.5	......	7.1	8.0	7.9	6.4	4.4	3.5	3.25	8.0	4.2	5.2
4	3.5	4.0	7.0	7.7	7.9	6.5	4.3	3.5	3.1	6.6	4.8	5.1
5	3.5	......	6.6	7.3	7.8	6.6	4.3	3.5	3.1	5.9	4.9	5.0
6	8.0	4.05	6.0	6.9	7.8	6.6	4.3	3.5	3.0	5.3	5.0	5.0
7	10.0	......	5.7	6.7	7.9	6.5	4.2	3.5	3.0	4.9	4.9	5.0
8	8.0	4.05	5.6	6.8	8.0	6.4	4.2	3.5	3.0	4.6	4.8	5.0
9	6.2	......	5.5	7.2	7.4	6.3	4.2	3.5	3.0	4.4	4.8	5.0
10	5.4	4.1	5.4	7.6	7.0	6.2	4.2	3.5	3.0	4.2	4.7	4.8
11	5.1	......	5.3	7.4	7.0	6.2	4.2	3.5	3.0	4.1	4.6	4.6
12	4.9	5.0	5.2	7.4	7.2	6.2	4.15	3.5	3.1	4.0	4.5	4.7
13	4.8	......	5.0	7.5	7.3	6.1	4.1	3.5	3.1	4.0	4.5	4.8
14	4.7	5.6	4.9	7.6	7.4	6.0	4.0	3.5	3.2	4.0	4.9	4.9
15	4.6	......	4.8	9.5	7.4	5.9	4.0	3.5	3.3	4.1	5.6	5.0
16	4.5	5.4	4.7	10.0	7.0	5.8	4.0	3.5	3.4	4.3	5.8	5.1
17	4.4	......	4.6	11.0	6.5	5.8	4.0	3.5	3.5	4.3	5.9	5.2
18	4.3	5.2	4.5	10.5	6.3	5.8	4.1	3.55	3.6	4.3	6.0	5.0
19	4.2	......	4.4	9.8	6.2	5.8	4.2	3.6	3.6	4.3	6.0	4.8
20	4.2	5.0	4.3	9.7	6.2	5.6	4.3	3.65	3.5	4.25	5.9	4.7
21	4.2	6.0	4.2	9.6	6.15	5.3	4.4	3.7	3.4	4.25	5.4	4.6
22	......	6.8	4.2	9.5	6.1	5.0	4.5	3.7	3.4	4.2	5.0	4.5
23	4.1	6.6	4.3	9.5	5.5	5.0	4.5	3.75	3.4	4.2	4.6	4.5
24	......	6.4	4.4	9.5	5.1	4.9	4.4	3.6	3.4	4.2	4.4	4.5
25	4.1	7.0	4.5	9.6	5.0	4.8	4.3	3.6	3.4	4.7	4.4	4.5
26	......	7.6	4.9	8.6	4.9	4.7	4.2	3.55	3.5	4.9	7.6	4.4
27	4.15	8.0	5.4	8.0	4.5	4.6	4.1	3.5	5.6	4.9	9.4	4.4
28	......	7.6	8.0	7.5	4.2	4.5	4.0	3.5	10.0	4.8	8.0	4.5
29	4.0	......	12.1	7.7	(a)	4.4	3.9	3.4	13.5	4.7	7.0	4.5
30	......	......	12.15	7.8	(a)	4.4	3.8	3.4	14.7	4.6	6.0	4.55
31	4.0	......	11.0	......	5.5	......	3.7	3.3	......	4.5	......	4.6

[a] Lower gage destroyed.

NOTE.—The extent and effect of ice conditions are doubtful; also the effects from logs and log jams. It is probable, however, that log jams affected conditions of flow from about June 1 up to the rise of Sept. 27.

Daily discharge, in second-feet, of Machias River at Whitneyville, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	250	482	2,920	5,680	3,380					9,570	698	1,490
2	250	482	3,190	4,580	3,380					6,010	642	1,350
3	250	482	2,740	3,580	3,480					3,580	587	1,210
4	250	482	2,650	3,280	3,480					2,290	937	1,140
5	250	495	2,290	2,920	3,380					1,720	1,000	1,070
6	3,580	508	1,800	2,560	3,380					1,280	1,070	1,070
7	5,680	508	1,560	2,380	3,480					1,000	1,000	1,070
8	3,580	508	1,490	2,470	3,580					814	937	1,070
9	1,960	521	1,420	2,830	3,010					698	937	1,070
10	1,350	534	1,350	3,190	2,650					587	875	937
11	1,140	802	1,280	3,010	2,650					534	814	814
12	1,000	1,070	1,210	3,010	2,830					482	755	875
13	937	1,280	1,070	3,100	2,920					482	755	937
14	875	1,490	1,000	3,190	3,010					482	1,000	1,000
15	814	1,420	937	5,130	3,010					534	1,490	1,070
16	755	1,350	875	5,680	2,650					642	1,640	1,140
17	698	1,280	814	6,780	2,200					642	1,720	1,210
18	642	1,210	755	6,230	2,040					642	1,800	1,070
19	587	1,140	698	5,460	1,960					642	1,800	937
20	587	1,070	642	5,350	1,960					614	1,720	875
21	587	1,800	587	5,240	1,920					614	1,350	814
22	560	2,470	587	5,130	1,880					587	1,070	755
23	534	2,290	642	5,130	1,420					587	814	755
24	534	2,120	698	5,130	1,140					587	698	755
25	534	2,650	755	5,240	1,070					875	698	755
26	547	3,190	1,000	4,180	1,000					1,000	3,190	698
29	560	3,580	1,350	3,580	755				1,490	1,000	5,020	698
28	521	3,190	3,580	3,100	587				5,680	937	3,580	755
29	482		8,100	3,280	860				9,830	875	2,650	755
30	482		8,160	3,380	1,140				11,100	814	1,800	784
31	482		6,780		1,420					755		814

NOTE.—The above daily discharges are based on a rating curve well defined between discharges 77 and 4,000 second-feet. Discharge has been interpolated for days of missing gage heights in January and February. No correction has been made for ice conditions; the effect from this cause is believed to be slight.

Monthly discharge of Machias River at Whitneyville, Maine, for 1909.

[Drainage area, 465 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	5,680	250	1,010	2.17	2.50	C.
February	3,580	482	1,370	2.95	3.07	C.
March	8,160	587	2,030	4.37	5.04	C.
April	6,780	2,380	4,130	8.88	9.91	B.
May	3,580	587	2,310	4.97	5.73	A.
June			1,200	2.58	2.88	C.
July			400	.860	.99	D.
August			200	.430	.50	D.
September	11,100		1,050	2.32	2.59	B.
October	9,570	482	1,350	2.90	3.34	A.
November	5,020	587	1,430	3.08	3.44	A.
December	1,490	698	959	2.06	2.38	C.
The year	11,100		1,450	3.13	42.37	

NOTE.—The discharge for June, July, August, and Sept. 1 to 26 has been estimated for effect of log jam. Mean discharge Sept. 1 to 26, 131 second-feet.

UNION RIVER DRAINAGE BASIN.

DESCRIPTION.

Union River is formed by the junction of its East and West branches.

The West Branch rises in the extreme northern part of Hancock County, in townships 39–MD and 40–MD, and flows in a general southerly direction for about 35 miles to its junction with the East Branch. In its course it passes through Brandy and Great ponds and receives the tributaries from a number of other ponds, the largest of which is Alligator Lake. The area contains little cultivated land, except near the town of Amherst. From Great Pond to Mariaville (17 miles) the fall of the river averages 10.6 feet per mile. This fall per mile is exceeded at several places, where the opportunities for power development are excellent.

The East Branch rises in the Lead Mountain Ponds of township 28–MD, flows southwesterly to Spectacle Pond, then northerly and westerly some 10 miles to its junction with the West Branch about a mile above Jordan's bridge, in Waltham. The territory drained is practically all woodland, either recently cut or covered with second growth. The river is made up of flat stretches and then quick falls. Opportunities for power development are numerous. The East Branch receives only two important tributaries—Middle Branch, which rises in the town of Aurora, and Bog River, which rises in the town of Eastbrook.

From the junction of the two branches the river flows southward about 15 miles, meeting tidewater at Ellsworth. The valley in this distance is flat, wide, and fertile. At Ellsworth Falls there are two dams, with a total head of about 25 feet. At Ellsworth the new dam of the Bar Harbor & Union River Power Co. develops about a 60-foot head. (See Pl. III.) The tributary streams entering from the west are the outlet of Floods Pond, Beach Hill Stream, Green Lake Stream, and Branch Lake Stream; from the east Webbs Brook is the only important tributary.

The average annual precipitation in this basin is probably about 48 inches. As a rule the winters are not severe, owing to the proximity of the ocean.

RIVER AND LAKE SURVEYS IN UNION DRAINAGE BASIN.

Special river and lake surveys have been made in the Union River drainage basin by the United States Geological Survey in cooperation with the State of Maine. The resulting maps, which may be obtained free of charge by applying to C. C. Babb, district engineer, United States Geological Survey, State House, Augusta, Maine, include plan

POWER PLANT OF THE BAR HARBOR & UNION RIVER POWER CO., ELLSWORTH, ME.

and profile of Union River from Great Pond on the West Branch to Goodwin's bridge; the profile only of the river from Goodwin's bridge to tidewater at Ellsworth, the plan for this section being shown on the map of the Ellsworth quadrangle of the United States Geological Survey; and maps of Abraham, Scammons, and Molasses ponds and Webbs Pond Outlet; Alligator, Rocky, and Spectacle ponds; Great Pond, Green Lake Stream, and Branch Lake Stream.

The following table gives the areas of water surface of a number of lakes and ponds in the Union River basin, as measured from recent topographic sheets, and the maps of the special lake surveys:

Lake and pond areas, Union River drainage basin.

	Square miles.		Square miles.
Branch Lake	4.33	Abraham Pond	0.69
Green Lake	4.43	Scammons Pond	1.11
Mountain Pond	1.00	Molasses Pond	1.90
Floods Pond	1.04	Alligator Pond	1.73
Beech Hill Pond	2.09	Rocky Pond	.96
Great Pond	1.01	Spectacle Pond	2.74
Webbs Pond	1.43		

WEST BRANCH OF UNION RIVER AT AMHERST, MAINE.

This station, which is maintained in cooperation with the State of Maine, was established July 25, 1909, at Summer's bridge, three-fourths of a mile west of Amherst post office, on the road to Bangor, to replace the station at Goodwin's bridge, near Mariaville.

Discharge measurements are made by wading from the highway bridge, to which the staff gage is attached.

Conditions governing the accurate determination of flow are favorable. All the dams above the station are partly or totally destroyed, hence the flow is not affected by storage. Anchor ice affects the winter flow. The gage datum was unchanged during the year. The rating curve, though incomplete, is fairly well outlined for low stages. Estimates of discharge are withheld for the present, however, pending the completion of the rating curve to high stages.

Discharge measurements of West Branch of Union River at Amherst, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 25	Butterfield and Brett	37	90.6	5.61	74.8
Aug. 2	G. M. Brett	35.5	80.5	5.30	40.6
Sept. 23[a]	F. E. Pressey	23	14.9	4.96	18.0
Do.[a]	....do	23	14.9	4.96	18.1
Oct. 24	T. W. Norcross	43	137	6.55	246

[a] Made by wading below bridge.

Daily gage height, in feet, of West Branch of Union River at Amherst, Maine, for 1909.

[Floyd Sumner, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	5.33	4.94	10.20	6.85	8.59	16	......	4.90	4.88	6.75	6.65	7.34
2	......	5.30	4.98	9.75	6.72	8.34	17	......	4.91	4.88	6.70	6.55	7.34
3	......	5.25	4.95	9.61	6.69	8.13	18	......	5.11	4.90	6.61	6.72	7.38
4	......	5.19	4.91	9.42	7.59	7.84	19	......	5.07	4.95	6.60	6.68	7.59
5	......	5.15	4.88	9.15	7.55	7.84	20	......	5.07	4.95	6.50	6.60	9.26
6	......	5.11	5.00	8.67	7.45	7.76	21	......	5.05	4.91	6.40	6.59	8.84
7	......	5.09	4.92	8.12	7.35	7.59	22	......	5.00	4.91	6.45	6.58	9.26
8	......	5.09	4.89	7.85	7.20	7.80	23	......	4.99	4.91	5.45	6.57	9.26
9	......	5.07	4.88	7.65	7.21	7.59	24	......	5.05	4.99	6.50	6.55	8.84
10	......	5.07	4.85	7.30	7.05	7.63	25	5.61	5.00	5.08	6.60	6.93	9.01
11	......	5.09	4.90	7.09	6.98	7.51	26	5.60	4.91	5.00	6.88	9.55	8.84
12	......	5.04	4.90	6.89	6.90	9.59	27	5.55	4.91	6.32	6.88	9.00	8.34
13	......	4.98	4.88	6.79	6.87	8.92	28	5.50	5.00	6.95	7.00	8.79	8.76
14	......	4.95	4.88	6.61	6.78	9.34	29	5.43	4.98	12.67	7.15	8.67	8.59
15	......	4.88	4.88	6.49	6.70	8.47	30	5.40	4.98	10.90	7.10	8.59	8.51
							31	5.40	4.97	......	6.92	......	8.42

NOTE.—River frozen over Dec. 6. Rise on Dec. 12 caused by ice jam.

WEST BRANCH OF UNION RIVER NEAR MARIAVILLE, MAINE.

This station was established July 7, 1909, at Goodwin's bridge, 1 mile from Mariaville post office, on the road from Mariaville to Tilden Corner, and was maintained in cooperation with the State of Maine.

As the conditions for obtaining accurate discharge data proved to be unsatisfactory, the station was abandoned August 2 in favor of that at Amherst.

Discharge measurements of West Branch of Union River near Mariaville, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 7	G. M. Brett	27	58.6	3.50	67
15	.....do	27	63.3	3.68	85
20	Barrows and Brett	27.5	63.7	3.80	94.8
Aug. 2	G. M. Brett	25	55.2	3.30	47.7

Daily gage height in feet and discharge in second-feet of West Branch of Union River near Mariaville, Maine, for 1909.

[Alton Frost, observer.]

Day.	July.		August.		Day.	July.		August.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1				57	16	3.6	76		
2			3.3	48	17	4.0	118		
3					18	4.0	118		
4					19	3.95	112		
5					20	3.8	96		
6					21	3.75	91		
7	3.5	66			22	3.7	86		
8	3.4	57			23	3.7	86		
9	3.7	86			24	3.72	88		
10	3.6	76			25	3.7	86		
11	3.6	76			26	3.6	76		
12	3.7	86			27	3.6	76		
13	3.7	86			28	3.6	76		
14	3.7	86			29	3.5	66		
15	3.7	86			30	3.5	66		
					31	3.5	66		

NOTE.—The above daily discharges are based on a rating curve which is well defined between discharges 48 and 96 second-feet.

UNION RIVER AT ELLSWORTH, MAINE.

A concrete dam about 60 feet high has been recently constructed at Ellsworth by the Bar Harbor & Union River Power Co. The power station generating electricity for use in the vicinity and at Bangor is located on the right bank. The equipment consists of two turbines 24-inch and 33-inch, two runners on each wheel; an 18-inch single runner wheel used for the exciter; two alternating current generators, of 1,000 and 500 kilowatts, connected to the turbines, and two direct-current exciters of 75 kilowatts each, connected to the exciter wheel, only one of these being run at a time, however. The plant is run 24 hours a day, and there is no auxiliary steam power. The turbines were rated at the Holyoke testing flume. (See Pl. III.)

The crest of the dam is very even. At times flashboards are used. The head of water at this plant ranges from 55 to 60 feet, and the tide seems to affect the tail-race readings 0.7 foot. Water can pass this gaging station over the dam, through the sluice gates (each 5 feet in diameter), at the base of the dam, through the wheels, through a 6-inch pipe reduced to 4-inch (used for cooling transformers), and through the waste weir and wasteway leading from the forebay.

A very complete daily record is kept at this station. The pond and tail gages are read four times a day at high tide and low tide. The gate openings and power readings are made hourly. A note is made when flashboards are put in place and of the time and amount of sluice-gate openings. The wasteway seldom carries any water.

A number of discharge measurements have been made at the highway bridge a short distance below the dam, and will be used in computing the daily discharge as soon as the records are available. The discharge measurements are referred to a reference point used to measure the distance to the water surface and noted in the table below in place of gage heights. The reference point is a white paint spot on the lower part of the downstream guard rail of the bridge, 15.8 feet from the right-hand iron post.

The drainage area at Ellsworth is 537 square miles.

Discharge measurements of Union River at Ellsworth, Maine, in 1909.

[G. M. Brett, hydrographer.]

Date.	Width.	Area of section.	Discharge.	Reference point to water surface. Varied— From—	To—	Mean.	Time of measurement.	Time of— High tide.	Low tide.
	Feet.	*Sq. ft.*	*Sec.-ft.*	*Feet.*	*Feet.*	*Feet.*			
June 28	102.5	333	1,100	16.19	16.39	16.29	10-12 a. m.		12.15 p. m.
28	105.8	364	1,110	16.15	14.90	15.53	3-5 p. m.	6.45 p. m.	
29	108.5	616	519	14.27	12.93	13.60	6-7.40 p. m.	7.45 p. m.	
29	111.0	657	579	12.93	13.10	13.02	7.40-8.30 p. m.	7.45 p. m.	
July 1	102.5	315	937			16.41	2.45-4.15 p. m.		3.15 p. m.
10	99.5	220	466	17.24	17.58	17.41	10.30-12 a.m.	4.45 p. m.	
17	104.5	363	491	17.13	14.40	15.76	7.45-9.15 a. m.	11 a. m.	
17	100	252	594	16.84	17.26	17.05	4-5.30 p. m.		5 p. m.
19	100	225	473	17.43	17.25	17.34	7.30-9 a. m.	12.20 p. m.	
Aug. 4[a]	97.5	169	305	18.02	17.70	17.86	6.30-7.20 a. m.		6.15 a. m.

[a] Flashboards halfway across dam.

EAST BRANCH OF UNION RIVER NEAR WALTHAM, MAINE.

This station, which is located at Jones's bridge, about 3 miles from the Waltham post office on the road to Aurora, was established July 6, 1909, in connection with the survey of Union River, a work cooperative with the State of Maine, and was maintained in cooperation with the State.

An old log-driving dam, half a mile below the station, backs water above the bridge when the gates are shut. These were open from the date of establishment until November 25, hence conditions of flow were constant and the effect of the dam can be disregarded. The station was discontinued November 30, 1909.

Discharge measurements are made from the highway bridge and by wading. The staff gage is driven into the river bottom near the right bank 25 feet below the bridge. A fairly good rating curve has been developed for low stages.

Discharge measurements of East Branch of Union River near Waltham, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 6	G. M. Brett	34	55.5	4.82	96.1
9	....do	34	55.3	4.82	92.0
20	Barrows and Brett	33	53.3	4.87	89.1
Aug. 2	G. M. Brett	26.5	37.0	4.46	57.8
Sept. 23[a]	F. E. Pressey	13.5	10.2	4.01	16.8
30[a]	....do	13.5	10.2	4.01	16.8
Oct. 23	T. W. Norcross	33.5	95.2	6.16	26.9

[a] Made by wading just below bridge.

Daily gage height, in feet, and discharge, in second-feet, of East Branch of Union River near Waltham, Maine, for 1909.

[Theron Haslam, observer.]

Day.	July.		August.		September.		October.		November.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			4.5	58	4.15	28	11.0	1,360	6.3	289
2			4.45	54	4.2	32	10.5	1,220	6.1	259
3			4.4	49	4.15	28	9.5	958	6.0	244
4			4.4	49	4.1	24	8.95	823	6.5	319
5			4.4	49	4.1	24	8.95	823	7.1	409
6	4.8	89	4.35	44	4.2	32	8.95	823	6.9	379
7	4.8	89	4.35	44	4.2	32	8.7	765	6.6	334
8	4.8	89	4.3	40	4.1	24	8.15	642	6.38	301
9	4.8	89	4.3	40	4.1	24	8.1	631	6.35	296
10	4.8	89	4.3	40	4.1	24	7.85	578	6.2	274
11	4.8	89	4.3	40	4.2	32	7.5	473	6.0	244
12	4.7	78	4.3	40	4.2	32	7.25	433	5.9	229
13	4.7	78	4.2	32	4.2	32	7.2	425	5.8	215
14	4.7	78	4.3	40	4.2	32	7.1	409	5.75	208
15	4.6	68	4.3	40	4.15	28	7.05	402	5.65	194
16	4.6	68	4.3	40	4.1	24	7.4	457	5.4	161
17	4.85	94	4.3	40	4.1	24	6.8	364	5.3	148
18	5.1	123	4.6	68	4.1	24	6.4	304	5.65	194
19	5.05	117	4.55	63	4.1	24	6.2	274	5.8	215
20	4.9	100	4.45	54	4.1	24	6.35	297	5.75	208

Daily gage height, in feet, and discharge, in second-feet, of East Branch of Union River near Waltham, Maine, for 1909—Continued.

Day.	July.		August.		September.		October.		November.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
21	4.8	89	4.4	49	4.1	24	6.1	259	5.2	135
22	4.8	89	4.3	40	4.05	20	6.0	244	5.2	135
23	4.75	84	4.3	40	4.0	16	6.1	259	5.1	123
24	4.7	78	4.25	36	4.0	16	6.15	266	5.1	123
25	4.7	78	4.2	32	4.15	28	6.8	364	5.2	135
26	4.65	73	4.2	32	4.1	24	6.78	361	9.1	
27	4.6	68	4.2	32	5.7	201	6.85	372	9.1	
28	4.6	68	4.2	32	8.15	642	6.75	356		
29	4.55	63	4.2	32	12.0	1,650	6.85	372		
30	4.5	58	4.2	32	11.7	1,560	6.8	364		
31	4.5	58	4.25	36			6.6	334		

NOTE.—Gage was under water Sept. 29 to Oct. 3. Gage heights estimated from marks made by observer. Gage heights of Nov. 26 and 27 were affected by backwater from pond below.
Daily discharges below gage height 7.5 feet are based upon a fairly well-defined rating curve. Above a stage of about 8 feet the daily discharge is liable to considerable error.

Monthly discharge of East Branch of Union River near Waltham, Maine, for 1909.

[Drainage area, 123 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July 6–31	123	58	82.5	0.671	0.65	A.
August	68	32	42.5	.346	.40	A.
September	1,650	16	158	1.28	1.43	C.
October	1,360	244	517	4.20	4.84	C.
Nov. 1–25	409	123	231	1.88	1.75	A.

WEBBS BROOK AT WALTHAM, MAINE.

Webbs Brook, the only important tributary entering Union River from the east, carries the flowage from Webbs, Scammons, Abraham, and Molasses ponds, which represent a drainage of about 4.3 square miles, or about 10 per cent of the total drainage area.

This drainage basin is rather low and swampy and is well wooded in sections. The slope of the river is very slight. Two dams near Waltham are already in place, but neither of these is completely developed.

The station, which was maintained in cooperation with the State of Maine, was established July 6, 1909, at a ford locally known as the "Board Landing," about 1 mile upstream from the highway bridge at Waltham. Measurements were made by wading near this place and also near the highway bridge. A staff gage was located just below the ford.

On November 30, 1909, the station was discontinued on account of backwater from the dam used in storing water for log driving.

Discharge measurements of Webbs Brook at Waltham, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 6[a]	G. M. Brett	45	63.5	4.30	30.5
20	Barrows and Brett	19	17.6	4.25	30.5
Aug. 2	G. M. Brett	18	15.6	4.18	24.0
Sept. 23[a]	F. E. Pressey	16.5	12.2	4.10	17.6
24[a]	do	16.5	12.2	4.10	17.3
Oct. 23	T. W. Norcross	21.5	117	[b] 5.74	114

[a] Made by wading.
[b] Gage height unreliable, as gage was flooded out by backwater from dam used for sluicing logs.

NOTE.—Measurement July 6 made at "Board Landing;" all other measurements made at the highway bridge.

Daily gage height, in feet, and discharge, in second-feet, of Webbs Brook at Waltham, Maine, for 1909.

[W. R. Jordan, observer.]

Day.	July.		August.		September.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			4.18	23	4.05	14
2			4.18	23	4.02	13
3			4.20	24	4.00	12
4			4.15	20	4.00	12
5			4.12	18	4.00	12
6			4.10	17	4.00	12
7	4.30	33	4.10	17	3.98	11
8	4.28	31	4.05	14	3.98	11
9	4.28	31	4.02	13	3.95	10
10	4.30	33	4.02	13	3.95	10
11	4.25	28	4.00	12	4.00	12
12	4.22	26	3.98	11	4.00	12
13	4.22	26	3.95	10		12
14	4.20	24	3.92	8.8	4.00	12
15	4.20	24	3.92	8.8	4.00	12
16	4.20	24		8.4	4.00	12
17	4.28	31	3.90	8.0	4.00	12
18	4.30	33	4.08	16	4.00	12
19	4.28	31	4.08	16	4.02	13
20	4.25	28	4.08	16	4.05	14
21	4.22	26	4.05	14	4.05	14
22	4.22	26	4.05	14	4.08	16
23		25	4.02	13	4.10	17
24	4.20	24	4.05	14	4.12	18
25	4.20	24	4.05	14	4.12	18
26	4.20	24	4.00	12		
27	4.20	24	3.90	8.0		
28	4.20	24	3.92	8.8		
29	4.18	23	4.00	12		
30	4.20	24	4.02	13		
31	4.20	24	4.02	13		

NOTE.—Gates closed in dam below on Sept. 26. Readings after Sept. 25 are of no value.
The above daily discharges are based on a rating curve fairly well defined above a discharge of 15 second-feet.

Monthly discharge of Webbs Brook at Waltham, Maine, for 1909.

[Drainage area, 50 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July 7-31	33	23	26.8	0.536	0.50	B.
August	24	8.0	14.0	.280	.32	B.
September 1-25	18	10	13.9	.278	.26	B.

GREEN LAKE AT GREEN LAKE, MAINE.

Green Lake is situated in the towns of Dedham and Ellsworth, about half its length and half its area being in each town. It lies in a general northwest-southeast direction, is nearly 6½ miles long, and broadens out about three-fourths of a mile at each end into a sort of basin about 1¼ miles wide. Its elevation is about 156 feet above sea level and the top of the dam at the north side of the gates is about 4 feet higher.

Most of the short inflowing streams drain small ponds. The stream entering the northwest end of the lake flows from Goose Pond, which has an area of 0.32 square mile, lies at an elevation of 307 feet above sea level, or 141 feet above the lake, and is distant from it about 3 miles. This stream is joined on its way to the lake by several other streams, and also receives the high-water overflow of Phillips Lake.

Brooks from Little Rocky Pond and Duck Pond enter on the southern shore, about 1½ miles from the western end of the pond and near each other. Little Rocky Pond covers an aera of 0.10 square mile and is at an elevation of 229 feet above sea level, 73 feet above the lake, and about half a mile from it. Duck Pond, about one-eighth mile from the lake, lies 170 feet above sea level, or 14 feet above the lake, and covers an area of 0.08 square mile.

On the northern shore three streams enter—one about a mile from the western end; the second, the outlet of Burnt, Rocky, and Mountain ponds, about midway; and the third, the outlet of Muddy Pond, at Northeast Cove. Burnt Pond is 230 feet above sea level and is 0.11 square mile in area; Rocky Pond is 206 feet above sea level and 0.20 square mile in area. Muddy Pond is practically a marsh.

A station was established near Green Lake railroad station in the town of Dedham at the northwest end of the lake on July 1, 1909, to determine the height of the lake. The staff gage is fastened to the highway bridge near the railroad station. The station is maintained in cooperation with the State of Maine.

Daily gage height, in feet, of Green Lake at Green Lake, Maine, for 1909.

[H. F. Lord, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	5.2	3.2	3.4	4.7	7.0	16	5.5	4.5	2.0	4.1	5.4	7.85
2	5.5	5.2	3.1	3.5	4.7	7.1	17	5.5	4.5	1.9	4.1	5.4	7.9
3	5.6	5.15	3.0	3.6	4.8	7.1	18	5.5	4.6	1.8	4.1	5.5	7.9
4	5.6	5.15	2.9	3.7	4.9	7.2	19	5.5	4.5	1.8	4.1	5.5	......
5	5.6	5.1	2.8	3.7	4.9	7.3	20	5.4	4.5	1.7	4.1	5.6	......
6	5.6	5.05	2.8	3.7	5.0	7.4	21	5.4	4.5	1.7	4.1	5.6	......
7	5.6	5.05	2.7	3.8	5.0	7.4	22	5.4	4.4	1.6	4.2	5.65	......
8	5.5	5.0	2.6	3.8	5.1	7.5	23	5.4	4.3	1.6	4.2	5.7	......
9	5.5	5.0	2.5	3.85	5.1	7.5	24	5.4	4.2	1.55	4.3	5.75	......
10	5.5	4.9	2.4	3.9	5.15	7.6	25	5.4	4.1	1.5	4.3	5.9	......
11	5.5	4.7	2.3	3.9	5.2	7.6	26	5.35	3.9	1.6	4.35	6.4	......
12	5.5	4.6	2.1	3.9	5.2	7.7	27	5.35	3.7	1.9	4.4	6.6	......
13	5.5	4.6	2.1	3.9	5.2	7.7	28	5.3	3.6	2.1	4.4	6.7	......
14	5.5	4.6	2.0	3.95	5.3	7.8	29	5.3	3.6	2.9	4.5	6.8	......
15	5.5	4.5	2.0	4.0	5.4	7.8	30	5.25	3.6	3.3	4.6	6.9	......
							31	5.25	3.5	......	4.7	......	......

NOTE.—Lake frozen over Dec. 19.

GREEN LAKE STREAM AT LAKEWOOD, MAINE.

This station, which is located at a highway bridge in Lakewood, about one-fourth mile downstream from the dam on Green Lake, was established July 2, 1909.

The staff gage is fastened to the right-hand abutment of the bridge. Its datum has remained unchanged. A complete rating curve has not yet been developed.

The station is maintained in cooperation with the State of Maine.

Discharge measurements of Green Lake Stream at Lakewood, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 30	G. M. Brett	37	51.7	2.66	49.5
July 2	.....do	37	50.1	2.64	43.9
19	Barrows and Brett	31.5	44.5	2.67	48.0
Aug. 3	G. M. Brett	31	48.7	2.68	48.1
Sept. 22	F. E. Pressey	32	53.3	2.89	70.6
22	.....do	32	54.2	2.89	74.0
Oct. 22	T. W. Norcross	35	43.5	2.44	20.5

Daily gage height, in feet, of Green Lake Stream at Lakewood, Maine, for 1909.

[Martin A. Garland, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	2.68	3.30	2.48	2.35	2.35	16	2.60	2.78	3.00	2.42	2.30	3.00
2	2.6	2.68	3.30	2.48	2.35	2.40	17	2.65	2.78	2.98	2.42	2.30	3.10
3	2.6	2.68	3.30	2.48	2.35	2.50	18	2.68	2.78	2.95	2.40	2.25	3.10
4	2.65	2.68	3.30	2.48	2.35	2.45	19	2.68	2.78	2.92	2.40	2.20	3.10
5	2.65	2.68	3.28	2.48	2.35	2.40	20	2.68	2.78	2.90	2.40	2.20	3.08
6	2.65	2.68	3.28	2.45	2.35	2.50	21	2.68	2.78	2.90	2.40	2.20	3.05
7	2.65	2.68	3.25	2.45	2.35	2.60	22	2.68	3.20	2.88	2.45	2.20	3.02
8	2.60	3.20	3.25	2.45	2.32	2.65	23	2.68	3.70	2.88	2.45	2.20	3.00
9	2.60	3.20	3.20	2.45	2.32	2.75	24	2.68	3.65	2.88	2.45	2.20	3.00
10	2.60	3.18	3.20	2.45	2.32	2.85	25	2.68	3.60	2.88	2.45	2.40	3.00
11	2.60	3.18	3.10	2.45	2.30	2.85	26	2.68	2.65	2.88	2.45	2.35	3.00
12	2.60	2.65	3.05	2.42	2.30	2.90	27	2.68	2.65	2.95	2.42	2.30	3.00
13	2.60	2.65	3.00	2.42	2.30	2.92	28	2.68	2.65	3.20	2.40	2.30	3.00
14	2.60	2.65	3.00	2.42	2.30	2.95	29	2.68	2.65	3.25	2.38	2.32	3.00
15	2.60	2.78	3.00	2.42	2.30	2.98	30	2.68	3.30	3.00	2.38	2.35	3.00
							31	2.68	3.30	......	2.35	......	3.00

BRANCH LAKE NEAR ELLSWORTH, MAINE.

Branch Lake lies in the town of Ellsworth, Maine, with its longer axis northwest-southeast. It is considered locally as consisting of three parts—the Mill Pond and the Lower and Upper lakes. The Mill Pond is formed by the dam at the lower end of the lake and is about 0.7 mile long and one-eighth mile in average width. It is connected with the Lower Lake by a narrow channel known as the "Outlet." The Lower Lake is about 2½ miles long and 0.6 mile in average width, and is connected with the Upper Lake by a comparatively narrow passage known as the "Narrows." The Upper Lake, 2½ miles long, widens out above the Narrows and attains its maximum width—nearly 2½ miles—at its extreme upper end. The total area of

Branch Lake is 4.33 square miles. The total length of all three parts along what would be called the natural center line of the lake, which extends from the mouth of Dean Brook to the dam at the Mill Pond, is 5.9 miles; from the head of McGowan's Cove to the dam the distance is 6.9 miles.

The elevation of the lake, as determined by the United States Geological Survey, is 236 feet above sea level, and this height was assumed as the height of the water surface at the time of the Union River survey reconnoissance. On this assumption the top of the dam is 240 feet above sea level. In most places the rise of the land is gradual and uniform, there being no lowland except at the northwest end around Lincompaw Brook. The 240-contour on the map represents a level about 30 feet back from the present lake, and the 250-foot is not far distant.

The shores are wooded to the water's edge, the growth being from 15 to 20 years' stand and comprising both hard and soft wood.

No large streams flow into the lake. Great Brook, which enters on the east shore of the lower lake, is about 2 miles long. At the head of the lake several streams enter, none being over 4 miles long. The largest, Lincompaw Brook, is the outlet of Harriman Pond, a pond 0.10 square mile in area and lying at an elevation of 536 feet above sea level, or 300 feet above Branch Lake. Rocky Pond, which has an area of 0.25 square mile and is situated about a mile from the lake and 117 feet above it, sends down a stream that enters on the south side, near the head of the lake.

In connection with the survey of the Union River basin, which was carried on in cooperation with the State of Maine, a station was established on the lake June 29, 1909, near the intake to the wheels of the Branch Pond Lumber Co.'s mill.

The gage readings indicate the height of the lake. No change has been made in the gage datum.

Daily gage height, in feet, of Branch Lake near Ellsworth, Maine, for 1909.

[H. B. Moor, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	5.85	4.85	3.6	5.4	5.25	6.55	16	......	5.45	4.02	3.15	5.3	5.4	6.7
2	......	5.8	4.8	3.6	5.45	5.25	6.55	17	......	5.42	3.9	3.0	5.3	5.45	6.75
3	......	5.75	4.75	3.6	5.45	5.25	6.55	18	......	5.42	3.85	2.95	5.3	5.5	6.75
4	......	5.7	4.7	3.55	5.45	5.3	6.55	19	......	5.4	3.95	3.1	5.25	5.5	6.75
5	......	5.7	4.6	3.55	5.45	5.35	6.55	20	......	5.4	3.85	3.1	5.2	5.45	6.75
6	......	5.7	4.52	3.6	5.45	5.4	6.55	21	......	5.35	3.9	3.0	5.2	5.45	6.75
7	......	5.65	4.45	3.5	5.4	5.4	6.6	22	......	5.3	3.9	3.0	5.15	5.45	6.7
8	......	5.6	4.42	3.4	5.4	5.4	6.6	23	......	5.28	3.9	2.95	5.15	5.4	6.7
9	......	5.6	4.4	3.35	5.4	5.4	6.6	24	......	5.2	3.9	2.75	5.15	5.4	6.7
10	......	5.6	4.38	3.35	5.4	5.4	6.6	25	......	5.15	3.85	2.9	5.2	5.55	6.7
11	......	5.55	4.28	3.35	5.35	5.4	6.6	26	......	5.1	3.85	2.9	5.25	6.2	6.7
12	......	5.5	4.2	3.3	5.35	5.4	6.6	27	......	5.05	3.85	3.4	5.25	6.35	6.65
13	......	5.5	4.18	3.3	5.32	5.4	6.6	28	......	5.0	3.85	4.75	5.25	6.5	6.6
14	......	5.48	4.15	3.25	5.3	5.45	6.6	29	6.0	4.95	3.85	4.9	5.3	6.55	6.6
15	......	5.45	4.1	3.2	5.3	5.45	6.65	30	5.9	4.9	3.8	5.25	5.3	6.55	6.55
								31	......	4.85	3.7	......	5.3	......	6.55

BRANCH LAKE STREAM NEAR ELLSWORTH, MAINE.

This station, which is located about 100 feet below the Branch Pond Lumber Co.'s mill, was established July 2, 1909, in connection with the survey of Union River, made in cooperation with the State of Maine. The records indicate the amount of water flowing from the pond.

The mill is equipped with a 3-foot and a 6-foot wheel. Ordinarily the 3-foot wheel is used 10 hours a day, the 6-foot wheel being used at irregular intervals. Water is also provided for the woolen mills $2\frac{1}{2}$ miles below, the waste gates being opened during the night for a usual period of 10 hours. Record is made of the wheels and the number of hours they are run, of the gage height corresponding to the flow through the wheels, and also of the gage heights representing the water furnished to the woolen mill. In periods of low water, when neither mill is running, the discharge amounts only to the leakage through the dam and wheels.

The results are considered good.

No change was made in the datum of the gage through the year.

The daily gage heights are not a correct index of the mean daily flow, and hence are not published.

Discharge measurements of Branch Lake Stream near Ellsworth, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.	Gage height Branch Lake.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*	*Feet.*
June 29[a]	G. M. Brett	25	85	4.7	135	6.0
29[a]	.....do	25	85	4.7	131	6.0
July 2[b]	.....do	23.5	61.8	3.78	27.2	5.8
2[c]	.....do	27	102	5.32	235	5.75
July 19[a]	Barrows and Brett	23	75.3	4.61	122	....
Aug. 3[b]	G. M. Brett	22	57	3.81	27.4	4.72
3[a]	.....do	23	76.9	4.66	114	4.7
Sept. 22[a]	F. E. Pressey	24	67	4.15	56.9	3.0
22[a]	.....do	24	67	4.15	58.1	3.0

[a] Three-foot wheel running. [b] No wheels running. [c] Both wheels running.

NOTE.—Gagings made 100 feet below Branch Pond Lumber Co.'s mill.

Daily discharge, in second-feet, of Branch Lake Stream near Ellsworth, Maine, for 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	48	32	76	48	49	34	16	80	71	55	48	52	62
2	48	77	51	45	49	68	17	49	99	74	24	52	62
3	118	77	51	10	49	68	18	10	118	68	68	52	62
4	10	79	33	79	52	62	19	85	71	2	55	98	62
5	10	75	21	48	52	62	20	71	120	39	52	74	62
6	48	77	48	45	52	62	21	108	4	39	88	17	62
7	118	57	50	45	27	62	22	98	2	39	49	52	122
8	48	30	68	84	52	62	23	71	23	30	42	52	122
9	70	73	47	45	74	62	24	53	2	77	10	98	62
10	48	73	45	10	52	62	25	40	2	30	49	52	62
11	42	104	30	77	52	62	26	85	2	10	49	109	62
12	80	73	6	79	52	62	27	82	6	55	49	58	100
13	80	71	43	83	10	62	28	82	6	80	94	20	100
14	80	53	46	59	17	125	29	82	25	80	49	58	62
15	80	28	72	45	98	62	30	82	59	57	49	58	62
							31	60	55	......	17	......	62

NOTE.—Daily discharges computed from gage heights and observer's additional daily notes of time to which gage heights apply. Discharge estimated for July 1.

Monthly discharge of Branch Lake Stream near Ellsworth, Maine, for 1909.

[Drainage area, 31 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July	118	10	66.6	2.15	2.48	B.
August	120	2	53.0	1.71	1.97	B.
September	80	2	47.4	1.53	1.71	B.
October	94	10	51.4	1.66	1.91	B.
November	109	10	54.6	1.76	1.96	B.
December	125	34	69.8	2.25	2.59	B.

PENOBSCOT RIVER DRAINAGE BASIN.[1]

DESCRIPTION.

The West or principal branch of Penobscot River rises in the mountainous region of Maine near the Canadian boundary and flows in a general southeasterly direction to its junction with the East Branch of the river at Medway, a distance of over 100 miles. From the mouth of the East Branch to tidewater at Bangor is about 75 miles, this latter point being 27 miles from the mouth of the river at Penobscot Bay. The total length of the river is, therefore, about 200 miles. The drainage basin has an extreme breadth of about 115 miles and comprises 8,500 square miles, or more than one-fourth the entire State.

The important tributaries of the Penobscot in the order of their confluence from the source of the river are as follows:

Tributaries of Penobscot River.

River.	Enters Penobscot at—	Drainage area (square miles).
East Branch Penobscot River	Medway	1,130
Mattawamkeag River	Mattawamkeag	1,500
Piscataquis River	Howland	1,500

The basin lies in general at a somewhat lower elevation than that of Kennebec River, for the latter is nearer to the summit mountain range on the western boundary of the State. As a whole, it is rather uniform in its topographic features, hills and low mountains stretching from the region near the sea to a point above Bangor. Farther north its surface is an undulating plain, westward it becomes more broken and is generally diversified by hills, detached peaks,

[1] All records of discharge prior to 1910 in this basin will be republished in a Water-Supply Paper entitled "Water resources of the Penobscot River basin."

lakes, ponds, and swamps. The headwaters of the Kennebec, Penobscot, and St. John are all in the same vicinity, a highland region intermingled with swamps and lagoons. Mount Katahdin, the highest peak of which is 5,273 feet above mean tide and the highest mountain in the State, lies in a detached range of mountains between the West and East branches of the Penobscot.

The predominant rocks of the Penobscot basin are shales, slates, and schists. In the Mount Katahdin region and near the mouth of the river granite also occurs in considerable areas. The character of the river valley is determined largely by the prevailing rocks. Thus, for many miles above Bangor the river flows through an area where the rocks are relatively soft shales, slates, and schists, and its valley here is broad. Between Hampden and Bucksport, however, where harder granites and schists are found, the valley is narrow with steep walls, and a short distance below Ripogenus Lake some of the finest river scenery in the country is found.

Chesuncook Lake lies near the center of the basin at an elevation of 930 feet above sea level. From this point to tide water the distance along the river is 126 miles, or an average fall of 7.4 feet per mile.

Nearly two-thirds of the Penobscot River basin consists of timber land. Spruce prevails, although white pine, cedar, and white birch are also produced in considerable quantities.

The mean annual precipitation varies from about 43 inches near the coast to less than 35 inches in the northern portions, the mean for the whole basin being about 39 inches, slightly less than that of the Kennebec.

The river freezes over during the winter and large accumulations of snow occur.

The natural storage facilities of the Penobscot, with its total lake and pond surface of approximately 550 square miles, are surpassed only by those of the Kennebec and Androscoggin basins. On the West Branch some 30 billion cubic feet of storage in the Twin and Chesuncook Lake systems is utilized in connection with the developments of the Great Northern Paper Co., at and near Millinocket, with marked effect upon the regimen of flow. On the East Branch Chamberlain and Allagash lakes and a number of others are capable of storing much of the flow. Mattawamkeag and Piscataquis rivers all have good storage possibilities, and it is safe to say that eighty or ninety billion cubic feet of water could economically be stored in the various portions of the Penobscot basin. Storage on the West Branch of the river is very efficiently controlled by the Great Northern Paper Co., but in all other localities the stored water is used only for log driving, and a systematic regulation of stored flow would be of great benefit to present and future users of power.

Log driving is an important industry on the Penobscot, and the annual drive amounts to over 200,000,000 feet b. m. The river is navigable to Bangor except during the winter months.

Considerable power has been developed on the Penobscot, notably for the pulp and paper mills at Oldtown, West Enfield, and Millinocket, but there is a very large amount of undeveloped power both on the main river and its principal tributaries.

The longest run-off record in the Penobscot basin is that at Millinocket, beginning in 1901. The driest year at that point since 1900 was 1904, and the wettest was 1902, the total flow during these two years being in the ratio of 1 to 2.08. Storage on the West Branch has very materially changed the regimen of flow since 1901.

RIVER AND LAKE SURVEYS IN PENOBSCOT DRAINAGE BASIN.

Surveys have been made in the Penobscot River drainage basin by the United States Geological Survey as follows:

Penobscot River, from tide water to Seeboomook Falls, near Northwest Carry; East Branch Penobscot River, from Grand Lake to mouth; Mattawamkeag River, from North Bancroft to mouth.

Allagash, Chamberlain, Telos, Webster, Second, and Grand lakes in East Branch Penobscot drainage basin.

Mattawamkeag and Baskahegan lakes and Pleasant Pond in Mattawamkeag drainage basin.

Schoodic, Seboois, and Endless lakes in Piscataquis drainage basin.

From the data collected by the river surveys sheets have been prepared showing as far as available the profile of water surface, plan of the river, contours along the banks, and prominent natural or artificial features.

From the lake surveys sheets have been prepared showing as far as possible the shore lines and bank contours covering any probable increase in storage capacity.

The results of these surveys have been in part published on sheets, which may be had on application to C. C. Babb, district engineer, United States Geological Survey, State House, Augusta, Maine.

WEST BRANCH OF PENOBSCOT RIVER AT MILLINOCKET, MAINE.

The discharge of Penobscot River at the Millinocket mill of the Great Northern Paper Co. has been computed, and the data furnished since 1901 by H. S. Ferguson, engineer for the company. The development at Millinocket was made by placing a concrete dam on the Penobscot at the outlet of Quakish Lake, a little over a mile from the mill site on Millinocket Stream, which enters the Penobscot about 4½ miles below Quakish Lake. Millinocket Stream has only a slight fall, though the main river drops some 112 feet in this vicinity, and by utilizing the former for a tailrace a head of about 110 feet has been obtained.

About 3 miles above Quakish Lake dam is North Twin Lake dam—a comparatively new storage dam affording about 14,500,000,000 cubic feet of storage.

Records are obtained by considering the flow through the wheels, the flow over the dam, and water used from time to time by the log sluice, filters, etc. The wheels were rated at Holyoke, Mass., before being placed in position. As the head under which they work, averaging about 110 feet, is much greater than the head under which they were tested, numerous tube-float measurements of flow in the canal leading to the mill have been made by Mr. Ferguson, in order to determine just how much water the mill used under different conditions of gate openings. In addition to this, during 1904, a series of current-meter measurements were made by the United States Geological Survey to check results as obtained by the floats and to obtain a suitable coefficient for use with the float measurements. It is believed that by means of these various checks on the measurements a very good estimate has been made of the flow through the wheels.

An automatic recording gage of the Friez type is installed at Quakish Lake dam and flow is computed by the formula $Q=cbh^{\frac{3}{2}}$, in which c is a variable coefficient obtained (1) from the results of weir measurements made by Mr. Ferguson on a 10-foot portion of the dam, and (2) from a study of the results of experiments made by George W. Rafter at the Cornell testing flume.

When the flow of the river is less than 2,500 second-feet all the water is generally used through the mill; flow over the flashboards, which are used much of the time, is computed by use of the formula $Q=3.33\ bh^{\frac{3}{2}}$. Quakish Lake dam is at an elevation of 456.3 feet above mean sea level, as determined by the Penobscot River survey of 1904.

Several storage dams, including the North Twin dam previously mentioned, which have been constructed at points in the basin above this mill, store water on a surface of about 65 square miles, with a capacity of about 30,000,000,000 cubic feet. Except during the time (usually in August) that excess water has to be supplied for log driving on the river below Millinocket and for a short time in the spring, the run-off is regulated by storage. Further storage capacity, sufficient to practically control the run-off from the drainage area above Millinocket, is contemplated by the Great Northern Paper Co. Millinocket Lake is now being used for power storage at the new mills of the company at East Millinocket and Dolby. It has been utilized for log driving for many years in the past.

The records of discharge at Millinocket are under the personal supervision of Mr. Ferguson, are carefully kept, and are rated as excellent. No difficulty is experienced in winter on account of ice affecting the estimates of discharge or the running of the wheels. Ferguson Pond, just above the entrance to the canal, eliminates effect from anchor ice.

The maximum daily discharge since the beginning of the records occurred April 1 and 2, 1903, and was a flow of 24,250 second-feet. The minimum weekly discharge at this point, not considering periods when water was not in use at the mill, was 291 second-feet, occurring January 28 to February 3, 1904.

The Millinocket mill of the Great Northern Paper Co., with nearly 25,000 horsepower of wheel installation, has a daily output of about 300 tons of pulp and 300 tons of paper, and is doubtless the largest mill in the world. At East Millinocket and Dolby, about 10 miles down river, are other mills of this company, constructed during 1907, and utilizing over 15,000 horsepower of wheels, with a daily capacity of about 180 tons of pulp and 130 tons of paper. This is, therefore, an important district in the manufacture of pulp and paper.

Daily discharge, in second-feet, of West Branch of Penobscot River at Millinocket, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,005	447	1,150	1,455	6,445	6,740	3,310	a3,925	2,270	2,270	2,000	2,290
2	1,957	568	1,453	1,460	a6,400	6,760	3,340	2,720	2,265	2,270	2,265	2,295
3	a2,011	563	1,453	1,458	5,350	6,780	3,925	3,570	2,240	a2,280	2,280	2,280
4	1,527	563	1,449	a1,458	3,060	6,770	a3,190	3,210	2,320	2,120	2,280	2,230
5	1,920	564	1,420	1,130	2,700	6,760	2,000	2,875	a2,285	2,275	2,275	a2,280
6	1,875	569	1,440	1,455	2,700	a6,730	2,235	2,375	1,756	2,240	2,270	2,090
7	1,938	a545	a1,440	1,462	2,720	6,005	3,159	2,450	1,862	2,218	a2,275	2,260
8	1,955	486	1,177	1,840	2,730	5,895	3,259	a2,120	2,248	2,228	1,950	2,210
9	1,960	543	1,460	1,861	a3,254	5,890	3,049	1,540	2,270	2,220	2,280	2,250
10	a1,910	537	1,298	1,861	2,970	5,850	2,701	2,130	2,460	a2,220	2,275	2,275
11	1,775	489	1,430	a1,875	3,338	5,060	a3,223	1,920	2,685	2,090	2,230	2,230
12	1,910	533	1,430	1,393	3,590	4,355	2,600	2,100	a2,570	2,220	2,280	a2,090
13	1,980	510	1,460	1,860	3,740	a3,235	3,350	2,670	1,550	2,220	2,220	2,075
14	1,867	a540	a1,460	1,857	3,870	3,465	3,380	2,315	2,455	2,220	a2,270	2,255
15	1,700	415	1,137	2,120	5,305	3,598	3,140	a2,625	2,750	2,230	2,020	2,255
16	1,802	813	1,380	2,270	a13,430	3,695	3,166	1,735	2,340	2,275	2,270	2,270
17	a1,730	987	975	2,275	16,230	3,506	3,105	2,240	2,305	a2,340	2,265	2,260
18	1,412	1,009	1,466	a2,630	18,070	4,275	a2,788	2,110	2,365	2,250	2,270	2,265
19	1,568	1,011	1,463	1,917	19,075	6,115	3,145	2,180	a2,480	2,275	2,270	a2,275
20	1,485	990	1,460	2,660	20,200	a3,757	3,000	2,210	2,120	2,275	2,270	2,090
21	1,020	a890	a1,485	2,660	21,000	3,560	3,240	2,213	2,445	2,275	a2,270	2,250
22	687	1,040	1,167	2,640	19,432	3,830	3,200	a2,220	2,260	2,255	1,985	2,245
23	635	1,360	1,497	2,600	a16,775	3,600	3,130	1,870	2,245	2,270	2,270	2,210
24	a545	1,358	1,485	2,640	15,840	3,510	3,345	2,065	2,240	a2,275	2,200	2,280
25	447	1,302	1,460	a2,645	14,585	3,440	a4,050	2,200	2,245	2,395	2,190	1,740
26	576	1,400	1,198	1,920	12,705	3,150	4,334	2,175	a2,155	2,275	2,280	a1,570
27	556	1,365	1,203	3,665	11,095	a3,260	5,280	2,150	2,015	2,260	2,240	2,060
28	531	a1,375	a1,500	5,515	10,450	3,015	4,283	2,190	2,278	2,275	a2,245	2,245
29	564	......	892	6,130	8,355	2,990	3,500	a2,230	2,265	2,275	1,960	2,215
30	572	......	1,450	6,380	a7,090	3,400	3,460	1,300	2,255	2,260	2,275	2,230
31	a570	......	1,455	......	7,045	......	3,635	2,195	......	a2,245	......	2.230

a Sunday.

Monthly discharge of West Branch of Penobscot River at Millinocket, Maine, for 1909.

[Drainage area, 1,880 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,010	447	1,390	0.739	0.85
February	1,400	415	813	.432	.45
March	1,500	892	1,360	.723	.83
April	6,380	1,130	2,440	1.30	1.45
May	21,000	2,700	9,340	4.97	5.73
June	6,780	2,990	4,630	2.46	2.74
July	5,280	2,000	3,310	1.76	2.03
August	3,920	1,300	2,320	1.23	1.42
September	2,750	1,550	2,270	1.21	1.35
October	2,400	2,090	2,250	1.20	1.38
November	2,280	1,950	2,210	1.18	1.32
December	2,300	1,570	2,190	1.16	1.34
The year	21,000	415	2,880	1.53	20.89

PENOBSCOT RIVER AT WEST ENFIELD, MAINE.

This station, which has been maintained to obtain data regarding the daily distribution of flow of the Penobscot, was established November 5, 1901, and prior to 1904 was designated as being at Montague, Me. In 1904 the name of this village was changed to West Enfield. It is located at the steel highway bridge about 1,000 feet below the mouth of Piscataquis River. There is a dam on Piscataquis River near its entrance into the Penobscot, and about a mile above the station is the dam of the International Paper Co., on the main river. During low water considerable daily fluctuations in gage height occur, due to the variations in wheel gate openings at the mills above.

The datum of the gage has remained the same during the maintenance of the station. Discharge measurements are made from the bridge. During the winter months the discharge is affected by ice. Conditions for obtaining accurate discharge data during the open-water season are good, and a good rating curve has been developed for 1909.

The regimen of flow of Penobscot River has been considerably affected by storage, principally in the lakes tributary to the West Branch, since about 1900.

Discharge measurements of Penobscot River at West Enfield, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 25	P. L. Bean	889	9,240	10.02	33,500
Sept. 25	University of Maine students, under direction of Prof. H. S. Boardman.	699	2,750	2.45	4,240
25	do.	698	2,670	2.45	4,180
25	do.	700	2,680	2.45	4,270
Oct. 1	do.	890	12,000	13.07	52,900
1	do.	888	12,100	13.07	52,900
2	do.	888	10,100	11.07	40,500
2	do.	888	10,200	11.07	39,600
7	do.	881	7,200	7.66	21,100
7	do.	881	7,190	7.66	21,700
9	do.	874	6,420	6.73	17,300
9	do.	872	6,340	6.73	17,200
28	do.	841	4,630	4.70	10,000
28	do.	842	4,610	4.70	10,200

Daily gage height, in feet, of Penobscot River at West Enfield, Maine, for 1909.

[R. J. Hanson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	4.90	7.40	9.55	10.65	7.50	4.55	3.30	2.80	12.86	3.99	6.30
2	3.50	4.60	7.30	9.45	10.50	7.25	4.65	3.25	2.90	11.05	3.98	6.00
3	3.40	4.50	7.10	9.35	10.45	6.90	4.50	3.20	3.15	10.05	4.16	5.88
4	3.50	4.70	7.00	9.00	10.45	6.65	4.40	3.15	3.20	9.20	5.22	5.78
5	3.50	5.40	6.80	9.35	10.85	6.30	4.35	3.10	3.30	8.40	5.78	5.74
6	4.20	5.10	6.70	9.70	10.85	5.70	4.30	2.80	3.30	8.18	5.68	5.72
7	5.10	4.90	6.70	10.20	10.90	5.60	4.30	2.50	3.80	7.62	5.65	5.78
8	7.70	4.70	6.60	11.50	11.00	5.90	4.40	2.30	3.65	7.28	5.18	5.62
9	7.30	4.70	6.50	11.70	11.20	6.40	4.50	2.20	3.50	6.68	5.10	5.45
10	6.60	4.80	6.40	11.90	11.70	6.15	4.70	2.35	3.40	6.10	5.09	5.74
11	6.30	4.90	6.10	11.25	12.30	5.90	4.45	2.45	3.60	5.70	4.95	4.30
12	6.00	4.90	6.10	10.35	12.40	5.60	4.25	2.55	3.62	5.45	4.75	4.00
13	5.80	4.80	6.00	10.80	11.95	5.25	4.15	2.70	3.70	5.12	4.48	3.60
14	5.60	4.80	5.80	12.55	11.60	4.65	4.00	2.55	3.70	4.78	4.44	4.15
15	5.40	4.60	5.60	13.60	11.50	4.45	3.90	2.45	3.70	4.70	4.40	4.42
16	5.20	4.60	5.60	15.00	11.95	4.25	4.10	2.40	3.68	4.70	4.38	4.45
17	5.10	4.60	5.65	15.20	12.35	4.35	4.20	2.30	3.68	4.65	4.32	4.40
18	4.90	4.50	5.50	14.35	11.95	5.25	3.95	2.50	3.60	4.65	4.38	4.48
19	4.70	4.60	5.40	14.00	12.00	6.95	3.80	2.70	3.52	4.45	4.40	4.25
20	5.00	4.80	5.40	14.35	11.80	6.65	4.20	2.85	3.38	4.28	4.28	4.00
21	5.30	5.30	5.30	14.30	11.45	5.75	4.20	2.95	3.05	4.21	4.15	3.85
22	4.90	5.60	5.30	14.25	10.85	5.40	4.10	3.05	2.58	4.20	4.02	3.82
23	4.90	6.60	5.40	14.05	10.45	5.30	4.25	2.95	2.50	4.14	4.10	3.80
24	4.80	7.10	5.60	13.75	10.15	5.20	4.20	3.10	2.40	4.12	4.24	3.72
25	4.60	7.30	5.80	13.50	10.20	4.90	4.00	3.20	2.40	4.28	4.38	3.50
26	4.50	7.80	5.70	12.45	9.80	4.75	3.95	3.40	2.40	4.66	5.10	3.48
27	4.50	7.90	6.40	12.00	9.10	4.60	4.20	3.60	2.60	4.70	8.12	3.65
28	4.40	7.60	7.00	11.65	8.80	4.40	4.35	3.40	6.50	4.64	7.85	3.32
29	4.50	....	7.70	11.60	8.65	4.35	3.90	3.10	14.35	4.41	7.48	4.52
30	4.60	....	9.00	11.40	8.55	4.60	3.55	2.95	[a]16.60	4.22	6.80	5.00
31	4.80	....	9.40	....	7.70	....	3.45	2.85	....	4.12	....	5.38

[a] Maximum recorded stage Sept. 30 was 17.8 feet.

NOTE.—Ice conditions existed from Jan. 1 to about Apr. 23, also during the last few days of December. Gage heights during the ice periods are to water surface in a hole in the ice. Ice thickness January to March varied from 0.4 foot to 1.3 feet.

Daily discharge, in second-feet, of Penobscot River at West Enfield, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	....	37,800	20,600	9,570	6,140	4,970	51,500	7,950	15,600
2	.....	.....	.....	....	36,800	19,500	9,880	6,020	5,190	40,200	7,930	14,400
3	.....	.....	.....	....	36,600	18,000	9,420	5,890	5,770	34,200	8,430	14,000
4	.....	.....	.....	....	36,600	17,000	9,120	5,770	5,890	29,300	11,700	13,600
5	.....	.....	.....	....	39,000	15,600	8,980	5,650	6,140	25,000	13,600	13,500
6	.....	.....	.....	....	39,000	13,400	8,830	4,970	6,140	23,800	13,300	13,400
7	.....	.....	.....	....	39,200	13,000	8,830	4,350	7,440	21,200	13,200	13,600
8	.....	.....	.....	....	39,800	14,100	9,120	3,970	7,040	19,600	11,600	13,100
9	.....	.....	.....	....	41,100	16,000	9,420	3,790	6,650	17,100	11,300	12,500
10	.....	.....	.....	....	44,200	15,000	10,000	4,060	6,390	14,800	11,300	13,500
11	.....	.....	.....	....	48,000	14,100	9,270	4,260	6,910	13,400	10,800	8,830
12	.....	.....	.....	....	48,600	13,000	8,680	4,450	6,960	12,500	10,200	7,980
13	.....	.....	.....	....	45,700	11,800	8,400	4,760	7,170	11,400	9,360	6,910
14	.....	.....	.....	....	43,600	9,880	7,980	4,450	7,170	10,300	9,240	8,400
15	.....	.....	.....	....	43,000	9,270	7,710	4,260	7,170	10,000	9,120	9,180
16	.....	.....	.....	....	45,700	8,680	8,260	4,160	7,120	10,000	9,060	9,270
17	.....	.....	.....	62,000	48,300	8,980	8,540	3,970	7,120	9,880	8,890	9,120
18	.....	.....	.....	57,100	45,700	11,800	7,840	4,350	6,910	9,880	9,060	9,360
19	.....	.....	.....	55,000	46,000	18,200	7,440	4,760	6,700	9,270	9,120	8,680
20	.....	.....	.....	57,100	44,800	17,000	8,540	5,080	6,340	8,770	8,770	7,980
21	.....	.....	.....	56,700	42,600	13,500	8,540	5,300	5,540	8,570	8,400	7,580
22	.....	.....	.....	56,500	39,000	12,300	8,260	5,540	4,510	8,540	8,040	7,490
23	.....	.....	.....	55,300	36,600	12,000	8,680	5,300	4,350	8,370	8,260	7,440
24	.....	.....	.....	56,500	34,800	11,600	8,540	5,650	4,160	8,320	8,660	7,220
25	.....	.....	.....	55,000	35,000	10,700	7,980	5,890	4,160	8,770	9,060	6,650
26	.....	.....	.....	48,900	32,700	10,200	7,840	6,390	4,160	9,910	11,300	6,600
27	.....	.....	.....	46,000	28,700	9,720	8,540	6,910	4,550	10,000	23,500	7,040
28	.....	.....	.....	43,900	27,100	9,120	8,980	6,390	16,400	9,840	22,200	6,190
29	.....	.....	.....	43,600	26,300	8,980	7,710	5,650	61,200	9,150	20,500	....
30	.....	.....	.....	42,300	25,700	9,720	6,780	5,300	76,300	8,600	17,600	....
31	.....	.....	.....	....	21,500	....	6,520	5,080	....	8,320	....	....

NOTE.—Daily discharges for open-water periods are based on a well-defined rating curve. The daily discharge, Apr. 17 to 23, has been reduced 5 per cent on account of ice.

Monthly discharge of Penobscot River at West Enfield, Maine, for 1909.

[Drainage area, 6,600 square miles.][a]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			4,740	0.718	0.83	C.
February			3,290	.498	.52	C.
March			7,290	1.10	1.27	C.
April	62,000		37,000	5.61	6.26	B.
May	48,600	21,500	38,700	5.86	6.76	A.
June	20,600	8,680	13,100	1.98	2.21	A.
July	10,000	6,520	8,520	1.29	1.49	A.
August	6,910	3,790	5,110	.774	.89	A.
September	76,300	4,160	10,600	1.61	1.80	A.
October	51,500	8,320	15,500	2.35	2.71	A.
November	23,500	7,930	11,400	1.73	1.93	A.
December	15,600		9,540	1.45	1.67	B.
The year	76,300	3,790	13,700	2.08	28.34	

[a] Includes Chamberlain Lake drainage, 270 square miles.

NOTE.—Estimates of discharge, January, February, and March, taken as the sum of the four stations above West Enfield, viz: Millinocket, Grindstone, Mattawamkeag, and Foxcroft, plus an inflow below these four stations and above West Enfield. The rate of inflow per square mile was assumed to be about equivalent to the average rate above Foxcroft and Mattawamkeag for the period in question. Discharge Apr. 1 to 16, estimated 23,300 second-feet; Dec. 29 to 31, estimated 5,500 second-feet.

EAST BRANCH OF PENOBSCOT RIVER AT GRINDSTONE, MAINE.

The East Branch of the Penobscot originally had its headwaters in Webster and East Branch streams in the north central part of Maine, but since 1845 about 270 square miles of additional territory, draining to Chamberlain Lake, have contributed in part to the flow of this stream, as explained in more detail under the description of the St. John drainage basin. The basin of the East Branch, which, including the 270 square miles of the St. John area, comprises an area of 1,100 square miles, is completely forested and largely wild, has much undeveloped water power, and affords excellent opportunities for water storage.

The gaging station, which has been maintained to obtain data regarding the daily distribution of flow of the river, was established October 23, 1902, at the Bangor & Aroostook Railroad bridge, half a mile south of the railroad station at Grindstone. It is about 8 miles above the junction of the East Branch with the Penobscot at Medway. No water power is used on the river above the station, but dams are maintained at the outlet of several of the lakes and ponds near the source of the river, and the impounded water is used for log driving.

The datum of the gage has remained the same during the maintenance of the station.

Discharge measurements are made from the railroad bridge. The discharge is affected by ice during the winter months, and in the log-driving season jams at the station and at Grindstone Falls immediately below are liable to materially vitiate the published results of discharge. When the flow is not affected by ice or logs conditions for obtaining accurate discharge data are good, except at low stages, when the current becomes very sluggish. A good rating curve has been developed, although more measurements are required at extreme low and extreme high stages.

Discharge measurements of East Branch of Penobscot River at Grindstone, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 29[a]	F. E. Pressey	266	2,380	8.72	5,530
Oct. 27	T. W. Norcross	260	1,800	6.06	1,770

[a] Discharge reduced 20 per cent by jam of logs on pier.

Daily gage height, in feet, of East Branch of Penobscot River at Grindstone, Maine, for 1909.

[G. H. Goddard, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.3			8.0	7.9	6.6	5.0	5.6	9.5	5.5	6.9
2	4.6		6.6		7.95	7.9	6.45	4.95	5.8	8.35	5.5	6.75
3				7.1	8.25	7.8	6.4	4.9	5.75	7.65	5.55	6.55
4	4.6	5.3	6.5		8.3	7.9	6.9	4.9	5.6	7.35	6.65	6.4
5					8.55	7.7	6.8	4.9	5.65	7.4	6.7	6.4
6		5.3	6.3	7.1	8.5	6.1	6.7	4.8	6.75	7.55	6.45	6.35
7	7.1				8.9	6.6	6.75	4.8	6.3	7.7	6.15	6.3
8					9.35	7.3	7.0	4.8	5.95	7.85	6.0	6.25
9	6.1	5.3	6.1		9.7	7.75	7.2	4.8	5.75	7.85	5.95	6.15
10				8.0	10.2	7.65	7.0	4.8	5.45	7.65	6.0	6.1
11	5.8		6.2		11.4	7.7	6.7	4.9	5.4	7.45	6.0	5.95
12		5.2			11.2	7.35	6.2	4.9	5.4	7.3	5.9	5.9
13			6.1	7.8	10.7	7.2	5.95	4.85	5.3	7.05	5.9	5.9
14					10.25	7.7	5.9	4.75	5.15	6.75	5.9	6.15
15	5.5	5.2			9.75	7.7	6.1	4.7	5.1	6.5	5.8	6.15
16			6.1	10.5	9.5	7.65	6.5	4.7	5.0	6.35	5.75	6.1
17				10.1	9.25	7.6	6.7	4.65	5.0	6.15	5.7	6.05
18	5.4	5.2		9.3	8.95	8.0	6.4	4.6	4.9	6.05	5.6	6.0
19			6.0	9.2	8.8	9.1	5.65	5.05	4.8	5.9	5.5	5.95
20				9.5	8.4	7.55	6.2	5.2	4.8	5.75	5.5	5.9
21	5.3			9.8	8.4	7.1	6.05	5.25	4.8	5.7	5.5	5.85
22		6.9	5.9	10.4	8.15	7.0	5.65	5.1	4.8	5.7	5.5	5.7
23				9.85	8.15	7.0	5.6	5.05	4.75	5.85	5.5	
24				9.75	8.4	7.1	5.55	5.25	4.7	5.9	6.0	
25	5.3	6.9	5.9	9.6	8.3	7.0	5.5	5.7	4.65	5.9	6.25	
26				9.2	8.15	6.9	5.5	6.0	4.65	6.05	7.95	
27			6.8	9.0	7.7	6.8	5.35	6.0	6.3	6.1	7.8	5.8
28	5.3	6.8		9.0	7.6	6.7	5.3	6.0	9.5	5.95	7.4	
29			7.0	8.6	8.0	6.7	5.2	5.9	13.4	5.75	7.1	
30				8.2	8.3	6.7	5.05	5.75	12.0	5.65	7.7	5.8
31			7.4		8.2		5.0	5.6		5.6		

NOTE.—Ice conditions existed Jan. 1 to Apr. 15, and Dec. 18 to 31. Anchor ice prevailed most of the time Dec. 1-21. Gage heights Jan. 1 to Apr. 10 and Dec. 27 to 31 are to the top of ice. Ice thickness January to April varied from .9 foot to 2.0 feet. Logs jammed on bridge pier Apr. 28 to 30.

Daily discharge, in second-feet, of East Branch of Penobscot River at Grindstone, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					5,160	4,930	2,440	630	1,130	9,280	1,030	2,960
2					5,040	4,930	2,210	600	1,340	5,980	1,030	2,700
3					5,740	4,710	2,130	570	1,290	4,390	1,080	2,360
4					5,860	4,930	2,960	570	1,130	3,780	2,520	2,130
5					6,500	4,500	2,780	570	1,180	3,880	2,610	2,130
6					6,360	1,700	2,610	510	2,700	4,180	2,210	2,060
7					7,480	2,440	2,700	510	1,980	4,500	1,770	1,980
8					8,830	3,680	3,130	510	1,520	4,820	1,580	1,910
9					9,880	4,600	3,500	510	1,290	4,820	1,520	1,770
10					11,400	4,390	3,130	510	985	4,390	1,580	1,700
11					15,100	4,500	2,610	570	940	3,980	1,580	1,520
12					14,500	3,780	1,840	570	940	3,680	1,460	1,460
13					12,900	3,500	1,520	540	855	3,220	1,460	1,460
14					11,500	4,500	1,460	482	738	2,700	1,460	1,770
15					10,000	4,500	1,700	455	700	2,280	1,340	1,770
16				12,300	9,280	4,390	2,280	455	630	2,060	1,290	1,700
17				11,100	8,530	4,280	2,610	430	630	1,770	1,240	1,640
18				8,680	7,630	5,160	2,130	405	570	1,640	1,130	1,580
19				8,380	7,190	8,080	1,180	665	510	1,460	1,030	1,520
20				9,280	6,110	4,180	1,840	775	510	1,290	1,030	1,460
21				10,200	6,110	3,310	1,640	815	510	1,240	1,030	1,400
22				12,000	5,500	3,130	1,180	700	510	1,240	1,030	
23				10,300	5,500	3,130	1,130	665	482	1,400	1,030	
24				10,000	6,110	3,310	1,080	815	455	1,460	1,580	
25				9,580	5,860	3,130	1,030	1,240	430	1,460	1,910	
26				8,380	5,500	2,960	1,030	1,580	430	1,640	5,040	
27				7,780	4,500	2,780	898	1,580	1,980	1,700	4,710	
28				[a]6,230	4,280	2,610	855	1,580	9,280	1,520	3,880	
29				[a]5,300	5,160	2,610	775	1,460	21,400	1,290	3,310	
30				[a]4,500	5,860	2,610	665	1,290	17,000	1,180	4,500	
31					5,620		630	1,130		1,130		

[a] Jam of logs on pier. Coefficient of 80 per cent used.

NOTE.—Daily discharges under free flow conditions are based on a rating curve well defined between discharges 360 and 11,000 second-feet.
Free flow assumed Dec. 1 to 21.

Monthly discharge of East Branch of Penobscot River at Grindstone, Maine, for 1909.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			660	0.600	0.69	D.
February			440	.400	.42	D.
March			770	.700	.81	D.
April	12,300		5,070	4.61	5.14	C.
May	15,100	4,280	7,580	6.89	7.94	B.
June	8,080	1,700	3,910	3.55	3.96	A.
July	3,500	630	1,860	1.69	1.95	A.
August	1,580	405	764	.695	.80	A.
September	21,400	430	2,470	2.25	2.51	A.
October	9,280	1,130	2,880	2.62	3.02	A.
November	5,040	1,030	1,930	1.75	1.95	A.
December	2,960		1,470	1.34	1.54	B.
The year	21,400		2,490	2.26	30.73	

NOTE.—Discharge estimated for periods of ice conditions on the basis of the discharge from adjacent drainages.
Mean discharge Apr. 1 to 15, estimated 1,200 second-feet; Dec. 22 to 31, estimated 660 second-feet.

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, MAINE.

Mattawamkeag River rises near the eastern boundary of Maine and drains a country that is generally low and swampy, although there are on the river a few good sites for power development, none of which have been utilized. Dams are maintained at the outlets of several large lakes and ponds in this drainage basin, but the stored water is used merely for log driving. The total area of the basin is about 1,500 square miles.

The gaging station, which was established August 26, 1902, for the purpose of obtaining information concerning the daily distribution of flow of the river, is located at the Maine Central Railroad bridge in the village of Mattawamkeag, about one-half mile from the mouth of the river.

The datum of the gage has remained the same during the maintenance of the station. Discharge measurements are made from the railroad bridge. The discharge is affected by ice during the winter and also occasionally affected by log jams for short periods in the log-driving season. When the channel is unobstructed conditions are good for obtaining accurate discharge data. A very good rating curve has been developed.

The following discharge measurement was made by F. E. Pressey:

April 30, 1909; width, 403 feet; area, 2,640 square feet; gage height, 9.80 feet; discharge, 12,400 second-feet.

Daily gage height, in feet, of Mattawamkeag River at Mattawamkeag, Maine, for 1909.

[W. T. Mincher, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					9.45	6.15	4.6	4.3	3.8	9.9	4.85	7.3
2					9.35	5.85	4.6	4.15	3.8	10.0	5.1	7.05
3	4.2				9.1	5.8	4.6	4.0	3.75	9.85	5.45	6.75
4				11.3	9.1	5.7	4.5	4.0	3.6	9.4	5.75	6.7
5					9.35	5.6	4.4	4.0	3.65	9.05	6.05	6.8
6					9.5	5.55	4.3	3.9	3.8	8.6	6.4	7.0
7		6.9	9.1		9.6	5.5	4.3	3.8	3.8	8.05	6.5	6.9
8					9.45	5.5	4.45	3.8	4.1	7.4	6.45	6.85
9					9.45	5.5	4.7	3.8	4.2	6.95	6.2	6.45
10	8.3				9.7	5.5	4.85	3.65	4.35	6.55	6.3	6.15
11				9.65	9.8	5.5	5.0	3.5	4.1	6.1	6.1	5.85
12				9.05	9.95	5.5	5.1	3.5	4.2	6.0	5.7	5.7
13				8.9	10.2	4.85	5.0	3.6	4.3	5.85	5.45	5.6
14		7.1	7.8	9.4	10.2	4.55	4.9	3.55	4.45	5.65	5.55	5.6
15				11.2	10.2	4.5	4.9	3.5	4.7	5.5	5.8	5.5
16				12.3	10.2	4.5	4.9	3.4	4.9	5.4	5.7	5.5
17	7.0			12.65	10.15	4.4	4.9	3.4	4.9	5.4	5.7	5.6
18				12.7	9.85	4.5	4.9	3.55	4.9	5.4	5.7	5.6
19				12.75	9.75	4.65	5.0	3.75	4.65	5.3	5.7	5.6
20				12.8	9.45	5.05	5.0	3.8	4.5	5.3	5.6	5.6
21		7.2	7.4	12.8	9.2	4.8	5.1	3.9	4.3	5.2	5.5	5.6
22				12.6	8.6	4.7	5.2	3.9	4.2	5.1	5.4	5.7
23				12.5	8.2	4.6	5.3	3.9	4.2	5.1	5.3	5.7
24	6.3			12.25	7.95	4.55	5.3	3.9	4.1	5.1	5.45	5.8
25				11.9	7.8	4.4	5.15	4.0	4.0	5.1	5.8	5.8
26				11.5	7.55	4.3	5.0	4.1	4.0	5.2	6.8	5.9
27				11.05	7.0	4.15	4.9	4.0	4.55	5.3	7.9	5.8
28		8.9	8.4	10.65	6.65	4.0	4.8	4.0	6.35	5.3	8.25	
29				10.25	6.45	3.95	4.7	3.95	9.0	5.2	7.95	
30				9.8	6.3	4.25	4.55	3.8	10.15	5.1	7.55	
31	6.2				6.3		4.4	3.7		5.0		

NOTE.—Ice conditions existed Jan. 1 to Apr. 11 and about Dec. 17 to 31. Gage heights are to water surface during periods of ice cover except Mar. 28 and Apr. 4, which are to top of ice. Ice thickness January to March varied from about 1.1 feet to 1.9 feet. Anchor ice was running Dec. 1 and 12. Logs cleared the bridge June 13.

Daily discharge, in second-feet, of Mattawamkeag River at Mattawamkeag, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					11,000	3,430	1,210	906	525	12,200	1,500	5,700
2					10,700	2,900	1,210	777	525	12,500	1,820	5,180
3					10,000	2,820	1,210	660	498	12,100	2,290	4,580
4					10,000	2,660	1,100	660	420	10,800	2,740	4,480
5					10,700	2,500	1,000	660	445	9,880	3,250	4,680
6					11,100	2,430	906	590	525	8,730	3,900	5,080
7					11,400	2,360	906	525	525	7,390	4,090	4,880
8					11,000	2,360	1,050	525	736	5,920	4,000	4,780
9					11,000	2,360	1,320	525	818	4,980	3,520	4,000
10					11,700	2,360	1,500	445	953	4,180	3,710	3,430
11					11,900	2,360	1,690	375	736	3,340	3,340	2,900
12				9,880	12,400	2,360	1,820	375	818	3,160	2,660	2,660
13				9,490	13,100	1,500	1,690	420	906	2,900	2,290	2,500
14				10,800	13,100	1,160	1,560	398	1,050	2,580	2,430	2,500
15				16,200	13,100	1,100	1,560	375	1,320	2,360	2,820	2,360
16				19,500	13,100	1,100	1,560	334	1,560	2,220	2,660	2,360
17				20,600	13,000	1,100	1,560	334	1,560	2,220	2,660	
18				20,800	12,100	1,100	1,560	398	1,560	2,220	2,660	
19				20,900	11,800	1,260	1,690	498	1,260	2,080	2,660	
20				21,100	11,000	1,760	1,690	525	1,100	2,080	2,500	
21				21,100	10,300	1,440	1,820	590	906	1,950	2,360	
22				20,400	8,730	1,320	1,950	590	818	1,820	2,220	
23				20,100	7,750	1,210	2,080	590	818	1,820	2,080	
24				19,400	7,160	1,160	2,080	590	736	1,820	2,290	
25				18,300	6,810	1,000	1,880	660	660	1,820	2,820	
26				17,100	6,250	906	1,690	736	660	1,950	4,680	
27				15,700	5,080	777	1,560	660	1,160	2,080	7,040	
28				14,500	4,380	660	1,440	660	3,800	2,080	7,870	
29				13,300	4,000	625	1,320	625	9,750	1,950	7,160	
30				11,900	3,710	862	1,160	525	13,000	1,820	6,250	
31					3,710		1,000	470		1,690		

NOTE.—Daily discharges for periods of free-flow conditions are based on a well-defined rating curve. Discharge probably affected by logging for some days previous to June 13.

Monthly discharge of Mattawamkeag River at Mattawamkeag, Maine, for 1909.

[Drainage area, 1,500 square miles.]

Month.	Discharge, in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			928	0.619	0.71	D.
February			888	.592	.62	D.
March			1,910	1.27	1.46	D.
April	21,100		12,400	8.27	9.23	C.
May	13,100	3,710	9,710	6.47	7.46	A.
June	3,430	625	1,690	1.13	1.26	B.
July	2,080	906	1,480	.987	1.14	A.
August	906	334	548	.365	.42	A.
September	13,000	420	1,670	1.11	1.24	A.
October	12,500	1,690	4,340	2.89	3.33	A.
November	7,870	1,500	3,410	2.27	2.53	A.
December	5,700		2,810	1.87	2.16	B.
The year	21,100		3,490	2.33	31.56	

NOTE.—Discharge during the frozen periods based on climatological data.
Discharge Apr. 1 to 11, estimated, 4,730 second-feet; Dec. 17 to 31, estimated, 1,670 second-feet.

PISCATAQUIS RIVER NEAR FOXCROFT, MAINE.

Piscataquis River rises in the hilly and mountainous region south and east of Moosehead Lake, flows for about 50 miles in an easterly direction, and enters the Penobscot at Howland. Its slopes and valleys are generally steep and the regimen of flow is therefore quite variable. Sebec, Schoodic, and Seboois streams, all outlets of large lakes having the same names, are the principal tributaries.

The gaging station, which was established August 17, 1902, to obtain information regarding the daily distribution of flow of the upper Piscataquis, is located at Low's bridge, about halfway between the villages of Guilford and Foxcroft, and is just above the mouths of Black and Salmon streams. Water power is used at several manufacturing plants within a few miles above the station, and the river fluctuates considerably at the gage during low stages. The little storage on the river above this point is used solely for log driving.

The gage datum has remained the same during the maintenance of the station. Discharge measurements are made from the bridge. During the winter the discharge is affected by ice. Conditions for obtaining accurate discharge data are good and a good rating curve has been developed for medium stages. At high and low stages the curve is not yet accurately defined.

The following discharge measurement was made by T. W. Norcross:

October 28, 1909; width, 112 feet; area, 244 square feet; gage height, 3.14 feet; discharge, 499 second-feet.

Daily gage height, in feet, of Piscataquis River near Foxcroft, Maine, for 1909.

[A. F. Harlow, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	3.5	5.0	4.2	4.45	3.15	2.15	1.55	2.25	4.65	2.65	3.55
2	2.2	3.25	4.95	4.05	4.3	3.0	2.15	1.55	2.25	4.25	2.65	3.45
3	2.2	3.2	4.7	4.0	4.75	2.85	2.15	1.55	2.25	3.95	2.65	3.35
4	2.25	3.2	4.7	3.75	5.55	2.85	2.7	1.55	2.25	3.75	3.5	3.2
5	2.25	3.2	4.7	3.8	5.6	2.85	2.7	1.55	2.5	3.75	3.5	3.2
6	3.4	3.35	4.7	4.25	5.45	2.5	2.55	1.55	2.45	3.6	3.1	3.2
7	5.25	3.25	4.5	5.1	5.45	2.7	2.4	1.55	2.3	2.7	2.9	3.3
8	4.25	3.25	4.5	5.9	5.45	2.7	2.3	1.55	2.3	2.7	3.0	3.3
9	4.25	3.25	4.4	6.05	5.3	2.65	2.2	1.55	2.25	2.5	2.95	3.3
10	3.9	3.25	4.4	4.7	5.45	2.55	2.2	1.55	2.25	2.45	2.95	3.8
11	3.75	2.95	4.4	4.4	5.45	2.5	1.8	1.55	2.25	2.45	2.95	4.0
12	3.25	2.95	4.25	4.4	6.25	2.5	2.2	1.55	1.8	2.45	2.65	3.35
13	3.25	3.1	4.25	4.55	6.4	2.2	2.2	1.55	2.1	2.9	2.65	3.0
14	3.25	2.95	4.25	6.65	6.0	2.1	1.95	1.55	2.0	3.7	2.5	2.9
15	3.25	2.95	4.25	9.65	5.7	2.1	1.95	1.2	1.95	3.7	2.65	3.05
16	3.25	2.95	4.0	9.2	5.6	2.05	1.95	1.7	1.95	3.7	2.65	3.05
17	3.15	3.2	4.0	7.5	5.1	2.05	1.95	2.05	1.95	2.95	2.7	2.9
18	3.75	3.3	4.1	6.45	4.8	2.95	1.9	2.25	2.0	2.95	2.7	2.9
19	3.75	3.3	4.1	6.35	4.8	3.35	1.95	2.15	1.8	3.05	2.7	2.9
20	3.2	3.5	4.1	7.15	4.35	3.7	2.3	2.2	1.95	3.1	2.7	2.85
21	3.0	3.5	3.8	7.0	3.85	2.8	2.3	2.2	2.0	3.1	2.6	2.8
22	3.0	5.3	4.05	6.5	3.25	2.8	2.3	1.8	2.0	3.2	2.8	2.8
23	2.95	5.5	4.05	6.4	3.0	2.5	2.3	2.1	2.0	3.2	2.65	2.8
24	2.0	5.65	4.05	6.0	2.95	2.3	2.3	2.1	2.0	2.9	2.65	2.8
25	2.95	5.8	4.05	5.6	2.95	2.3	2.0	2.15	1.9	3.05	2.65	2.55
26	2.95	5.75	4.15	5.6	2.95	2.3	1.95	2.15	1.7	3.1	4.1	2.5
27	3.2	5.7	4.75	5.6	2.95	2.0	1.95	2.15	2.3	3.1	3.9	2.65
28	3.25	5.6	4.8	5.6	2.95	2.2	1.95	2.15	4.7	3.15	3.7	2.65
29	3.25	......	4.8	5.45	2.95	2.15	1.95	1.8	12.75	3.05	3.7	2.65
30	3.25	......	4.85	4.95	2.7	2.15	1.95	2.15	6.1	2.85	3.55	3.0
31	2.75	......	4.6	......	2.7	......	1.95	2.15	......	2.65	......	3.0

NOTE.—No ice conditions reported for 1909. On the basis of the run-off from adjacent drainages and climatalogical data, ice conditions probably prevailed from about Jan. 9 to the first week in April and about Dec 18 to 31.

Daily discharge, in second-feet, of Piscataquis River near Foxcroft, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	100	......	......	1,400	1,670	536	90	22	111	1,900	243	820
2	100	......	......	1,260	1,510	437	90	22	111	1,460	243	746
3	100	......	......	1,210	2,020	345	90	22	111	1,160	243	674
4	111	......	......	980	3,180	345	267	22	111	980	782	569
5	111	......	......	1,020	3,260	345	267	22	180	980	782	569
6	709	......	......	1,460	3,020	180	199	22	163	858	502	569
7	2,710	......	......	2,490	3,020	267	148	22	123	267	374	638
8	1,460	......	......	3,790	3,020	267	123	22	123	267	437	638
9	......	......	......	4,060	2,780	243	100	22	111	180	405	638
10	......	......	......	1,960	3,020	199	100	22	111	163	405	1,020
11	......	......	......	1,620	3,020	180	40	22	111	163	405	1,210
12	......	......	......	1,620	4,430	180	100	22	40	163	243	674
13	......	......	......	1,780	4,700	100	100	22	81	374	243	437
14	......	......	......	5,180	3,970	81	58	22	64	938	180	374
15	......	......	......	11,200	3,440	81	58	9	58	938	243	470
16	......	......	......	10,300	3,260	72	58	31	58	938	243	470
17	......	......	......	6,820	2,490	72	58	72	58	405	267	374
18	......	......	......	4,800	2,080	405	51	111	64	405	267	......
19	......	......	......	4,610	2,080	674	58	90	40	470	267	......
20	......	......	......	6,130	1,560	938	123	100	58	502	267	......
21	......	......	......	5,840	1,070	318	123	100	64	502	220	......
22	......	......	......	4,890	604	318	123	40	64	569	318	......
23	......	......	......	4,700	437	180	123	81	64	569	243	......
24	......	......	......	3,970	405	123	123	81	64	374	243	......
25	......	......	......	3,260	405	123	64	90	51	470	243	......
26	......	......	......	3,260	405	123	58	90	31	502	1,300	......
27	......	......	......	3,260	405	64	58	90	123	502	1,110	......
28	......	......	......	3,260	405	100	58	90	1,960	536	938	......
29	......	......	......	3,020	405	90	58	40	18,100	470	938	......
30	......	......	......	2,280	267	90	58	90	4,150	345	820	......
31	......	......	......	......	267	......	58	90	......	243	......	......

NOTE.—The above daily discharges are based on a rating curve well defined between discharges 20 and 3,970 second-feet. The discharge for the first few days of April may have been affected by ice.

Monthly discharge of Piscataquis River near Foxcroft, Maine, for 1909.

[Drainage area, 286 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	2,710	....	296	1.03	1.19	D.
February	....	....	150	.524	.55	D.
March	....	....	500	1.75	2.02	D.
April	11,200	980	3,710	13.0	14.50	B.
May	4,700	267	2,020	7.06	8.14	A.
June	938	64	249	.871	.97	A.
July	267	40	99.4	.348	.40	B.
August	111	9	51.7	.181	.21	B.
September	18,100	31	885	3.09	3.45	A.
October	1,900	163	600	2.10	2.42	A.
November	1,300	180	447	1.56	1.74	A.
December	1,210	....	449	1.57	1.81	B.
The year	18,100	9	788	2.76	37.40	

NOTE.—Discharge for winter months is based on the discharge from adjacent drainages and climatological data. Discharge Jan. 9. to 31, estimated 164 second-feet; Dec. 18 to 31 estimated 217 second-feet.

KENDUSKEAG STREAM NEAR BANGOR, MAINE.

This station, which was established September 15, 1908, to determine the daily distribution of flow of Kenduskeag Stream, is located at the wooden highway bridge about 6 miles northwest of the Bangor post office, and is just below Sixmile Falls, which affords the best unutilized power site of the lower stretch of the river.

The discharge at this point does not always represent the actual discharge from the original or natural drainage basin of Kenduskeag Stream. A number of years ago an artificial cut for use in log driving was made through a low divide between Souadabscook Stream and Black Stream, the latter a tributary of the Kenduskeag, entering it about 7 miles above the gaging station. During high stages in the Souadabscook a portion of its waters finds its way through the cut into Kenduskeag; at low stages in the Souadabscook all of the flow continues down its own channel. It is believed that all of the flow of Black Stream is into the Kenduskeag and none into the Souadabscook. The drainage area of Kenduskeag Stream above the mouth of Black Stream is 136 square miles; at the gaging station, including all of Black Stream but none of Souadabscook, it is 191 square miles; at the mouth, under the same conditions, it is 214 square miles. The drainage area of Black Stream itself is 40 square miles. The monthly discharge data show the conditions actually existing at the station. The estimates of discharge per square mile and depth in inches on the drainage area are not absolutely accurate, on account of the conditions outlined above. There is no way of determining the actual area of the Souadabscook that contributes to the Kenduskeag discharge.

Gage heights are furnished by Fred Cort, of Bangor. The datum of the chain gage attached to the highway bridge has remained the same during the maintenance of the station. Discharge measurements are made from the highway bridge. During the winter months the discharge is somewhat affected by ice. Conditions for obtaining accurate discharge data are good and a good rating curve has been developed for low and medium stages. More measurements are needed for high stages.

Discharge measurements of Kenduskeag Stream near Bangor, Maine, in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 25	F. E. Pressey	100	297	4.13	656
25[a]	.....do	105	274	(b)	770
July 9[a]	.....do	82	56.3	(c)	28.6
9	.....do	87	52.4	1.71	29.8
Sept. 4	.....do	64	44.1	1.52	21.3
15	.....do	42	25.1	1.31	7.2
Dec. 11	.....do	97	150	2.98	94.9
24	.....do	87	52.9	[d] 2.08	40.1
1909.					
Apr. 21	F. E. Pressey	100	448	5.42	1,420
May 24	.....do	93	142	2.40	148
Sept. 20	.....do	47	34.5	1.45	13.5

[a] Gaging made from upstream side of highway bridge at East Bangor.
[b] Distance to water surface from top of floor beam 100 feet; from left abutment, 15.19 feet.
[c] Distance to water surface from the top of floor beam, 100 feet; from left abutment, 16.77 feet.
[d] Gage height to top of ice, 2.14 feet; average thickness of ice, 0.58 foot.

Daily gage height, in feet, of Kenduskeag Stream near Bangor, Maine, for 1909.

[Fred Cort, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				8.3	4.8	2.6	1.9	1.65	1.35	8.2	2.85	4.2
2				8.3	4.95	2.4	1.9	1.55	1.35	5.8	2.7	4.05
3	2.2			6.9	5.2	2.4	1.9	1.55	1.35	4.65	3.85	4.0
4	2.2			6.4	5.2	2.3	1.9	1.55	1.35	4.1	4.7	3.95
5	2.2			6.3	5.0	2.35	1.8	1.55	1.45	3.75	4.5	3.75
6	2.45			6.85	4.8	2.2	1.8	1.55	1.55	3.55	4.1	3.7
7	6.65	3.7	5.5	7.35	4.55	2.2	1.8	1.55	1.65	3.3	3.65	3.8
8	6.6			8.1	4.25	2.1	1.8	1.55	1.65	3.05	3.3	3.9
9	6.05			8.1	4.2	2.0	1.8	1.55	1.65	2.75	3.2	3.4
10	5.0			7.4	4.25	1.9	1.9	1.55	1.65	2.55	3.2	2.95
11	4.8			6.4	4.65	1.9	1.8	1.55	1.65	2.5	3.35	3.05
12	4.6			6.3	4.8	1.9	1.8	1.55	1.65	2.6	3.25	3.3
13	4.45		5.3	7.7	4.6	1.8	1.8	1.55	1.55	2.6	3.05	3.45
14	4.4	4.2		8.6	4.3	1.85	1.75	1.55	1.55	2.5	3.0	3.4
15	4.4			9.65	3.9	1.9	1.7	1.55	1.45	2.4	3.0	3.3
16				10.0	3.45	1.8	1.7	1.55	1.45	2.35	2.9	3.75
17	[a]4.4			9.3	3.2	2.05	1.8	1.65	1.45	2.65	2.95	3.8
18				7.75	3.15	2.25	1.9	1.65	1.45	2.55	3.3	3.7
19				6.8	3.15	2.35	2.4	1.75	1.55	2.4	3.3	3.7
20				6.55	3.3	2.5	2.5	1.75	1.55	2.25	3.2	3.8
21		6.0	6.6	5.9	3.25	2.6	2.5	1.75	1.5	2.15	3.05	3.7
22			6.4	5.4	3.05	2.55	2.35	1.75	1.5	2.25	2.85	3.45
23			6.0	5.8	3.0	2.4	2.25	1.65	1.5	2.35	3.0	2.9
24	[a]3.6		6.0	5.8	2.6	2.3	2.05	1.65	1.5	2.6	3.0	3.0
25			6.45	4.9	2.6	2.2	1.9	1.55	1.5	2.7	3.35	3.0
26			6.8	4.6	2.55	2.1	1.85	1.55	1.7	3.15	4.8	2.75
27			6.85	4.5	2.9	2.0	1.75	1.45	3.1	3.45	5.6	2.75
28		6.0	7.0	4.2	2.65	2.0	1.75	1.45	5.15	3.5	5.3	2.75
29			7.75	4.5	2.9	1.9	1.75	1.45	7.8	3.7	4.9	2.65
30	3.6		8.4	4.7	2.75	1.9	1.75	1.45	9.2	3.55	4.55	2.55
31			8.9		2.6		1.65	1.35		3.15		2.5

[a] Gage height to top of ice.

NOTE.—Ice conditions existed from Jan. 15 to Apr. 2. Gage heights Mar. 21 to Apr. 2 were probably affected by backwater from ice jams below. Ice conditions during the latter part of December probably slight.

Daily discharge, in second-feet, of Kenduskeag Stream near Bangor, Maine, for 1908–9.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1										7	167	105
2										18	190	105
3										22	202	88
4										22	190	105
5										15	167	105
6										12	145	124
7										12	124	145
8										12	105	145
9										18	72	120
10										18	72	100
11										30	72	95
12										18	72	90
13										12	58	90
14										12	58	90
15									7	12	58	90
16									7	18	145	80
17									7	18	265	80
18									7	25	265	80
19									7	22	202	80
20									7	18	134	60
21									7	18	80	60
22									7	25	65	60
23									7	25	88	40
24									7	25	105	40
25									7	25	105	60

[a] The 1908 daily discharges for periods of free flow conditions are based upon a well-defined rating curve. Discharge for the period of ice conditions Dec. 9 to 26, 1908, estimated on basis of two measurements made during that period.

Daily discharge, in second-feet, of Kenduskeag Stream near Bangor, Maine, for 1908–9—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
26	......	......	......	......	......	......	......	......	7	25	145	114
27	......	......	......	......	......	......	......	......	7	52	145	88
28	......	......	......	......	......	......	......	......	7	96	145	88
29	......	......	......	......	......	......	......	......	7	105	145	88
30	......	......	......	......	......	......	......	......	7	105	134	88
31	......	......	......	......	......	......	......	......	......	167	......	105
1909.[a]												
1	105	......	......	......	1,000	190	58	30	9.5	3,860	252	707
2	105	......	......	......	1,080	145	58	22	9.5	1,660	214	644
3	105	......	......	2,600	1,240	145	58	22	9.5	920	566	624
4	105	......	......	2,160	1,240	124	58	22	9.5	665	945	604
5	105	......	......	2,070	1,120	134	45	22	15	529	845	529
6	156	......	......	2,560	1,000	105	45	22	22	459	665	511
7	2,380	......	......	3,020	870	105	45	22	30	379	494	547
8	2,330	......	......	3,760	729	88	45	22	30	306	379	585
9	1,860	......	......	3,760	707	72	45	22	30	226	349	410
10	1,120	......	......	3,070	729	58	58	22	30	178	349	278
11	1,000	......	......	2,160	920	58	45	22	30	167	394	306
12	895	......	......	2,070	1,000	58	45	22	30	190	364	379
13	821	......	......	3,360	895	45	45	22	22	190	306	426
14	797	......	......	4,280	751	52	40	22	22	167	292	410
15	......	......	......	5,420	585	58	34	22	15	145	292	379
16	......	......	......	5,800	426	45	34	22	15	134	265	529
17	......	......	......	5,040	349	80	45	30	15	202	278	547
18	......	......	......	3,420	334	114	58	30	15	178	379	511
19	......	......	......	2,510	334	134	145	40	22	145	379	511
20	......	......	......	2,280	379	167	167	40	22	114	349	547
21	......	......	......	1,740	364	190	167	40	18	96	306	511
22	......	......	......	1,370	306	178	134	40	18	114	252	426
23	......	......	......	1,660	292	145	114	30	18	134	292	265
24	......	......	......	1,660	190	124	80	30	18	190	292	292
25	......	......	......	1,060	190	105	58	22	18	214	394	292
26	......	......	......	895	178	88	52	22	34	334	1,000	226
27	......	......	......	845	265	72	40	15	320	426	1,510	226
28	......	......	......	707	202	72	40	15	1,210	442	1,300	226
29	......	......	......	845	265	58	40	15	3,460	511	1,060	202
30	......	......	......	945	226	58	40	15	4,920	459	870	178
31	......	......	......	......	190	......	30	9.5	......	334	......	167

[a] The 1909 daily discharges for conditions of free flow are based on a well-defined rating curve below 1,500 second-feet.

Monthly discharge of Kenduskeag Stream near Bangor, Maine, for 1908–9.

[Drainage area, 191 square miles.[a]]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1908.						
September 15–30	7	7.0	7.0	0.037	0.02	A.
October	167	7	32.5	.170	.20	A.
November	265	58	131	.686	.77	A.
December	145	....	90.6	.474	.55	B.
1909.						
January	2,380	....	538	2.82	3.25	C.
February	....	....	272	1.42	1.48	D.
March	....	....	984	5.15	5.94	D.
April	5,800	707	2,500	13.10	14.62	C.
May	1,240	178	592	3.10	3.57	B.
June	190	45	102	.534	.60	A.
July	167	30	63.5	.333	.38	A.
August	40	9.5	24.3	.127	.15	A.
September	4,920	9.5	348	1.82	2.03	A.
October	3,860	96	454	2.38	2.74	A.
November	1,510	214	521	2.73	3.05	A.
December	707	167	419	2.19	2.52	B.
The year	5,800	9.5	568	2.97	40.33	

[a] Does not include any of the Souadabscook drainage area.

NOTE.—Discharge estimated for periods of ice conditions in December, 1908, and January to April, 1909. Discharge Jan. 15 to 31, 1909, estimated 282 second-feet. Discharge Apr. 1 to 2, estimated, 2,000 second-feet.

KENNEBEC RIVER DRAINAGE BASIN.

DESCRIPTION.[1]

Kennebec River rises in Moosehead Lake in the west central part of Maine, the headwaters being collected by Moose River, Roach River, and a number of smaller streams rising in the hilly forested areas east and west of the lake. The drainage basin extends from the Canada line to the ocean. It measures about 150 miles in length, varies in width from 50 to 80 miles in the main portion, and embraces a total area of 5,970 square miles (about one-fifth the total area of the State), of which 1,240 square miles are tributary to Moosehead Lake. The length of the river from the lake to its entrance into Merrymeeting Bay, near Brunswick, including the more considerable windings, is about 140 miles.

The important tributaries of the Kennebec, in the order of their confluence from the source of the river, are as follows:

Tributaries of Kennebec River.

River.	Enters Kennebec at—	Drainage area (square miles).
Moose River	Moosehead Lake	680
Dead River	The Forks	876
Carrabassett River	North Anson	395
Sandy River	Madison	670
Sebasticook River	Winslow	970
Messalonskee Stream	Waterville	210
Cobbosseecontee Stream	Gardiner	240

The northern part of the drainage basin is broken by offsets from the White Mountains. Near Moosehead Lake the hills and highlands lie well back from the lake, leaving a great open plain. Below the lake nearly to The Forks the river is a torrent, flowing in a narrow, rocky chasm with precipitous sides. Below the junction of Dead River at The Forks the Kennebec flows through a broader valley with gentler slopes. The general elevation of the basin is less than that of the Androscoggin, which adjoins it on the west, although near the center of the area Saddleback, Abraham, and Bigelow mountains rise as isolated peaks to an elevation higher than any mountains in the State except Katahdin. The extreme headwaters of the Kennebec at the Canadian line reach an elevation of approximately 2,000 feet. Moosehead Lake is about 1,026 feet above tidewater and distant from it 120 miles, corresponding to an average descent of 8.55 feet per mile.

The Kennebec basin presents considerable variety in its rock formations. In the northern part of the basin the rocks are mostly

[1] All available data pertaining to the Kennebec River drainage basin collected prior to 1907 have been assembled and published in Water-Supply Paper 198, Water Resources of Kennebec River basin.

sedimentary, including sandstones, conglomerates, shales, slates, and impure limestones. A few masses of igneous rocks are found, notably the rhyolite of Mount Kineo. In the central and southern portions of the basin extensive areas of granite appear, and in general the tendency is toward metamorphic rocks. The quarries at Hallowell are located on one of the larger masses of pure granite. A notable characteristic of the rocks in the Kennebec basin is their compactness and hardness, which gives a permanence to the present channels of the river. The surface materials are usually finely pulverized, and water-retaining sands and gravels are more abundant in the northern part, succeeded by a greater proportion of loam and clay to the southward.

The greater part of the Kennebec River drainage basin is forest covered, and the upper portion is heavily timbered, although extensive cutting has been going on for many years. Spruce is most abundant, and large quantities of poplar, valuable in the production of the best grades of paper, are found. About one-third of all the lumber used in the State for pulp and paper comes from the Kennebec basin.

The mean annual precipitation in the Kennebec basin above Waterville is about 40 inches. It ranges from a little over 44 inches at Gardiner to probably not over 35 inches in the extreme northwestern part of the basin.

The river is generally frozen over during the winter, and the accumulations of snow in the northern portions of the basin frequently reach a depth of 3 feet, with a water equivalent of 5 or 6 inches.

The natural storage facilities on the Kennebec basin are excellent, there being about 420 square miles of lake and pond surface. Moosehead Lake, with an area of about 115 square miles, is the largest lake in New England. It is about 35 miles in extreme length, 12 miles in maximum width, and of such depth that it is crossed by steamboats from end to end. It has been in use many years as a reservoir to store the spring flow for use in log driving and for power and is commanded by substantial log-crib dams at its two outlets. The east outlet stream is the most important and is joined by the west outlet stream at the upper end of Indian Pond, about 4 miles below the lake.

The present head of water at Moosehead Lake is about 7.5 feet, corresponding to about 23.5 billion cubic feet storage, but surveys and estimates have been made by the Kennebec Water Power Co. covering an additional depth of 2 feet, corresponding to approximately 1.6 square miles of additional water area. Considerable damage to property at Greenville and Kineo would occur by this change, but an additional storage capacity of about 6.5 billion cubic feet would result. The lake could also be drawn down to a lower level by dredging at the outlet, which, however, would doubtless be objected to by the navigation interests.

Other important storage basins in Kennebec headwaters, little used at present, are Brassua Lake, Long, Wood, Attean, and the Roach ponds. Economical storage in the headwaters up to 40,000,000,000 cubic feet capacity is possible, which with that on Dead River and other tributaries should make the Kennebec River, with its large amount of fall, one of the best power streams in the country.

While the regimen of flow of the Kennebec has been much improved by storage in Moosehead Lake, a systematic regulation of the use of stored water is greatly needed, for much of the stored water impounded by the lake at the present time is needlessly wasted during log driving and at other times for lack of an adequate system of measuring and recording the flow from the outlets.

The Kennebec has always been an important river for log driving, the annual drive at present amounting to about 150,000,000 feet b. m.

Below Skowhegan practically all of the fall is utilized for power, but above this point there is a large amount of unutilized power. About 40 feet of fall in the vicinity of Madison is being developed by the Hollingsworth & Whitney Co. for a pulp and paper mill. Some of the important industries using water power on the main river are the cotton mills at Augusta and Waterville, the pulp and paper mills at Waterville, Skowhegan, Madison, and Solon, and numerous lumber mills.

The longest continuous run-off record on the main river is that at Waterville, beginning in 1893. The driest year since that time was 1908, and the wettest was 1907, the total flow in these two years being in the ratio of about 1 to 2.32.

RIVER AND LAKE SURVEYS IN KENNEBEC DRAINAGE BASIN.

In order to point out the power and storage possibilities in the Kennebec basin, surveys have been made as follows:

From tidewater to Moosehead Lake, for the determination of the profile and plan of the river.

Moose River from Moosehead Lake to near Long Pond.

Surveys of Wood and Attean ponds and Brassua Lake, to determine their storage capacity.

Surveys of Holeb, Long, Lower and Middle Roach, West Carry, and Spencer ponds, and Flagstaff and Spring lakes, to determine their areas.

From the data collected by the river surveys, sheets have been prepared, showing as far as available the profile of water surface, plan of the river, contours along the banks, and prominent natural or artificial features.

From the lake surveys sheets have been prepared showing as far as possible the shore lines and bank contours, covering from 10 to 20 feet depth of storage.

The results of these surveys have been published on sheets, and may be had on application to C. C. Babb, district engineer, United States Geological Survey, State House, Augusta, Maine.

MOOSEHEAD LAKE AT EAST OUTLET, MAINE.

A record of gage heights of Moosehead Lake level at Moosehead Lake East Outlet has been kept since April, 1895, by the Hollingsworth & Whitney Co. This record, supplemented by gage readings at Greenville for a portion of the time, has been furnished for publication by the company.

Two gage datums have been used at the East Outlet: The first is at elevation 1,011.30 feet above mean sea level, and approximately 10 feet below the gate sills; the other is 10 feet higher, i. e., the zero at the sill of the gates. All gage readings refer to this latter datum.

The maximum gage height recorded since the beginning of the records occurred May 9 and 30, 1902, and was 8 feet.

The lowest gage heights recorded occurred as follows: September 28, 1895, gage height 0.1 foot; between December 4, 1903, and April 29, 1904, no gage readings were obtained, the water being below the bottom of the gage; February 12 and 15, 1909, gage height 0.1 foot. The extreme range of lake level at present is thus about 8 feet.

Gage readings prior to 1907 have been compiled in Water-Supply Paper 198.

Dates of closing and opening of Moosehead Lake.

Closed.	Opened.
December 2, 1906	May 14, 1907
December 2, 1907	May 11, 1908
December 5, 1908	May 15, 1909
December 11, 1909	April 20, 1910

Daily gage height, in feet, of Moosehead Lake at East Outlet, Maine, for 1909.

[C. E. Wilson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.5	0.5						3.5	3.55	4.1	4.35
2	0.4						6.55	5.25				
3		.4	.5	0.95	5.7				3.45		4.1	4.35
4						7.6						
5		.4	.5	1.0	6.0						4.1	
6	.45						6.55	4.95	3.4	3.9		4.35
7				1.05	6.3	7.4	6.55					
8		.2	.55						3.3	4.0	4.1	4.4
9				1.15			6.45	4.75				
10		.15	.9		6.4	7.35		4.75	3.2	4.15		4.45
11	.45					7.25		4.65		4.3		
12		.1	.9	1.3	6.6		6.25				4.1	
13	.45							4.55	3.15	4.35		4.4
14				1.4		7.1	6.2					
15	.45	.1	.8						3.1	4.4	4.05	4.45
16				1.8		7.05	6.1	4.3				
17		.2	.8		7.4				3.0		4.0	4.55
18	.4					7.05		4.25		4.4		
19		.35	.85	2.45	7.5						3.95	
20	.35						6.0	4.1	2.95	4.35		4.45

Daily gage height, in feet, of Moosehead Lake at East Outlet, Maine, for 1909—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21				2.95	7.5	6.95	5.9					
22	.5	.35	.8							4.25	3.95	4.45
23				3.45		6.95	5.8	3.95				
24		.4	.8		7.55						3.95	4.4
25	.5					6.85		3.8		4.25		
26		.4	.8	4.3	7.8		5.65				4.1	
27	.5							3.8	2.75	4.25		4.4
28				4.7		6.75	5.55					
29	.5		.85						3.25	4.2	4.3	4.35
30				5.1		6.65	5.45	3.6				4.35
31			.9		7.6							

NOTE.—The storage capacity of Moosehead Lake is approximately equal to a discharge of 100 second-feet for one month for each inch of depth over the lake surface.

KENNEBEC RIVER AT THE FORKS, MAINE.

This station, which was established September 28, 1901, to determine the daily distribution of flow of the Kennebec, is located at the wooden highway bridge across the Kennebec at The Forks, about 2,000 feet above the mouth of Dead River.

The nearest dam used for storage is about 12 miles above the station, at the outlet of Indian Pond. From about May 1 to July 31 considerable fluctuation in gage height, ranging from 2 to over 5 feet, occurred daily, owing to regulation of flow for log driving.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. Its elevation above mean sea level, revised July, 1906, is 565.44 feet. Discharge measurements are made from the bridge. During the winter months the discharge is affected by ice. Conditions for obtaining accurate discharge data during conditions of free flow are fairly good except for occasional backwater from Dead River, and a good rating curve has been developed.

Data prior to 1907 have been revised and compiled in Water-Supply Paper 198.

Discharge measurements of Kennebec River at The Forks, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 18	F. E. Pressey	134	1,470	*a* 7.95	12,500
Oct. 30	T. W. Norcross	125	739	2.22	1,650

a The gage at the Dead River station was 4.20 feet; hence there was no backwater effect from this source.

Daily gage height, in feet, of Kennebec River at The Forks, Maine, for 1909.

[W. W. Young, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					2.8	5.25	3.45	2.9	2.5	2.8	2.2	1.2
2	1.9	3.4			2.9	5.4	3.45	2.9	2.5	2.5	2.2	1.3
3			1.9	2.7	2.5	5.0	3.4	2.9	2.5	2.4	2.55	1.4
4	1.9	3.4		2.7	2.5	6.0	3.4	2.85	2.5	2.45	2.9	1.35
5				2.7	3.0	4.5	3.45	2.85	2.5	1.2	3.0	1.2

Daily gage height, in feet, of Kennebec River at The Forks, Maine, for 1909—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6	1.1	......	......	2.6	3.15	4.8	3.1	2.85	2.5	1.1	2.4	1.2
7	......	......	2.1	2.6	5.2	4.05	3.1	2.85	2.4	.95	2.2	.9
8	1.0	3.2	......	2.5	6.05	3.9	3.2	2.85	2.45	.85	2.2	.9
9	......	......	......	2.5	7.05	3.85	3.15	2.8	2.3	.8	2.2	.9
10	......	......	2.2	2.5	7.55	4.05	3.15	2.8	2.3	.65	2.05	1.0
11	......	......	......	2.5	8.65	4.0	3.15	2.8	2.2	.5	2.0	1.0
12	1.2	......	......	2.5	8.1	4.0	3.15	2.8	2.2	.5	2.1	1.0
13	......	3.1	......	2.6	7.45	4.15	3.1	2.8	2.3	1.0	2.1	1.15
14	......	......	......	2.65	4.75	4.2	3.15	2.8	2.3	1.5	2.1	1.25
15	......	......	......	3.7	5.5	3.85	3.15	2.8	2.3	1.7	2.0	1.3
16	......	3.0	4.0	4.6	6.25	3.85	3.15	2.8	2.4	2.5	2.0	1.3
17	......	......	......	4.6	7.75	3.9	3.15	2.85	2.3	2.45	2.0	1.5
18	2.9	......	......	4.6	8.1	3.5	3.15	3.3	2.3	2.25	1.9	1.5
19	......	......	3.8	4.55	7.95	3.45	3.15	3.1	2.3	2.0	1.8	1.5
20	......	3.0	......	4.5	7.8	3.4	3.15	3.0	2.3	2.0	1.8	1.65
21	......	......	......	4.5	6.6	3.25	3.15	2.9	2.3	1.85	1.8	2.2
22	......	2.3	3.7	4.5	5.85	3.25	3.1	2.9	2.2	2.25	1.8	2.45
23	3.2	......	......	3.95	7.0	3.2	3.05	2.9	2.2	2.3	1.8	2.65
24	......	......	......	4.05	6.1	3.2	3.05	2.9	2.2	2.1	1.8	2.7
25	......	......	......	3.8	5.9	3.2	3.05	2.8	2.2	2.2	2.25	2.6
26	......	......	......	3.45	6.1	3.2	2.8	2.75	2.2	2.2	1.9	2.35
27	3.4	2.5	2.6	2.45	6.45	3.2	2.85	2.6	2.45	2.2	1.6	2.7
28	......	......	......	2.65	6.05	3.35	2.85	2.6	3.05	2.2	1.5	2.95
29	......	......	......	2.8	5.8	3.4	2.9	2.55	3.8	2.2	1.2	3.0
30	3.4	......	......	2.8	5.9	3.45	3.0	2.5	3.2	2.2	1.2	3.05
31	......	......	1.8	......	5.5	......	2.95	2.5	......	2.35	......	3.15

NOTE.—Ice conditions existed from Jan. 1 to about Apr. 14 and Dec. 13 to 31. Gage heights are to water surface except Jan. 23, which is to top of ice. Ice thickness January to March ranged from 1.1 feet to 2.4 feet.

The above mean daily gage heights are not true indexes of the discharge during the log-driving or ice periods. See footnote to daily discharge.

Daily discharge, in second-feet, of Kennebec River at The Forks, Maine, for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	2,200	6,380	3,100	2,940	1,850	2,200	1,530	715
2	......	2,330	6,690	3,100	2,940	1,850	1,850	1,530	780
3	......	1,850	5,870	3,020	2,940	1,850	1,740	1,910	850
4	......	1,850	7,970	3,020	2,860	1,850	1,800	2,330	815
5	......	2,460	4,880	3,100	2,860	1,850	715	2,460	715
6	......	2,660	5,460	3,380	2,860	1,850	655	1,740	715
7	......	6,280	4,060	3,380	2,860	1,740	572	1,530	545
8	......	8,080	3,810	3,500	2,860	1,800	520	1,530	545
9	......	10,300	3,730	3,420	2,780	1,630	495	1,530	545
10	......	11,500	4,060	3,420	2,780	1,630	430	1,380	600
11	......	14,200	3,980	3,420	2,780	1,530	370	1,330	600
12	......	12,900	3,980	3,420	2,780	1,530	370	1,430	600
13	......	11,300	4,240	3,240	2,780	1,630	600	1,430	......
14	......	5,360	4,320	3,420	2,780	1,630	920	1,430	......
15	3,480	6,900	3,730	3,420	2,780	1,630	1,080	1,330	......
16	5,070	8,520	3,730	3,420	2,780	1,740	1,850	1,330	......
17	5,070	12,000	3,810	3,420	2,820	1,630	1,800	1,330	......
18	5,070	12,900	3,170	3,420	2,880	1,630	1,580	1,240	......
19	4,980	12,500	3,100	3,420	2,600	1,630	1,330	1,160	......
20	4,880	12,100	3,020	3,420	2,460	1,630	1,330	1,160	......
21	4,880	9,300	2,800	3,420	2,330	1,630	1,200	1,160	......
22	4,880	7,640	2,800	3,240	2,330	1,530	1,580	1,160	......
23	3,900	10,200	2,740	3,160	2,330	1,530	1,630	1,160	......
24	4,060	8,190	2,740	3,160	2,330	1,530	1,430	1,160	......
25	3,640	7,750	2,740	3,160	2,200	1,530	1,530	1,580	......
26	3,100	8,190	2,740	2,830	2,140	1,530	1,530	1,240	......
27	1,800	8,960	2,740	2,850	1,960	1,800	1,530	995	......
28	2,020	8,080	2,950	2,850	1,960	2,530	1,530	920	......
29	2,200	7,540	3,020	2,890	1,910	3,640	1,530	715	......
30	2,200	7,750	3,100	3,030	1,850	2,740	1,530	715	......
31	......	6,900	......	3,080	1,850	......	1,680	......	......

NOTE.—The above daily discharges are based on a well-defined rating curve. Values for May to August may be much in error, however, due to errors in computed discharge caused by controlled flow for flushing logs down the river and backwater from log jams.

From July 6 to Aug. 17 the daily discharge was computed by applying the rating table to the several gage readings taken during any given day and weighing these values in accordance with the proportional part of the day to which each gage height is applicable.

Monthly discharge of Kennebec River at The Forks, Maine, for 1909.

[Drainage area, 1,570 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			476	0.303	0.35	C.
February			900	.573	.60	C.
March			900	.573	.66	C.
April	5,070		2,710	1.73	1.93	C.
May	14,200	1,850	8,020	5.11	5.89	B.
June	7,970	2,740	3,950	2.52	2.81	B.
July	3,500	2,830	3,230	2.06	2.38	B.
August	2,940	1,850	2,560	1.63	1.88	B.
September	3,640	1,530	1,800	1.15	1.28	A.
October	2,200	370	1,260	.803	.93	A.
November	2,460	715	1,380	.879	.98	A.
December			881	.561	.65	C.
The year	14,200		2,350	1.49	20.34	

NOTE.—The relatively low accuracy for May to August is due to complications caused by controlled flow and logging.

The winter periods are based on the discharge at Waterville. Coefficients of reduction to obtain natural flow at Bingham and The Forks were assumed and applied to the Waterville discharge. To these results were added or subtracted the increase or decrease in discharge due to storage at Moosehead Lake.

Mean discharge Apr. 1 to 14, estimated, 1,440 second-feet; Dec. 13 to 17, estimated, 500 second-feet; Dec. 18 to 31, estimated, 1,200 second-feet.

KENNEBEC RIVER AT BINGHAM, MAINE.

This station, which is located at the new steel highway bridge across Kennebec River at Bingham, was established June 21, 1907, to determine the daily distribution of flow of the Kennebec. It is located just below the mouth of Austin Stream. The nearest dam is about 11 miles downstream, at Solon, but the station is above the influence of backwater.

The datum of the chain gage attached to the highway bridge has remained the same during the maintenance of the station. Discharge measurements are made from the bridge. During the winter months discharge is affected by ice. Conditions for obtaining accurate discharge data are good and a well-defined rating curve has been developed.

This station was established to replace the stations at North Anson, on the Kennebec, and The Forks, on Dead River. In connection with the other stations in this drainage basin the records of discharge will afford a basis for an estimate of water for power and storage flowing in the Kennebec at any point.

Discharge measurements of Kennebec River at Bingham, Maine, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 23	F. E. Pressey	444	3,120	6.03	13,200
May 19	.....do	461	3,940	7.87	23,200
Oct. 29	T. W. Norcross	420	1,850	3.07	2,430

Daily gage height, in feet, of Kennebec River at Bingham, Maine, for 1909.

[C. R. Ellis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0				4.2	5.85	3.7	3.4	2.9	5.6	2.95	a 3.15
2		4.3	5.1		4.85	5.65	3.8	3.5	2.9	5.2	2.85	3.05
3					4.1	5.1	3.7	3.15	2.9	4.5	2.95	2.95
4					4.4	4.85	3.9	3.9	2.9	3.9	3.15	2.85
5					5.55	5.2	3.8	3.85	3.0	3.4	3.25	2.75
6		4.2		4.6	5.45	5.2	3.8	3.8	3.0	3.0	3.05	2.75
7					5.25	4.85	4.15	3.55	3.0	2.7	2.85	2.55
8	3.3		4.4	5.1	6.35	4.4	4.05	3.45	2.9	2.6	2.85	2.35
9					7.45	4.6	3.75	3.5	2.9	2.5	2.85	2.55
10				5.2	7.9	4.35	3.8	3.5	2.8	2.5	2.95	2.65
11	3.4	4.0		5.2	9.1	4.0	3.65	3.55	2.8	2.4	2.95	2.95
12			4.3	5.1	9.05	4.2	3.65	3.35	2.8	2.4	2.95	a 4.55
13					8.65	4.25	3.6	3.3	2.8	2.4	2.95	5.35
14	3.3	4.1		5.5	7.5	4.05	3.6	3.35	2.8	2.6	2.95	5.75
15				5.95	7.35	3.75	3.7	3.3	2.9	3.1	2.95	6.35
16				6.5	7.45	4.0	3.65	3.3	2.9	3.1	2.95	a 7.85
17		4.2		6.7	8.1	3.8	3.8	3.95	2.9	3.0	3.05	
18	3.3			6.6	8.0	4.05	3.7	3.6	2.9	2.8	3.05	
19			4.6	6.7	7.7	4.25	3.65	3.6	2.9	2.8	3.05	a 7.35
20		4.7		6.9	7.25	4.4	3.75	3.5	2.9	2.8	2.95	
21	3.9			6.8	6.55	4.3	3.9	3.3	2.8	2.8	2.95	
22	4.2	5.3		6.8	6.5	4.05	3.85	3.1	2.8	2.8	2.95	a 6.85
23				6.1	7.1	4.4	3.75	3.1	2.8	2.9	2.95	
24				6.2	6.35	4.25	3.65	3.1	2.8	3.0	2.95	
25				5.6	5.95	3.9	3.65	3.1	2.7	3.1	3.15	
26	4.2			5.4	6.7	4.0	3.65	3.1	2.7	3.0	3.45	7.55
27		5.0		4.3	5.85	3.85	3.55	3.1	3.0	3.0	3.15	
28				4.95	5.95	3.8	3.75	3.1	3.3	3.0	2.95	
29				5.35	6.0	3.8	3.55	3.1	5.7	3.05	2.85	7.75
30				4.85	6.4	3.75	3.6	3.1	5.9	2.95	3.05	
31					6.05		3.55	2.9		2.95		

a Gage height to top of ice; all other readings during the winter periods are to water surface.

NOTE.—Ice conditions existed from Jan. 1 to about Apr. 13, Nov. 26 to Dec 2, and Dec. 9 to 31. Ice thickness January to April was between 1 and 2 feet. Between Apr. 23 and Aug. 18 the opening and closing of gates at Moosehead and Indian lakes caused much variation in the gage heights.

Daily discharge, in second-feet, of Kennebec River at Bingham, Maine, for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5,480	12,200	3,980	3,200	2,090	11,000	2,200	
2		7,800	11,200	4,260	3,450	2,090	9,210	1,990	
3		5,160	8,790	3,980	2,620	2,090	6,500	2,200	2,200
4		6,150	7,800	4,550	4,550	2,090	4,550	2,620	1,990
5		10,800	9,210	4,260	4,400	2,300	3,200	2,840	1,800
6		10,300	9,210	4,260	4,260	2,300	2,300	2,400	1,800
7		9,420	7,800	5,320	3,580	2,300	1,700	1,990	1,440
8		14,600	6,150	5,000	3,320	2,090	1,520	1,990	1,120
9		20,700	6,860	4,120	3,450	2,090	1,350	1,990	
10		23,400	5,980	4,260	3,450	1,890	1,350	2,200	
11		31,200	4,850	3,840	3,580	1,890	1,190	2,200	
12		30,800	5,480	3,840	3,080	1,890	1,190	2,200	
13		28,100	5,640	3,710	2,960	1,890	1,190	2,200	
14	10,500	21,000	5,000	3,710	3,080	1,890	1,520	2,200	
15	12,600	20,100	4,120	3,980	2,960	2,090	2,510	2,200	
16	15,400	20,700	4,850	3,840	2,960	2,090	2,510	2,200	
17	16,500	24,600	4,260	4,260	4,700	2,090	2,300	2,400	
18	15,900	24,000	5,000	3,980	3,710	2,090	1,890	2,400	
19	16,500	22,200	5,640	3,840	3,710	2,090	1,890	2,400	
20	17,600	19,500	6,150	4,120	3,450	2,090	1,890	2,200	
21	17,000	15,700	5,810	4,550	2,960	1,890	1,890	2,200	
22	17,000	15,400	5,000	4,400	2,510	1,890	1,890	2,200	
23	13,400	18,700	6,150	4,120	2,510	1,890	2,090	2,200	
24	13,900	14,600	5,640	3,840	2,510	1,890	2,300	2,200	
25	11,000	12,600	4,550	3,840	2,510	1,700	2,510		
26	10,100	16,500	4,850	3,840	2,510	1,700	2,300		
27	5,810	12,200	4,400	3,580	2,510	2,300	2,300		
28	8,180	12,600	4,260	4,120	2,510	2,960	2,300		
29	9,860	12,900	4,260	3,580	2,510	11,400	2,400		
30	7,800	14,900	4,120	3,710	2,510	12,400	2,200		
31		13,100		3,580	2,090		2,200		

NOTE.—The above daily discharges are based on a well-defined rating curve. They may, however, be individually considerably in error, due to fluctuation of water surface from operations at Moosehead and Indian lakes and logging.

Monthly discharge of Kennebec River at Bingham, Maine, for 1909.

[Drainage area, 2,660 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			1,070	0.402	0.46	C.
February			1,740	.654	.68	C.
March			2,000	.752	.87	C.
April	17,600		9,000	3.38	3.77	C.
May	31,200	5,160	16,600	6.24	7.19	B.
June	12,200	4,120	6,170	2.32	2.59	B.
July	5,320	3,580	4,070	1.53	1.76	B.
August	4,700	2,090	3,160	1.19	1.37	B.
September	12,400	1,700	2,720	1.02	1.14	A.
October	11,000	1,190	2,750	1.03	1.19	A.
November	2,840		2,250	.846	.94	B.
December			1,620	.609	.70	C.
The year	31,200		4,450	1.67	22.66	

NOTE.—The winter periods are based on the discharge at Waterville. Coefficients of reduction to obtain natural flow at Bingham and The Forks were assumed and applied to the Waterville discharge. To these results were added or subtracted the increase or decrease in discharge due to storage at Moosehead Lake.

Mean discharge Apr. 1 to 13, 3,930 second-feet; Nov. 25 to 30, 2,270 second-feet; Dec. 1 to 2, 2 200 second-feet; Dec. 9 to 17, 1,000 second-feet; Dec. 18 to 31, 1,900 second-feet.

KENNEBEC RIVER AT WATERVILLE, MAINE.

Observations of the flow of Kennebec River at Waterville have been made by the Hollingsworth & Whitney Co. since November, 1891, and have been continuous since January 12, 1893. This company manufactures manila paper and ground-wood and sulphite pulp. The records for 1909 have been furnished for computation by George H. Marr, engineer for the company.

The station is located about 2 miles above the mouth of Sebasticook River. Messalonskee Stream enters about 3½ miles below the station.

The dam is of timber cribwork, the main portion having a vertical downstream face with a horizontal crest about 5.75 feet wide and an upstream slope of about 40° from the horizontal. The average elevation of the crest of the dam, as determined by levels during July, 1906, was 119.37 feet above the Hollingsworth & Whitney datum, or 71.53 feet above mean sea level, according to the Kennebec datum as corrected by levels of 1906. The total length of the dam is 800 feet, which includes a width of logway of 34 feet. Flashboards are kept on the dam a greater part of the time, their average elevation in July, 1906, being 123.73 feet above the Hollingsworth & Whitney datum, or 75.89 feet above mean sea level. The crest of the dam is in fairly good condition. The leakage has never been measured, but is assumed arbitrarily as 100 second-feet. The water which flows in the canals is used through 46 wheels, most of which have been rated at Holyoke under practically the same head, the average head at Waterville being about 23 feet. Some water is lost from the canal through small waste gates and over wasteweirs. A small amount, estimated at 100 second-feet, is used for washing and mill purposes.

Methods and diagrams for estimating the flow through the wheels and over the dam were developed by the late Sumner Hollingsworth, engineer for the company. Observations were made at 12 o'clock noon of each day, that hour having been chosen after investigation as a time when the flow is least affected by storage of dams upstream and as giving most nearly the average for the day. When the flow of the river is less than about 3,500 second feet, all of the water is used through the wheels.

Prior to 1906 some errors have occurred in computing discharge data at this point, owing to the use of inaccurate information regarding flashboards, and the records are considered as only fair. Since 1906 more care has been taken, and the present results are fairly good.

The maximum crest discharge since records have been kept occurred from 7 until 9 a. m. December 16, 1901, and was 156,800 second-feet. The average discharge during the 24 hours of that day was 127,000 second-feet. This was probably the greatest flood occurring in the last hundred years on the Kennebec, and even with this great discharge much of the flood flow above Moosehead Lake (some 1,240 square miles of drainage area) was being held in the lake. (See Water-Supply Paper 198 for discussion of this flood.)

The discharge for the minimum week occurred December 14 to 20, 1903, and averaged 638 second-feet.

Data prior to 1907 have been compiled in Water-Supply Paper 198.

Daily discharge, in second-feet, of Kennebec River at Waterville, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	990	2,710	5,610	7,440	11,400	20,600	5,400	[a] 2,980	2,450	13,700	3,280	3,390
2......	1,010	2,170	5,290	6,760	[a] 10,900	12,900	4,480	3,620	2,440	8,370	3,020	3,900
3......	[a] 990	2,180	4,390	6,960	13,200	30,200	5,130	2,120	2,720	[a] 6,160	2,980	4,400
4......	960	2,250	4,160	[a] 6,600	8,630	12,600	[a] 4,740	2,900	2,720	5,350	3,920	4,440
5......	1,000	1,950	3,860	8,490	15,100	9,580	4,440	3,450	[a] 910	[b] 4,640	4,060	[a] 2,390
6......	2,310	2,260	3,230	12,600	16,400	[a] 11,500	6,460	3,150	2,430	3,930	4,040	3,700
7......	4,190	[a] 900	[a] 2,070	16,000	15,900	9,660	5,090	3,140	2,450	3,160	[a] 2,770	3,650
8......	5,610	2,580	2,500	16,500	22,200	9,660	4,850	[b] 3,140	2,680	3,280	3,940	3,530
9......	3,960	2,220	2,920	6,770	[a] 27,800	5,370	5,390	2,110	2,410	3,160	3,950	3,110
10......	[a] 2,800	2,120	2,540	4,720	24,600	7,310	5,400	3,410	2,770	[a] 1,240	3,680	2,480
11......	2,400	2,260	2,770	[a] 3,330	38,500	7,350	[a] 2,960	3,280	2,420	2,980	3,640	2,120
12......	2,840	2,700	3,670	5,030	37,700	6,720	4,380	3,150	[a] 940	2,180	3,350	[a] 920
13......	2,680	2,240	3,660	11,300	38,400	[a] 7,060	4,460	3,250	2,460	2,490	3,520	1,710
14......	2,370	[a] 1,240	[a] 2,070	21,000	31,600	7,320	3,940	3,460	2,740	2,130	[a] 2,050	3,020
15......	2,380	2,420	3,620	41,200	25,200	7,370	3,880	[a] 2,270	2,480	2,360	3,890	3,880
16......	1,750	2,290	3,310	44,200	[a] 25,800	6,660	4,500	3,200	2,170	3,520	3,290	3,470
17......	[a] 1,260	2,240	3,310	30,100	22,700	6,250	5,330	3,250	2,130	[a] 2,560	2,970	4,690
18......	880	2,010	3,030	[a] 26,400	30,000	6,720	[a] 6,030	3,700	2,640	3,810	3,750	3,630
19......	1,950	1,810	3,340	29,900	29,600	8,680	5,370	3,080	[a] 920	3,280	3,810	[a] 2,600
20......	1,620	2,260	3,050	24,400	22,700	[a] 7,080	4,890	3,600	2,700	2,720	3,740	2,980
21......	1,670	[a] 1,870	[a] 2,120	23,600	24,700	6,550	4,900	3,470	2,470	2,730	[a] 2,630	3,220
22......	1,900	5,280	2,960	23,900	17,500	6,210	5,020	[a] 1,760	2,710	3,010	3,800	2,150
23......	1,900	6,250	2,990	25,600	[a] 18,000	5,450	5,390	3,120	2,010	3,270	3,320	2,620
24......	[a] 1,660	6,730	3,030	20,200	15,800	6,260	4,790	3,040	2,400	[a] 2,100	3,780	3,250
25......	2,830	6,300	2,960	[a] 17,200	16,800	6,970	[a] 3,730	2,750	2,440	3,930	2,380	1,440
26......	2,740	7,630	3,820	15,100	11,200	4,900	5,370	3,030	[a] 900	3,930	4,160	[a] 3,690
27......	2,550	7,380	6,680	12,700	10,500	[a] 3,530	4,440	2,760	2,740	3,920	4,020	3,070
28......	2,470	[a] 8,080	[a] 8,050	9,590	10,000	4,800	4,290	2,490	5,710	3,930	[a] 2,410	3,070
29......	2,320	....	8,800	13,300	15,900	4,380	4,320	[a] 1,460	34,300	3,520	3,950	2,730
30......	2,320	....	8,080	10,100	[a] 21,600	4,500	4,070	2,710	22,600	3,490	4,090	2,460
31......	[a] 610	....	7,540	....	18,600	....	3,670	2,720	....	[a] 2,060	....	2,350

[a] Sunday. [b] No record. Discharge estimated.

Monthly discharge of Kennebec River at Waterville, Maine, for 1909.

[Drainage area, 4,270 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	5,610	610	2,160	0.506	0.58
February	7,630	900	3,230	.756	.79
March	8,800	2,070	4,050	.948	1.09
April	44,200	3,330	16,700	3.91	4.36
May	38,500	8,630	20,900	4.89	5.64
June	30,200	3,530	8,470	1.98	2.21
July	6,460	2,960	4,750	1.11	1.28
August	3,700	1,460	2,950	.691	.80
September	34,300	900	4,130	.967	1.08
October	13,700	1,240	3,770	.883	1.02
November	4,160	2,050	3,470	.813	.91
December	4,690	920	3,030	.710	.82
The year	44,200	610	6,470	1.51	20.58

SEBASTICOOK RIVER AT PITTSFIELD, MAINE.

Sebasticook River rises in ponds in southeastern Somerset and western Penobscot counties and flows in a general southwesterly direction 45 miles to Kennebec River at Winslow, opposite Waterville. It is the largest tributary of the Kennebec, and it is also one of the most fully developed for power. Out of a total fall of 170 feet between Moose Pond and the Kennebec only about 50 feet remain undeveloped. Storage facilities are good, but have been only in part utilized. The basin is largely in farm lands.

The gaging station, which was established July 3, 1908, to determine the daily distribution of flow of the river is located at the steel highway bridge just above the Maine Central Railroad bridge across the river in the town of Pittsfield, Maine.

About 800 feet upstream from the highway bridge is a dam which furnishes power to the Robert Dobson Co. and the Smith Woolen Co.; the dam of the Waverly woolen mill is about one-half mile farther upstream. About 5 miles below the station and 2 miles from Burnham is the Sebasticook Power Co.'s dam. There is a clear fall below the gage, and the dam below has no effect on the discharge.

The gage datum has remained the same since the establishment of the station. Discharge measurements are made from the highway, bridge. Conditions are good for obtaining accurate discharge data, and a rating curve has been partly developed. Owing to the proximity of the dam above and the rapid fall of the stream, it is believed that the discharge at the gaging station is not materially affected by ice.

Discharge measurements of Sebasticook River at Pittsfield, Maine, in 1907–1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	F. E. Pressey	108	205	3.68	486
1908.					
July 3	.....do	106	175	3.26	362
23	.....do	106	172	3.22	322
Sept. 21	.....do	100	140	3.06	231
Nov. 4	Wood and French	98.5	154	2.96	224
Dec. 24	F. E. Pressey	96	102	2.56	86.7
1909.					
Apr. 23	.....do	109	534	6.54	3,860
May 20	.....do	106	195	3.44	398

Daily gage height, in feet, of Sebasticook River at Pittsfield, Maine, for 1909.

[Easter B. Morrill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	3.3	4.7	4.5	4.7	3.15	3.25	2.75	3.25	3.5	3.4	4.05
2	2.6	3.25	4.65	4.4	4.75	3.35	3.15	3.15	3.2	3.6	3.4	4.05
3	2.5	3.15	4.4	4.75	4.85	3.25	3.25	3.05	3.15	3.2	3.45	4.0
4	2.8	3.3	4.4	5.1	4.7	3.25	3.2	3.1	2.9	3.65	3.35	3.9
5	2.9	3.3	4.3	5.15	4.85	3.15	3.2	3.2	2.65	3.75	3.4	3.8
6	3.35	3.2	4.3	5.25	4.7	2.95	3.25	3.25	3.05	3.75	3.25	3.8
7	3.65	3.05	4.1	5.25	4.7	3.25	3.2	3.15	3.1	3.65	3.0	3.75
8	3.5	3.1	3.9	5.7	4.7	3.35	3.25	2.9	3.1	3.55	3.5	3.65
9	3.25	3.1	3.8	6.15	4.85	2.9	3.3	3.2	2.95	3.5	3.55	3.65
10	2.9	3.1	3.65	6.2	4.7	3.05	3.4	3.1	3.0	3.35	3.45	3.6
11	3.3	3.15	3.85	6.05	4.6	3.05	3.25	3.25	2.8	3.6	3.55	3.65
12	3.25	3.1	3.7	5.9	4.5	2.95	3.3	3.15	2.65	3.5	3.65	3.45
13	3.25	3.2	3.6	5.6	4.35	2.9	3.25	3.25	2.95	3.35	3.3	3.55
14	3.2	3.0	3.55	6.45	4.15	3.2	3.2	3.05	3.15	3.45	2.95	3.55
15	3.2	3.05	3.7	7.5	3.35	3.2	3.25	2.75	3.05	3.4	3.5	3.5
16	3.05	3.2	3.7	8.35	2.55	3.15	3.2	3.25	2.95	3.25	3.55	3.65
17	2.95	3.15	3.65	8.5	3.05	3.2	3.15	3.25	2.95	3.0	3.55	3.55
18	3.4	3.2	3.7	8.3	2.95	3.3	2.85	3.2	3.0	3.45	3.5	3.55
19	3.15	3.2	3.6	7.65	3.1	3.1	3.2	3.25	2.85	3.4	3.55	3.55
20	3.25	3.3	3.6	7.3	3.35	2.95	3.25	3.2	3.1	3.35	3.35	3.55
21	3.25	3.4	3.6	6.95	3.4	3.25	3.15	3.1	3.15	3.35	3.15	3.55
22	3.2	3.6	3.5	6.5	3.35	3.1	3.15	2.9	3.1	3.3	3.55	3.55
23	3.2	3.65	3.6	6.4	3.05	3.2	3.15	3.15	3.1	3.2	3.55	3.55
24	3.1	3.95	3.55	6.0	3.1	3.25	3.0	3.05	3.05	3.0	3.5	3.45
25	3.25	4.1	3.5	5.8	3.25	3.2	2.95	2.9	3.0	3.3	3.2	3.25
26	3.35	4.7	3.7	5.6	3.3	3.1	3.0	2.85	2.55	3.35	3.8	3.25
27	3.3	4.75	3.8	5.3	3.35	3.0	3.0	3.0	3.4	3.35	3.8	3.45
28	3.4	4.7	3.9	5.15	3.35	3.3	3.05	2.95	3.7	3.35	3.85	3.5
29	3.3	......	4.1	5.0	3.0	3.2	3.15	2.85	4.35	3.35	4.0	3.55
30	3.1	......	4.35	4.8	2.95	3.2	3.05	3.15	3.9	3.1	4.1	3.5
31	3.0	......	4.4	......	3.0	......	3.0	3.25	......	2.85	......	3.55

NOTE.—No information about ice conditions available. On account of the rapid fall and proximity of the power plant above, it is believed that there is no effect from ice, except possibly at rare intervals and for short periods.

Daily discharge, in second-feet, of Sebasticook River at Pittsfield, Maine, for 1908–9.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	......	......	......	......	......	......	......	142	176	142	a 84	176
2	......	......	......	......	......	......	......	a 126	176	126	176	142
3	......	......	......	......	......	......	......	212	176	84	176	231
4	......	......	......	......	......	......	......	193	176	a 84	231	193
5	......	......	......	......	......	......	......	193	97	158	212	97
6	......	......	......	......	......	......	......	212	a 97	158	158	a 48
7	......	......	......	......	......	......	......	212	176	176	97	158
8	......	......	......	......	......	......	......	126	176	158	a 71	231
9	......	......	......	......	......	......	......	a 126	176	158	126	212
10	......	......	......	......	......	......	......	212	176	97	193	193
11	......	......	......	......	......	......	......	212	176	a 112	193	176
12	......	......	......	......	......	......	......	193	97	193	158	71
13	......	......	......	......	......	......	......	212	a 84	193	142	a 48
14	......	......	......	......	......	......	......	272	158	176	112	142
15	......	......	......	......	......	......	......	212	176	158	a 60	193
16	......	......	......	......	......	......	......	a 176	176	142	126	212
17	......	......	......	......	......	......	......	252	158	97	158	193
18	......	......	......	......	......	......	......	231	158	a 112	193	231
19	......	......	......	......	......	......	......	231	84	142	193	158
20	......	......	......	......	......	......	......	231	a 71	158	126	a 126
21	......	......	......	......	......	......	......	212	142	158	112	231
22	......	......	......	......	......	......	......	142	142	112	a 48	231
23	......	......	......	......	......	......	......	a 126	142	84	112	193
24	......	......	......	......	......	......	......	193	142	84	193	193
25	......	......	......	......	......	......	......	193	142	a 71	176	60
26	......	......	......	......	......	......	......	212	71	126	112	112
27	......	......	......	......	......	......	212	212	a 60	158	97	a 60
28	......	......	......	......	......	......	231	193	126	158	97	193
29	......	......	......	......	......	......	231	126	142	158	a 30	158
30	......	......	......	......	......	......	212	a 112	142	126	112	176
31	......	......	......	......	......	......	193	158	......	97	......	158
1909.												
1	193	364	1,520	1,300	1,520	294	340	a 142	340	470	415	862
2	97	340	1,470	1,190	a 1,580	390	294	294	316	530	415	862
3	a 71	294	1,190	1,580	1,700	340	340	252	294	a 316	442	820
4	158	364	1,190	a 2,000	1,520	340	a 316	272	193	562	390	740
5	193	364	1,090	2,060	1,700	294	316	316	a 112	630	415	a 665
6	390	316	1,090	2,180	1,520	a 212	340	340	252	630	340	665
7	562	a 252	a 905	2,180	1,520	340	316	294	272	562	a 231	630
8	470	272	740	2,740	1,520	390	340	a 193	272	500	470	562
9	340	272	665	3,320	a 1,700	193	364	316	212	470	500	562
10	a 193	272	562	3,390	1,520	252	415	272	231	a 390	442	530
11	364	294	702	a 3,200	1,410	252	a 340	340	158	530	500	562
12	340	272	595	3,000	1,300	212	364	294	a 112	470	562	a 442
13	340	316	530	2,620	1,140	a 193	340	340	212	390	364	500
14	316	a 231	a 500	3,720	950	316	316	252	294	442	a 212	500
15	316	252	595	5,320	390	316	340	a 142	252	415	470	470
16	252	316	595	6,860	a 84	294	316	340	212	340	500	562
17	a 212	294	562	7,160	252	316	294	340	212	a 231	500	500
18	415	316	595	a 6,770	212	364	a 176	316	231	442	470	500
19	294	316	530	5,580	272	272	316	340	a 176	415	500	a 500
20	340	364	530	4,990	390	a 212	340	316	272	390	390	500
21	340	a 415	a 530	4,440	415	340	294	272	294	390	a 294	500
22	316	530	470	3,790	390	272	294	a 193	272	364	500	500
23	316	562	530	3,650	a 252	316	294	294	272	316	500	500
24	a 272	780	500	3,130	272	340	231	252	252	a 231	470	442
25	340	905	470	a 2,870	340	316	a 212	193	231	364	316	340
26	390	1,520	595	2,620	364	272	231	176	a 84	390	665	a 340
27	364	1,580	665	2,240	390	a 231	231	231	415	390	665	442
28	415	a 1,520	a 740	2,060	390	364	252	212	595	390	a 702	470
29	364	......	905	1,880	231	316	294	a 176	1,140	390	820	500
30	272	......	1,140	1,640	a 212	316	252	294	740	272	905	470
31	a 231	......	1,190	......	231	......	231	340	......	a 176	......	500

a Sunday.

NOTE.—The above daily discharges are based on a rating curve well defined between discharges 70 and 470 second-feet. Below these limits the discharges are approximate, the rating curve having been extended by study of area and velocity curves. Above 470 second-feet the rating curve is based on one measurement at discharge 3,860 and can be considered fairly well defined.

Monthly discharge of Sebasticook River at Pittsfield, Maine, for 1908-9.

[Drainage area, 314 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1908.						
July 27-31	231	193	216	0.688	0.13	A.
August	272	112	189	.602	.69	A.
September	176	60	140	.446	.50	A.
October	193	71	134	.427	.49	A.
November	231	30	136	.433	.48	A.
December	231	48	159	.506	.58	B.
1909.						
January	562	71	306	.975	1.12	B.
February	1,580	231	496	1.58	1.64	B.
March	1,520	470	771	2.46	2.84	B.
April	7,160	1,190	3,320	10.6	11.88	B.
May	1,700	84	829	2.64	3.04	B.
June	390	193	296	.943	1.05	A.
July	415	176	301	.959	1.11	A.
August	340	142	269	.857	.99	A.
September	1,140	84	297	.946	1.06	A.
October	630	176	413	1.32	1.52	A.
November	905	212	479	1.53	1.71	A.
December	862	340	546	1.74	2.01	B.
The year	7,160	71	694	2.21	29.92	

NOTE.—The minima are low on account of storage of water at power plant above the station.

COBBOSSEECONTEE STREAM AT GARDINER, MAINE.

Cobbosseecontee Stream drains a group of lakes lying 5 to 15 miles west of Augusta. From the largest of these, Cobbosseecontee Pond, which has an area of 8.4 square miles, the river flows southward, eastward, and then northeastward, entering Kennebec River at Gardiner. Its total drainage area, 240 square miles, is largely in farm lands. The aggregate area of the ponds at the head of the stream is about 19 square miles. From Lake Maranacook—one of the upper lakes—to the Kennebec the fall is 206 feet, about 128 feet in the last three-fourths of a mile of the river course.

The Cobbosseecontee is a most remarkable example of the regularity of flow that can be obtained with proper storage, and except for a short time each spring there is usually no water wasted.

Records of flow of Cobbosseecontee River have been kept at the dam of the Gardiner Water Power Co. since 1890. This dam is the uppermost of a series of seven dams near the mouth of the river at Gardiner, and is of stone masonry, with a timber apron at the toe. The downstream face has an approximate slope of 1 horizontal to 4 vertical. The crest is horizontal and is about 6 feet wide. The upstream slope is about 1 vertical to 8 horizontal. The total length of the dam is about 100 feet, and flashboards 4.5 feet high are maintained continuously. The total head obtained is about 10 feet. The head-bay entrance is on the right bank, and from this runs a wooden penstock in which is placed a 39-inch Hercules wheel. In the head bay there is also a gatehouse with two gates which are kept partially open most of the time to regulate the proper flow down the river.

The records of flow are made up by considering (1) the flow over the dam, which is usually nothing, except for a short time in the spring; (2) the flow through the sluice gates, which is regulated by means of tables drawn up for the company by Hiram F. Mills, C. E., showing the discharge through the two gates for different pond level, the practical application of this method being to obtain a given flow at any time by setting these gates at the required gate opening, the flow through the wheel being taken into account; (3) the amount of water flowing through the 39-inch wheel, which is ascertained from this gate opening and pond level by means of a table, also provided for this purpose by Mr. Mills. The water that is pumped for the Gardiner supply is neglected in computations, being but a small percentage of the flow. It is also assumed that the tail-water level remains constant. The leakage by the dam was measured during 1905 and found to be 10 second-feet, and correction made accordingly until August, 1907, when the dam was repaired. On Sundays and legal holidays gates are closed and no water is allowed to run unless the lake is full.

These records have been furnished by S. D. Warren & Co., through their engineer, Joseph A. Warren, and are considered excellent.

The maximum daily discharge since the establishment occurred March 12, 1903, and was 3,275 second-feet. The discharge for the minimum week (not including holidays or times when for some reason the plant was shut down) occurred October 23 to 29, 1899, and averaged 57 secona-feet.

Data prior to 1907 have been compiled in Water-Supply Paper 198.

Daily discharge, in second-feet, of Cobbosseecontee Stream at Gardiner, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	140	180	275	1,080	280	285	260	[a] 0	260	260	260	260
2	140	180	275	880	[a] 80	285	260	260	260	260	260	260
3	[a] 0	180	275	830	315	285	260	260	260	[a] 0	260	260
4	140	180	275	[a] 870	320	280	[a] 0	260	260	260	260	260
5	140	180	275	830	320	280	10	260	[a] 0	260	260	[a] 0
6	200	180	275	855	315	[a] 0	130	260	260	260	260	260
7	270	[a] 0	[a] 0	1,145	300	280	260	260	260	260	[a] 0	260
8	270	180	275	1,450	295	280	260	[a] 0	260	260	260	260
9	270	180	275	1,620	[a] 295	280	260	260	260	260	260	260
10	[a] 0	180	275	1,800	290	280	260	260	260	[a] 0	260	260
11	180	180	275	[a] 1,770	280	280	[a] 0	260	260	260	260	260
12	180	180	275	1,730	280	280	260	260	[a] 0	260	260	[a] 0
13	180	180	275	1,390	280	[a] 0	260	260	260	260	260	260
14	180	[a] 0	[a] 0	1,030	280	270	260	260	260	260	[a] 0	260
15	180	180	275	1,450	280	270	260	[a] 0	260	260	260	260
16	180	180	275	1,950	[a] 0	270	260	260	260	260	260	260
17	[a] 0	180	275	2,000	280	270	260	260	260	[a] 0	260	260
18	180	180	275	[a] 1,970	280	270	[a] 0	260	260	260	260	260
19	180	180	275	1,950	280	270	260	260	[a] 0	260	260	[a] 0
20	180	180	275	1,700	280	[a] 0	260	260	260	260	260	260

[a] Sunday.

Daily discharge, in second-feet, of Cobbosseecontee Stream at Gardiner, Maine, for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	180	a0	a0	1,320	280	270	260	260	260	260	a0	260
22	180	260	275	1,150	280	270	260	a0	260	260	260	260
23	180	260	275	1,050	a0	270	260	260	260	260	260	260
24	a0	270	275	770	280	270	260	260	260	a0	260	260
25	180	275	275	a300	280	270	a0	260	260	260	260	260
26	180	275	280	290	280	270	260	260	a0	260	260	a0
27	180	275	280	280	280	a0	260	260	260	260	260	250
28	180	a0	a140	280	280	270	260	260	260	260	a0	230
29	180	......	630	280	280	270	260	a0	260	260	260	230
30	180	......	965	280	a25	265	260	260	260	260	260	230
31	a0	......	1,140	......	0	......	260	260	......	a0	......	230

a Sunday.

Monthly discharge of Cobbosseecontee Stream at Gardiner, Maine, for 1909.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	270	0	155	0.646	0.74
February	275	0	173	.721	.75
March	1,140	0	306	1.28	1.48
April	2,000	280	1,140	4.75	5.30
May	320	0	245	1.02	1.18
June	285	0	238	.992	1.11
July	260	0	214	.892	1.03
August	260	0	218	.908	1.05
September	260	0	225	.938	1.05
October	260	0	218	.908	1.05
November	260	0	225	.938	1.05
December	260	0	222	.925	1.07
The year	2,000	0	298	1.24	16.86

ANDROSCOGGIN RIVER DRAINAGE BASIN.

DESCRIPTION.

Androscoggin River is formed by the junction of Magalloway River and the outlet of the Umbagog-Rangeley lakes near the Maine-New Hampshire boundary. For about 35 miles it flows southward in New Hampshire, then turns abruptly and flows eastward in Maine, finally turning toward the south and joining the Kennebec in Merrymeeting Bay, near Brunswick. The river is about 200 miles long and the greatest width of its basin about 70 miles. The total drainage area is 3,470 square miles, about 80 per cent of which is in Maine. Its only important tributary is Little Androscoggin River, which enters at Lewiston.

The lower part of the basin is hilly and partly wooded, and much of it is farm land; the upper part is very broken and mountainous and is largely in forest. The general elevation of the basin is greater than that of any other on the Atlantic coast. Umbagog Lake is about 1,240 feet above sea level, and Rangeley Lake about 1,500 feet. The sources of Magalloway River reach elevations of from 2,600 to 2,900 feet.

Granite, gneiss, and mica schists are found along the main course of the river, with clay slate in the upper part of the basin. The bed of the river, like that of the Kennebec and Penobscot, is rocky where falls occur, and its high banks little subject to overflow—conditions that are advantageous in the development of water power.

The mean annual precipitation is probably about 40 inches, ranging from 43 inches near the coast to less than 35 inches in the extreme northern part of the basin. Winters in the northern portions of the basin are extremely rigorous and low water frequently occurs during the winter months on this account.

The Androscoggin is naturally provided with storage facilities as fine as those of any river in the East. Including the Umbagog-Rangeley series, which afford a combined water surface of about 80 square miles, there is a storage of about 22,000,000,000 cubic feet. The drainage area at the outlet of Umbagog Lake and above the mouth of Magalloway River is 635 square miles; of Magalloway River at its mouth, 460 square miles. Under the efficient management of the Union Water Power Co. the storage afforded by these lakes has had a marked effect upon the regimen of flow during low water for the past few years. A number of the companies on the river have united in making plans for a dam on Magalloway River which will afford approximately 8,000,000,000 cubic feet of additional storage and very materially increase the low-water flow of the Androscoggin.

Androscoggin River is probably as well developed as any other river in the country. Of the 1,240 feet fall between Umbagog Lake and tide water more than 600 feet has been developed and furnishes power to many mills, including the cotton mills of Brunswick and Lewiston, and the great pulp and paper mills of Livermore Falls, Rumford Falls, and Berlin; but there still remain some excellent unutilized sites of especial value on account of the uniform flow of the stream.

Androscoggin River is an important stream for log driving, and care is exercised in the amount of water used for this purpose. The regulation of the flow is under one management, and is controlled in the interests of both log driving and the water-power developments.

Little Androscoggin River, about 30 miles long and draining an area of about 380 square miles, is well endowed with storage facilities and is an important water-power stream for its size. Developments have been made at Mechanic Falls and near Auburn, and considerable power is still unutilized.

The longest record of flow on the Androscoggin is that at Rumford Falls, extending back to 1892. The driest year since the beginning of the records was 1905, and the wettest 1893, the total flow during these two years being about in the ratio of 1 to 1.89.

RIVER AND LAKE SURVEYS IN ANDROSCOGGIN DRAINAGE BASIN.

Surveys have been made in this basin by the United States Geological Survey, as follows:

From tide water at Brunswick to Livermore Falls; survey for profile only.
From Livermore Falls to Umbagog Lake at Errol Dam; for plan and profile.
Surveys of Umbagog, Upper and Lower Richardson, and Mooselucmaguntic lakes.

The results of these surveys may be had on application to C. C. Babb, district engineer, United States Geological Survey, State House, Augusta, Maine.

ANDROSCOGGIN RIVER AT ERROL DAM, N. H.

Errol dam controls the storage of Umbagog, the lower of the Rangeley series of lakes. The dam is located about 5 miles below the outlet of the lake and about 3.5 miles below the mouth of Magalloway River, thus making this latter stream one of the feeders of Umbagog Lake.

Records of the discharge through Errol dam have been maintained since January 1, 1905, by the Union Water Power Co., by which the following records have been furnished.

The dam is a frame structure about 175 feet between abutments. It is designed with a number of gate openings of sufficient capacity to discharge the flood flow, making a spillway unnecessary.

The elevation of the sill of deep gate No. 6 and of the zero of the Errol dam gage is 1,231.3 feet above sea level. A "deadhead" a short distance above the dam at present controls the low-water flow, and its height, 2.66 feet, must be subtracted from the head as read from Errol dam gage to obtain the depth of water in Umbagog available for storage.

The gates of the Errol dam have not been rated as thoroughly as might be desired, but the records as published below approximate the true discharge.

Daily discharge, in second-feet, of Androscoggin River at Errol dam, N. H., for 1905–9.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	1,847	1,399	1,021	1,168	3,837	1,872	2,341	1,595	1,288	1,064	1,298	1,212
2	1,847	1,493	1,008	1,249	4,515	1,694	2,334	1,615	1,276	1,213	1,330	1,233
3	1,532	1,439	961	1,316	4,515	1,683	2,480	1,615	1,276	1,206	1,381	812
4	1,565	1,383	940	1,374	4,515	1,672	2,638	1,588	1,269	1,314	1,409	1,007
5	1,571	1,330	923	1,446	4,606	1,659	2,651	1,575	1,269	1,362	1,440	1,116
6	1,593	1,296	902	1,494	5,388	1,651	2,196	1,558	1,269	1,360	1,472	1,139
7	1,593	1,287	860	1,516	5,535	1,670	2,000	1,410	1,269	1,364	1,489	1,154
8	1,593	1,271	842	1,537	5,631	1,670	2,340	1,396	1,276	1,337	1,379	1,161
9	1,593	1,419	825	1,551	5,631	1,678	2,314	1,373	1,269	1,349	1,392	1,167
10	1,593	1,314	791	1,557	6,047	1,694	2,941	1,348	1,269	1,400	1,392	1,172
11	1,593	1,294	752	1,578	5,958	1,725	2,815	1,348	1,262	1,400	1,401	1,183
12	1,605	1,242	735	1,598	5,146	1,741	2,695	1,333	1,254	1,400	1,410	1,183
13	1,605	1,189	718	1,612	3,849	2,539	1,690	1,313	1,242	1,440	1,410	1,183
14	1,605	1,169	701	1,625	3,764	2,597	1,576	1,295	1,253	1,414	1,417	1,188
15	1,621	1,144	684	1,646	3,789	2,654	1,554	1,277	1,261	1,414	1,417	1,188

Daily discharge, in second-feet, of Androscoggin River at Errol dam, N. H., for 1905–9—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
16	1,621	1,268	667	1,664	2,739	2,707	1,543	1,270	1,270	1,392	1,417	1,188
17	1,621	1,248	654	1,677	2,707	2,707	1,348	1,270	1,286	1,381	1,417	1,183
18	1,621	1,227	654	1,657	2,046	2,667	1,338	1,259	1,397	1,381	1,327	1,183
19	1,605	1,198	636	1,631	3,252	2,623	1,331	1,259	1,371	1,381	1,327	1,183
20	1,593	1,176	619	1,106	3,252	2,541	1,314	1,253	1,363	1,381	1,327	1,183
21	1,577	1,155	602	1,114	2,707	2,471	1,306	1,253	1,293	1,381	1,417	1,183
22	1,565	1,174	602	1,143	2,633	2,415	1,296	1,486	1,408	1,381	1,417	1,183
23	1,545	1,174	619	1,169	2,623	2,387	1,288	1,477	1,423	1,371	1,417	1,183
24	1,507	1,157	619	1,193	2,581	2,371	1,218	1,462	1,426	1,371	1,410	1,188
25	1,491	1,125	636	1,216	2,139	2,371	1,212	1,439	1,272	1,363	1,410	1,188
26	1,474	1,113	654	618	2,118	2,371	1,200	1,412	1,266	1,352	1,400	1,188
27	1,456	1,092	667	628	2,105	2,402	1,272	1,379	1,258	1,337	1,400	1,188
28	1,434	1,042	752	616	2,105	2,402	1,254	1,355	1,134	1,327	1,400	1,188
29	1,419	....	710	3,149	2,077	2,387	1,240	1,435	1,081	1,316	1,172	1,183
30	1,419	....	918	3,789	1,899	2,371	1,232	1,504	1,074	1,316	1,192	1,183
31	1,419	....	788	....	1,884	....	1,288	1,297	....	1,310	....	1,183
1906.												
1	1,177	1,229	1,102	841	2,824	5,997	2,282	1,469	1,261	1,324	1,002	887
2	1,172	1,229	1,081	841	2,988	5,313	1,974	1,469	1,261	1,324	999	880
3	1,166	1,229	1,053	841	3,120	4,123	1,833	1,461	1,261	1,324	990	876
4	1,161	1,229	1,053	825	3,219	3,469	1,817	1,455	1,254	1,379	987	935
5	1,166	1,220	1,033	794	3,346	3,469	1,702	1,447	1,245	1,415	1,060	990
6	1,166	1,234	993	775	3,681	4,162	1,628	1,447	1,236	1,313	1,128	976
7	1,161	1,272	969	757	4,564	4,177	1,616	1,447	1,236	1,313	1,119	965
8	1,154	1,258	950	740	5,355	4,212	1,564	1,440	1,226	1,324	1,109	961
9	1,148	1,246	923	740	5,602	4,969	1,442	1,422	1,209	1,278	1,098	928
10	1,144	1,235	904	740	5,580	5,214	1,429	1,408	1,194	1,294	1,095	910
11	1,138	1,223	904	740	5,528	5,051	1,425	1,298	1,174	1,358	1,087	902
12	1,134	1,166	882	740	5,495	4,918	1,415	1,252	1,174	1,413	1,077	874
13	1,129	1,202	904	740	5,457	3,382	1,410	1,261	1,162	1,497	1,069	874
14	1,121	1,185	904	757	5,424	3,779	1,410	1,253	1,162	1,506	1,054	924
15	1,167	1,167	904	664	5,506	3,671	1,450	1,245	1,162	1,534	1,044	949
16	1,241	1,139	904	443	5,475	3,524	1,532	1,245	1,162	1,651	1,032	949
17	1,228	1,111	904	612	5,451	3,449	1,518	1,240	1,162	1,683	1,026	925
18	1,213	1,078	904	880	5,451	3,377	1,504	1,240	1,148	1,718	1,022	925
19	1,199	1,078	889	1,029	5,400	3,304	1,494	1,240	1,148	1,562	1,016	925
20	1,190	1,073	889	1,222	5,368	3,228	1,494	1,240	1,193	1,375	1,011	925
21	1,173	1,042	889	1,434	6,169	3,137	1,504	1,240	1,348	1,322	1,007	937
22	1,162	1,014	867	1,641	6,324	2,839	1,511	1,286	1,348	1,238	822	937
23	1,101	983	841	2,117	5,666	2,575	1,511	1,326	1,272	1,308	702	949
24	810	951	841	2,682	5,376	2,478	1,511	1,316	1,247	1,319	781	949
25	1,024	920	841	2,783	5,351	2,515	1,504	1,309	1,235	1,161	937	957
26	1,167	882	841	3,287	5,351	2,681	1,504	1,289	1,235	1,064	930	965
27	1,194	908	841	3,500	5,216	2,656	1,494	1,289	1,317	1,145	924	965
28	1,210	1,169	841	3,000	5,157	2,634	1,490	1,311	1,366	1,139	911	978
29	1,220	....	841	2,678	5,248	2,412	1,483	1,311	1,300	996	908	978
30	1,225	....	841	2,758	5,799	2,293	1,474	1,277	1,300	914	898	997
31	1,229	....	841	....	6,213	....	1,474	1,269	....	862	....	1,013
1907.												
1	1,026	1,100	1,070	1,095	4,257	2,386	2,021	1,775	1,487	1,197	2,927	1,789
2	1,036	1,154	1,053	1,187	6,421	2,329	2,130	1,789	1,552	1,251	2,960	1,850
3	1,048	1,136	1,053	1,187	7,332	2,159	2,169	1,800	1,539	1,298	3,030	1,874
4	1,048	1,136	1,179	1,187	7,427	2,036	2,220	1,800	1,438	1,077	4,021	1,845
5	1,057	1,154	1,249	1,187	7,332	2,068	2,247	1,775	1,382	904	4,464	1,799
6	1,066	1,154	1,249	1,176	5,790	2,136	2,220	1,765	1,391	921	5,249	1,837
7	1,080	1,136	1,235	1,175	5,012	2,237	2,209	1,738	1,402	923	6,146	1,835
8	1,080	1,125	1,221	1,175	5,171	2,325	2,057	1,712	1,391	944	7,962	1,785
9	1,089	1,106	1,247	1,143	4,844	2,411	2,020	1,633	1,391	960	8,760	1,734
10	1,089	1,090	1,239	1,132	4,928	2,378	1,982	1,497	1,420	982	8,467	1,704
11	1,104	1,079	1,213	1,107	5,045	2,411	1,943	1,507	1,486	991	7,544	1,508
12	1,111	1,068	1,172	1,093	5,189	2,424	1,920	1,474	1,503	2,172	6,534	1,464
13	1,124	1,055	1,128	1,080	5,127	2,450	1,991	1,443	1,486	3,008	4,491	1,494
14	1,124	1,041	1,115	1,052	5,103	2,468	1,902	1,433	1,486	2,639	3,649	1,508
15	1,132	1,021	1,087	1,024	5,044	2,478	1,890	1,414	1,472	2,419	3,643	1,556
16	1,124	1,021	1,076	1,012	4,886	2,497	1,863	1,396	1,513	2,417	3,207	1,764
17	1,124	1,021	1,051	988	4,966	2,509	1,825	1,413	1,562	2,397	2,897	1,757
18	1,124	1,010	1,038	971	5,436	2,523	1,887	1,442	1,550	2,118	2,870	1,749
19	1,111	996	1,024	953	6,329	2,523	1,762	1,431	1,537	1,763	2,460	1,749
20	1,111	982	1,009	953	6,392	2,555	1,719	1,432	1,528	1,759	1,993	1,740
21	1,111	963	1,016	944	6,261	2,577	1,681	1,506	1,503	1,749	1,983	1,729
22	1,111	948	994	944	6,072	2,606	1,656	1,483	1,483	1,745	1,976	1,721
23	1,101	937	1,025	944	4,970	2,488	1,632	1,468	1,483	1,739	1,958	1,711
24	1,101	1,129	1,035	1,000	3,965	2,289	1,632	1,497	1,477	1,735	1,935	1,688
25	1,101	1,082	1,028	1,188	3,549	2,234	1,620	1,485	1,502	1,729	1,922	1,725

Daily discharge, in second-feet, of Androscoggin River at Errol dam, N. H., for 1905–9—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	1,090	1,070	1,026	1,481	3,477	2,183	1,632	1,389	1,522	1,725	1,908	1,757
27	1,090	1,070	1,026	1,763	3,310	2,182	1,632	1,400	1,537	2,207	1,888	1,771
28	1,083	1,070	1,014	1,979	2,936	2,052	1,656	1,483	1,537	2,473	1,861	1,910
29	1,083	......	1,014	2,442	2,742	2,034	1,688	1,550	1,520	2,597	1,839	2,108
30	1,083	......	1,001	3,563	2,474	2,007	1,714	1,597	1,171	2,769	1,814	2,108
31	1,083	......	1,026	......	2,446	......	1,765	1,513	......	2,848	......	2,098
1908.												
1	1,640	1,570	1,924	2,506	6,799	3,934	1,445	1,257	1,253	1,750	1,141	806
2	1,636	1,570	1,916	2,556	7,068	4,351	1,440	1,209	1,286	1,412	1,166	1,007
3	1,626	1,570	1,916	2,604	7,396	5,006	1,440	1,116	1,242	1,468	1,141	1,070
4	1,613	1,570	1,907	2,623	7,589	6,256	1,440	1,100	1,263	1,514	1,118	1,049
5	1,608	1,570	1,907	2,655	7,400	5,454	1,616	1,100	1,316	1,514	1,096	1,049
6	1,598	1,570	1,898	2,636	6,070	4,715	1,662	1,116	1,328	1,548	978	1,070
7	1,615	1,570	1,890	2,590	5,656	4,446	1,744	1,139	1,294	1,548	1,053	970
8	1,639	1,570	1,882	2,521	6,665	3,782	1,754	1,057	1,273	1,514	1,078	954
9	1,622	1,511	1,873	2,473	6,935	3,109	1,372	1,023	1,235	1,514	1,053	954
10	1,614	1,810	1,856	2,439	6,391	3,001	1,346	1,092	1,190	1,534	1,053	941
11	1,598	1,789	1,847	2,387	6,507	3,020	1,376	1,192	1,134	1,568	1,040	941
12	1,586	1,777	1,837	2,358	6,631	3,070	1,289	1,218	1,141	1,568	1,040	941
13	1,571	1,769	1,837	2,303	6,690	3,070	1,289	1,240	1,142	1,596	1,053	954
14	1,565	1,747	1,856	2,253	6,606	3,005	1,242	1,026	1,076	1,596	1,053	894
15	1,557	1,747	1,870	2,224	6,746	3,072	1,344	832	1,030	1,568	1,053	869
16	1,552	1,760	1,873	1,674	7,803	2,894	1,434	830	1,117	1,568	1,061	854
17	1,543	1,789	1,882	2,042	7,266	3,322	1,481	1,043	1,353	1,537	1,059	840
18	1,538	1,816	1,907	2,356	7,188	2,883	1,481	1,153	1,484	1,537	1,006	812
19	1,583	1,839	1,924	2,276	7,290	2,651	1,464	1,130	1,392	717	1,052	797
20	1,631	1,873	1,838	2,176	6,043	2,579	1,299	1,109	1,414	1,117	1,025	786
21	1,625	1,898	1,942	1,575	5,471	2,522	1,170	1,096	1,414	1,026	988	760
22	1,610	1,898	1,950	1,516	5,254	2,401	1,194	1,087	1,430	977	988	746
23	1,603	1,907	1,963	1,996	4,445	2,133	1,204	1,079	1,642	997	1,014	730
24	1,594	1,916	1,974	1,976	4,126	2,178	1,304	1,100	1,599	1,850	1,014	716
25	1,593	1,924	1,978	1,576	4,025	1,934	1,365	1,136	1,552	1,038	1,014	703
26	1,587	1,924	1,993	1,181	3,364	1,641	1,365	1,123	1,582	1,073	1,036	692
27	1,578	1,924	2,002	1,308	3,446	1,483	1,345	1,181	1,621	946	991	692
28	1,578	1,924	2,026	1,684	4,148	1,479	1,323	1,285	1,638	929	1,047	668
29	1,569	1,924	2,056	4,311	4,712	1,467	1,307	1,264	1,685	718	1,116	647
30	1,568	......	2,235	6,799	4,187	1,452	1,296	1,186	1,721	669	732	629
31	1,570	......	2,487	......	3,899	......	1,287	1,186	......	946	618	618
1909.												
1	591	765	902	806	3,468	6,693	2,160	1,232	1,308	881	1,228	1,129
2	591	746	902	798	3,363	6,684	2,007	1,210	1,239	958	1,162	1,118
3	577	740	917	788	3,234	5,802	1,907	1,272	1,340	909	553	1,118
4	565	740	931	788	3,191	4,897	1,353	1,347	1,375	832	877	1,118
5	565	740	931	798	3,164	4,558	1,257	1,372	1,233	895	1,024	1,118
6	577	740	947	806	2,784	3,970	1,324	1,539	1,208	922	866	1,117
7	591	726	961	833	2,616	3,750	1,313	1,491	1,246	903	1,239	1,117
8	618	726	961	960	2,787	3,733	1,324	1,486	1,297	881	1,436	1,117
9	627	726	947	1,163	3,060	3,503	1,346	1,406	1,311	880	1,373	1,076
10	627	740	947	1,267	3,363	3,244	1,410	1,411	1,366	935	1,310	1,050
11	641	740	931	1,381	5,391	3,230	1,427	1,419	1,355	886	1,310	1,050
12	751	746	917	1,550	8,108	3,258	1,427	1,478	1,227	948	1,291	1,063
13	961	746	917	1,735	8,593	3,258	1,410	1,525	1,360	923	1,274	1,067
14	961	765	902	1,324	8,655	3,195	1,388	1,475	1,382	882	1,212	1,110
15	931	765	902	1,980	9,237	2,846	1,376	1,495	1,369	872	1,071	1,089
16	917	765	880	3,274	9,368	2,703	1,388	1,508	1,332	939	998	1,077
17	917	765	864	5,317	9,321	2,484	1,388	1,268	1,259	894	1,035	1,057
18	917	765	864	5,741	9,368	2,372	1,410	1,314	1,253	941	1,050	1,046
19	917	765	849	6,320	9,417	2,344	1,358	1,331	1,264	951	1,107	1,035
20	902	774	833	6,619	8,970	2,309	1,337	1,356	1,247	934	1,160	1,029
21	864	774	833	6,883	7,905	2,269	1,373	1,340	1,274	1,010	1,053	1,020
22	833	788	820	6,600	6,977	2,226	1,373	1,340	1,287	1,085	980	1,020
23	820	788	820	6,363	6,783	2,135	1,356	1,320	1,275	1,085	874	1,056
24	806	798	806	5,752	7,835	2,051	1,299	1,317	1,213	1,065	824	1,112
25	798	806	798	5,023	7,861	1,940	1,299	1,340	1,217	873	860	1,099
26	798	820	798	5,902	7,069	1,852	1,299	1,340	1,110	906	893	1,099
27	788	849	806	5,659	6,689	1,800	1,299	1,301	1,170	906	923	1,099
28	788	864	806	5,010	5,891	1,719	1,263	1,301	742	909	952	1,099
29	774	......	806	4,188	5,651	2,029	1,247	1,321	467	966	1,090	1,089
30	774	......	806	3,697	5,853	2,213	1,247	1,343	971	1,040	1,140	1,089
31	774	......	806	......	6,394	......	1,247	1,374	......	1,146	......	1,162

Monthly discharge of Androscoggin River at Errol dam, New Hampshire, for 1905–1909.

[Drainage area, 1,095 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1905.					
January	1,850	1,420	1,570	1.44	1.66
February	1,490	1,040	1,240	1.14	1.19
March	1,020	602	757	.69	.80
April	3,790	616	1,490	1.36	1.52
May	6,050	1,880	3,600	3.29	3.79
June	2,710	1,650	2,180	1.99	2.22
July	2,940	1,200	1,780	1.63	1.88
August	1,620	1,250	1,400	1.27	1.46
September	1,430	1,070	1,280	1.17	1.30
October	1,440	1,060	1,350	1.23	1.42
November	1,490	1,170	1,380	1.26	1.41
December	1,230	812	1,160	1.06	1.22
The year	6,050	602	1,600	1.46	19.87
1906.					
January	1,240	810	1,160	1.06	1.22
February	1,270	880	1,130	1.03	1.07
March	1,100	840	915	.84	.97
April	3,500	443	1,390	1.27	1.42
May	6,320	2,820	5,060	4.62	5.33
June	6,000	2,290	3,630	3.32	3.70
July	2,280	1,410	1,560	1.42	1.64
August	1,470	1,240	1,330	1.21	1.40
September	1,370	1,150	1,230	1.13	1.26
October	1,720	862	1,320	1.21	1.40
November	1,130	702	995	.91	1.02
December	1,010	876	939	.86	.99
The year	6,320	443	1,720	1.57	21.42
1907.					
January	1,130	1,030	1,090	1.00	1.15
February	1,150	937	1,070	.97	1.01
March	1,250	994	1,090	1.00	1.15
April	3,560	944	1,230	1.12	1.25
May	7,430	2,450	4,980	4.54	5.23
June	2,610	2,010	2,330	2.13	2.38
July	2,250	1,620	1,880	1.72	1.98
August	1,800	1,390	1,550	1.41	1.63
September	1,560	1,170	1,480	1.35	1.51
October	3,010	904	1,470	1.34	1.54
November	8,760	1,810	3,740	3.42	3.82
December	2,110	1,460	1,760	1.61	1.86
The year	7,430	904	1,970	1.80	24.51
1908.					
January	1,640	1,540	1,590	1.46	1.68
February	1,920	1,510	1,760	1.60	1.73
March	2,490	1,840	1,940	1.77	2.04
April	6,800	1,180	2,390	2.18	2.43
May	7,590	3,360	5,930	5.41	6.24
June	6,260	1,450	3,080	2.81	3.14
July	1,750	1,170	1,390	1.27	1.46
August	1,280	830	1,120	1.02	1.18
September	1,720	1,030	1,360	1.24	1.38
October	1,850	669	1,320	1.20	1.38
November	1,170	618	1,040	.95	1.06
December	1,070	618	844	.77	.89
The year	7,590	618	1,980	1.81	24.61
1909.					
January	961	565	760	.69	.80
February	864	726	767	.70	.73
March	961	798	874	.80	.92
April	6,880	788	3,310	3.02	3.37
May	9,420	2,620	6,200	5.67	6.54
June	6,690	1,720	3,170	2.89	3.22
July	2,160	1,250	1,410	1.29	1.49
August	1,540	1,210	1,370	1.25	1.44
September	1,380	467	1,220	1.12	1.25
October	1,150	832	941	.86	.99
November	1,440	553	1,070	.98	1.09
December	1,160	1,020	1,080	.99	1.14
The year	9,420	467	1,850	1.69	22.98

ANDROSCOGGIN RIVER AT RUMFORD FALLS, MAINE.

The discharge of Androscoggin River at Rumford Falls since 1892 has been computed and furnished by Charles A. Mixer, engineer for the Rumford Falls Power Co., by adding the actual measured quantities passing through the wheels to the computed flow over the dam, using the customary Francis weir formula with modified coefficient.

At Rumford Falls is one of the finest water powers on the Atlantic coast. Here the Androscoggin descends 177 feet in a mile in several pitches over granite ledges. A comprehensive plan of development for the use of power from three levels has been laid out and partly executed. From the high-level canal there is a fall of 97 feet to the middle level, which also receives a direct and independent supply of water from the river. The water in the middle-level canal is then used and discharged, after a fall of 50 feet, into the low-level canal, from which, in turn, there is a final drop of 30 feet to the river. Dams have been built at the entrance of the high and middle level canals.

At present about 19,000 gross horsepower are utilized at Rumford Falls, largely in the manufacture of pulp and paper. The total comprises some 40,000 gross horsepower, under present conditions of storage in the Rangeley Lake system. Further storage will probably be available in a few years and add still more to the value of this privilege, which is only about 85 miles by rail from Portland and has excellent transportation facilities.

The maximum daily discharge occurred April 15, 1895, and was about 55,200 second-feet. The discharge for the minimum week occurred February 15 to 21, 1904, and averaged 686 second-feet.

Daily discharge, in second-feet, of Androscoggin River at Rumford Falls, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	931	1,051	2,203	2,093	6,599	7,268	2,288	a1,575	1,456	2,428	1,380	1,384
2	949	1,084	2,221	2,110	a6,515	7,331	2,537	1,440	1,789	1,832	1,570	1,986
3	a837	1,019	2,088	2,200	6,528	7,612	2,603	1,616	1,667	a1,746	1,760	2,171
4	824	1,052	2,008	a2,252	6,878	6,417	a2,105	1,465	1,481	1,875	1,950	2,040
5	919	1,032	1,942	2,558	8,104	5,788	2,065	1,637	a1,262	1,847	1,935	a1,833
6	2,172	1,070	1,873	3,481	8,215	a5,893	1,927	1,683	1,309	1,559	1,728	1,848
7	3,138	a1,172	a1,836	5,977	8,878	5,022	2,015	1,751	1,611	1,562	a1,622	1,846
8	2,077	1,359	1,744	10,241	8,928	4,569	1,541	a1,665	1,688	1,581	1,558	1,801
9	1,795	1,377	1,767	7,825	a9,948	4,390	1,584	1,746	1,459	1,576	1,710	1,526
10	a1,564	1,294	1,722	5,741	12,472	4,174	1,592	1,757	1,488	a1,451	1,762	1,382
11	1,433	1,305	1,706	a5,007	14,639	3,811	a1,653	1,719	1,640	1,422	1,627	1,289
12	1,437	1,246	1,740	4,162	14,532	3,612	1,558	1,683	a1,471	1,514	1,507	a1,287
13	1,268	1,237	1,692	5,559	13,295	a3,483	1,792	1,704	1,529	1,682	1,663	1,165
14	1,200	a1,198	a1,662	16,759	12,701	3,683	1,817	1,705	1,452	1,658	a1,540	1,344
15	1,282	1,087	1,546	23,622	12,698	3,598	1,752	a1,758	1,411	1,581	1,565	1,626
16	1,342	1,197	1,685	20,660	a13,033	3,285	1,563	1,685	1,459	1,540	1,626	1,865
17	a1,245	1,112	1,518	16,822	16,094	3,330	1,798	1,836	1,620	a1,481	1,568	1,656
18	1,062	1,113	1,479	a15,165	14,678	4,034	a2,278	1,865	1,522	1,554	1,678	1,571
19	1,247	1,098	1,472	16,959	13,043	3,753	1,929	1,994	a1,133	1,488	1,608	a1,517
20	1,182	1,413	1,489	20,040	11,802	a3,223	1,798	1,836	1,242	1,507	1,559	1,501

a Sunday.

Daily discharge, in second-feet, of Androscoggin River at Rumford Falls, Maine, for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1,212	a4,669	a1,392	16,765	10,826	2,947	1,762	1,805	1,580	1,448	a1,582	1,668
22	1,218	3,127	1,365	15,336	9,838	3,056	1,780	a1,753	1,425	1,495	1,648	1,503
23	1,260	2,523	1,448	15,862	a 8,217	2,932	1,708	1,607	1,368	1,588	1,818	1,542
24	a1,316	2,342	1,188	14,182	7,833	2,843	1,779	1,656	1,405	a1,607	1,762	1,502
25	1,380	2,418	1,488	a11,465	8,063	2,697	a1,750	1,539	1,419	1,635	1,698	1,534
26	1,443	2,567	1,662	9,715	8,414	2,643	1,700	1,532	a1,396	1,708	2,748	a 1,347
27	1,344	2,472	2,009	8,461	7,578	a2,278	1,727	1,486	1,770	1,730	2,518	1,575
28	1,325	a2,308	a2,100	8,825	7,352	2,048	1,613	1,508	4,692	1,706	a2,192	1,589
29	1,234	....	2,081	8,553	9,514	2,133	1,480	a1,394	7,874	1,651	2,228	1,488
30	1,204	....	2,160	7,819	a 8,528	2,032	1,533	1,308	3,285	1,499	2,024	1,438
31	a1,133	....	2,033	....	7,677	....	1,635	1,490	....	a1,453	....	1,408

a Sunday.

Monthly discharge of Androscoggin River at Rumford Falls, Maine, for 1909.

[Drainage area, 2,090 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	3,140	824	1,350	0.646	0.74
February	4,670	1,020	1,640	.785	.82
March	2,220	1,190	1,750	.837	.96
April	23,600	2,090	10,200	4.88	5.44
May	16,100	6,520	10,100	4.83	5.57
June	7,610	2,030	4,000	1.91	2.13
July	2,600	1,480	1,830	.876	1.01
August	1,990	1,310	1,650	.789	.91
September	7,870	1,130	1,860	.890	.99
October	2,430	1,420	1,630	.780	.90
November	2,750	1,380	1,770	.847	.94
December	2,170	1,160	1,590	.761	.88
The year	23,600	824	3,280	1.57	21.29

PRESUMPSCOT RIVER DRAINAGE BASIN.

DESCRIPTION.

Presumpscot River, the outlet of Sebago Lake, rises about 17 miles northwest of Portland. The principal tributary of the lake is Crooked River, a stream heading 35 miles farther north and within 3 miles of the Androscoggin. The area of the lake is 46 square miles. The total water surface in the drainage basin is 97 square miles. The area of the drainage basin at the outlet of the lake is 436 square miles, and at the mouth of the river 616 square miles.

The northern part of the basin is mountainous and wooded; the southern part is moderately hilly and mostly in farm land. Granite gneiss, and mica-schists appear in many places, and the soil is gravelly and sandy. The fall from Sebago Lake to tidewater is about 265 feet in a distance of nearly 22 miles, or an average of about 12 feet per mile.

The mean annual precipitation is probably about 42 inches. The river and lake generally freeze over during the winter.

Sebago Lake is a magnificent natural storage reservoir, and its utilization for this purpose has made the regimen of flow of the

Presumpscot extremely regular. Nowhere in the United States is there a better example of efficient regulation of storage than on the Presumpscot.

A record of flow from Sebago Lake has been kept since 1887. During this period of over 20 years the driest season was that of 1905 and the wettest 1891, the total flow for these two years being about in the ratio of 1 to 2.22.

PRESUMPSCOT RIVER AT OUTLET OF SEBAGO LAKE, MAINE.

Since January, 1887, the flow from Sebago Lake has been regularly recorded, the quantity being deduced during most of this time from the openings in the gates at the dam, the discharging capacity of which under different conditions of head has been determined and tabulated by Hiram F. Mills, of Lowell. In March, 1904, S. D. Warren & Co. completed a hydroelectric plant at Eel Weir Falls, near Sebago Lake, bringing water directly from the dam at the lake by means of a canal. A head of 40 feet is thus obtained at average lake level.

The development of Eel weir has necessitated a different method of recording the flow from the lake. The water is used through three pairs of 33-inch Hercules wheels. The water used by these wheels is recorded by three Allen meters, one on each pair. These meters were rated by the result of a test at Holyoke of one pair of these wheels.

Since the station was finished the performance of the wheels and of the recording meters has been checked by careful current-meter readings in the canal and brake tests of the wheels, combined with electrical readings of the generator output. The records of the generator output of the station are kept and the constant ratio between these readings and the Allen meter records gives a good check on the latter.

It is usually desired to keep a constant flow through the canal, and when demands for power are not sufficient to utilize the entire flow through the wheels the excess of water is run off through a pair of regulating gates at the power station, a record of the openings of these gates being kept and the flow computed from a coefficient determined by current-meter tests.

The flow at times from the lake may be greater than it is safe to carry through the canal, though this has not as yet happened. At such times it will be necessary to draw part of the water through the old regulating gates in the main dam.

A continuous record of the Sebago Lake level has been kept since January, 1872. The lake fills rapidly after March 1, attaining its maximum height between the middle of April and June 1, and then gradually subsides as water is withdrawn for mill purposes, until a minimum stage is reached—sometimes in the autumn, but usually in the winter.

The records of lake level and discharge make an unusually complete and valuable series of data. These have been furnished from time to time by S. D. Warren & Co., and the data regarding the new methods of measurement, etc., is from a description furnished by Joseph A. Warren.

The maximum daily discharge occurred March 6, 1896, and was 13,800 second-feet. The discharge for the minimum week (not considering periods when for some reason the plant was not running) occurred March 17 to 23, 1907, and averaged 256 second-feet.

Daily discharge, in second-feet, of Presumpscot River at outlet of Sebago Lake, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	533	517	733	417	550	733	750	[a] 367	698	675	717	705
2	542	530	717	425	[a] 217	733	750	752	692	657	720	707
3	[a] 342	530	692	508	608	725	633	747	705	[a] 369	723	712
4	533	530	717	[a] 267	650	725	[a] 42	753	640	698	707	658
5	533	530	717	542	692	708	192	753	[a] 356	700	713	[a] 400
6	533	530	650	533	725	[a] 333	700	752	675	705	645	707
7	533	[a] 258	[a] 375	467	742	750	742	667	683	703	[a] 188	708
8	542	600	750	408	650	750	750	[a] 317	695	705	712	712
9	525	600	767	417	[a] 300	750	733	747	693	640	700	707
10	[a] 333	592	767	400	717	750	658	753	703	[a] 312	712	707
11	533	600	717	[a] 317	733	725	[a] 225	720	650	703	697	677
12	533	592	767	525	742	667	750	695	[a] 400	703	712	[a] 363
13	533	592	667	608	775	[a] 375	750	693	692	708	653	720
14	533	[a] 267	[a] 383	600	783	742	750	627	690	687	[a] 542	613
15	533	600	758	417	708	742	750	[a] 330	700	703	718	612
16	527	600	742	433	[a] 358	750	750	690	683	648	707	643
17	[a] 333	600	747	483	642	750	683	693	698	[a] 358	702	653
18	533	600	692	[a] 183	583	750	[a] 342	695	653	700	703	614
19	533	617	708	550	650	658	750	700	[a] 407	697	707	[a] 548
20	533	558	658	550	683	[a] 333	750	700	733	695	687	637
21	533	[a] 300	[a] 317	550	683	742	750	650	707	695	[a] 508	648
22	533	542	700	542	533	750	750	[a] 413	693	692	717	645
23	533	542	683	575	[a] 283	725	750	698	717	653	708	687
24	[a] 283	442	650	542	775	767	697	693	693	[a] 442	700	703
25	533	567	567	[a] 308	750	742	[a] 325	690	667	718	692	707
26	533	542	408	550	733	642	745	703	[a] 400	697	685	[a] 439
27	533	442	317	617	750	[a] 342	750	703	695	708	657	670
28	533	[a] 267	[a] 192	633	725	742	750	647	687	693	[a] 416	672
29	533	......	500	625	617	750	747	[a] 335	478	700	703	672
30	525	......	383	633	[a] 133	750	738	700	472	658	708	668
31	[a] 342	......	333	......	550	......	667	697	......	[a] 473	......	667

[a] Sunday.

Monthly discharge of Presumpscot River at outlet of Sebago Lake for Maine.

[Drainage area, 436 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	542	283	500	1.15	1.33
February	617	258	517	1.19	1.24
March	767	192	606	1.39	1.60
April	633	183	488	1.12	1.25
May	783	133	614	1.41	1.63
June	767	333	680	1.56	1.74
July	750	42	649	1.49	1.72
August	753	317	648	1.49	1.72
September	733	356	635	1.46	1.63
October	718	312	642	1.47	1.70
November	723	188	662	1.52	1.70
December	720	363	645	1.48	1.71
The year	783	42	607	1.39	18.97

SACO RIVER DRAINAGE BASIN.

DESCRIPTION.

Saco River rises in the White Mountain region of New Hampshire at an elevation of about 1,900 feet above the sea and has a general southeasterly course to the Atlantic Ocean. It is about 105 miles long, the maximum width of its drainage basin is about 30 miles, and its drainage area, comprising 1,720 square miles, lies about equally in Maine and New Hampshire. Ossipee River, the largest tributary of the Saco, enters the main stream near Great Falls, N. H.

The headwaters of the Saco are in one of the highest and roughest mountain regions in the eastern portion of the United States, with steep wooded slopes and narrow river valleys, and with heavy falls to the mountain streams. The mountains grow gradually lower as the ocean is approached, becoming undulating hills in the central portions of the basin and comparatively flat land near the sea. The southern half of the drainage basin has been practically cleared of forests, but the remainder is still largely wooded. The prevailing rock is granite, which makes excellent building material for dams and foundations. The surface material covering the larger part of the region is sand and gravel.

The mean annual precipitation is about 43 inches. Winter conditions in the mountainous part of the basin are quite rigorous and snowfall usually deep.

The Saco River drainage basin has about 84 square miles of lake surface, of which Great Ossipee and Moose lakes are the most important. In its upper courses the river falls very rapidly, but the regimen of flow is variable and typical of the mountain stream. In the lower part of the basin, particularly below the entrance of Ossipee River, the stream is more stable in regimen. There are some excellent undeveloped power sites on Saco River, and at Biddeford and Saco are the important developments of the Saco Water Power Co., furnishing power for cotton mills. The Saco is probably destined to much development in the next few years, as its power is adjacent to Portland and other cities where a good market is available.

Complete yearly records are not available, but the driest year since 1903 was 1906, and the wettest 1907, the total flow during these two years being about in the ratio of 1 to 1.45.

SACO RIVER NEAR CENTER CONWAY, N. H.

This station is located at the wooden highway bridge between Center Conway and Redstone, N. H., about 2 miles from each place. It was established August 26, 1903, in cooperation with the New Hampshire forestry commission, to obtain general information concerning the daily distribution of the flow of Saco River. Since 1904 it has been maintained by the United States Geological Survey.

It is about 3 miles below the mouth of Swift River and 2 miles above the outlet of Conway Lake. During the winter months the discharge is so affected by ice that observations are discontinued. Conditions for obtaining accurate discharge data during the rest of the year are good, and a good rating curve has been developed except for extreme high stages.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. Discharge measurements are made from the bridge or by wading.

The following discharge measurement was made by wading by D. M. Wood:

September 7, 1909; width, 135 feet; area, 157 square feet; gage height, 3.49 feet; discharge, 232 second-feet.

Daily gage height, in feet, of Saco River near Center Conway, N. H., for 1909.

[Fred Masterton, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	4.34	6.12	5.34	3.68	3.30	3.19	4.46	3.50	4.10
2	......	4.35	6.30	5.08	3.67	3.26	3.76	4.18	3.51	4.17
3	......	4.45	6.13	4.96	3.80	3.24	3.49	4.57	3.57	3.89
4	......	4.37	6.50	4.94	3.93	3.24	3.36	4.16	3.80	3.74
5	......	4.55	6.98	4.76	3.89	3.25	3.32	3.93	3.76	3.74
6	......	5.17	6.78	5.34	3.75	3.28	3.63	3.79	3.64	3.76
7	......	7.08	7.62	4.88	3.73	3.30	3.54	3.70	3.56	3.69
8	......	8.56	7.18	4.67	3.65	3.23	3.26	3.64	3.53	3.72
9	......	6.93	7.14	4.52	3.59	3.22	3.28	3.58	3.54	3.60
10	......	6.16	6.65	4.44	3.54	3.18	3.26	3.54	3.57	4.02
11	......	5.64	8.06	4.43	3.51	3.16	3.27	3.50	3.52	......
12	......	5.48	7.82	4.35	3.53	3.16	3.28	3.55	3.51	......
13	......	5.93	7.29	4.23	3.49	3.16	3.24	4.00	3.52	......
14	......	10.69	7.17	4.28	3.47	3.16	3.21	3.78	3.52	......
15	......	12.26	7.92	4.27	3.33	3.18	3.20	3.70	3.52	......
16	......	9.92	7.27	4.09	3.41	3.16	3.20	3.73	3.50	4.40
17	......	8.92	8.82	4.11	4.09	3.24	3.20	3.63	3.56	......
18	......	8.51	7.60	5.73	3.66	3.40	3.16	3.61	3.69	......
19	......	8.33	7.20	5.22	3.55	3.59	3.14	3.57	3.65	4.61
20	......	10.32	6.90	4.64	3.49	3.43	3.13	3.54	3.59	......
21	......	8.52	6.54	4.35	3.48	3.31	3.12	3.50	3.52	......
22	......	7.96	6.22	4.36	3.45	3.24	3.10	3.57	3.54	......
23	......	8.26	5.97	4.13	3.43	3.22	3.12	3.69	3.60	......
24	......	7.48	5.76	4.09	3.64	3.15	3.16	3.73	3.64	......
25	......	7.10	5.82	4.00	3.85	3.14	3.20	3.72	4.07	......
26	......	6.76	5.51	3.95	3.63	3.14	3.23	3.69	4.98	4.43
27	......	6.43	5.45	3.85	3.49	3.15	3.60	3.62	4.28	......
28	......	6.75	5.69	3.86	3.44	3.18	5.68	3.60	4.04	......
29	......	6.33	6.51	3.77	3.35	3.17	5.96	3.57	4.14	......
30	......	6.38	5.86	3.74	3.32	3.16	5.14	3.55	4.46	......
31	4.54	......	5.52	......	3.33	3.14	......	3.52	......	......

NOTE.—River frozen Jan. 1 to Mar. 30 and Dec. 11 to 31; also backwater due to ice Dec. 10 to 31.

Daily discharge, in second-feet, of Saco River near Center Conway, N. H., for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	581	1,870	1,230	296	176	149	647	235	463
2	586	2,050	1,040	292	166	325	501	238	496
3	641	1,880	957	340	161	232	710	258	375
4	597	2,250	944	391	161	193	491	340	318
5	698	2,770	827	375	164	182	391	325	318
6	1,100	2,550	1,230	322	171	278	336	282	325
7	2,890	3,580	904	314	176	248	303	255	300
8	5,000	3,010	771	286	158	166	282	245	310
9	2,710	2,960	681	265	156	171	261	248	268
10	1,910	2,410	635	248	147	166	248	258	......
11	1,460	4,210	630	238	142	168	235	242	......
12	1,330	3,860	586	245	142	171	252	238	......
13	1,700	3,140	525	232	142	161	420	242	......
14	8,980	2,990	550	226	142	154	333	242	......
15	12,300	4,000	545	184	147	151	303	242	......
16	7,440	3,120	459	207	142	151	314	235	......
17	5,600	5,430	468	459	161	151	278	255	......
18	4,920	3,560	1,530	289	204	142	272	300	......
19	4,630	3,030	1,140	252	265	138	258	286	......
20	8,240	2,680	752	232	213	136	248	265	......
21	4,930	2,290	586	229	179	133	235	242	......
22	4,060	1,970	592	220	161	129	258	248	......
23	4,520	1,740	477	213	156	133	300	268	......
24	3,390	1,560	459	282	140	142	314	282	......
25	2,910	1,610	420	360	138	151	310	450	......
26	2,530	1,360	400	278	138	158	300	971	......
27	2,180	1,310	360	232	140	268	275	550	......
28	2,520	1,500	363	216	147	1,490	268	437	......
29	2,080	2,260	329	190	144	1,730	258	482	......
30	2,130	1,640	318	182	142	1,080	252	647	......
31	......	1,360	......	184	138	......	242	......	......

NOTE.—The above daily discharges are based on a rating curve well defined between discharges 176 and 5,740 second-feet.

Monthly discharge of Saco River near Center Conway, N. H., for 1909.

[Drainage area, 385 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	....	....	340	0.883	1.02	D.
February	....	....	350	.909	.95	D.
March	....	....	700	1.82	2.10	D.
April	12,300	581	3,490	9.06	10.11	A.
May	5,430	1,310	2,580	6.70	7.72	A.
June	1,530	318	690	1.79	2.00	A.
July	459	182	267	.694	.80	A.
August	265	138	160	.416	.48	B.
September	1,730	129	302	.784	.87	B.
October	710	235	326	.847	.98	A.
November	971	235	327	.849	.95	A.
December	496	....	274	.712	.82	C.
The year	12,300	....	816	2.12	28.80	

NOTE.—The discharge January, February, and March, taken as 25 per cent of the discharge at West Buxton. These values are probably not excessive, since they show a much lower rate of run-off per square mile than Pemigewasset at Plymouth, with which this station usually compares very favorably. Discharge Dec. 10 to 31 based on climatological data. December compares very favorably with the December record at Plymouth and West Buxton. Mean discharge Dec. 10 to 31, 241 second-feet.

SACO RIVER AT WEST BUXTON, MAINE.

During October, 1907, a hydroelectric plant was completed at West Buxton, Maine, by the Portland Electric Co. Records of flow at this point have been kept since that time, under the direction of J. G. White & Co., engineers and builders of the plant, and furnished the United States Geological Survey through their courtesy.

The dam is of concrete, with a rollway about 300 feet long, and a head of about 25 feet is utilized by three 750-kilowatt units. The discharge is based upon gage readings taken every hour and the results are considered excellent.

Daily discharge, in second-feet, of Saco River at West Buxton, Maine, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	515	1,345	2,513	6,484	8,954	5,041	1,475	[a]891	730	2,197	679	1,293
2	586	1,119	2,318	6,440	[a]8,476	4,221	1,516	737	670	2,159	1,010	1,159
3	[a]379	1,191	2,233	6,579	8,503	4,414	1,660	1,082	435	1,698	862	1,089
4	601	1,122	2,126	[a]6,129	8,028	3,953	[a]1,235	917	650	[a]2,119	905	1,288
5	707	1,102	1,994	6,708	7,862	3,726	1,344	739	[a]493	1,918	914	[a]903
6	1,092	1,107	1,884	7,575	7,523	[a]3,481	1,659	814	505	1,751	892	1,507
7	2,190	[a]923	[a]1,512	8,963	7,176	3,893	1,496	870	787	1,734	[a]663	1,295
8	1,941	1,307	1,848	9,872	6,990	3,616	1,337	[a]544	747	1,591	849	1,371
9	1,901	1,001	1,599	10,527	[a]6,744	3,345	1,229	738	753	1,407	979	1,326
10	[a]1,722	1,045	1,419	10,795	7,050	3,126	1,162	956	762	[a]1,052	929	1,068
11	1,744	1,071	1,549	[a]10,307	7,213	3,006	[a]975	910	755	1,379	833	1,082
12	1,769	1,062	1,463	10,081	7,515	2,790	871	814	[a]1,146	1,317	851	[a]613
13	1,769	1,045	1,451	9,662	7,886	[a]2,367	1,345	885	787	1,119	826	1,116
14	1,662	[a]995	[a]1,194	10,357	8,425	2,594	1,040	808	264	1,134	[a]583	1,260
15	1,775	1,134	1,509	13,278	8,373	2,325	996	[a]555	514	1,088	801	1,354
16	1,503	916	1,353	16,805	[a]7,939	2,137	1,013	773	463	1,088	889	1,253
17	[a]1,543	843	1 788	20,488	8,836	2,171	1,013	842	694	[a]949	882	1,253
18	1,546	1,134	2,199	[a]20,759	8,836	2,431	[a]545	842	663	874	747	1,221
19	1,403	1,094	2,221	19,451	8,805	2,811	1,386	793	[a]488	1,130	738	[a]739
20	1,339	1,232	2,041	17,902	8,856	[a]2,389	1,233	803	448	1,014	823	1,366
21	1,365	[a]1,203	[a]1,770	16,817	8,618	2,928	1,197	810	575	976	[a]454	1,215
22	1,218	1,874	2,198	16,743	8,218	2,882	1,277	[a]612	664	890	529	1,138
23	1,262	1,932	1,971	15,814	[a]7,329	2,750	1,255	863	635	1,042	927	1,204
24	[a]1,440	2,143	2,136	14,540	7,237	2,552	1,377	894	646	[a]841	920	1,093
25	1,320	2,649	2,233	[a]13,402	6,712	2,491	[a]982	851	616	835	833	1,052
26	1,218	2,677	5,319	12,196	6,033	2,222	1,168	923	[a]448	1,098	1,132	[a]712
27	1,169	2,693	7,387	10,911	5,685	[a]1,798	1,291	774	415	994	1,149	1,193
28	1,326	[a]2,588	[a]7,278	10,181	5,624	1,896	1,213	782	747	1,037	[a]822	1,045
29	1,262	......	6,714	9,805	5,804	1,777	1,211	[a]548	1,354	982	1,493	928
30	1,164	......	6,518	9,257	[a]5,452	1,621	1,087	750	1,739	967	1,293	913
31	[a]1,001	......	6,885	......	5,536	......	1,039	641	......	[a]815	......	878

[a] Sunday.

Monthly discharge of Saco River at West Buxton, Maine, for 1909.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,190	379	1,340	0.865	1.00
February	2,690	843	1,410	.910	.95
March	7,390	1,190	2,790	1.80	2.08
April	20,800	6,130	12,000	7.74	8.64
May	8,950	5,450	7,490	4.83	5.57
June	5,040	1,620	2,890	1.86	2.08
July	1,660	545	1,210	.781	.90
August	1,080	544	799	.515	.59
September	1,740	264	686	.443	.49
October	2,200	815	1,260	.813	.94
November	1,490	454	874	.564	.63
December	1,510	613	1,130	.729	.84
The year	20,800	264	2,820	1.82	24.71

MERRIMAC RIVER DRAINAGE BASIN.

DESCRIPTION.

Merrimac River is formed near Franklin, N. H., by the union of Pemigewasset and Winnepesaukee rivers. The Winnepesaukee is a short stream flowing southwestward from Lake Winnepesaukee; the Pemigewasset is the outlet of Profile Lake in Franconia, N. H., 50 to 60 miles north of Franklin, and less than 10 miles from Mount Washington. From Franklin the Merrimac flows southward for about 60 miles, crosses into Massachusetts, and a few miles below the State line, as it approaches the city of Lowell, it turns abruptly and runs for some 40 miles northeastward to the ocean at Newburyport. Its total length is about 110 miles. Of its 5,015 square miles of drainage area, about 1,200 square miles are in Massachusetts, 212 square miles lying in the Nashua, Sudbury, and Lake Cochituate drainages, from which water is permanently diverted for the supply of the metropolitan district adjacent to Boston.

Important tributaries of the Merrimac, other than the headwater streams, are the Contoocook, Suncook, Piscataquog, Souhegan, and Nashua rivers. Nashua River lies nearly all in Massachusetts but enters the Merrimac near Nashua, N. H. The other tributaries mentioned are all in New Hampshire.

The headwaters of the Pemigewasset reach an elevation approximately 2,000 feet above the sea; at Franklin the river is at an elevation of about 270 feet. The upper portion of the basin is rough and mountainous and very largely in forest. Below Franklin the country is more uniform in topography and largely in farm land.

The main river flows in reaches of moderate slope separated by falls over ledge rock. It is navigable as far as Haverhill, and for small boats as far as Lawrence.

The mean annual rainfall in this basin is about 42 inches, ranging from about 46 inches at Lowell to about 38 inches at Plymouth, but is probably much greater in the mountainous regions near the head of the Pemigewasset than elsewhere in the drainage basin. The river is generally frozen during the winter, and especially in its northern portions there is usually a deep fall of snow.

The basin of the Merrimac is well supplied with natural facilities for storage, the combined area of lakes and ponds amounting to approximately 183 square miles. About 105 square miles of this is tributary to Winnepesaukee—next to Moosehead Lake the largest body of water in New England—which has about 4 feet of available depth of storage, corresponding to somewhat less than 8,000,000,000 cubic feet. Squam Lake, tributary to the Pemigewasset through Squam River at Ashland, is nearly 15 square miles in area. Newfound Lake, with about half the water area of Squam Lake, is also tributary to the Pemigewasset. The storage on all of these lakes, besides numerous smaller ones, is controlled by users of water power on the river and greatly improves the regimen of low-water flow. In a general way, the most favorable opportunities for storage on the Merrimac are being utilized, but in the upper portions of the drainage basin there are still many unutilized reservoir sites.

The Merrimac is world-famous for its developed water powers. Lawrence, Lowell, and Manchester are great industrial centers, largely devoted to cotton and woolen manufactures, that owe their location to the excellent water power available at their sites. There are only one or two sites remaining for power development on the main river, but on the tributaries, especially the Pemigewasset and its tributaries, there is a large amount of unutilized fall. The longest available run-off record of flow on the Merrimac is that at Lawrence, extending back to 1890; the driest year was 1893; the wettest 1890; the total flow during these two years was about in the ratio of 1 to 1.93.

PEMIGEWASSET RIVER AT PLYMOUTH, N. H.

This station is located at the covered wooden highway bridge a short distance below the mouth of Bakers River in the town of Plymouth, and was established September 5, 1903, in cooperation with the New Hampshire Forestry Commission, to procure general information regarding the daily distribution of flow of this river. From 1904 to June 30, 1907, it was maintained by the United States Geological Survey, and since the latter date gage heights have been furnished by the Locks & Canals Co., of Lowell, Mass.

The nearest dam upstream is at the pulp mills at Livermore Falls, distant some 3 miles. Downstream the nearest dam is at Franklin, 25 miles away.

The datum of the chain gage, which is attached to the upstream side of the bridge, has remained the same during the maintenance of the station. The datum of the staff gage belonging to the Locks & Canals Co., which is located about 40 feet above the bridge and on the same side of the river as the chain gage, is 1.1 feet higher than the chain-gage datum. All gage readings are reduced to chain-gage datum. It is believed that there is relatively little difference between the relations of the two gages to the discharge. Discharge measurements are made from the bridge at ordinary and high stages. At low water the left channel is measured by wading. During the winter months the discharge is affected by ice. Conditions for obtaining accurate discharge data are good, and a good rating curve has been developed.

Prior to 1903 a record of gage heights at Plymouth was obtained by the Locks & Canals Co. extending back to 1886, and estimates of discharge of the river were made covering this period and published in Water-Supply Paper 124, pages 97–101. At the time of publishing these estimates of discharge it was believed that conditions of flow were stable. Two quite radical changes in conditions of flow have since occurred, one in 1905 and one in 1910, the discharges at a stage of 1.2 feet having varied as follows: 1904, discharge 110 second-feet; 1905, discharge 158 second-feet; 1910, discharge 210 second-feet (provisional). Hence these earlier estimates of discharge should be used with caution for low stages, although they are probably essentially correct for medium and high stages.

The following discharge measurement was made by D. M. Wood:

September 11, 1909: Width, 164 feet; area, 309 square feet; gage height, 1.36 feet; discharge, 251 second-feet.

Daily gage height, in feet, of Pemigewasset River at Plymouth, N. H., for 1909.

[Frank Morton, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	3.0	4.35	4.1	4.25	3.25	1.85	......	1.45	2.25	1.5	1.95
2	1.75	2.95	4.25	3.7	......	3.0	1.7	1.25	1.5	2.1	1.5	2.0
3	......	2.95	4.1	3.75	4.45	2.85	1.75	1.2	1.6	......	1.45	1.85
4	2.2	2.6	4.1	......	4.45	2.75	......	1.25	1.5	2.2	1.6	2.0
5	2.1	2.35	3.95	4.2	5.6	2.6	2.0	1.25	......	2.0	1.85	......
6	8.25	2.2	3.7	4.1	4.95	......	1.95	1.5	1.5	1.95	1.75	1.95
7	5.95	......	......	7.7	6.1	3.35	1.75	1.45	1.7	1.95	......	1.95
8	4.1	3.95	3.25	10.45	5.85	3.1	1.85	......	1.6	1.85	1.7	1.85
9	3.1	3.7	3.6	7.1	......	2.7	1.7	1.35	1.5	1.75	1.7	1.85
10	......	3.5	3.6	5.25	6.75	2.5	1.75	1.35	1.45	......	1.6	1.75
11	3.45	3.2	3.5	......	7.6	2.45	......	1.5	1.45	1.7	1.6	1.75
12	3.35	3.1	3.35	4.95	6.25	2.35	1.7	1.25	......	1.7	1.6	......
13	3.0	3.1	3.2	4.7	5.2	......	1.6	1.35	1.5	1.75	1.5	1.7
14	2.95	......	......	9.95	4.95	2.45	1.5	1.25	1.45	1.85	......	1.75
15	2.95	3.45	3.45	14.95	5.7	2.35	1.5	......	1.35	1.7	1.5	1.85
16	2.7	3.35	3.6	11.85	......	2.25	1.35	1.2	1.35	1.6	1.45	1.85
17	......	3.25	3.5	8.85	7.6	2.2	1.45	1.2	1.25	......	1.7	1.75
18	2.5	3.2	3.5	......	6.2	4.45	......	1.45	1.35	1.7	1.85	1.95
19	3.1	3.1	3.25	7.45	5.95	4.45	1.5	1.6	......	1.6	1.75	......
20	3.1	3.25	3.1	12.6	5.75	......	1.5	1.45	1.25	1.5	1.7	2.0
21	3.45	......	......	8.45	4.1	2.75	1.45	1.6	.8	1.5	......	2.0
22	3.35	7.1	2.95	7.35	4.45	2.35	1.45	......	1.2	1.6	1.5	2.1
23	3.25	5.5	2.85	7.5	......	2.25	1.35	1.45	1.2	1.85	1.6	2.1
24	......	5.35	2.75	6.1	3.85	2.2	1.35	1.35	1.35	......	1.95	2.2
25	3.5	5.85	2.75	......	3.5	2.1	......	1.25	1.35	1.75	1.85	2.0
26	3.7	5.2	3.95	5.2	3.25	2.1	1.45	1.25	......	1.7	3.2	......
27	3.6	4.85	4.95	4.85	3.25	......	1.6	1.35	1.5	1.7	2.75	2.0
28	3.45	......	......	5.25	3.1	1.85	1.45	1.2	2.2	1.6	......	1.95
29	3.25	......	4.6	5.2	4.5	1.95	1.25	......	5.95	1.6	2.2	1.85
30	3.2	......	4.5	4.5	......	1.85	1.25	1.35	3.1	1.7	2.25	1.85
31	......	......	4.35	......	3.7	......	.9	1.2	......	......	......	2.7

NOTE.—Gage heights reduced to chain-gage datum. Ice conditions prevailed from Jan. 1 to about Mar. 25, and from about Dec. 16 to 31.

Gage heights below the Locks and Canals gage zero July 31 and Sept. 21, and estimated.

Daily discharge in second-feet, of Pemigewasset River at Plymouth, N. H., for 1909.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	2,460	2,620	1,600	503	166	300	760	322	560
2	....	2,040	2,730	1,370	420	218	322	655	322	590
3	....	2,090	2,840	1,240	448	200	370	750	300	503
4	....	2,330	2,840	1,150	519	218	322	725	370	590
5	....	2,570	4,290	1,030	590	218	322	590	503	575
6	....	2,460	3,440	1,800	560	322	322	560	448	560
7	....	7,780	5,020	1,690	448	300	420	560	434	560
8	....	13,500	4,640	1,460	503	278	370	503	420	503
9	....	6,680	5,360	1,110	420	257	322	448	420	503
10	....	3,820	6,080	950	448	257	300	434	370	448
11	....	3,630	7,590	910	434	322	300	420	370	448
12	....	3,440	5,250	832	420	218	311	420	370	434
13	....	3,140	3,760	871	370	257	322	448	322	420
14	....	12,400	3,440	910	322	218	300	503	322	448
15	....	23,400	4,430	832	322	209	257	420	322	....
16	....	16,500	6,010	760	257	200	257	370	300	....
17	....	10,100	7,590	725	300	200	218	395	420	....
18	....	9,700	5,170	2,840	311	300	257	420	503	....
19	....	7,310	4,800	2,840	322	370	238	370	448	....
20	....	8,200	4,500	2,000	322	300	218	322	420	....
21	....	9,260	2,460	1,150	300	370	90	322	371	....
22	....	7,130	2,840	832	300	335	200	370	322	....
23	....	7,400	2,520	760	257	300	200	503	370	....
24	....	5,020	2,190	725	257	257	257	476	560	....
25	....	4,390	1,840	655	278	218	257	448	503	....
26	2,300	3,760	1,600	655	300	218	290	420	1,550	....
27	3,440	3,320	1,600	579	370	257	322	420	1,150	....
28	3,230	3,820	1,460	503	300	200	725	370	938	....
29	3,020	3,760	2,900	560	218	228	4,800	370	725	....
30	2,900	2,900	2,470	503	218	257	1,460	420	760	....
31	2,740	....	2,040	....	115	200	....	371	....	....

NOTE.—Daily discharge based on a rating curve well defined between discharges 200 and 15,000 second-feet.

Discharge interpolated for days when the gage height is not given, except June 6 and Oct. 3, which are estimated on the basis of Saco River at Center Conway.

Monthly discharge of Pemigewasset River at Plymouth, N. H., for 1909.

[Drainage area, 615 square miles.]

Month.	Discharge in second-feet.				Run-off. (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	....	....	677	1.10	1.27	D.
February	....	....	830	1.35	1.41	D.
March	3,440	....	1,100	1.79	2.06	D.
April	23,400	2,040	6,780	11.0	12.29	A.
May	7,590	1,460	3,750	6.10	7.03	A.
June	2,840	503	1,130	1.84	2.05	A.
July	590	115	360	.585	.67	A.
August	370	166	254	.413	.48	A.
September	4,800	90	488	.793	.88	A.
October	760	322	470	.764	.88	A.
November	1,550	300	486	.790	.88	A.
December	590	....	387	.629	.73	C.
The year	23,400	90	1,390	2.26	30.63	

NOTE.—Discharge during the frozen periods based on climatological data and the discharge at Franklin Junction and Center Conway.

Mean discharge Mar. 1 to 25, estimated, 660 second-feet; Dec. 15 to 31, estimated, 284 second-feet.

MERRIMAC RIVER AT FRANKLIN JUNCTION, N. H.

This station, which is located at the wooden bridge near Franklin Junction, about 1 mile below the union of Pemigewasset and Winnepesaukee rivers, was established July 8, 1903.

Since June 30, 1907, gage heights at this point have been furnished by the Locks & Canal Co., of Lowell, Mass.

The records at this station, in conjunction with those at Garvins Falls and Lawrence, furnish fairly complete information regarding the daily distribution of flow of the main river.

There are dams on both Pemigewasset and Winnepesaukee rivers within 2 miles of the station. The nearest dam downstream is at Sewall Falls, near Concord, distant some 15 miles.

The datum of the chain gage attached to the railroad bridge has remained the same since the establishment of the station. Discharge measurements are made from the bridge.

During the winter months the discharge is slightly affected for short periods by ice. Conditions for obtaining accurate discharge data are good, and a good rating curve has been developed for this station.

The following discharge measurement was made by D. M. Wood:

September 10, 1909; width, 213 feet; area, 756 square feet; gage height, 4.11 feet; discharge, 1,200 second-feet.

Daily gage height, in feet, of Merrimac River at Franklin Junction, N. H., for 1909.

[F. R. Roers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.42	6.02	6.18	6.65	5.30	4.25		4.10	5.48	4.28	4.18
2		4.65	5.72	6.18		5.32	4.28		4.18	5.10	4.32	4.18
3		4.55	5.55	6.40	6.50	5.20	4.22		4.15		4.32	4.15
4		4.52			6.10	5.10		4.15	4.18	4.92	4.30	4.18
5	3.95	4.50	5.05	6.62	6.15	5.15		4.18		4.78		4.22
6	4.52	4.55	4.88	7.85	6.40		4.25	4.10		4.55	4.12	4.20
7	8.88			10.35	6.45	5.30	4.32	4.08	4.15	4.38	4.02	
8	5.90	4.72	4.60	12.85	6.70	5.15	4.28		4.15	4.25	4.10	4.12
9		4.65	4.68	8.65		5.00	4.25	4.05	4.12	4.20	4.00	4.20
10		4.78	4.58		7.35	4.95	4.20	4.12	4.20		3.95	4.22
11	4.75	4.75	4.58		7.95	4.92		4.08	4.18	4.20	3.90	4.20
12	4.60	4.88	4.68	6.65	7.35	4.85	4.18	4.05		4.28		4.18
13	4.45	4.68	4.58		6.55		4.20	4.08	4.10	4.32	3.98	4.18
14	4.38			13.00	6.15	4.82	4.15	4.00	4.12	4.35	4.00	
15	4.45	4.48	4.62	17.60	6.35	4.75	4.18		4.22	4.38	4.08	4.20
16	4.50	4.48	4.58	15.75		4.68	4.10	3.95	4.25	4.28	4.00	4.22
17		4.48	4.60	12.45	8.15	4.60	4.08	4.00	4.12		4.02	4.20
18	4.78	4.55	4.58		7.35	5.05		4.15	4.10	4.30	3.95	4.18
19	5.00	4.52	4.60	10.00	6.90	4.85	4.00	4.12		4.28		4.12
20		4.68		13.45	6.90		4.08	4.12	4.18	4.20	3.88	4.15
21				10.85	6.45	4.90	4.05	4.15	4.10	4.20	3.92	
22		7.18	4.60	8.85	5.95	4.80	4.00		4.10	4.28	3.88	4.20
23	4.82	6.22	4.52	8.75		4.75	4.10	4.18	4.15	4.20	3.90	4.20
24		5.88		8.20	5.90	4.52	4.12	4.15	4.10		3.88	4.15
25	4.75	6.10	4.72		5.80	4.50		4.15	4.10	4.30	3.85	4.22
26	4.70	6.18		7.15	5.75	4.42	3.98	4.12	4.08	4.28		4.65
27	4.62	6.12	6.30	6.45	5.70		4.05	4.08	4.22	4.30	4.02	4.88
28	4.70			6.80	5.65	4.38	4.12	4.05	4.50	4.28	4.10	
29	4.52		6.02	6.70	5.55	4.38	4.15		6.65	4.30	4.02	4.60
30	4.48		5.95	6.60		4.30	4.10	3.92	5.85	4.22	3.95	4.35
31			16.15		5.45		4.10	4.05				

NOTE.—Ice conditions prevailed from about Jan. 1 to 4, Jan. 9 to Feb. 10, Mar. 1 to 5, and Dec. 5 to 31. Gage readings are stated by observer to be to top of ice.

Daily discharge, in second-feet, of Merrimac River at Franklin Junction, N. H., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	......	......	4,320	5,180	2,840	1,360	1,190	1,180	3,130	1,400	1,280
2	......	......	......	4,320	5,040	2,870	1,400	1,210	1,280	2,530	1,450	1,280
3	......	......	......	4,720	4,900	2,680	1,320	1,230	1,240	2,400	1,450	1,240
4	......	......	......	4,920	4,180	2,530	1,330	1,240	1,280	2,260	1,420	1,280
5	1,000	......	......	5,120	4,270	2,600	1,350	1,280	1,270	2,060	1,310	......
6	1,710	......	2,200	7,500	4,720	3,000	1,360	1,180	1,250	1,740	1,200	......
7	9,650	......	2,000	12,600	4,810	2,840	1,450	1,160	1,240	1,520	1,080	......
8	3,830	......	1,810	17,900	5,270	2,600	1,400	1,140	1,240	1,360	1,180	......
9	......	......	1,920	9,100	5,880	2,380	1,360	1,120	1,200	1,300	1,060	......
10	......	......	1,780	6,500	6,500	2,300	1,300	1,200	1,300	1,300	1,000	......
11	......	2,020	1,780	5,500	7,700	2,260	1,290	1,160	1,280	1,300	950	......
12	......	2,200	1,920	5,180	6,500	2,160	1,280	1,120	1,230	1,400	995	......
13	......	1,920	1,780	5,000	4,990	2,140	1,300	1,160	1,180	1,450	1,040	......
14	......	1,780	1,810	18,200	4,270	2,120	1,240	1,060	1,200	1,480	1,060	......
15	......	1,650	1,840	27,900	4,630	2,020	1,280	1,030	1,320	1,520	1,160	......
16	......	1,650	1,780	24,000	6,360	1,920	1,180	1,000	1,360	1,400	1,060	......
17	......	1,650	1,810	17,100	8,100	1,810	1,160	1,060	1,200	1,410	1,080	......
18	......	1,740	1,780	14,500	6,500	2,460	1,120	1,240	1,180	1,420	1,000	......
19	......	1,710	1,810	11,900	5,650	2,160	1,060	1,200	1,230	1,400	965	......
20	......	1,920	1,810	19,200	5,650	2,200	1,160	1,200	1,280	1,300	930	......
21	......	4,050	1,810	13,700	4,810	2,230	1,120	1,240	1,180	1,300	972	......
22	......	6,180	1,810	9,500	3,920	2,090	1,060	1,260	1,180	1,400	930	......
23	......	4,400	1,710	9,300	3,880	2,020	1,180	1,280	1,240	1,300	950	......
24	......	3,800	1,840	8,200	3,830	1,710	1,200	1,240	1,180	1,360	930	......
25	......	4,180	1,980	7,160	3,660	1,680	1,120	1,240	1,180	1,420	900	......
26	......	4,320	3,260	6,120	3,580	1,580	1,040	1,200	1,160	1,400	990	......
27	......	4,220	4,540	4,810	3,490	1,550	1,120	1,160	1,320	1,420	1,080	......
28	......	3,800	4,290	5,460	3,400	1,520	1,200	1,120	1,680	1,400	1,180	......
29	......	......	4,040	5,270	3,240	1,520	1,240	1,040	5,180	1,420	1,080	......
30	......	......	3,920	5,080	3,160	1,420	1,180	972	3,740	1,320	1,000	......
31	......	......	4,270	......	3,080	......	1,180	1,120	......	1,360	......	......

NOTE.—Daily discharges based on a rating curve which is fairly well defined. Discharges interpolated on days when the gage height was not recorded, except Apr. 10, 11, and 13, and June 6, which were estimated from the discharge at Garvins Falls.

Monthly discharge of Merrimac River at Franklin Junction, N. H., for 1909.

[Drainage area, 1,460 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,560	....	1,530	1.05	1.21	C.
February	6,180	....	2,350	1.61	1.68	C.
March	4,540	1,710	2,440	1.67	1.92	B.
April	27,900	4,320	10,000	6.85	7.64	A.
May	8,100	3,080	4,880	3.34	3.85	A.
June	3,000	1,420	2,170	1.49	1.66	A.
July	1,450	1,040	1,240	.849	.98	A.
August	1,280	972	1,160	.795	.92	A.
September	5,180	1,160	1,470	1.01	1.13	A.
October	3,130	1,300	1,570	1.08	1.24	A.
November	1,450	900	1,090	.747	.83	A.
December	1,280	....	1,050	.719	.83	C.
The year	27,900	....	2,580	1.77	23.89	

NOTE.—Discharge during the frozen periods estimated on the basis of the discharge at Garvins Falls and climatological data. Mean discharge Jan. 1 to 4, estimated, 525 second-feet; Jan. 9 to 31, estimated, 1,270 second-feet; Feb. 1 to 10, estimated, 1,260 second-feet; Mar. 1 to 5, estimated, 2,850 second-feet; Dec. 5 to 31, estimated, 1,010 second-feet.

MERRIMAC RIVER AT GARVINS FALLS, N. H.

The power at Garvins Falls, 4 miles below Concord, is one of the best on Merrimac River. There has been a dam at this point since

1815, first in connection with the Old Bow canal, and later to furnish power for a pulp mill. This privilege has since become the property of the Manchester Traction, Light & Power Co., and has been more completely developed. During 1903–4 an overfall dam of the ogee type, somewhat similar in cross section to the dam at Holyoke, was completed. This dam is 550 feet long between abutments and about 800 feet over all, including headgates, and is of stone masonry, substantially built. A canal has been completed which is about 500 feet long and 74 feet wide at the water line, and wasteways are provided from the sides of this, one 90 feet long at elevation 102 (the main crest of the dam being taken as elevation 100) and another 45 feet long at elevation 103. A waste gate 10 feet wide and capable of being lowered to elevation 93 is also provided, for use especially in floating out any obstructions which lodge against the racks. The new dam and head gates to the canal are situated about 800 feet downstream from the old dam, which was destroyed on the completion of the new structure. There are six triplex turbines of somewhat over 1,000 horsepower each, and one small duplex turbine of 75 horsepower used in running exciters. Each large unit has three 39-inch runners, mounted on a horizontal shaft, which revolves at 180 revolutions a minute. Two of the wheels in each set discharge through a common T center and draft tube near the fore bay wall. The third wheel is set opposite a quarter turn at the downstream end of the casing and discharges through this quarter turn into a smaller draft tube. The top of the penstock opening is at elevation 95.5, while the lower ends of the draft tubes are horizontal and are about 2 feet below the level of usual tail water. The gates for the runners are of the plain cylindrical pattern without fingers and are controlled by governors. The average head on the wheels is about 29 feet and there are six 650-kilowatt 3-phase generators direct connected with the turbines. The power developed is transmitted at 12,000 volts tension to Manchester, about 14 miles away, where it enters a substation and is transformed to a lower voltage and through a distributing switchboard utilized for light and power. The Garvins Falls station is one of a system of three water-power plants and one steam-power plant operated by this company.

Careful record of the pond and tail-race levels, wheel openings, etc., have been kept by the company since the completion of the new dam in 1904, and have been furnished for computations of flow by J. Brodie Smith, manager. The original records for 1909 have been furnished by Hollis French and Allen Hubbard, consulting engineers for the power company. The computations of daily discharge were made by the United States Geological Survey. A number of current-meter measurements have been made from time to time by the hydrographers of the Survey for the purpose of rating turbines and to assist in computing flow over the dam.

Conditions are favorable at this station for accurate records of discharge. The flow over the dam is affected somewhat by ice during the winter.

The maximum daily discharge during the maintenance of the station occurred March 31, 1905, and was about 33,970 second-feet. Discharge for the minimum week occurred September 13 to 19, 1909, and averaged about 944 second-feet.

Daily discharge, in second-feet, of Merrimac River at Garvins Falls, N. H., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,110	1,710	4,890	8,640	7,430	3,600	1,950	a968	1,270	2,720	1,270	1,770
2	1,030	1,420	4,270	8,820	a7,770	3,150	1,410	1,110	981	2,000	1,240	1,550
3	a749	1,600	3,920	9,190	8,270	2,850	1,190	1,070	1,060	a1,720	1,150	1,560
4	1,040	1,550	3,400	a8,660	7,690	2,770	a1,550	1,030	1,100	1,650	1,360	1,670
5	1,070	1,570	3,330	9,590	7,850	2,670	1,530	1,080	a1,140	1,720	1,120	a1,340
6	1,940	1,660	3,170	11,200	7,870	a3,310	1,690	1,220	1,030	1,470	1,380	1,620
7	8,510	a2,440	a3,000	15,000	7,020	4,610	1,540	959	1,060	1,400	a812	1,370
8	7,100	2,480	3,020	20,900	8,680	4,140	1,560	a1,030	1,450	1,420	1,320	1,600
9	4,430	2,740	2,670	21,700	a8,590	3,300	1,390	1,300	1,220	962	1,370	1,470
10	a3,470	2,700	2,800	16,500	8,370	2,900	1,170	1,130	1,240	a924	1,160	1,180
11	2,910	2,840	2,720	a11,800	9,400	2,740	a1,170	1,020	1,110	1,430	1,330	1,860
12	2,650	2,720	2,700	9,190	9,320	2,830	1,240	1,140	a947	1,130	1,260	a904
13	2,050	3,120	2,970	8,770	7,080	a2,780	1,210	994	1,070	1,160	1,360	1,510
14	1,780	a2,900	a2,860	13,100	6,020	2,480	1,190	885	985	1,090	a708	1,400
15	1,860	2,600	2,740	28,700	5,710	2,330	973	a662	1,040	1,280	1,240	1,250
16	1,800	2,500	2,670	32,900	a6,060	2,410	1,030	1,140	1,030	1,640	1,230	1,430
17	a1,380	2,360	2,670	26,100	7,200	2,190	1,230	1,320	992	a1,040	1,290	1,390
18	1,640	2,310	2,630	a20,800	9,180	2,880	a1,250	1,010	1,080	1,280	1,310	1,340
19	1,250	2,320	2,510	16,900	8,190	5,780	1,380	969	a413	1,080	1,340	a959
20	1,620	2,420	2,630	18,300	7,410	a4,800	1,320	979	1,190	1,240	1,090	1,560
21	1,690	a3,920	a2,570	18,500	7,090	3,620	1,180	967	1,110	1,160	a651	1,560
22	1,640	7,600	2,600	14,500	6,450	2,910	1,220	a1,000	1,030	1,120	1,290	1,340
23	1,710	7,060	2,690	13,600	a5,340	2,440	1,180	a1,350	1,080	1,280	1,210	1,330
24	a2,190	6,140	2,930	12,600	4,670	2,110	1,160	1,050	1,130	a913	1,320	1,270
25	1,950	6,300	3,590	a10,300	4,240	1,990	a1,150	1,070	1,060	1,540	1,060	995
26	1,910	6,740	7,180	8,780	3,860	1,900	1,320	1,150	a769	1,300	1,670	a772
27	1,990	7,000	8,390	7,930	3,490	a1,850	1,120	1,030	1,380	1,410	2,210	1,400
28	2,050	a5,770	a8,920	7,640	3,520	1,870	1,210	1,000	1,250	1,340	a2,060	1,310
29	1,740	....	8,920	8,390	4,080	1,540	1,240	a906	3,250	1,250	1,990	1,190
30	1,660	....	8,830	7,930	a5,060	1,550	1,140	1,260	4,430	1,120	1,810	1,040
31	a2,480	....	8,440	....	4,460	....	1,240	1,160	....	a832	....	927

a Sunday.

Monthly discharge of Merrimac River at Garvins Falls, N. H., for 1909.

[Drainage area, 2,340 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	8,510	749	2,270	0.970	1.12
February	7,600	1,420	3,450	1.47	1.53
March	8,920	2,510	4,080	1.74	2.01
April	32,900	7,640	14,200	6.07	6.77
May	9,400	3,490	6,690	2.86	3.30
June	5,780	1,540	2,880	1.23	1.37
July	1,950	973	1,290	.551	.64
August	1,350	662	1,060	.453	.52
September	4,430	413	1,260	.538	.60
October	2,720	832	1,340	.573	.66
November	2,210	651	1,320	.564	.63
December	1,860	772	1,350	.577	.67
The year	32,900	413	3,430	1.47	19.82

MERRIMAC RIVER AT LAWRENCE, MASS.

Records of flow of the Merrimac at Lawrence have been kept for more than 50 years, but have been published only since 1890. Data in regard to the flow are furnished by R. A. Hale, principal assistant engineer of the Essex Water Power Co.

The station is located at the dam of the Essex Co. in Lawrence, and a careful record is kept of the flow over the dam and through the various wheels and gates in connection with the sale of power to the various users. The nearest dam on the river upstream is at Lowell, about 12 miles away, while a short distance below the Lawrence dam the river is within reach of tidal effect at high tide.

Water is diverted from the drainage basins of Sudbury and Nashua rivers for use by the metropolitan district in the vicinity of Boston, but during a portion of the year water is wasted into the Merrimac at these diversion dams, consequently the drainage area is somewhat variable.

The drainage areas are as follows:

	Square miles.
Total of Merrimac River drainage basin above Lawrence	4,664
Nashua River drainage basin above gaging station at Clinton, Mass	118
Sudbury River drainage basin, Framingham, Dam No. 1	75
Cochituate River drainage basin	19
Total of Nashua, Sudbury, and Cochituate river drainage basins	212
Net drainage basin of Merrimac River, excluding Nashua, Sudbury, and Cochituate river basins	4,452

The quantity as measured at Lawrence includes the water from Sudbury, Nashua, and Cochituate rivers, and in getting the absolute yield of the river this should be considered in reference to the drainage areas, either by deducting it from the Merrimac flow and using the net area and the net flow of the Merrimac, or by getting the total yield of both the Sudbury and Nashua rivers with the Merrimac and using the total area.

The accompanying tables, furnished by Mr. Hale, give the flow of the Merrimac at Lawrence, and also the quantity wasted from the Sudbury and Nashua drainage basins into the Merrimac, the latter being based on data furnished by the Metropolitan Water and Sewerage Board of Boston.

Much care is taken in procuring the base data used and in making computations, and these records are regarded as excellent.

The maximum daily discharge during the maintenance of the station occurred in March, 1896, and was about 82,150 second-feet, this being the greatest flood since that of 1846. The discharge for the minimum week occurred Sept. 21 to 27, 1908, and averaged 1,240 second-feet.

Average weekly flow, in second-feet, of Merrimac River at Lawrence, Mass., for 1909.

[Weeks arranged in order of amount of flow.]

Week ending Sunday.	Merrimac River at Lawrence (total drainage area 4,664 square miles).	Wasting into Merrimac from—				Net yield of Merrimac River from 4,452 square miles (mean discharge in second-feet).	
		Nashua River at Clinton (drainage area, 118 square miles).	Sudbury River at Dam 1 (drainage area, 75 square miles).	Lake Cochituate, Bannister Brook (drainage area, 19 square miles).	Total waste of these basins (total drainage area, 212 square miles).	Per week.	Per square mile.
Sept. 5	1,321	3	2	0	5	1,316	0.296
26	1,468	4	2	0	6	1,462	.328
Nov. 21	1,472	4	5	0	9	1,463	.329
Oct. 24	1,520	3	2	0	5	1,515	.340
Nov. 28	1,563	2	17	0	19	1,544	.347
Sept. 12	1,592	5	2	0	7	1,585	.356
Nov. 14	1,623	2	8	0	10	1,613	.362
Aug. 22	1,651	5	3	0	8	1,643	.369
Sept. 19	1,661	5	2	0	7	1,654	.372
Aug. 15	1,687	6	2	0	8	1,679	.377
Oct. 17	1,725	2	2	0	4	1,721	.387
Nov. 7	1,741	2	33	0	35	1,706	.383
Jan. 2, 1910	1,752	2	13	0	15	1,737	.390
Oct. 31	1,779	2	17	0	19	1,760	.395
Aug. 8	1,789	5	2	0	7	1,782	.400
29	1,849	5	3	0	8	1,841	.414
1	1,870	5	2	0	7	1,863	.418
July 18	1,884	5	2	0	7	1,877	.422
Jan. 3	1,888	5	9	0	14	1,874	.421
July 25	1,909	5	2	0	7	1,902	.427
Oct. 10	2,004	2	2	0	4	2,000	.449
July 11	2,146	5	2	0	7	2,139	.480
Dec. 12	2,150	2	16	0	18	2,132	.479
26	2,161	2	19	0	21	2,140	.481
Jan. 24	2,338	5	2	0	7	2,331	.524
July 4	2,427	5	4	0	9	2,418	.543
Dec. 5	2,598	2	17	0	19	2,579	.579
19	2,640	1	38	0	39	2,601	.584
Feb. 7	2,657	5	17	0	22	2,635	.592
Oct. 3	2,821	3	8	0	11	2,810	.631
Jan. 31	2,933	5	2	0	7	2,926	.657
17	3,328	5	2	0	7	3,321	.746
June 27	3,728	5	6	0	11	3,717	.835
Jan. 10	4,231	5	16	0	21	4,210	.946
June 20	4,259	5	20	0	25	4,234	.951
6	4,525	4	48	6	58	4,467	1.003
13	5,194	5	19	0	24	5,170	1.161
Mar. 21	5,207	5	90	19	114	5,093	1.144
Feb. 21	5,238	4	149	46	199	5,039	1.132
14	5,316	4	97	0	101	5,215	1.171
May 30	5,607	5	57	10	72	5,535	1.246
Mar. 14	6,003	4	126	24	154	5,849	1.314
7	8,011	5	127	36	168	7,843	1.762
May 23	8,391	4	63	21	88	8,303	1.865
16	9,506	5	79	18	102	9,404	2.112
Mar. 28	9,936	4	161	63	228	9,708	2.181
Apr. 4	10,437	4	160	22	186	10,251	2.303
May 9	11,243	4	89	27	120	11,123	2.498
2	11,904	4	132	47	183	11,721	2.633
Apr. 11	13,536	5	90	22	117	13,419	3.014
Feb. 28	15,261	3	231	88	322	14,939	3.353
Apr. 25	18,352	3	116	39	158	18,194	4.087
18	19,737	4	148	55	207	19,530	4.387
Weekly average	4,709	4	43	10	57	4,652	1.045

NOTE.—This table covers a period of 53 weeks, beginning with Dec. 27, 1908, and ending Jan. 2, 1910.

Daily discharge, in second-feet, of Merrimac River at Lawrence, Mass., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,171	3,897	11,354	10,029	11,568	5,869	2,666	a *97*	1,270	*4,857*	2,010	2,832
2	1,470	2,868	9,658	9,851	a11,570	4,852	2,746	2,239	1,401	2,746	2,002	2,610
3	a *309*	2,820	8,761	9,381	*12,935*	4,649	1,664	2,164	1,960	a1,656	2,091	2,777
4	2,057	2,773	8,230	a 8,620	12,216	4,438	a 328	2,108	1,257	3,676	2,190	2,028
5	1,771	2,626	7,292	9,164	11,125	2,627	522	2,213	a *135*	2,313	2,227	a 393
6	2,345	1,878	5,514	10,239	11,212	a3,108	*3,596*	2,404	581	2,151	1,454	2,682
7	4,045	a *1,739*	a 5,266	12,774	10,583	6,386	2,928	1,271	2,379	2,056	a 212	2,671
8	*8,704*	4,763	7,023	16,622	10,432	*6,753*	2,771	a 121	1,960	2,221	2,001	2,657
9	6,312	4,328	5,608	19,402	a10,196	5,822	2,924	2,198	2,317	1,507	2,072	2,442
10	a4,381	4,924	5,141	15,813	10,897	5,220	2,065	2,200	2,356	a *101*	1,965	2,606
11	5,301	6,016	7,821	a10,740	11,010	4,720	a 216	2,092	1,399	1,914	1,944	1,738
12	4,327	6,287	5,573	8,831	11,530	3,936	2,371	1,988	a 150	2,046	1,893	a *253*
13	3,710	5,768	5,335	*7,370*	10,482	a3,518	2,366	2,025	1,839	2,159	1,341	2,451
14	3,584	a 5,125	a 5,517	7,945	8,591	5,117	2,392	1,179	1,893	2,040	a 143	2,737
15	3,435	6,153	6,696	18,503	7,227	3,779	2,266	a 126	1,998	2,124	1,750	3,263
16	2,331	5,369	4,650	34,505	a 6,803	3,674	2,283	1,903	2,210	1,668	1,731	3,441
17	a 609	4,627	5,932	*34,929*	7,666	3,665	1,408	1,827	2,213	a 125	1,859	3,665
18	3,106	4,154	5,682	a26,077	9,304	3,626	a *99*	2,120	1,337	2,011	1,870	2,256
19	2,633	4,363	5,199	21,554	9,721	3,716	2,292	2,327	a 139	1,855	1,882	a 666
20	2,527	4,335	*3,788*	19,239	9,210	a6,239	2,347	2,132	1,889	1,778	1,124	*3,729*
21	2,575	a 7,666	a 4,500	21,389	8,661	6,053	2,390	1,121	1,718	1,825	a *90*	3,043
22	2,595	13,970	6,140	18,690	7,672	4,489	2,409	a 130	1,749	1,899	1,830	2,763
23	2,038	14,370	5,163	17,116	a 6,506	4,300	2,341	2,006	1,729	1,159	1,897	2,545
24	a 894	14,500	5,270	16,553	7,040	3,914	1,470	2,134	1,753	a 116	1,993	2,280
25	3,952	*18,150*	6,293	a13,920	6,276	3,592	a 116	2,241	1,271	2,048	358	321
26	3,340	18,080	14,949	12,884	5,536	2,287	2,388	2,282	a 167	2,230	2,145	a 446
27	3,182	15,295	*17,542*	11,551	5,431	a*1,464*	2,450	*2,543*	1,894	2,353	1,622	2,461
28	3,186	a12,460	a14,198	11,240	5,114	4,074	2,421	1,456	2,056	2,453	a1,097	2,216
29	3,275	....	12,987	12,112	*4,497*	3,062	2,322	a 283	2,438	2,054	*4,368*	2,138
30	2,223	....	11,469	12,400	a 5,352	2,448	2,160	1,737	*4,101*	1,180	3,175	2,053
31	a1,374	....	10,719	....	6,132	....	1,252	1,486	....	a 138	....	2,050

a Sunday.

NOTE.—Maximum and minimum appear in italics.

Monthly discharge of Merrimac River at Lawrence, Mass., for 1909.

Month.	Mean discharge of Merrimac River at Lawrence, as measured (total drainage area=4,664 square miles).	Amount washing into Merrimac River from drainage area.				Average yield of Merrimac River from drainage area of 4,452 square miles.		Run-off (depth in inches on drainage area).
		Nashua River at Clinton (118 square miles).	Sudbury River at Dam 1 (75 square miles).	Lake Cochituate, Bannister Brook (19 square miles).	Total, 212 square miles.			
		Second-feet.				Second-feet.	Second-feet per square mile.	
1909.								
January	3,025	5	6	0	11	3,014	0.677	0.78
February	7,118	4	124	33	161	6,957	1.563	1.63
March	7,718	4	133	36	173	7,545	1.695	1.95
April	15,315	4	120	35	159	15,156	3.404	3.80
May	8,790	4	77	22	103	8,687	1.951	2.25
June	4,247	5	20	1	26	4,221	.948	1.06
July	1,999	5	2	0	7	1,992	.447	.52
August	1,682	5	2	0	7	1,675	.376	.43
September	1,652	4	3	0	7	1,645	.369	.41
October	1,886	2	6	0	8	1,878	.422	.49
November	1,745	3	16	0	19	1,726	.388	.43
December	2,265	2	21	0	23	2,242	.504	.58
The year	4,787	4	44	11	59	4,728	1.062	14.33

NOTE.—About July 1, 1909, 1 square mile of Cochituate drainage area was diverted to Charles River drainage area, leaving 18 square miles. Merrimac River net drainage area unaffected.

SOUHEGAN RIVER AT MERRIMAC, N. H.

Souhegan River is formed in the hills and mountains of southern New Hampshire, in the townships of Temple and New Ipswich, one branch starting from the township of Ashby, Mass. The stream flows in a general northeasterly direction to Wilton, where it is joined by Stony Branch, then flows eastward, and joins Merrimac River at Merrimac, N. H. Baboosic Stream enters near its mouth.

The fall of the stream is very large, its bed and banks are rocky, and it affords numerous power sites. (See Pl. IV, A.)

The mean annual precipitation in this basin is about 42 inches. Winters are rather severe. The average depth of snowfall in January and February is about 18 inches.

The gaging station, which was established July 13, 1909, in cooperation with the W. H. McElwain Co., is located about 1½ miles upstream from this company's dam and just above Atherton Falls. The slope of the river below the station is very great, falls and rips extending for three-fourths of a mile.

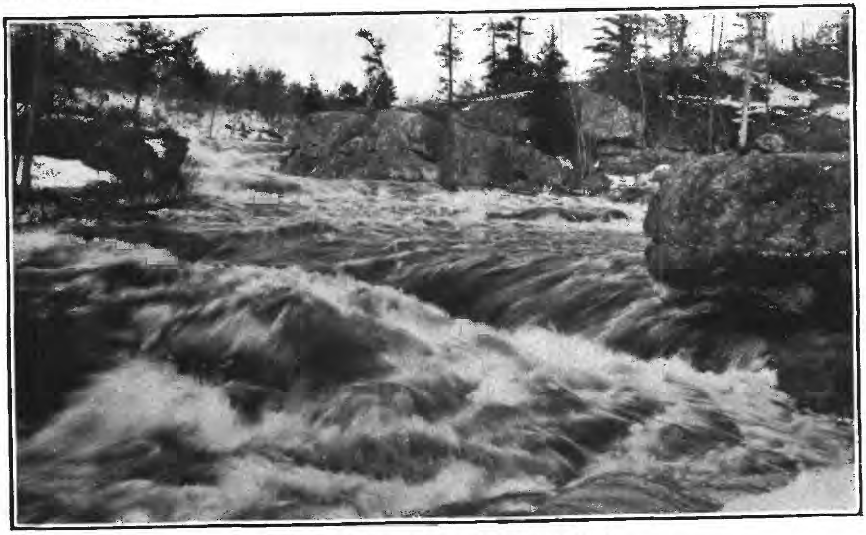
A vertical staff gage is located on the left bank about 40 feet above the falls. A chain gage for use during high water is attached to a tree a short distance upstream from the staff gage. All published readings are referred to the staff gage. Discharge measurements are made by wading or from bridges above and below the station. A rating curve has been developed, based on 1909 and 1910 discharge measurements.

Discharge measurements of Souhegan River at Merrimac, N. H., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 13	D. M. Wood	31	40.3	2.22	37.7
Aug. 16	.....do	36	37.0	2.05	27.1
Sept. 20	.....do	28	27.5	1.99	20.5
20	.....do	28	26.9	1.99	20.4
Dec. 15[a]	Wood and Garratt	75	307	3.02	215
Dec. 31[b]	D. M. Wood	105	393	2.37	43.8

[a] Section 1½ miles above gage. Ice conditions. [b] Section 100 feet above gage. Ice conditions.

NOTE.—Measurements made July 13 to Sept. 20 were made by wading at a section about 2,000 feet below gages.



A. SOUHEGAN RIVER AT MERRIMAC, N. H.

Falls just below gage.

B. DEVELOPMENT ON MILLERS RIVER AT WENDELL, MASS.

Daily gage height, in feet, of Souhegan River at Merrimac, N. H., for 1909.

[G. M. Norton, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	2.12	2.02	2.60	2.20	2.50	16	2.20	2.07	2.03	2.02	2.12	2.88
2	......	2.08	2.02	2.59	2.20	2.50	17	2.25	2.11	2.02	2.10	2.10	2.76
3	......	2.04	2.02	2.38	2.16	2.46	18	2.22	2.26	2.03	2.12	2.12	2.60
4	......	2.08	2.04	2.22	2.17	2.44	19	2.12	2.64	2.00	2.14	2.07	2.38
5	......	2.12	2.12	2.20	2.20	2.31	20	2.10	2.52	2.00	2.16	2.06	2.34
6	......	2.17	2.10	2.12	2.18	2.37	21	2.10	2.48	2.04	2.14	2.05	2.42
7	......	2.15	2.00	2.12	2.18	2.32	22	2.10	2.48	2.04	2.16	2.04	2.28
8	......	2.10	1.95	2.12	2.19	2.54	23	2.25	2.30	2.05	2.20	2.04	2.42
9	......	2.06	2.01	2.10	2.16	2.38	24	2.25	2.28	2.04	2.27	2.04	2.44
10	......	2.13	2.02	2.08	2.12	2.32	25	......	2.26	2.10	2.30	2.04	2.45
11	......	2.10	2.02	2.05	2.11	2.37	26	2.10	2.24	2.15	2.29	2.15	......
12	......	2.08	2.02	2.04	2.10	2.28	27	2.27	2.20	2.22	2.25	2.71	2.32
13	2.22	2.10	2.00	2.02	2.10	2.25	28	2.20	2.12	2.42	2.20	2.52	2.38
14	2.25	2.08	2.06	2.03	2.12	2.55	29	2.20	2.11	2.88	2.22	2.42	2.31
15	2.20	2.08	2.00	2.02	2.11	2.99	30	2.14	2.10	2.78	2.22	2.50	2.32
							31	2.14	2.05	......	2.20	......	2.37

NOTE.—Ice conditions prevailed from about Dec. 15 to 31.

Daily discharge, in second-feet, of Souhegan River at Merrimac, N. H., for 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	30	22	105	37	83	16	37	26	23	22	30	......
2	......	27	22	103	37	83	17	43	29	22	28	28	......
3	......	24	22	61	33	75	18	39	44	23	30	30	......
4	......	27	24	39	34	72	19	30	115	21	32	26	......
5	......	30	30	37	37	50	20	28	87	21	33	25	......
6	......	34	28	30	35	60	21	28	79	24	32	24	......
7	......	32	21	30	35	52	22	28	79	24	33	24	......
8	......	28	18	30	36	92	23	43	49	24	37	24	......
9	......	25	22	28	33	61	24	43	47	24	45	24	......
10	......	31	22	27	30	52	25	36	44	28	49	24	......
11	......	28	22	24	29	60	26	28	42	32	48	32	......
12	......	27	22	24	28	47	27	45	37	39	43	134	......
13	39	28	21	22	28	43	28	37	30	68	37	87	......
14	43	27	25	23	30	94	29	37	29	187	39	68	......
15	37	27	21	22	29	215	30	32	28	155	39	83	......
							31	32	24	......	37	......	......

NOTE.—Daily discharge based on a fairly well-defined rating curve.

Monthly discharge of Souhegan River at Merrimac, N. H., for 1909.

[Drainage area, 168 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July 13-31	45	28	36.1	0.215	0.15	B.
August	115	24	39.2	.233	.27	B.
September	187	18	35.2	.209	.23	B.
October	105	22	38.4	.229	.26	B.
November	134	24	38.5	.229	.26	B.
December	215	43	69.1	.411	.47	B.

NOTE.—Discharge Dec. 15 to 31 estimated on the basis of two measurements made under ice conditions. Mean discharge Dec. 15 to 31 estimated 72 second-feet.

SOUTH BRANCH OF NASHUA RIVER AT CLINTON, MASS.

Nashua River is formed by the union of its North and South branches. The North Branch rises in the northern part of Worcester County and flows southeastward about 18 miles; the South Branch rises in the central part of the same county and pursues a circuitous course toward the south, east, and north. From the junction of these branches the Nashua takes a general northerly and easterly course, passing into Middlesex County and thence into New Hampshire, joining the Merrimac at Nashua. For 3 or 4 miles above its mouth the fall of the stream is rapid, its bed is rocky, and its banks are high; above that point its fall is less for a distance of 8 or 10 miles, but the banks are still high enough to confine the river except in high freshets. From Groton to the junction of the branches the stream is very sluggish, its bed and banks are sandy and gravelly, and considerable areas of meadow land bordering the streams are at times inundated.

The South Branch of Nashua River has been measured at Clinton by the engineers of the Metropolitan Water and Sewerage Board since July, 1896. The results of these measurements have been furnished by Dexter Brackett, chief engineer.

A large reservoir, storing about 8,500,000,000 cubic feet, has been constructed at Clinton, Mass., and water stored since 1903. Beginning with 1897, the estimates have been corrected for gain and loss of storage in reservoirs and mill ponds in the drainage basin, so that the results show the natural flow of the stream.

The accompanying tables give data on discharge and precipitation for 1909, also the average for the years 1897–1909, inclusive, precipitation averages being based on records at several stations in the Nashua drainage basin:

Yield and rainfall in South Branch of Nashua River basin at Clinton, Mass., for 1909.

[Drainage area, 118.19 square miles.]

Month.	Total yield, in million gallons.	Average yield per square mile.		Rainfall, in inches.	Rainfall collected, in inches.	Per cent collected.
		Million gallons per day.	Second-feet.			
1909.						
January	2,168.6	0.592	0.916	3.523	1.056	30.0
February	8,459.5	2.556	3.955	6.100	4.118	67.5
March	7,801.3	2.129	3.294	4.378	3.798	86.8
April	8,588.0	2.422	3.748	5.705	4.181	73.3
May	4,441.2	1.212	1.876	2.648	2.162	81.7
June	2,239.8	.632	.977	3.028	1.091	36.0
July	854.0	.233	.361	4.253	.416	9.8
August	708.7	.193	.299	3.588	.345	9.6
September	735.9	.208	.321	3.903	.358	9.2
October	329.0	.090	.139	1.703	.160	9.4
November	1,286.7	.363	.561	1.683	.627	37.2
December	1,967.9	.537	.831	3.995	.958	24.0
The year	39,580.6	.918	1.420	44.507	19.270	43.3

Summary of yield and rainfall in South Branch of Nashua River basin at Clinton, Mass., for 1897–1909.

Month.	Total yield, in million gallons.	Average yield per square mile.		Rainfall, in inches.[a]	Rainfall collected, in inches.[a]	Per cent collected.
		Million gallons per day.	Second-feet.			
1897-1909.						
January	56,984.2	1.196	1.851	3.645	2.134	58.6
February	63,160.4	1.460	2.258	3.907	2.365	60.5
March	133,258.4	2.798	4.328	4.490	4.990	111.2
April	105,786.9	2.295	3.551	4.054	3.962	97.7
May	59,332.9	1.246	1.927	3.535	2.222	62.9
June	38,894.5	.844	1.306	4.142	1.457	35.2
July	22,412.9	.471.	.728	4.426	.839	19.0
August	21,714.2	.456	.705	4.256	.813	19.1
September	19,403.4	.421	.651	4.015	.727	18.1
October	27,258.5	.572	.885	3.485	1.021	29.3
November	39,376.2	.854	1.322	3.337	1.475	44.2
December	63,891.4	1.341	2.075	4.499	2.393	53.2
	651,473.9	1.161	1.797	47.791	24.398	51.1

[a] Average of totals per calendar month 1897–1909.

Yield in South Branch of Nashua River basin at Clinton, Mass., for 1897–1909.

[Drainage area, 119 square miles to 1907; 118.19 square miles after 1907.]

[Second-feet per square mile.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1897	1.232	1.440	4.270	2.525	1.800	1.828	2.231	1.386	0.588	0.377	1.984	3.521	1.938
1898	2.418	2.530	4.778	3.137	2.151	1.281	.514	2.049	1.045	2.334	3.358	3.189	2.400
1899	3.236	1.687	4.295	5.224	1.334	.869	.548	.365	.387	.379	.665	.555	1.626
1900	1.232	6.271	5.759	2.444	2.139	.894	336	.304	.197	.437	1.354	2.429	1.956
1901	.803	.551	4.205	7.711	4.222	1.525	.738	.792	.495	1.001	.799	5.002	2.332
1902	2.579	2.168	6.176	3.341	1.595	.635	.452	.459	.372	1.471	.982	2.859	1.930
1903	1.957	3.300	5.297	3.463	.880	3.297	.966	.734	.580	1.065	.981	1.476	1.988
1904	1.020	1.434	4.653	4.617	2.317	1.179	.769	.549	.764	.538	.530	.680	1.550
1905	1.959	.700	4.648	2.502	.688	.838	.565	.497	1.900	.567	.684	1.575	1.432
1906	1.751	1.588	2.878	3.263	2.371	1.831	1.127	.915	.428	.820	1.160	1.229	1.613
1907	2.257	1.070	2.626	2.221	1.494	1.196	.518	.135	1.254	2.138	3.930	3.035	1.825
1908	2.689	2.685	3.391	1.964	2.188	.624	.341	.685	.136	.245	.194	.599	1.311
1909	.916	3.955	3.294	3.748	1.876	.977	.361	.299	.321	.139	.561	.831	1.420

SUDBURY RIVER AT FRAMINGHAM AND LAKE COCHITUATE AT COCHITUATE, MASS.

Sudbury River, a small stream of eastern Massachusetts, receives water from an area west of Framingham. It flows thence in a northerly course through meadows and swamps and joins Assabet River to form Concord River, which in turn continues northward, and enters Merrimac River immediately below the city of Lowell. Storage reservoirs have been constructed by the city of Boston and the Metropolitan Water and Sewerage Board, controlling the greater part of the flow from this basin.

Lake Cochituate drains into Sudbury River a short distance below Framingham. It is controlled as a storage reservoir by the Metropolitan waterworks.

Sudbury River and Lake Cochituate have been studied by the engineers of the city of Boston, the State Board of Health of Massachusetts, and the Metropolitan Water and Sewerage Board, and records of rainfall in the Sudbury basin have been kept since 1875, and in the Cochituate basin since 1852, but the latter are considered of doubtful accuracy previous to 1872.

The accompanying tables, furnished by Dexter Brackett, chief engineer, give data regarding discharge and precipitation for 1909, also the average for 35 years for Sudbury River and for 47 years for Lake Cochituate. (See also footnote, p. 295.)

Yield and rainfall in Sudbury River basin, at Framingham, Mass., for 1909, and summaries for 1875–1909.

[Drainage area, 75.2 square miles.]

Month.	Total yield, in million gallons.	Average yield per square mile.		Rainfall, in inches.[a]	Rainfall collected, in inches.[a]	Per cent collected.
		Million gallons per day.	Second-feet.			
1909.						
January	914.7	0.392	0.607	3.975	0.700	17.6
February	4,814.0	2.286	3.537	5.795	3.684	63.6
March	4,042.2	1.734	2.683	4.255	3.093	72.7
April	3,881.9	1.721	2.662	4.668	2.970	63.6
May	2,339.9	1.004	1.553	2.425	1.791	73.8
June	540.2	.239	.370	2.808	.413	14.7
July	− 282.2	− .121	− .187	1.595	− .216	−13.5
August	− 104.2	− .045	− .069	2.933	− .080	− 2.7
September	336.2	.149	.231	4.743	.257	5.4
October	− 119.7	− .051	− .079	1.120	− .092	− 8.2
November	185.6	.082	.127	3.383	.142	4.2
December	612.6	.263	.407	4.050	.469	11.6
The year	17,161.2	.625	.967	41.750	13.131	31.5
1875–1909.						
January	99,567.3	1.220	1.888	4.137	2.177	52.6
February	130,881.1	1.762	2.725	4.222	2.862	67.8
March	233,462.9	2.861	4.426	4.493	5.104	113.6
April	161,325.2	2.043	3.161	3.537	3.527	99.7
May	89,834.4	1.101	1.703	3.396	1.964	57.8
June	40,671.9	.515	.797	3.105	.889	28.6
Jufy	14,559.4	.178	.276	3.604	.318	8.8
August	20,915.1	.256	.397	3.885	.457	11.8
September	20,343.9	.258	.399	3.550	.445	12.5
October	38,181.6	.468	.724	3.987	.835	20.9
November	65,349.3	.828	1.280	3.827	1.429	37.3
December	84,966.0	1.041	1.611	3.846	1.857	48.3
	1,000,058.1	1.040	1.610	45.589	21.864	48.0

[a] For 1909, total for month; 1875 to 1909, average of totals per calendar month.

Yield, in second-feet per square mile, of Sudbury River basin at Framingham, Mass., for 1875 to 1909.

[Drainage area, 75.2 square miles.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1875	0.159	2.315	2.482	4.718	1.838	1.346	0.497	0.612	0.321	1.000	2.015	0.903	1.504
1876	.995	2.116	6.862	5.094	1.761	.343	.283	.627	.285	.361	1.683	.702	1.756
1877	1,019	1.469	7.448	3.703	2.153	.924	.312	.187	.092	.977	2:193	1.995	1.878
1878	2.800	3.814	5.426	2.516	2.158	.782	.199	.736	.249	.799	2.619	4.916	2.246
1879	1.083	2.647	3.605	4.821	1.723	.640	.243	.611	.218	.109	.318	.716	1.383

Yield, in second-feet per square mile, of Sudbury River basin at Framingham, Mass., for 1875 to 1909—Continued.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1880....	1.733	2.765	2.126	1.808	.796	.271	.273	.184	.124	.157	.318	.271	.895
1881....	.642	2.392	6.195	2.392	1.493	2.070	.428	.229	.305	.287	.611	1.199	1.515
1882....	1.920	3.718	4.392	1.342	1.998	.818	.133	.086	.474	.463	.324	.487	1.334
1883....	.518	1.598	2.492	2.088	1.450	.464	.178	.122	.141	.288	.317	.299	.824
1884....	1.540	4.397	5.857	4.415	1.594	.644	.346	.397	.068	.129	.271	1.431	1.747
1885....	1.910	2.095	2.433	2.808	2.067	.659	.096	.372	.187	.519	1.822	1.816	1.393
1886....	2.260	7.428	3.185	3.013	1.114	.314	.179	.146	.182	.225	1.041	1.578	1.682
1887....	4.006	4.377	4.437	4.053	1.561	.640	.178	.331	.172	.294	.570	.995	1.785
1888....	1.629	3.011	5.009	4.093	2.526	.652	.182	.587	1.786	3.093	4.267	4.708	2.626
1889....	4.305	1.850	2.071	2.182	1.361	1.011	.980	2.216	1.274	1.903	3.003	3.467	2.140
1890....	1.941	2.366	5.636	2.900	2.114	.878	.166	.204	.708	3.515	1.879	1.541	1.989
1891....	4.669	5.393	6.891	3.709	.901	.639	.231	.252	.314	.325	.472	.842	2.034
1892....	2.893	1.459	3.025	1.348	1.947	.662	.331	.433	.355	.195	1.079	.750	1.209
1893....	.671	2.386	5.021	3.288	4.461	.680	.244	.280	.167	.343	.493	1.252	1.604
1894....	1.072	1.533	3.463	2.538	1.299	.648	.249	.324	.231	.579	1.293	1.108	1.192
1895....	1.600	.837	3.728	3.892	.984	.269	.357	.354	.138	2.134	4.296	2.757	1.782
1896....	1.677	4.140	5.933	2.312	.557	.617	.147	.088	.600	.916	1.020	1.017	1.576
1897....	1.307	1.651	3.968	2.344	1.416	1.488	1.018	.914	.282	.145	1.407	2.451	1.533
1898....	2.535	4.676	4.029	2.830	1.927	.820	.357	1.712	.571	1.795	3.073	2.783	2.244
1899....	3.541	2.137	6.507	3.900	.790	.102	.030	−.054	.145	.179	.474	.340	1.506
1900....	1.229	5.880	5.653	2.088	2.031	.489	−.028	−.052	.101	.287	1.026	1.696	1.674
1901....	.676	.464	4.262	6.504	4.570	1.165	.473	.655	.473	.637	.734	4.170	2.076
1902....	2.728	2.590	6.497	2.916	1.149	.469	.101	.208	.276	.782	.688	2.753	1.764
1903....	2.685	3.526	5.344	3.498	.542	3.075	.689	.475	.201	.761	.561	.901	1.841
1904....	.738	1.365	4.640	5.096	2.699	.648	.096	.262	.614	.295	.447	.417	1.441
1905....	2.182	.510	3.864	2.543	.460	.723	.275	.177	1.928	.245	.431	1.373	1.230
1906....	1.745	1.610	3.727	3.015	1.639	1.093	.615	.279	.030	.466	.747	1.019	1.331
1907....	2.091	.965	2.565	2.487	1.374	1.178	.014	−.161	.837	1.146	3.092	3.143	1.562
1908....	2.978	2.377	3.492	1.729	1.618	.301	−.022	.157	−.127	.072	.110	.210	1.074
1909....	.607	3.537	2.683	2.662	1.553	.370	−.187	−.069	.231	−.079	.127	.407	.967

Yield and rainfall in Lake Cochituate basin at Cochituate, Mass., for 1909, and summaries for 1863 to 1909.

[Drainage area, 18.87 square miles.]

Month.	Total yield in million gallons.	Average yield per square mile.		Rainfall, in inches.[a]	Rainfall collected, in inches.[a]	Per cent collected.
		Million gallons per day.	Second-feet.			
1909.						
January	239.5	0.409	0.633	4.34	0.73	16.8
February	1,089.8	2.063	3.191	5.66	3.32	58.7
March	803.4	1.373	2.125	3.98	2.45	61.5
April	784.9	1.387	2.145	4.50	2.39	53.2
May	460.5	.787	1.218	2.05	1.40	68.5
June	218.7	.386	.598	3.09	.67	21.6
July	68.3	.117	.181	1.73	.21	12.0
August	163.4	.279	.432	2.84	.50	17.5
September	240.8	.425	.658	4.33	.74	17.0
October	53.8	.092	.142	1.06	.16	15.5
November	136.3	.241	.373	3.76	.42	11.1
December	210.8	.360	.558	4.10	.64	15.7
The year	4,470.2	.649	1.004	41.44	13.63	32.9
1863–1909.						
January	30,463.1	1.108	1.714	3.925	1.98	50.4
February	38,741.7	1.547	2.394	3.960	2.51	63.5
March	59,903.3	2.179	3.371	4.386	3.88	88.6
April	45,004.5	1.692	2.617	3.629	2.92	80.5
May	26,656.0	.970	1.500	3.689	1.73	46.9
June	12,306.4	.463	.716	3.026	.80	26.4
July	7,841.0	.285	.441	3.978	.51	12.8
August	11,199.5	.407	.630	4.220	.73	17.2
September	11,369.7	.427	.661	3.613	.74	20.4
October	15,302.0	.557	.861	4.192	.99	23.7
November	21,115.4	.794	1.228	4.043	1.37	33.9
December	25,746.0	.936	1.449	3.578	1.67	46.7
	305,648.6	.944	1.460	46.239	19.83	42.9

[a] For 1909, total for month; 1863 to 1909, average of totals per calendar month.

Yield, in second-feet per square mile, of Lake Cochituate basin at Cochituate, Mass., for 1863 to 1909.

[Drainage area, 18.87 square miles.]

[Corrected for water drawn from Dudley Pond.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1863....	1.661	2.992	3.221	3.955	1.252	0.595	2.553	1.334	0.886	1.135	2.365	1.899	1.980
1864....	2.088	1.445	3.550	2.374	1.400	.436	.357	.585	.440	1.228	1.112	1.020	1.338
1865....	1.784	1.690	4.041	2.421	4.121	.298	.396	.414	.397	.603	.917	.983	1.509
1866....	.641	2.726	1.544	1.452	1.123	.974	1.092	.554	1.181	.813	.872	1.346	1.181
1867....	.951	5.028	3.014	2.567	1.891	.594	.486	1.820	.279	.912	.991	.975	1.603
1868....	1.072	1.035	3.339	3.131	5.358	1.430	.395	.985	1.633	.822	1.781	1.017	1.836
1869....	1.581	1.791	2.888	2.227	1.882	.939	.642	.513	.995	2.024	1.167	2.743	1.618
1870....	4.107	3.790	2.926	6.152	1.440	.870	.464	.347	.575	.831	.716	.677	1.891
1871....	.892	2.195	2.199	1.412	1.733	.782	.373	.604	.255	.532	1.105	1.025	1.086
1872....	.957	.827	1.172	2.655	.951	1.331	.124	1.146	1.522	1.462	1.791	1.048	1.245
1873....	2.682	1.511	3.378	5.458	2.311	.406	.535	1.215	.700	1.768	1.663	2.328	2.000
1874....	2.709	2.104	1.597	2.859	2.410	1.753	.821	.800	.477	.454	.521	.441	1.407
1875....	.115	2.807	2.308	2.823	1.209	1.327	.220	.538	.534	1.037	1.760	1.058	1.296
1876....	.942	1.656	4.507	3.766	1.236	.453	.735	.254	.519	.313	1.664	.855	1.405
1877....	1.040	1.318	5.907	2.907	1.765	.823	.560	.568	.362	.973	2.414	1.704	1.699
1878....	2.816	3.813	4.684	2.559	1.439	.693	.406	.725	.259	.637	1.854	3.501	1.940
1879....	1.118	2.234	2.860	4.019	1.218	.689	.283	.820	.546	.519	.647	.904	1.312
1880....	1.276	2.078	1.553	1.405	.382	.051	.283	.202	.217	.240	.594	.512	.727
1881....	1.035	2.140	4.905	1.607	1.093	1.170	.139	.074	.206	.159	.753	1.220	1.204
1882....	1.595	2.885	3.185	.836	1.345	.556	.052	.062	.865	.731	.520	.796	1.109
1883....	.730	1.526	1.769	1.487	1.091	.060	.015	.063	.392	.381	.359	.813	.719
1884....	1.593	2.656	4.053	3.581	1.203	.603	.227	.530	.120	.294	.557	1.575	1.411
1885....	1.645	1.919	1.916	2.114	1.401	.383	.000	.291	.227	.684	1.838	1.422	1.147
1886....	1.980	7.615	3.046	2.261	.943	.172	.217	.117	266	.360	1.075	1.817	1.615
1887....	3.524	4.168	4.080	3.011	1.171	.735	.625	1.149	.574	.428	.622	.835	1.729
1888....	.984	2.568	4.129	3.090	2.056	.478	.407	.815	2.072	2.229	3.775	4.732	2.275
1889....	3.905	1.778	1.809	1.947	1.038	1.055	1.413	2.973	1.604	1.655	2.642	2.830	2.059
1890....	1.665	1.955	5.092	1.999	1.608	1.261	.284	.402	1.255	2.953	1.333	1.833	1.806
1891....	5.428	6.360	6.965	3.865	.764	.690	.432	.626	.682	.681	.743	1.093	2.337
1892....	2.628	1.446	2.618	.808	1.758	.442	.286	.483	.543	.495	.977	.728	1.104
1893....	.555	2.450	3.577	2.177	1.585	.671	.330	.669	.378	.923	.749	1.283	1.272
1894....	1.053	1.607	2.210	1.927	.789	.403	.325	.359	.407	.571	.827	.992	.951
1895....	1.368	.721	3.032	2.997	.841	.364	.486	.429	.621	1.711	3.145	2.083	1.486
1896....	1.494	3.419	4.791	1.805	.541	.639	.325	.410	.923	1.113	1.250	1.131	1.480
1897....	1.421	1.588	2.792	1.659	1.207	1.067	.653	.542	.410	.375	1.510	1.870	1.256
1898....	1.971	3.894	2.700	2.414	1.615	.700	.321	1.129	.278	1.393	2.073	2.377	1.725
1899....	2.991	2.223	5.505	2.545	.599	.102	.028	.079	.449	.543	.446	.352	1.319
1900....	1.060	4.136	4.020	1.454	1.641	.455	.293	.558	.640	.689	1.087	1.502	1.445
1901....	.840	.629	3.845	4.649	3.704	1.019	.792	1.101	1.012	1.083	1.034	3.675	1.959
1902....	2.071	1.934	6.022	2.741	.955	.319	.398	.604	.688	.814	.710	2.052	1.612
1903....	2.184	2.734	4.311	3.106	.689	2.132	.553	.408	.130	.886	.534	.815	1.531
1904....	.910	1.167	4.108	4.695	2.032	.489	.059	.398	.901	.364	.758	.698	1.379
1905....	1.824	.422	3.127	2.064	.531	.643	.180	.571	1.647	.685	.878	1.398	1.169
1906....	1.363	1.226	3.017	2.388	1.395	.772	.640	.490	.429	.738	.722	.705	1.157
1907....	1.645	.903	2.061	1.964	1.238	.902	.108	.252	.952	.988	2.361	2.492	1.322
1908....	2.049	2.412	2.946	1.525	1.331	.315	.245	.184	—.030	.108	.123	.387	.964
1909....	.633	3.191	2.125	2.145	1.218	.598	.181	.432	.658	.142	.373	.558	1.004

TAUNTON RIVER DRAINAGE BASIN.

DESCRIPTION.

The headwaters of Taunton River rise in the swamps and small ponds of Plymouth and Bristol counties, in the eastern part of Massachusetts. The main river is formed in the eastern part of the township of Bridgewater, by the union of Matfield and Town rivers.

Matfield River rises near Holbrook and flows in a general southerly direction, receiving the drainage of several swamps and ponds in its course. Near East Bridgewater it is joined by Beaver Brook, which rises in the townships of Whitman and Abington, and near Elmwood it receives Satucket River, which drains several large swamps and ponds of East Bridgewater, Whitman, Abington, Halifax, and Hanson. The river then flows in a generally southeasterly course to its junction with Town River. Town River rises in Stoughton and Easton, flows southward into a swamp of about 7,000 acres, known as Great Cedar Swamp, and from this natural reservoir passes eastward through Bridgewater to its junction with Matfield River at Paper Mill village.

The principal tributaries of Taunton River are Wenatuxet, Namasket, Mill, and Threemile rivers, the last two entering below tidewater. Wenatuxet River rises in several small ponds in Plympton and Carver and flows in a general westerly course, receiving Raven Brook and Bartletts Brook from the south. Namasket River enters the Taunton near Titicut. In its drainage area Assawompsett and Long ponds. Mill River rises in Foxboro, Mansfield, and Easton, flows southward into Great Cedar Swamp, and joins the Taunton in the city of Taunton. Threemile River rises in Foxboro and flows southeastward, joining the Taunton at North Dighton. The Taunton is tidal up to East Taunton, where there is about 2½ feet of rise and fall, and it is navigable to Weir village.

On account of the large number of small ponds and swamps throughout the drainage the run-off through the year is fairly uniform, except in the Matfield drainage basin. There are several power plants on the main river and on the branches.

The average rainfall in this region is about 46 inches. On account of the proximity of this basin to the ocean the winters are not severe.

The country as a whole is very flat, swamps are numerous, and not much rock is found. The western portion of the drainage area is clay bottom and the eastern is sandy but fairly fertile. Nearly all the timber has been removed.

MATFIELD RIVER AT ELMWOOD, MASS.

This station, which is located at the stone arch bridge at Bedford Street, near the village of Elmwood, in the southern part of the town of East Bridgewater, was established September 29, 1909, in cooperation with the State of Massachusetts, for the purpose of determining the amount of water available for a canal (surveys for which have been made by the United States Army engineers) and to aid in an inquiry as to the pollution of Taunton River by sewage.

Above the station is a small unused mill dam. Below, at Paper Mill village, Bridgewater, there is a dam which materially affects the flow at times by creating backwater. In using the records from this station for any day account should be taken of the conditions at this dam.

A staff gage is set in the river about 30 feet above the bridge and a chain gage is located on the bridge.

Measurements are made at medium and high water from the bridge and at low water by wading. During ordinary winters ice does not affect the flow. A fairly good rating curve, has been developed but is withheld for the present, together with the daily gage readings, pending confirmation of data.

Discharge measurements of Matfield River at Elmwood, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
Sept. 29	P. M. Churchill	19	21.5	1.50	34.4
Oct. 1	D. M. Wood	19.5	13.8	1.12	11.3
1	R. J. Coffin	19.5	14.4	1.12	11.9
21	D. M. Wood	13	3.6	.70	6.0
Nov. 11	P. M. Churchill	9	11.8	.93	5.7
11	.....do	9	12.6	.92	6.1
15	R. J. Coffin	21	13.6	1.22	6.4
29	P. M. Churchill	25	39.9	2.26	44.6
Dec. 1	T. W. Norcross	27.5	36.0	1.98	33.4
1	R. J. Coffin	27.5	35.8	2.00	33.1
17	P. M. Churchill	26	47.5	2.53	61.7

NOTE.—Gage heights Sept. 29 and Oct. 1 obtained from corresponding staff gage readings by means of curve of relation. Measurements Dec. 1 made from bridge; all others by wading.

SATUCKET RIVER NEAR ELMWOOD, MASS.

This station, which is located at a bridge owned by the Carver Cotton Gin Co., about 200 feet downstream from their dam, was established September 29, 1909, in cooperation with the State of Massachusetts. In conjunction with the station on the Matfield, records are being obtained for use in the investigation of water supply, water power, and the pollution of the streams in this locality.

Water power is used at this place for only a portion of the year. When the wheels are running it is necessary to make special computations of the flow.

On account of the large number of swamps and ponds in this drainage the flow is more evenly distributed throughout the year than on the Matfield.

A staff gage was at first used at this station. This gage was soon replaced by a chain gage, which was set at a different datum. Discharge measurements are made from the bridge on which the gage is placed, and at low water by wading below the station. The rating curve is not yet fully developed. Ice does not usually interfere with the flow. The daily gage readings are withheld pending the confirmation of data.

Discharge measurements of Satucket River at Elmwood, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 29[a]	P. M. Churchill	20	16.5	1.51	27.8
Oct. 1[a]	D. M. Wood	21	16.7	1.21	14.9
1[b]	.....do	24.5	16.6	1.21	12.8
Oct. 21[a]	.....do	20	12.4	1.09	5.7
Nov. 11[b]	P. M. Churchill	19	14.4	1.17	9.3
11[b]	.....do	21	12.3	1.17	6.8
Nov. 29[a]	.....do	26	46.8	2.55	67.6
Dec. 1	T. W. Norcross	27.3	43.4	2.30	73.1
Do..	R. J. Coffin	27.3	43.3	2.32	74.4
Dec. 17[a]	.....do	26.8	41.2	2.39	74.3

[a] Made by wading. [b] Made by wading; accuracy questionable.

TENMILE RIVER DRAINAGE BASIN.

DESCRIPTION.

Tenmile River rises near North Attleboro, Mass., and flows in a general southerly direction to Lebanon Mills, where it is met by another branch which rises near Attleboro. The river then flows southward, following very closely the Rhode Island and Massachusetts boundary line. Near East Providence Center, R. I., it makes an abrupt turn to the west, and enters Seekonk River, the head of Narragansett Bay. As the basin contains many small ponds, the flow of the river is fairly uniform through the year. Practically all of the fall is already developed.

The basin is in general rather flat. The timber is practically removed. The soil is mainly clay and sand.

The average rainfall of this region is about 46 inches. The basin is so near the coast that winters are rather mild.

TENMILE RIVER NEAR RUMFORD, R. I.

This station, which is located at a wooden highway bridge just below the outlet of Central Pond and is near the town of Rumford, R. I., was established August 12, 1909, in cooperation with the Natural Resources Survey of the State of Rhode Island.

A staff gage was nailed to a supporting pile under the bridge. During the low-water period, when no water is going over the Central Pond dam, the flow at the gaging station is controlled by gates at the dam. About a mile below the station is the filtration plant of the East Providence Water Co. As the dam at this place at times causes backwater at the gage, an auxiliary gage has been placed near the gates of the Central Pond dam.

Discharge measurements are made from the highway bridge or by wading. The natural conditions governing measurements are poor, and hence the station was discontinued December 31, 1909.

Owing to the difficulties caused by the relocation of the gage and to backwater effects it has been impossible to make satisfactory estimates of daily discharge.

Discharge measurements of Tenmile River at Rumford, R. I., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 12	D. M. Wood	25	18.3	1.42	10.9
Sept. 3	.....do	21	12.7	1.30	11.2
21	.....do	6.5	2.7	1.10	6.5
24	.....do			[a] 1.26	[b] 4.2
Nov. 18	T. W. Norcross	26	23.4	[c] 1.64	31.5

[a] Upper gage, 5.92 feet. [b] Discharge estimated. [c] Upper gage, 6.18 feet.

NOTE.—Gage heights refer to lower gage.

Daily gage height, in feet, of Tenmile River at Rumford, R. I., for 1909.

[S. F. Dunlap, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Date.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.60	5.92	6.14		16	1.42				
2						17	1.52				
3		1.50	5.90	6.17		18	1.76		5.90		
4		1.40	5.90			19	1.86				6.30
5			5.92			20	1.72		5.90	6.03	
6			5.92	6.30		21	1.52	1.18			
7			6.11			22	1.42	1.27			
8			6.27			23	1.52				
9				6.30		24	1.63	1.32			
10					6.30	25	1.53		5.90		
11			6.03			26	1.42		5.90	5.90	
12	1.42	1.32		6.30		27	1.20	6.08	6.05		
13				6.30		28	1.26		5.90		
14	1.30		5.90			29	1.22	6.24	6.10		
15	1.35					30	1.20	6.21		6.03	
						31	1.80		6.20		

NOTE.—All readings to Sept. 24 refer to lower staff gage at bridge. Readings beginning Sept. 27 refer to upper staff gage at the Central Pond gates.

BLACKSTONE RIVER DRAINAGE BASIN.

DESCRIPTION.

Blackstone River rises in Worcester County, near the city of Worcester, Mass., where it is formed by the run-off from several ponds. It flows in a general southeasterly direction, receiving from the west Singleton Brook, Cold Spring Brook, Mumford River, and Branch River, and from the east Quinsigamond River (the outlet of Quinsigamond Lake), West River, Mill River, and Abbot River, and empties into Seekonk River, the head of Narragansett Bay, below Pawtucket, R. I.

The Blackstone has always been important as a water-power stream and has been very fully utilized. The basin contains no large lakes, but its many small ponds and reservoirs are used for storage. The flow of the river is thus made fairly constant. The tributaries, though small, are also well developed for power.

The average rainfall on this drainage basin is about 45 inches.

BRANCH RIVER AT BRANCH VILLAGE, R. I.

Branch River rises near the western boundary of the State of Rhode Island, flows easterly and northeasterly through several small ponds and receives the drainage from other ponds and swamps, and enters Blackstone River near Blackstone, Mass.

The gaging station, which is located at Branch village just below the mill of James Pitts & Son, three-fourths of a mile from Forestdale and about 2 miles from Woonsocket, was established in cooperation with the State of Rhode Island in its survey of the natural resources of the State.

A staff gage is bolted to a ledge outcrop about 500 feet below the dam and mill. A chain gage is attached to a tree on top of the ledge. Discharge measurements are made by wading at low and medium stages and from the bridge above the dam or from a boat at high stages. The conditions are fairly favorable for accurate measurements. The flow is affected by the mill control directly above the station and by similar control farther up the river. The storage above the Pitts mill is small, and water goes over the dam for a large portion of the time. During the winter ice affects the flow only in severe weather.

A fairly good discharge curve has been developed from 1909 and 1910 measurements. The daily gage heights are not published, as they are not a true index of the discharge for 24-hour periods.

Discharge measurements of Branch River at Branch village, R. I., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 2	D. M. Wood	100	83.6	2.10	193
4	.....do	27.5	16.6	.81	9.9
25	.....do	30	22.7	.76	5.5
Nov. 26	T. W. Norcross	92	83.3	2.16	182

NOTE.—Measurements made by wading. Gage heights refer to the staff gage.

Daily discharge, in second-feet, of Branch River at Branch village, R. I., for 1909.

Date.	Sept.	Oct.	Nov.	Dec.	Date.	Sept.	Oct.	Nov.	Dec.
1	....	97	53	97	16	70	24	93	105
2	156	37	56	90	17	80	*a* 8	37	136
3	146	*a* 4	73	77	18	26	86	86	32
4	26	84	81	15	19	*a* 8	90	91	*a* 4
5	*a* 8	102	54	*a* 3	20	61	90	21	74
6	11	97	15	83	21	80	94	*a* 4	90
7	61	88	*a* 8	83	22	80	50	84	89
8	84	88	92	90	23	91	28	94	91
9	80	31	92	90	24	70	*a* 8	105	86
10	53	*a* 6	37	90	25	26	42	11	20
11	34	108	90	20	26	*a* 8	54	90	*a* 20
12	*a* 8	96	99	*a* 6	27	61	26	7	103
13	61	90	26	79	28	72	71	*a* 6	101
14	80	97	*a* 4	101	29	80	65	85	110
15	80	85	90	103	30	96	16	88	101
					31	....	*a* 6	....	100

a Sunday.

NOTE.—Daily discharges were obtained by weighting discharges obtained from gage heights observed when mill was running and not running.

Monthly discharge of Branch River at Branch village, R. I., for 1909.

[Drainage area, 93 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Sept. 2–30	156	8	62.0	0.667	0.72	B.
October	108	4	60.3	.648	.75	B.
November	105	4	59.1	.635	.71	B.
December	136	3	73.8	.794	.92	B.

PAWTUXET RIVER DRAINAGE BASIN.

DESCRIPTION.

Pawtuxet River is formed near Richmond, R. I., by the union of Ponagansett and Moswansicut rivers. Ponagansett River rises in Ponagansett reservoir, in the town of Foster, R. I., and flows in a general southeasterly direction, receiving the drainage from several small ponds and swamps. Moswansicut River rises in a pond of the same name near North Scituate, R. I., and flows southward, receiving near its source several small brooks coming from the northwest. Pine Swamp reservoir and Quonopaug Brook also drain into this river. Below the junction of the two branches the river flows to the east and south to Riverpoint, where it is joined by the southwest branch of Pawtuxet River. This river drains a region of ponds and swamps, the largest of which is Flat River reservoir.

The Pawtuxet then flows to the northeast, receiving the Pocasset River from the north, and enters Narragansett Bay at Pawtuxet.

PAWTUXET RIVER AT HARRIS, R. I.

This station, which is located at the highway bridge near the Harris railroad station, was established August 12, 1909, and is maintained in cooperation with Natural Resources Survey of the State of Rhode Island.

The station is located between two mills, each about 2,000 feet distant. When the lower mill is not running backwater exists at the bridge. The rating curve is applicable for periods when both mills are running. When both are stopped the rating curve is applicable only for periods when the water is flowing over the lower dam.

The flow through the wheels at the mill above the station does not vary materially through the day except at times of extreme low water, when the amount of water is insufficient to run the mill for the entire day. Except for the difficulties caused by the mills the conditions for obtaining accurate discharge data are good. Careful observations of the many important conditions are made by the observer. The daily gage heights are not published because they do not truly indicate the discharge for 24-hour periods. Discharge measurements are made from the highway bridge, where the conditions are good. No change has been made in the datum of the chain gage located on the bridge.

Discharge measurements of Pawtuxet River at Harris, R. I., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 11	D. M. Wood	75.5	135	1.78	135
31	do			1.23	14.2
Sept. 23	do	74.5	108	1.58	74.2
23	do			1.30	a2
Nov. 27	T. W. Norcross			1.15	a 0
27	do	75.5	127	1.77	126

a Discharge estimated; mills not running.

Daily discharge, in second-feet, of Pawtuxet River at Harris, R. I., for 1909.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		23	54	13	55	16	68	24	0	23	166
2		13	26	25	30	17	85	20	a 0	43	85
3		9	a 0	21	24	18	160	14	20	20	34
4		0	25	25	30	19	45	a 0	22	28	a 10
5		a 0	0	40	a 5	20	40	26	14	23	129
6		4	17	19	46	21	25	24	16	a 0	105
7		4	25	a 0	143	22	a 0	19	27	31	90
8		4	21	40	95	23	2	20	13	24	94
9		16	12	40	96	24	11	17	a 0	28	96
10		31	a 0	23	79	25	18	30	26	7	0
11		14	26	25	26	26	0	a 0	18	102	a 22
12	70	a 0	26	12	a 0	27	17	10	21	30	114
13	68	4	21	5	20	28	9	21	23	a 12	60
14	40	21	18	a 0	230	29	a 0	94	11	76	100
15	a 0	28	23	9	200	30	8	78	17	95	97
						31	14		a 0		96

a Sunday.

NOTE.—Daily discharges were obtained by special computations by weighting the discharges for hours when mills were running and when not running.

Monthly discharge of Pawtuxet River at Harris, R. I., for 1909.

[Drainage area, 103 square miles.]

Month.	Discharge, in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Aug. 12-31	160	0	34.0	0.330	0.25	C.
September	94	0	18.9	.183	.20	C.
October	54	0	16.8	.163	.19	C.
November	102	0	28.0	.272	.30	C.
December	230	0	76.7	.745	.86	C.

PAWCATUCK RIVER DRAINAGE BASIN.

DESCRIPTION.

Pawcatuck River is formed near Wood River Junction, R. I., by the union of Wood and Charles rivers. Wood River rises in swampy land in Sterling, Conn., flows generally southeast to Mount Tom,

R. I., where it is joined by Flat River, which rises in swamps at West Greenwich, R. I. Wood River then flows southward to its junction with Charles River. The Charles is formed by the outflow from Great Swamp and from Wordens Pond, flows westward, and receives the drainage of several small swamps and ponds. The Pawcatuck follows a winding course, in general westerly for about 8 miles, then turns to the south, and enters the ocean at Little Narragansett Bay.

The slope of the river is in general small, but several of the small power sites on Wood River are undeveloped. The natural storage on this drainage is good.

WOOD RIVER AT HOPE VALLEY, R. I.

This station, which is located just below the dam of the Taylor Manufacturing Co. and about half a mile below Hope Valley, was established August 13, 1909, in cooperation with the State of Rhode Island, to obtain data regarding the flow of streams in this section in connection with the investigation of the natural resources of the State.

The low-water portion of the staff gage is bolted to a bowlder in the middle of the river a little below the outlet of the tailraces. The high-water portion is on the left bank nearly opposite the low-water portion. At low and moderately low water measurements are made by wading about one-fourth mile downstream, where the conditions are favorable for obtaining accurate data. At medium and high stages measurements must be made from the highway bridge just above the gage and from the bridge over the tailrace. The sections at these two places are not very good and the distribution of velocity is unfavorable for accurate results. The flow during the day is rather uniform, except as governed by the wheels at the Taylor plant.

The datum at the gage has remained the same during the maintenance of the station. During the winter months the discharge is somewhat affected by ice. A good rating curve has been developed from 1909 and 1910 discharge measurements.

Discharge measurements of Wood River at Hope Valley, R. I., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 13	D. M. Wood	50	24.5	1.07	44.3
Sept. 1	.....do	40	23.7	1.02	39.4
Do.	.....do	38	16.0	.77	17.5
Sept. 22	.....do	42	29.6	1.15	59.2
Nov. 19	T. W. Norcross	55	47.9	1.38	98.7

NOTE.—All measurements by wading except that of August 13, which was made by floats.

Daily gage height, in feet, and discharge, in second-feet, of Wood River, at Hope Valley, R. I., for 1909.

[C. S. Taylor, observer.]

Day.	August.		September.		October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.05	43	1.19	62	1.26	75	1.26	75
2			1.10	49	1.18	61	1.26	75	1.26	75
3			1.18	61	1.05	43	1.26	75		70
4			1.18	61	1.25	73	1.26	75	1.20	64
5			.92	29	1.26	75	1.24	71		78
6			1.16	58	1.26	75	1.27	77	1.35	93
7			1.14	55	1.24	71	1.10	49	1.35	93
8			1.16	58	1.18	61	1.25	73	1.21	66
9			1.14	55	1.02	39	1.25	73	1.20	64
10			1.19	62	1.22	68	1.27	77	1.26	75
11			1.16	58	1.25	73	1.28	78	1.21	66
12			.88	25	1.27	77	1.28	78		70
13	1.07	45	1.14	55	1.24	71	1.26	75	1.26	75
14		50	1.14	55	1.26	75	1.10	49	1.50	128
15		55	1.14	55	1.23	69	1.25	73	1.61	159
16		60	1.16	58	1.19	62	1.31	84	1.46	118
17	1.20	64	1.15	56	1.05	43	1.28	78	1.41	106
18	1.16	58	1.16	58	1.24	71	1.28	78	1.35	93
19	1.16	58	1.12	52	1.25	73	1.28	78		88
20	1.15	56	.96	33	1.24	71	1.15	56	1.30	82
21	.92	29	1.16	58	1.24	71	1.00	49	1.34	91
22	1.15	56	1.20	64	1.25	73	1.24	71	1.30	82
23	1.16	58	1.19	62	1.22	68	1.29	80	1.30	82
24	1.10	49	1.20	64		70	1.30	82	1.28	78
25	1.13	54	1.06	44	1.24	71		82		74
26	1.23	69	1.00	37	1.25	73	1.30	82		68
27	1.19	62	1.12	52	1.26	75	1.30	82	1.20	64
28	1.15	56	1.15	56	1.24	71		88	1.25	73
29	.91	28	1.22	68	1.23	69	1.35	93	1.28	78
30	1.06	44	1.26	75	1.24	71	1.35	93	1.38	100
31	1.12	52			1.00	37			1.28	78

NOTE.—The daily discharge is based on a well-defined rating curve. Discharge on days of missing gage heights interpolated.

Monthly discharge of Wood River at Hope Valley, R. I., for 1909.

[Drainage area, 72 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Aug. 13-31	69	28	52.8	0.733	0.52	A.
September	75	25	53.9	.749	.84	A.
October	75	37	66.5	.924	1.07	A.
November	93	49	75.0	1.04	1.16	A.
December	159	64	84.1	1.17	1.35	A.

CONNECTICUT RIVER DRAINAGE BASIN.

DESCRIPTION.

Connecticut River rises in the Connecticut Lakes in northern New Hampshire, flows in a southerly direction between New Hampshire and Vermont and across Massachusetts and Connecticut to Long

Island Sound. It is the largest river in New England except the St. John, is about 345 miles long and drains an area of 11,085 square miles, of which about 155 square miles lie in the Province of Quebec.

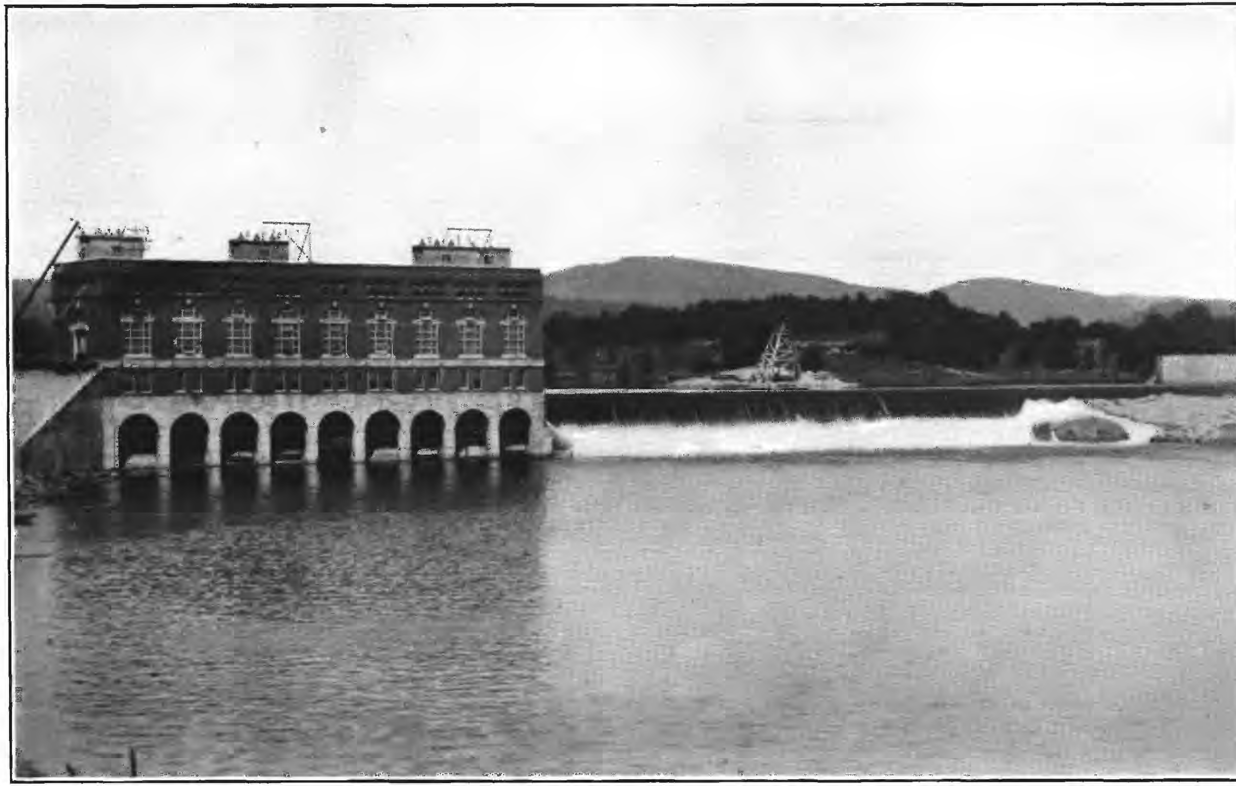
The river has many important tributaries, among which are Passumpsic, Ammonoosuc, Wells, White, Mascoma, Ottaqueechee, Sugar, West, and Ashuelot rivers, which join north of the Massachusetts line; Millers, Deerfield, Chicopee, and Westfield rivers, which enter in the State of Massachusetts; and Farmington River, which enters near Hartford, Conn.

From its headwaters in the Connecticut Lakes to Long Island Sound the Connecticut falls about 1,900 feet. The upper portions of the drainage area are rugged and the surface of the country is broken by undulating ridges, here and there rising to mountain height, and is for the most part forested. In central and southern New Hampshire and Vermont the country is hilly, and most of the tributary streams have a good fall but more of the area is in cultivation. Deerfield and Westfield rivers, rising in the Berkshires, in Massachusetts, are quick-spilling streams, with steep slopes and narrow valleys, largely wooded; Millers and Chicopee rivers on the east drain a flatter country with numerous ponds and reservoirs. In Connecticut the river valley is generally broad and the country rolling, its soil is very fertile, and it is an important farming district.

The rocks are in general granite, gneiss, mica slate, and mica schists. An exception to this is the red sandstone in the Connecticut Valley, extending from New Haven nearly to the northern boundary of Massachusetts. The prevailing surface material is glacial drift.

The mean annual precipitation in the Connecticut Valley is about 40 inches, ranging from about 47 inches at Hartford to probably about 35 inches in the extreme upper portions. In a general way, there is usually a difference of a month in the time of beginning of the spring season in the lower portion of the river and its headwaters, and this tends to diminish the severity of floods from melting snow and equalize the spring run-off. The range in winter conditions is also somewhat variable, the lower courses of the river being subject usually to several thaws, while the upper third of the river usually remains frozen throughout the winter. Snow accumulates to considerable depths. The river is navigable to Hartford and, by smaller boats, as far as Holyoke.

The natural facilities for storage on Connecticut River are perhaps less than on many of the New England rivers, although on Millers, Chicopee, and Farmington rivers some storage has been developed. There are, however, many localities in this basin where reservoirs could be constructed, and there is need of systematic effort in this direction as the low-water flow on the Connecticut could be much improved by utilizing some of these storage sites, especially in the upper portions of the basin.



HYDROELECTRIC PLANT OF CONNECTICUT RIVER TRANSMISSION CO. AT VERNON, VT.

The Connecticut and its tributaries are very important for water power. On the main river large power plants are in operation at Wilder, Bellows Falls, Turners Falls, and Holyoke. In 1909 a hydro-electric power station on the Connecticut at Hinsdale, N. H., was completed. This plant furnishes power for Fitchburg and Worcester. Many power sites in this basin are still undeveloped. (See Pl. V.)

The longest record of flow in the Connecticut is at Holyoke, Mass., and extends back to 1880. This record was interrupted in 1899, but since 1904 the records of the station at Sunderland are available for purposes of comparison. The driest year during the period covered by these records was 1883, and the wettest 1888, the total flow during these two years being about in the ratio of 1 to 2.14.

CONNECTICUT RIVER AT ORFORD, N. H.

This station, which is located at the wooden highway bridge between Orford, N. H., and Fairlee, Vt., was established August 6, 1900, to obtain information regarding the daily distribution of flow of the upper Connecticut River. Several small streams enter the Connecticut near Orford, but the only one of any considerable size is Waits River, about 5 or 6 miles above the station. The nearest dam is at Wilder, about 18 miles downstream. Backwater from this dam reaches probably within a few miles of Orford. Upstream the nearest dam is at East Ryegate, Vt., about 20 miles distant.

The chain gage is attached to the bridge, from which discharge measurements are made. Its datum has remained the same during the maintenance of the station. During the winter months the discharge is affected by ice, but numerous discharge measurements under ice cover have been made, and fairly good rating curves have been developed for these conditions. Conditions for obtaining accurate discharge data during the open season are good, and a fairly good rating curve has been developed for the period prior to 1906.

During 1906 the 1905 rating curve is assumed to apply. Measurements made during 1908 to 1911 indicate considerable change in conditions of flow and new location for high-water portions of the curve, necessitating a new rating curve, which is used for 1908–9. For 1907 the curve is assumed parallel to the later curve and 0.3 foot lower in gage heights.

Discharge measurements of Connecticut River at Orford, N. H., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gauge height.	Dis-charge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 9[a]	H. F. French	270	2,200	[b]8.90	4,140
July 19	D. M. Wood	271	1,460	4.48	1,800
Sept. 9	do	268	1,430	4.53	1,800
Oct. 26	do	277	1,590	5.18	2,340
Dec. 18[c]	do	275	1,570	5.10	1,640

[a] Measurement made under ice cover. Average thickness of ice, 1.5 feet.
[b] Gage height to water surface in a hole in the ice.
[c] Ice cover above and below bridge; open at gage. Shore ice at gaging section.

Daily gage height, in feet, of Connecticut River at Orford, N. H., for 1909.

[F. H. Gardner, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1			10.2	13.1	9.4	4.1	3.0	3.0	8.5	4.3	6.5
2		7.2	9.8	10.6	12.9	8.8	4.3	3.0	3.3	8.7	4.4	6.8
3	4.0			11.2	12.4	8.2	4.3	2.8	3.0	6.1	4.4	6.7
4		7.1	9.0	12.3	12.3	7.6	4.2	2.7	3.1	6.1	4.5	6.5
5	5.2			13.9	12.7	7.2	4.0	2.8	3.1	6.7	4.7	6.2
6		7.3	8.5	16.1	13.0	7.9	4.5	2.8	3.3	6.5	4.9	5.6
7	10.0			18.0	13.0	8.5	5.2	3.0	3.7	6.4	5.4	5.4
8	9.8	7.4	8.3	21.2	14.3	8.1	5.0	2.9	4.2	5.2	5.0	5.3
9	9.0			21.6	15.0	7.5	4.7	3.0	4.5	5.0	5.0	5.1
10	8.6	8.8	7.9	19.0	15.7	6.9	4.2	2.5	4.3	4.5	4.8	5.2
11				18.8	16.8	6.3	4.4	2.8	4.2	4.0	5.0	5.0
12	7.7	8.4	7.6	18.7	18.4	6.1	4.1	2.5	3.9	4.2	5.3	4.9
13				18.2	17.7	6.0	3.8	2.6	3.7	4.0	5.1	4.8
14	6.6	7.7	7.8	19.0	17.0	5.7	3.8	2.7	4.0	4.0	5.0	4.7
15				27.0	15.3	6.3	3.5	2.6	4.0	4.0	4.9	5.2
16	6.1	7.1	7.5	30.3	15.2	6.0	3.5	2.8	3.9	4.1	5.0	5.0
17				30.25	15.8	5.9	3.5	2.7	3.7	3.8	5.0	4.8
18	5.6	6.7	7.4	29.1	16.3	6.9	4.0	2.7	3.4	4.0	4.8	5.2
19				27.1	16.8	6.6	4.7	2.6	3.5	4.0	4.8	4.8
20	5.5	6.6	7.3	25.6	16.4	6.8	4.4	2.7	3.6	4.3	4.8	4.8
21	5.7	10.0		25.3	15.2	6.6	4.3	2.9	3.5	4.2	4.9	4.8
22		11.9	7.0	23.9	14.8	6.2	4.2	3.0	3.6	4.3	5.0	4.7
23		11.0		21.9	12.0	6.0	4.0	3.2	3.6	4.3	5.0	4.6
24	6.0	11.9	6.6	19.8	11.7	6.1	3.9	3.4	3.5	4.4	4.6	4.5
25		12.0		17.2	10.2	5.9	3.7	3.4	3.8	4.5	5.6	4.3
26	6.0	11.9	8.2	15.5	9.9	5.9	4.0	3.3	3.7	4.9	6.2	4.2
27	7.9			14.3	9.4	4.8	3.5	3.1	3.6	5.0	6.5	4.2
28		11.2	9.7	13.3	9.0	4.7	3.4	3.0	3.7	5.7	6.7	4.4
29	8.0			13.5	10.4	4.4	3.2	3.1	6.2	5.1	6.5	5.0
30			9.8	13.4	12.3	4.2	3.1	3.3	8.0	4.5	6.2	4.5
31	7.3		9.9		11.0		3.1	3.2		4.5		4.0

NOTE.—Ice conditions prevailed from Jan. 1 to Apr. 2 and from Dec. 15 to 31. Gage heights during these periods are to water surface, except Dec. 30 and 31, which are to the top of the ice.

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for 1907–1909.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1,500	1,420	1,360	21,900	35,400	5,320	6,900	4,600	1,340	10,700	11,600	3,200
2	1,500	1,400	1,340	16,600	39,000	5,450	9,770	6,100	1,400	11,200	9,180	3,000
3	1,500	1,380	1,320	15,000	40,600	4,720	9,320	6,230	1,400	10,400	10,100	3,000
4	2,000	1,320	1,320	13,000	36,300	4,600	9,470	5,580	1,400	8,600	11,800	2,800
5	2,800	1,300	1,320	12,000	30,200	4,840	8,300	4,960	1,950	7,740	11,500	2,500
6	3,550	1,250	1,320	13,000	24,200	4,960	7,460	4,600	4,260	7,880	12,800	2,200
7	3,500	1,180	1,320	12,100	19,100	5,200	5,450	4,380	5,080	7,180	14,200	2,000
8	3,500	1,100	1,320	11,600	17,600	5,080	4,600	4,030	3,920	6,500	15,900	2,000
9	3,200	1,040	1,320	9,770	14,000	4,840	4,490	3,590	3,380	11,300	14,800	2,000
10	2,900	980	1,320	8,880	15,500	4,960	4,260	3,280	2,790	14,000	12,800	2,500
11	2,600	1,000	1,310	8,740	16,100	4,260	4,260	2,880	3,280	13,300	10,700	21,300
12	2,300	1,000	1,300	8,600	15,900	4,030	4,030	2,700	2,430	11,600	8,880	26,500
13	2,040	1,000	1,290	8,020	14,200	3,810	4,380	2,430	3,700	13,300	8,020	24,200
14	2,000	1,010	1,290	8,300	11,600	3,810	4,600	2,190	4,840	13,300	7,180	19,100
15	1,900	1,030	1,270	8,740	12,500	3,170	4,720	2,110	4,960	11,600	6,500	9,770
16	1,800	1,050	1,260	8,740	12,600	2,790	5,450	1,950	3,280	9,620	5,840	7,880
17	1,700	1,070	1,240	8,020	14,400	2,610	3,920	1,740	2,970	7,740	5,320	7,180
18	1,600	1,050	1,600	8,600	16,400	2,520	3,170	1,460	2,520	6,500	5,080	6,500
19	1,500	1,080	1,600	8,020	16,600	2,790	2,880	1,400	2,110	5,840	5,080	6,100
20	1,400	1,100	1,800	7,600	13,500	3,170	2,520	1,280	2,610	6,640	4,840	6,900
21	1,400	1,090	2,050	7,320	11,500	8,600	2,430	1,280	2,030	4,960	4,600	7,320
22	1,450	1,200	2,300	7,460	9,620	10,100	2,270	1,220	1,530	5,450	4,380	7,880
23	1,450	1,320	2,500	8,300	8,160	8,450	2,350	1,220	1,530	4,380	4,490	8,160
24	1,450	1,440	2,700	13,000	7,600	5,080	2,520	1,220	2,190	4,140	4,380	12,800
25	1,470	1,440	3,800	24,800	6,230	4,380	2,700	1,160	2,880	3,920	4,380	18,000
26	1,490	1,420	4,500	25,200	5,840	3,810	2,520	1,160	3,810	3,700	4,490	16,300
27	1,510	1,400	6,000	31,200	6,230	3,590	2,700	1,100	3,380	3,590	4,260	15,200
28	1,500	1,380	10,000	31,700	5,960	3,480	2,970	1,100	2,970	3,810	3,920	11,800
29	1,480		15,000	32,300	6,100	4,600	3,380	1,050	3,070	14,400	3,810	10,700
30	1,460		20,000	32,600	5,840	5,580	4,260	1,280	7,180	18,700	3,480	10,100
31	1,440		27,000		5,320		4,490	1,340		15,300		9,920

[a] Gage heights for 1907-8 were published in Water-Supply Paper 241.

NOTE.—Daily discharges for 1907 under open-channel conditions based on a rating curve parallel to the 1908-9 curve and assumed to represent conditions of flow between 1906 and 1908. It can probably be considered fairly representative of conditions during 1907. During the frozen periods, Jan. 1 to Mar. 30 and Dec. 1 to 10, 1907, the daily discharges are based on two ice measurements made during 1907, and approximate ice rating curves. They are only approximate.

Daily discharge, in second feet, of Connecticut River at Orford, N. H., for 1907–1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	9,320	2,350	2,790	16,400	35,400	6,230	1,810	1,200	780	550	640	2,050
2	8,740	2,350	2,770	13,500	31,200	10,800	1,740	1,200	980	640	685	1,890
3	8,300	2,320	2,560	11,000	23,800	8,160	1,740	1,200	830	730	730	1,810
4	7,500	2,340	2,340	8,880	20,900	6,900	1,970	880	830	880	830	1,740
5	7,000	2,360	2,300	6,900	18,200	6,360	1,890	1,200	980	780	780	1,740
6	6,500	2,380	2,260	7,040	15,000	5,080	1,740	1,200	880	1,040	640	980
7	6,000	2,400	2,260	7,880	13,300	4,260	1,660	3,810	730	980	685	1,140
8	6,000	2,420	2,260	10,100	12,000	3,810	1,590	3,590	640	980	730	1,390
9	5,550	2,430	2,200	9,920	13,200	3,170	1,660	3,480	780	880	685	1,590
10	5,100	2,400	2,200	9,320	15,200	2,870	1,590	2,680	550	730	730	1,390
11	4,600	2,400	2,500	10,400	18,200	2,780	1,460	2,220	595	730	730	1,260
12	4,060	2,400	3,000	13,000	16,800	2,780	1,320	1,890	640	640	780	1,200
13	4,000	2,450	3,660	12,300	14,200	2,680	1,090	1,660	685	730	1,040	1,260
14	3,900	3,000	4,500	11,200	15,000	2,400	980	1,590	528	830	1,200	1,390
15	3,800	12,000	5,500	10,400	15,300	2,220	1,140	1,520	550	930	1,260	1,390
16	3,700	18,000	6,600	10,700	13,200	5,320	1,260	1,460	640	980	1,260	1,240
17	3,600	13,000	6,000	10,800	10,700	8,300	1,260	1,460	550	880	1,320	1,120
18	3,480	9,000	5,500	10,200	8,600	11,500	1,220	1,520	595	830	1,260	1,000
19	3,360	7,800	5,300	9,620	8,160	8,160	1,390	1,660	595	685	780	1,000
20	3,250	7,000	5,000	9,470	8,160	5,700	1,660	2,050	505	595	980	1,040
21	3,200	6,200	4,700	9,180	7,880	4,260	2,310	2,050	385	595	930	1,000
22	3,100	5,500	4,500	9,320	6,900	3,170	2,220	1,890	595	640	880	950
23	2,950	4,620	4,300	9,470	6,640	2,780	2,050	1,660	505	595	780	800
24	2,800	4,400	6,900	9,920	6,230	2,680	1,740	1,460	425	640	830	698
25	2,600	4,100	10,000	11,000	5,700	2,220	1,590	1,200	550	640	930	780
26	2,430	4,000	14,000	14,000	5,200	2,050	1,390	1,260	595	595	1,040	860
27	2,450	3,900	18,000	19,700	5,450	1,890	1,200	1,200	465	685	1,320	860
28	2,400	3,500	23,400	22,100	5,700	1,740	1,140	1,200	288	595	1,740	860
29	2,400	3,100	26,500	34,900	5,580	1,660	1,200	1,090	550	730	2,780	870
30	2,400	....	30,600	36,700	6,230	1,520	1,200	880	595	730	2,140	890
31	2,350	....	20,700	....	5,960	....	1,200	880	....	685	....	950

NOTE.—Daily discharges for open-channel conditions 1908–9 based on a well-defined rating curve. Daily discharges during the periods of ice conditions, Jan. 4 to Mar. 27 and Dec. 16–31, 1908, based on two ice measurements made during 1908, approximate ice-rating curves, and climatalogical data. The daily discharges during the periods of ice conditions are only approximate.

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for 1907–1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	1,030	2,840	5,740	7,000	13,000	7,320	1,520	880	880	6,100	1,660	3,700
2	1,030	2,780	4,980	8,200	12,600	6,500	1,660	880	1,040	6,360	1,740	4,030
3	1,020	2,740	4,560	9,920	11,800	5,700	1,660	780	880	3,280	1,740	3,920
4	1,330	2,710	4,150	11,600	11,600	4,960	1,590	730	930	3,280	1,810	3,700
5	1,640	2,740	3,920	14,400	12,300	4,490	1,460	780	930	3,920	1,970	3,380
6	3,820	2,760	3,690	18,500	12,800	5,320	1,810	780	1,040	3,700	2,140	2,780
7	6,000	2,800	3,640	22,300	12,800	6,100	2,400	880	1,260	3,590	2,580	2,580
8	5,720	2,830	3,590	29,100	15,200	5,580	2,220	830	1,590	2,400	2,220	2,490
9	4,850	4,140	3,520	29,900	16,400	4,840	1,970	880	1,810	2,220	2,220	2,310
10	4,480	3,990	3,240	24,400	17,800	4,140	1,590	640	1,660	1,810	2,050	2,400
11	4,100	3,830	3,150	24,000	19,900	3,480	1,740	780	1,590	1,460	2,220	2,220
12	3,570	3,670	3,060	23,800	23,200	3,280	1,520	640	1,390	1,590	2,490	2,140
13	3,000	3,360	3,160	22,700	21,700	3,170	1,320	685	1,260	1,460	2,310	2,050
14	2,430	3,040	3,260	24,400	20,300	2,870	1,320	730	1,460	1,460	2,220	1,970
15	2,270	2,810	3,150	42,000	17,000	3,480	1,140	685	1,460	1,460	2,140	1,990
16	2,100	2,580	3,040	49,700	16,800	3,170	1,140	780	1,390	1,520	2,220	1,870
17	1,900	2,410	2,980	49,600	18,000	3,070	1,140	730	1,260	1,320	2,220	1,760
18	1,690	2,240	2,920	46,800	18,900	4,140	1,460	730	1,090	1,460	2,050	1,640
19	1,660	2,170	2,860	42,200	19,900	3,810	1,970	685	1,140	1,460	2,050	1,520
20	1,640	2,100	2,800	38,800	19,100	4,030	1,740	730	1,200	1,660	2,050	1,520
21	1,700	5,000	2,720	38,100	16,800	3,810	1,660	830	1,140	1,590	2,140	1,520
22	1,770	7,120	2,630	35,000	16,100	3,380	1,590	880	1,200	1,660	2,220	1,470
23	1,940	6,110	2,480	30,600	11,200	3,170	1,460	980	1,200	1,660	2,220	1,410
24	2,010	7,120	2,320	26,100	10,700	3,280	1,390	1,090	1,140	1,740	1,890	1,360
25	2,010	7,310	3,000	20,700	8,450	3,070	1,260	1,090	1,320	1,810	2,780	1,240
26	2,010	7,320	3,680	17,400	8,020	3,070	1,460	1,040	1,260	2,140	3,380	1,190
27	3,440	6,910	4,430	15,200	7,320	2,050	1,140	930	1,200	2,220	3,700	1,190
28	3,500	6,500	5,200	13,300	6,770	1,970	1,090	880	1,260	2,870	3,920	1,210
29	3,570	....	5,400	13,700	8,740	1,740	980	930	3,380	2,310	3,700	1,310
30	3,230	....	5,800	13,500	11,600	1,590	930	1,040	5,450	1,810	3,380	1,260
31	2,890	....	6,300	....	9,620	....	930	980	....	1,810	....	1,020

NOTE.—Daily discharges for open-channel conditions 1908–9 based on a well-defined rating curve. Daily discharges during the periods of ice conditions Jan. 1 to Apr. 2 and Dec. 15–31, 1909, based on two ice measurements made during 1909, approximate ice rating curves, and climatological data. The daily discharges during the periods of ice conditions are only approximate.

Monthly discharge of Connecticut River at Orford, N. H., for 1907–1909.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1907.						
January	3,550	1,400	1,960	0.594	0.68	C.
February	1,440	980	1,190	.361	.38	C.
March	27,000	1,240	3,970	1.20	1.38	C.
April	32,600	7,320	14,400	4.36	4.86	A.
May	40,600	5,320	15,900	4.82	5.56	A.
June	10,100	2,520	4,690	1.42	1.58	A.
July	9,770	2,270	4,600	1.39	1.60	B.
August	6,230	1,050	2,600	.788	.91	B.
September	7,180	1,340	3,010	.912	1.02	B.
October	18,700	3,590	8,940	2.71	3.12	B.
November	15,900	3,480	7,810	2.37	2.64	B.
December	26,500	2,000	9,320	2.82	3.25	C.
The year	40,600	980	6,570	1.99	26.98	
1908.						
January	9,320	2,350	4,410	1.34	1.54	C.
February	18,000	2,320	4,830	1.46	1.56	C.
March	30,600	2,200	7,580	2.30	2.65	C.
April	36,700	6,900	12,800	3.88	4.33	A.
May	35,400	5,200	12,700	3.85	4.44	A.
June	11,500	1,520	4,450	1.35	1.51	A.
July	2,310	980	1,540	.467	.54	A.
August	3,810	880	1,690	.512	.59	A.
September	980	288	627	.190	.21	A.
October	1,040	550	747	.226	.26	A.
November	2,780	640	1,040	.315	.35	A.
December	2,050	698	1,200	.364	.42	B.
The year	36,700	288	4,470	1.36	18.40	
1909.						
January	6,000	1,020	2,690	.815	.94	C.
February	7,320	2,100	4,000	1.21	1.26	C.
March	6,300	2,320	3,620	1.10	1.27	C.
April	49,700	7,000	25,400	7.70	8.59	A.
May	23,200	6,770	14,400	4.36	5.03	A.
June	7,320	1,590	3,890	1.18	1.32	A.
July	2,400	930	1,490	.452	.52	A.
August	1,090	640	836	.253	.29	A.
September	5,450	880	1,460	.442	.49	A.
October	6,360	1,320	2,360	.715	.82	A.
November	3,920	1,660	2,380	.721	.80	A.
December	4,030	1,020	2,070	.627	.72	B.
The year	49,700	640	5,370	1.63	22.05	

CONNECTICUT RIVER AT SUNDERLAND, MASS.

This station, which is located at a five-span steel highway bridge at Sunderland, about 18 miles above the Holyoke dam and 5 miles below that at Turners Falls, was established March 31, 1904, to obtain information regarding the daily distribution of flow of the river.

A record of flow of the Connecticut at Holyoke was carried on from 1880 to 1899, but interrupted after that time, and as this station has practically the same drainage area, it is of especial value in continuing the Holyoke records, which have been very widely used in power, storage, and navigation studies both on the Connecticut and on streams of similar regimen.

Deerfield River enters the Connecticut a short distance below Turners Falls, about 4 miles above the station.

The chain gage attached to the bridge is read twice daily. Its datum has remained the same during the maintenance of the station Discharge measurements are made from the bridge. During the winter months the discharge is usually affected by ice. Conditions for obtaining accurate discharge data are fairly good, although there have been some changes in the condition of the bed of the river, and a fairly good rating curve has been developed.

Discharge measurements of Connecticut River at Sunderland, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 23[a]	D. M. Wood	742	5,280	[b] 7.77	4,430
Feb. 11[c]	.....do	754	7,010	[b] 10.30	11,400
Mar. 3[d]	.....do	761	8,050	[b] 11.00	15,300
June 3	.....do	729	4,890	6.88	13,300
July 16	.....do	596	1,940	2.53	2,940
Oct. 13	.....do	620	2,250	3.02	3,660
Dec. 21[e]	F. F. Henshaw	690	3,210	4.45	4,430

[a] Measurement made under ice cover; also some anchor ice at section. Average thickness of ice 0.55 foot. Ice covered with 0.2 foot of snow saturated with water. Water surface even with top surface of ice.

[b] Gage height to water surface in a hole in the ice.

[c] Measurement made under ice cover; no anchor ice. Average thickness of ice 0.8 foot. Water surface 0.15 foot below top of ice.

[d] Measurement made under complete ice cover. Partially estimated owing to dangerous condition of ice. Average thickness of ice 0.2 foot. Water surface even with top surface of ice.

[e] Partial ice cover.

Daily gage height, in feet, of Connecticut River at Sunderland, Mass., for 1909.

[V. Lawer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	......	......	8.92	12.2	7.85	2.9	2.08	2.22	5.35	3.0	4.05
2	2.9	8.0	12.0	9.25	12.8	7.75	2.65	2.22	2.1	5.45	3.15	3.75
3	2.55	......	10.95	9.7	12.6	7.08	2.62	2.08	2.15	4.7	3.05	3.55
4	2.7	......	......	9.95	12.12	6.55	2.58	1.98	2.1	4.5	3.05	3.55
5	2.95	7.2	10.3	11.0	12.0	6.1	2.98	2.18	1.4	4.1	2.9	3.5
6	8.98	......	9.1	13.5	11.65	6.92	3.25	2.22	1.85	3.9	2.78	3.7
7	13.55	......	......	17.6	11.72	9.05	3.35	2.28	1.85	4.0	2.32	3.68
8	14.0	9.0	......	22.8	12.28	8.92	3.32	2.22	1.95	3.88	2.9	3.55
9	13.75	10.05	8.4	22.85	12.45	7.02	3.20	2.4	1.95	3.62	3.3	3.5
10	12.9	......	......	19.9	12.2	6.4	3.05	2.1	2.0	2.6	3.28	3.42
11	12.5	10 3	8.6	16.6	12.05	6.52	3.05	2.15	2.3	2.8	3.15	3.3
12	11.8	......	......	14.52	12.42	5.6	3.08	1.95	2.25	3.15	3.2	3.32
13	10.7	10.0	8.8	13.58	12.55	5.58	2.8	2.55	2.65	3.02	3.15	3.55
14	......	......	8.45	18.35	12.45	5.55	2.7	2.8	2.55	2.95	2.8	4.6
15	9.3	......	8.15	26.2	11.8	4.75	2.52	2.4	2.42	2.9	3.1	4.3
16	......	......	7.8	27.7	10.95	4.45	2.6	2.28	2.25	2.72	3.18	3.85
17	......	8.6	7.2	26.45	10.65	6.58	2.65	3.0	2.15	1.95	3.0	3.68
18	8.1	......	6.65	25.15	11.3	6.45	2.55	3.9	2.02	2.5	3.0	3.65
19	7.85	......	6.2	23.92	12.2	6.6	2.38	3.98	1.45	2.85	3.2	3.45
20	......	10.9	5.75	23.3	12.35	5.72	2.2	3.38	2.1	2.75	3.08	3.85
21	......	13.8	5.3	22.05	11.9	6.48	2.1	2.9	2.12	2.7	2.1	4.35
22	7.7	14.0	5.05	20.2	11.22	5.78	2.2	2.6	2.22	2.78	2.75	4.3
23	7.75	......	4.95	19.55	10.25	4.62	2.3	2.68	1.98	2.78	3.05	4.1
24	......	13.8	5.08	18.05	9.5	4.52	3.22	2.45	1.9	2.45	3.05	4.18
25	8.6	16.2	5.82	16.0	8.92	4.48	3.85	2.5	1.7	3.02	3.18	3.58
26	......	15.1	8.8	14.5	8.48	4.35	2.8	2.35	1.18	3.52	3.3	......
27	9.3	14.2	8.35	13.38	8.18	3.32	2.25	2.25	1.5	3.88	3.8	5.4
28	......	13.6	8.42	12.7	7.38	3.0	2.1	2.4	2.88	3.42	3.95	5.9
29	......	......	8.68	12.6	7.48	3.8	2.22	1.85	4.1	3.35	4.25	5.55
30	8.35	......	8.62	12.1	8.0	3.82	2.38	2.25	4.6	3.15	4.35	......
31	......	......	8.7	......	7.95	......	2.38	2.5	......	2.78	......	......

NOTE.—Ice conditions prevailed from Jan. 1 to Mar. 16 and from about Dec. 20 to 31. There may also have been slight ice effect during the first part of December.

Daily discharge, in second-feet, of Connecticut River at Sunderland, Mass., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,300	4,700	20,000	20,400	33,100	16,600	3,500	2,300	2,480	8,790	3,670	5,720
2	2,300	4,600	18,000	21,600	35,600	16,300	3,100	2,480	2,320	9,060	3,940	5,100
3	1,900	4,400	15,500	23,300	34,700	14,000	3,050	2,300	2,380	7,180	3,760	4,690
4	2,100	4,100	16,000	24,200	32,800	12,300	2,990	2,180	2,320	6,720	3,760	4,690
5	2,300	3,900	16,500	28,300	32,300	11,000	3,640	2,420	1,530	5,830	3,500	4,590
6	6,200	3,900	14,000	38,500	30,900	13,500	4,120	2,480	2,020	5,410	3,300	4,500
7	11,600	5,600	13,000	56,600	31,200	20,900	4,300	2,550	2,020	5,620	2,610	4,450
8	12,200	7,200	13,000	80,500	33,400	20,400	4,250	2,480	2,140	5,370	3,500	4,200
9	11,800	8,600	12,000	80,700	34,100	13,800	4,030	2,720	2,140	4,830	4,210	4,120
10	10,800	10,000	14,000	67,100	33,100	11,900	3,760	2,320	2,200	3,020	4,170	4,000
11	10,300	11,500	16,000	52,100	32,500	12,200	3,760	2,380	2,580	3,330	3,940	3,800
12	9,400	11,200	16,000	42,900	34,000	9,470	3,810	2,140	2,520	3,940	4,030	3,820
13	8,100	11,000	17,000	38,800	34,500	9,410	3,330	2,940	3,100	3,710	3,940	4,200
14	7,300	10,400	17,700	60,000	34,100	9,330	3,170	3,330	2,940	3,580	3,330	6,950
15	6,500	9,800	16,700	96,100	31,500	7,300	2,900	2,720	2,750	3,500	3,850	6,270
16	6,000	9,200	15,500	103,000	28,100	6,600	3,020	2,550	2,520	3,200	3,990	5,300
17	5,400	8,600	14,400	97,300	27,000	12,400	3,100	3,670	2,380	2,140	3,670	4,950
18	4,700	10,400	12,700	91,300	29,500	12,000	2,940	5,410	2,220	2,870	3,670	4,890
19	4,500	12,200	11,200	85,600	33,100	12,500	2,690	5,580	1,580	3,420	4,030	4,500
20	4,500	14,000	9,900	82,800	33,700	9,820	2,450	4,360	2,320	3,250	3,810	4,450
21	4,400	20,000	8,660	77,000	31,900	12,100	2,320	3,500	2,350	3,170	2,320	4,430
22	4,400	20,000	8,020	68,500	29,200	10,000	2,450	3,020	2,480	3,300	3,250	4,350
23	4,500	20,000	7,780	65,500	25,400	7,000	2,580	3,140	2,180	3,300	3,760	4,100
24	4,800	20,000	8,100	58,600	22,500	6,770	4,070	2,800	2,080	2,800	3,760	3,900
25	5,200	25,000	10,100	49,400	20,400	6,670	5,300	2,870	1,850	3,710	3,990	3,800
26	5,600	23,000	19,900	42,800	18,800	6,380	3,330	2,650	1,310	4,630	4,210	4,000
27	5,900	23,000	18,300	38,000	17,700	4,250	2,520	2,520	1,630	5,370	5,200	4,200
28	5,600	21,000	18,600	35,100	15,000	3,670	2,320	2,720	3,470	4,440	5,520	4,400
29	5,200	....	19,500	34,700	15,400	5,200	2,480	2,020	5,830	4,300	6,160	4,000
30	4,900	....	19,300	32,700	17,100	5,240	2,690	2,520	6,950	3,940	6,380	3,900
31	4,800	....	19,600	....	16,900	....	2,690	2,870	....	3,300	....	3,800

NOTE.—Daily discharges during the open period based on a well-defined rating curve. Daily discharges during the frozen periods can only be considered roughly approximate. They are based on four measurements made under ice conditions and on climatological data.

Monthly discharge of Connecticut River at Sunderland, Mass., for 1909.

[Drainage area, 7,700 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	12,200	1,900	5,980	0.777	0.90	C.
February	25,000	3,900	12,000	1.56	1.62	C.
March	20,000	7,780	14,700	1.91	2.20	B.
April	103,000	20,400	56,400	7.32	8.17	A.
May	35,600	15,000	28,400	3.69	4.25	A.
June	20,900	3,670	10,600	1.38	1.54	A.
July	5,300	2,320	3,250	.422	.49	A.
August	5,580	2,020	2,900	.377	.43	A.
September	6,950	1,310	2,550	.331	.37	A.
October	9,060	2,140	4,420	.574	.66	A.
November	6,380	2,320	3,970	.516	.58	A.
December	6,950	3,800	4,520	.587	.68	B.
The year	103,000	1,310	12,400	1.62	21.89	

CONNECTICUT RIVER AT HARTFORD, CONN.

Daily readings of the height of water at Hartford have been recorded since February 8, 1896, by the Connecticut River bridge and highway district. Through the courtesy of John T. Henderson, deputy chief engineer, these have been furnished to the United States Geological Survey prior to 1909.

River observations were begun by the United States Weather Bureau in 1902, and daily records are now published in Daily River Stages. Gage heights taken by the Connecticut River bridge and highway district were read on what is known as the tollhouse gage, the zero of which is set at the low-water mark of 1801. The highest water ever known in the river (29 feet 10 inches) was in May, 1854; the lowest (1½ inches below zero) in 1858, until 1908, when, on November 2 at 5 a. m., a height of 0.50 foot below zero was recorded.

This datum was used in the various surveys of the river below Hartford in 1866–67;[1] also in the surveys above Hartford in 1871–1878[2] and in the survey of 1897.[3] It has again been used, 1902–1905, in a further survey by the Secretary of War to study the problem of river improvements above Hartford.

During low-water periods the tidal wave comes up the river to Hartford. The visible effect of this wave is dependent on the height of the water and the direction and course of the wind.

During 1908 (records beginning September 8) an automatic recording gage of the Friez type was installed by the United States Weather Bureau in one of the piers of the new stone arch bridge, this being set to record gage heights to the same datum as the tollhouse gage.[4]

From figures given in the Report of the Chief of Engineers for 1878, pages 348–391, and from other data, computations of the discharge of Connecticut River at Hartford from 1871 to 1886, inclusive, were prepared and published in the Fourteenth Annual Report of the U. S. Geological Survey, Part II, pages 141–144.

PASSUMPSIC RIVER NEAR ST. JOHNSBURY, VT.

Passumpsic River rises in several small ponds and lakes in the mountainous region of the eastern part of northern Vermont. The West Branch of the river is formed near the base of Mount Pisgah and flows in a general southeasterly direction to its junction with East Branch, which was formed about 8 miles to the north by the run-off from several hills and small mountains. The main river then runs in a general southwesterly direction, receiving several small tributary streams along its course and being joined at Lyndonville by an important branch which rises in the towns of Sheffield and Sutton; it then flows southward to join Connecticut River at East Barnet, having received from the east Sheldon Brook and

[1] See report of Theodore G. Ellis, 1867 (H. R. Ex. Doc. No. 153, 40th Cong., 2d sess.).
[2] Engineer's Report 1878, pp. 348-391.
[3] Engineer's Report 1898, pp. 976-988.
[4] See Monthly Weather Review, October, 1908, pp. 340-342.

Moose River, and from the west Millers River, and West, Sleepers, and Joes branches.

The river is in general quick falling. There are many power plants along the main river and also on the tributaries, which furnish power chiefly for the manufacture of lumber and kindred products, and for electric lighting. The storage is rather small, but the opportunities for improvement are good.

The upper parts of the basin are fairly well forested; in the lower parts much of the land is cultivated. The whole area is hilly and a great portion of it is rocky. The prevailing rocks are granite and limestone. Clay is found throughout the drainage area, and drift sand is also abundant.

The mean annual precipitation on this basin is probably about 40 inches. The river is generally frozen throughout the winter. On account of the topography and geology the run-off in the freshet season is usually large.

The gaging station, which is located about 5 miles above St. Johnsbury and 2 miles above Centervale, Vt., at a footbridge a short distance below the plant operated by Pierce Bros. in the manufacture of leather board, was established May 26, 1909, in cooperation with the State of Vermont.

The nearest dam below the station is the electric-light plant just below Centervale. At high water this dam causes backwater at the gaging station, but as the power output at this plant is small the effect on the conditions at the Pierce mills is constant for any gage height. At usual stages the river below the station is quick falling, rips being found at several places. On account of the winding of the river in its course, and because of the dam below the station, jams of ice sometimes occur at the bends during the winter and spring.

The staff gage, in two sections, is located at the footbridge. It is read twice daily. The datum has remained unchanged since the establishment of the station. Measurements are made from a suspension footbridge, where the conditions for good results are excellent. As the storage at the Pierce mills is rather small and as the amount of water used during the day is rather uniform, it is believed that the gage heights are a true index of the flow, and the results are excellent. During the winter months the discharge is affected by ice. A good rating curve has been developed which is based on 1909–10 discharge measurements.

Discharge measurements of Passumpsic River near St. Johnsbury Center, Vt., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	D. M. Wood	91	212	2.50	359
June 29	.....do	86	142	1.68	172
Do	.....do	85	120	1.45	118
July 27	.....do	79	93	1.29	68
Oct. 27	.....do	86	142	1.64	164

Daily gage height, in feet, of Passumpsic River near St. Johnsbury, Vt., for 1909.

[J. W. Pierce and Joseph Cox, observers.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	2.35	1.60	1.44	1.49	1.90	1.60	1.86
2	....	2.25	1.60	1.38	1.72	1.78	1.60	1.72
3	....	2.15	1.65	1.36	1.50	2.42	1.65	1.74
4	....	2.10	2.00	1.36	1.41	2.02	1.67	1.71
5	....	2.10	1.80	1.35	1.39	1.76	1.71	1.60
6	....	2.80	1.70	1.41	1.77	1.70	1.64	1.69
7	....	2.35	1.65	1.38	1.55	1.62	1.58	1.69
8	....	2.15	1.60	1.28	1.48	1.56	1.62	1.68
9	....	2.05	1.50	1.30	1.39	1.50	1.80	1.61
10	....	2.00	1.50	1.35	1.35	1.49	1.71	1.58
11	....	1.90	....	1.38	1.40	1.52	1.61	1.62
12	....	1.90	....	1.31	1.43	1.48	1.65	1.58
13	....	1.85	....	1.30	1.44	1.51	1.62	....
14	....	2.50	....	1.46	1.39	1.48	1.60	1.69
15	....	2.10	....	1.29	1.34	1.52	1.60	1.72
16	....	1.90	....	1.30	1.40	1.50	1.62	1.71
17	....	1.80	....	1.35	1.39	1.66	1.58	1.65
18	....	2.85	....	1.32	1.38	1.79	1.72	1.58
19	....	2.45	....	1.39	1.30	1.70	1.64	1.56
20	....	2.05	....	1.50	1.34	1.58	1.61	1.60
21	....	1.95	....	2.35	1.35	1.64	1.60	1.59
22	....	1.85	....	1.64	1.36	1.93	1.72	1.50
23	....	1.80	....	1.48	1.34	2.00	1.95	1.56
24	....	1.70	....	1.43	1.35	1.78	1.88	1.56
25	....	1.70	....	1.38	1.54	1.74	1.84	1.60
26	2.50	1.80	....	1.35	1.40	1.69	2.32	1.55
27	2.40	1.60	1.38	1.62	1.61	1.60	1.92	1.55
28	2.60	1.65	1.34	1.49	*a* 2.85	1.66	1.78	....
29	3.20	1.65	1.34	1.36	3.38	1.66	2.18	....
30	2.75	1.65	1.42	1.41	2.20	1.60	1.90	....
31	2.50	....	1.66	1.38	....	1.56	....	....

a Crest gage height Sept. 28, 8 p. m., was 4.08 feet.

NOTE.—Mill shut down for repairs Oct. 13 to Nov. 3; also shut down Sundays and Dec. 25. Ice conditions Dec. 13 and 28 to 31.

Daily discharge, in second-feet, of Passumpsic River near St. Johnsbury, Vt., for 1909.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	372	149	110	122	230	149	219
2	....	238	149	96	180	197	149	180
3	....	306	162	91	124	397	162	186
4	....	290	260	91	102	266	167	178
5	....	290	202	89	98	191	178	149
6	....	537	175	102	194	175	159	172
7	....	372	162	96	136	154	144	172
8	....	306	149	74	119	139	154	170
9	....	275	124	78	98	124	202	152
10	....	260	124	89	89	122	178	144
11	....	230	....	96	100	129	152	154
12	....	230	....	80	107	119	162	144
13	....	216	....	78	110	126	154	162
14	....	426	....	114	98	119	149	172
15	....	290	....	76	87	129	149	180
16	....	230	....	78	100	124	154	178
17	....	202	....	89	98	165	144	162
18	....	556	....	82	96	199	180	144
19	....	408	....	98	78	175	159	139
20	....	275	....	124	87	144	152	149
21	....	245	....	372	89	159	149	146
22	....	216	....	159	91	239	180	124
23	....	202	....	119	87	260	245	139
24	....	175	....	107	89	197	224	139
25	....	175	....	96	134	186	213	149
26	426	202	....	89	100	172	362	136
27	390	149	96	154	152	149	236	136
28	462	162	87	122	556	165	197	149
29	700	162	87	91	777	165	316	136
30	518	162	105	102	322	149	230	136
31	426	....	165	96	....	139	....	136

NOTE.—Discharges estimated for Dec. 13 and 28 to 31. Other discharges were obtained from a rating curve well defined above 60 second-feet and based on 1909 and 1910 measurements.

Monthly discharge of Passumpsic River near St. Johnsbury, Vt., for 1909.

[Drainage area, 237 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May 26-31	700	390	487	2.05	0.46	B.
June	556	149	272	1.15	1.28	B.
July	260	....	127	.536	.62	C.
August	372	74	108	.456	.53	B.
September	777	87	154	.650	.73	B.
October	397	119	174	.734	.85	B.
November	362	144	185	.781	.87	B.
December	219	124	156	.658	.76	B.

NOTE.—Discharge July 11 to 26 estimated 109 second-feet, based on discharge of White River at Sharon, Vt.

WHITE RIVER NEAR SHARON, VT.

White River, one of the largest streams in Vermont and an important tributary of the Connecticut, rises in the mountainous region of north-central Vermont. It is formed of four main branches. The Third Branch rises in the town of Roxbury, Vt., flows in a general southeasterly direction, is joined near Randolph by Ayers Brook and joins the West Branch at Bethel. This latter branch has its origin in the hills and mountains of Hancock and Granville and flows easterly, being joined at Rochester by the South Branch, and near Bethel by the Locust Branch. The third important branch of the main river, called the Second Branch, rises in the township of Brookfield, flows southward, and joins White River at Royalston. The fourth branch, called the First Branch, is adjacent to the Second Branch, rising in the township of Washington, flowing south, and entering White River at South Royalston. Below South Royalston White River follows a general southeasterly direction to its union with the Connecticut River at White River Junction.

A large portion of the drainage basin is characterized by steep wooded slopes. The river furnishes power for several plants used for quarrying or for electric lighting. The mean annual precipitation in this drainage at Strafford is about 40 inches. The winters are fairly severe.

The gaging station, which is located about 1,500 feet below the dam of the Vermont Copper Co., about 800 feet above Central Vermont Railroad bridge, was established May 13, 1909, in cooperation with the State of Vermont, to determine the conditions of flow in this section and to continue the records formerly obtained by the United States Geological Survey at a station on the highway bridge at Sharon.

An inclined staff gage reading to 10 feet is attached to a large rock on the left bank. A chain gage for use in high water is nailed to trees about 80 feet upstream from the staff gage. There is no danger of backwater at the gage and the effect of the power station is not material.

An island divides the channel above the gages. Discharge measurements are made from two suspension footbridges, which connect the island with either shore. A good rating curve covering the medium and low flows has been developed. The gage datum has not been changed.

The conditions are good for obtaining reliable data except that ice affects the flow during the winter months.

Discharge measurements of White River near Sharon, Vt., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 12	D. M. Wood	271	822	5.85	2,640
29	.....do	267	675	5.30	1,830
June 24	.....do	212	288	4.07	496
July 20[a]	.....do	116	162	3.70	255
21	.....do	160	177	3.63	224
Sept. 10[b]	.....do	101	78.8	3.50	175

[a] Measurement made partly by wading. [b] Water diverted to one channel by construction work.

Daily gage height, in feet, of White River near Sharon, Vt., for 1909.

[C. V. Vaughan, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.65	3.80	3.25	3.40	3.80	3.65	3.78
2		4.52	3.75	3.71	3.40	3.71	3.71	3.78
3		4.48	3.72	3.50	3.45	3.75	3.58	3.84
4		4.38	3.95	3.45	3.42	3.78	3.56	3.86
5		4.50	3.75	3.47	3.70	3.72	3.72	3.70
6		5.82	3.95	3.65	3.62	3.60	3.60	3.78
7		5.10	3.80	3.67	3.42	3.60	3.63	3.82
8		4.80	3.75	3.56	3.41	3.60	3.90	3.81
9		4.62	3.72	3.57	3.46	3.48	3.65	3.68
10		4.52	3.65	3.50	3.42	3.20	3.66	4.00
11		4.75	3.70	3.45	3.33	3.64	3.65	3.72
12	5.85	4.62	3.80	3.47	3.17	3.49	3.65	3.70
13	5.33	4.37	3.55	3.45	3.31	3.64	3.72	3.45
14		4.89	3.52	3.47	3.40	3.54	3.54	3.60
15		4.80	3.55	3.18	3.41	3.60	3.70	3.70
16	5.06	4.51	3.50	3.30	3.42	3.50	3.49	3.72
17	5.94	4.35	3.50	3.40	3.45	3.58	3.64	3.80
18	5.98	4.68	3.51	3.85	3.40	3.56	3.62	3.70
19	5.66	4.47	3.75	3.72	3.20	3.66	3.55	3.60
20	5.60	3.86	3.65	3.80	3.20	3.58	3.79	3.68
21	5.42	4.38	3.57	3.70	3.40	3.49	3.50	3.68
22	5.20	4.18	3.55	3.64	2.90	3.52	3.68	3.65
23	5.20	4.08	3.50	3.85	3.20	3.51	3.72	3.62
24	5.06	4.00	3.48	3.55	3.40	3.85	3.76	3.75
25	4.82	4.00	3.30	3.40	3.41	3.85	3.85	3.65
26	4.74	3.90	3.55	3.45	3.10	3.76	3.92	3.72
27	4.68	4.02	3.51	3.50	3.26	3.65	3.85	3.60
28	4.75	4.00	3.51	3.32	3.56	3.62	3.85	3.69
29	5.18	3.85	3.45	3.30	4.50	3.61	3.81	4.18
30	5.06	3.70	3.44	3.55	3.97	3.58	3.85	
31	4.85		3.40	3.55		3.56		4.10

NOTE.—Ice conditions prevailed from about Dec. 10 to 31.

Daily discharge, in second-feet, of White River near Sharon, Vt., for 1909.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1,020	315	86	135	315	238	304
2		885	288	266	135	266	266	304
3		846	271	175	155	288	207	339
4		752	408	155	143	304	199	341
5		865	288	163	260	271	271	260
6		2,590	408	238	224	215	215	304
7		1,560	315	246	143	215	238	327
8		1,180	288	199	139	215	375	321
9		986	271	203	159	167	238	251
10		885	238	175	143	72	242	256
11		1,130	260	155	110	233	238	271
12	2,640	986	315	163	64	171	238	260
13	1,870	743	195	155	104	233	271	
14	1,750	1,290	183	163	135	191	191	
15	1,630	1,180	195	67	139	215	260	
16	1,510	875	175	100	143	175	171	
17	2,780	725	175	135	155	207	233	
18	2,840	1,050	179	345	135	199	224	
19	2,350	836	288	271	72	242	195	
20	2,260	351	238	315	72	207	310	
21	2,000	752	203	260	135	171	175	
22	1,700	579	195	233	10	183	251	
23	1,700	500	175	345	72	179	271	
24	1,510	440	167	195	135	345	293	
25	1,210	440	100	135	139	345	345	
26	1,120	375	195	155	47	293	388	
27	1,050	455	179	175	89	238	345	
28	1,130	440	179	107	199	224	345	
29	1,670	345	155	100	865	220	321	
30	1,510	260	151	195	420	207	345	
31	1,240		135	195		199		

NOTE.—Discharge based on a rating curve well defined above a discharge of 175 second-feet. Discharge interpolated May 14 and 15, and estimated Dec. 10.

Monthly discharge of White River near Sharon, Vt., for 1909.

[Drainage area, 686 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May 12 to 31	2,840	1,050	1,780	2.60	1.93	A.
June	2,590	260	844	1.23	1.37	A.
July	408	100	230	.335	.39	A.
August	345	67	189	.276	.32	B.
September	865	10	163	.238	.27	B.
October	345	72	226	.329	.38	A.
November	388	171	261	.380	.42	A.
December	341		237	.345	.40	C.

NOTE.—Discharge Dec. 13-31, estimated 201 second-feet.

ASHUELOT RIVER AT HINSDALE, N. H.

Ashuelot River, a rather important power stream, rises in the town of Washington, Sullivan County, N. H., and flows in a general southwesterly direction about 45 miles to Connecticut River near Hinsdale. Its drainage basin, comprising approximately 442 square miles, includes Mount Monadnock and is to a considerable extent forested. Water is stored for power at several ponds and reservoirs in the basin.

The gaging station, which is located at the lower highway bridge in the town of Hinsdale, about one-fourth mile below the dam used jointly by the Fisk Paper Co. and the Haile & Frost Manufacturing Co., was established February 22, 1907, in cooperation with Charles Bigelow, treasurer of the Haile & Frost Manufacturing Co., to obtain information regarding the daily distribution of flow of the Ashuelot. Since June 13, 1909, records have been furnished by Frederick S. Leonard of the Fisk Paper Co.

The station is about 2 miles above the mouth of the river, but as there is considerable fall below no backwater influence is shown except possibly at very high stages of the Connecticut. The use of water at the dam at Hinsdale causes some daily fluctuations in stage during low-water season.

The chain gage is attached to the bridge and is read twice daily. Its datum has remained the same during the maintenance of the station. Discharge measurements are made from the bridge. During the winter the discharge is affected by ice.

Conditions for obtaining accurate discharge data are good, and a fairly good rating curve has been developed.

Discharge measurements of Ashuelot River at Hinsdale, N. H., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 8[a]	H. F. French	104	210	4.05	397
June 23	D. M. Wood	126	196	3.41	307
Oct. 23	.....do	101	145	3.09	182
Oct. 24	.....do	78.5	66.6	2.43	42.0
Do	.....do	78.0	70.6	2.45	43.9

[a] Partial ice cover.

Daily gage height, in feet, of Ashuelot River at Hinsdale, N. H., for 1909.

[W. W. King, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.88	3.78	4.30	4.90	4.75	3.50	3.15	2.75	2.78	3.32	2.82	3.10
2	3.27	4.08	4.12	4.95	5.05	3.48	2.91	2.93	2.70	3.19	2.96	3.02
3	2.25	4.28	4.08	5.08	5.05	3.42	3.00	2.77	2.63	2.69	2.94	3.01
4	2.42	4.50	4.02	5.05	4.82	3.45	2.68	2.69	2.53	3.02	3.02	2.80
5	3.08	4.58	3.95	5.02	4.65	3.30	2.80	2.69	2.48	2.89	2.82	2.72
6	5.28	3.65	3.95	5.22	4.50	4.10	3.04	2.91	2.78	2.89	2.70	2.78
7	5.22	3.88	3.88	5.78	4.58	4.22	3.01	2.97	2.80	2.85	2.58	2.85
8	4.68	4.02	3.75	6.22	4.55	4.02	2.91	2.69	2.33	2.82	2.62	2.95
9	4.18	3.92	3.78	6.28	4.42	3.80	2.94	2.79	2.63	2.80	2.72	2.95
10	3.85	3.82	3.82	5.80	4.25	3.68	2.91	2.91	2.53	2.33	2.66	2.95
11	3.75	4.18	3.92	5.28	4.20	3.75	2.58	2.93	2.38	2.83	2.52	3.02
12	3.72	4.45	4.00	4.92	4.10	3.68	2.75	3.03	2.38	2.84	2.80	2.92
13	3.70	4.38	3.98	4.75	4.08	3.58	3.04	2.80	2.60	2.69	2.78	2.65
14	3.80	4.18	3.92	5.18	3.92	3.48	2.98	2.71	2.43	2.57	2.68	2.98
15	3.72	4.05	3.88	6.78	3.88	3.42	3.02	2.58	2.43	2.83	2.55	3.10
16	3.78	3.98	3.88	7.48	3.75	3.35	2.91	2.55	2.70	2.89	2.72	3.10
17	3.85	3.82	3.88	6.85	3.88	3.32	2.85	2.69	2.63	2.33	2.75	3.07
18	4.55	3.68	3.82	6.00	3.98	3.68	2.91	3.33	2.60	2.73	2.82	2.99
19	5.10	3.68	3.78	5.48	3.92	4.28	2.85	3.27	2.30	2.75	2.75	3.14
20	5.35	4.58	3.72	5.22	3.88	3.95	2.76	3.27	2.46	2.67	2.85	3.47
21	5.18	5.18	3.72	5.02	3.80	3.72	2.81	3.04	2.58	2.81	2.46	3.56
22	4.78	5.05	3.75	4.98	3.72	3.62	2.88	2.61	2.79	2.92	2.40	3.05
23	4.30	4.72	3.78	5.02	3.70	3.38	2.71	2.94	2.68	2.88	2.68	2.96
24	4.15	4.68	3.88	5.02	3.70	3.31	2.61	2.94	2.67	2.40	2.65	3.06
25	3.98	5.25	4.35	4.85	3.70	3.28	2.85	2.97	2.67	2.80	2.70	3.26

Daily gage height, in feet, of Ashuelot River at Hinsdale, N. H., for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	3.88	5.15	5.02	4.68	3.62	3.20	2.91	2.86	2.39	2.98	2.80	3.22
27	3.88	4.80	5.10	4.58	3.52	3.14	2.97	2.90	2.55	2.98	2.68	3.52
28	3.65	4.52	5.00	4.62	3.65	3.06	2.84	2.80	2.65	2.92	2.72	
29	3.68		5.02	4.80	3.72	3.03	3.04	2.28	3.62	2.85	2.90	
30	3.45		4.85	4.72	3.62	3.12	2.99	2.58	3.59	2.70	3.10	
31	3.42		4.88		3.60		2.95	2.76		2.50		

NOTE.—Ice conditions prevailed from Jan. 1 to Feb. 28 and Dec. 10 to 31.

Daily discharge, in second-feet, of Ashuelot River at Hinsdale, N. H., for 1909.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	900	1,510	1,340	350	200	90	97	266	106	183
2	751	1,560	1,680	340	128	133	80	214	141	158
3	720	1,720	1,680	310	152	95	67	78	136	155
4	675	1,680	1,420	326	76	78	52	158	158	101
5	625	1,640	1,240	257	101	78	45	123	106	84
6	625	1,890	1,090	735	164	128	97	123	80	97
7	577	2,640	1,170	832	155	144	101	113	59	113
8	493	3,310	1,140	675	128	78	28	106	66	138
9	512	3,410	1,010	524	136	99	67	101	84	138
10	537	2,670	858	450	128	128	52	28	73	
11	604	1,960	815	493	59	133	33	108	50	
12	660	1,530	735	450	90	161	33	111	101	
13	646	1,340	720	393	164	101	62	78	97	
14	604	1,840	604	340	147	82	39	58	76	
15	577	4,260	577	311	158	59	39	108	54	
16	577	5,600	493	279	128	54	80	123	84	
17	577	4,390	577	266	113	78	67	28	90	
18	537	2,970	646	450	128	270	62	86	106	
19	512	2,220	604	883	113	245	25	90	90	
20	474	1,890	577	625	93	245	42	75	113	
21	474	1,640	524	474	103	164	59	103	42	
22	493	1,600	474	416	120	64	99	130	35	
23	512	1,640	462	292	82	136	76	120	76	
24	577	1,640	462	261	64	136	75	35	71	
25	945	1,460	462	249	113	144	75	101	80	
26	1,640	1,270	416	218	128	115	34	147	101	
27	1,740	1,170	361	197	144	125	54	147	76	
28	1,620	1,210	433	171	111	101	71	130	84	
29	1,640	1,400	474	161	164	23	416	113	125	
30	1,460	1,310	416	190	149	59	399	80	183	
31	1,490		404		138	93		47		

NOTE.—The above daily discharge is based on a fairly well defined rating curve.

Monthly discharge of Ashuelot River at Hinsdale, N. H., for 1909.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			349	0.793	0.91	D.
February			631	1.43	1.49	D.
March	1,740	474	799	1.82	2.10	B.
April	5,600	1,170	2,150	4.89	5.46	C.
May	1,680	361	770	1.75	2.02	B.
June	883	161	397	.903	1.01	A.
July	200	59	125	.284	.33	A.
August	270	23	117	.266	.31	A.
September	416	25	84.2	.191	.21	A.
October	266	28	107	.243	.28	A.
November	183	35	91.4	.208	.23	A.
December	183		118	.268	.31	C.
The year	5,600	23	478	1.09	14.66	

NOTE.—Discharge during the frozen periods based on measurements made under ice conditions, approximate ice-rating curves, and climatological data. Discharge, Dec. 10 to 31, estimated, 113 second-feet.

MILLERS RIVER AT WENDELL, MASS.

Millers River rises in several small ponds and lakes in the towns of Ashburnham and Winchendon in north-central Massachusetts, flows in a general southwesterly direction to its junction with Otto River near South Royalston, and thence westward to Millers Falls, where it enters Connecticut River. The principal tributary streams from the north are Tilly River, Moss Brook, and Kemp Brook; from the south, Beaver Brook.

The drainage basin is in general long and narrow. On account of the large number of ponds the river is not flashy, offering a striking contrast to Deerfield River, which enters the Connecticut from the westward, and drains an area of about the same size.

Millers River is important because of its power sites, many of which are already developed. (See Pl. IV, B, p. 120.) Below Erving the slope of the river is great.

The average precipitation through the basin ranges from 44 inches in the upper to 39 inches in the lower part.

A considerable portion of the drainage area is well wooded, hardwood growths predominating. Only a small part is farmed. Clay and sand are found in abundance and the predominant rocks are granites.

The gaging station, which is located at the railroad bridge just west of the Wendell railroad station, was established June 4, 1909. The work is carried on in cooperation with the State of Massachusetts and the Orange Electric Light Co., which is constructing a dam just above the bridge.

Near and above the site of the new dam is an old dam and power station. During the year the wheels at this station were run at irregular intervals to furnish power and to divert the water from the construction work. During the low-water period the use of these wheels interfered seriously with the determination of the daily flow of the river. By means of a series of frequent readings through day and night, the two most favorable times of day for reading the gage heights were determined, and it is believed the mean of these two readings represents the true height of the river for the day.

Discharge measurements are made from the railroad bridge or by wading. The conditions are only fair on account of the rough bed, swift velocity, and the distance from the bridge to the water. A good curve has been developed from 1909–10 discharge measurements.

During the winter the formation of ice in the still water below the bridge causes a backwater effect at the gage section. The chain gage is attached to the railroad bridge. The datum has been unchanged throughout the year. The gage heights are observed under the direction of A. W. Hubbard, superintendent Orange Electric Light Co.

Discharge measurements of Millers River at Wendell, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 5	D. M. Wood	108	181	2.00	598
22	.....do	104	161	1.80	463
Aug. 3	.....do	90.5	78.0	1.12	104
27	.....do	90.5	124	1.38	229
Oct. 8	Norcross & Wood	91	102	1.21	132
Do.[a]	.....do	62.5	50.9	.67	22.7
Dec. 17	D. M. Wood	102	154	1.69	376

[a] Measurement not exact; some velocity estimated.

Daily gage height, in feet, of Millers River at Wendell, Mass., for 1909.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	1.59	0.97	1.25	1.45	1.08	1.15	16	1.82	1.39	1.17	1.28	1.02	.68	1.50
2	......	1.49	1.40	1.21	1.15	.55	.80	17	1.78	1.65	.99	1.23	.62	.38	1.30
3	......	1.20	1.43	1.19	.71	1.12	.90	18	1.98	1.43	1.58	1.09	1.05	.70	1.05
4	1.85	1.25	1.36	1.10	1.08	1.12	1.15	19	2.04	1.53	.98	.58	1.02	.70	1.35
5	1.92	1.17	1.23	.79	1.14	1.14	1.10	20	1.63	1.56	1.28	1.17	1.02	1.05	1.50
6	1.82	1.52	1.32	.58	1.09	.92	1.45	21	1.79	1.40	1.22	1.11	.99	.35	1.30
7	2.11	1.61	1.18	.88	1.09	.30	.65	22	1.94	1.39	1.09	1.19	.92	.86	1.30
8	2.02	1.54	.98	1.09	1.12	1.06	.85	23	1.89	1.44	1.19	1.23	1.05	.80	1.00
9	1.94	1.56	1.23	1.19	.52	1.02	1.35	24	1.80	1.39	1.21	1.21	.60	.82	1.16
10	1.96	1.32	1.08	1.19	.58	.78	1.35	25	1.76	1.02	1.22	.81	.92	.72	1.00
11	1.98	1.06	1.18	1.03	.86	.78	.90	26	1.70	1.43	1.21	.58	1.02	.80	1.45
12	1.98	1.54	1.18	.81	1.12	.80	.78	27	1.27	1.28	1.18	1.01	1.00	.85	.75
13	1.58	1.34	1.33	1.11	1.15	.72	1.00	28	1.58	1.28	1.08	1.31	.93	1.15	.80
14	1.86	1.38	1.28	1.31	1.16	.30	.80	29	1.72	1.32	.71	1.55	1.06	1.35	.85
15	1.86	1.36	.97	1.09	1.12	.68	1.55	30	1.64	1.36	1.01	1.51	1.02	1.45	1.35
								31	......	1.28	1.11	......	.30	......	1.42

NOTE.—Discharge probably affected by ice from about Dec. 19 to 31.

Daily discharge, in second-feet, of Millers River at Wendell, Mass., for 1909.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	320	65	155	245	95	118	16	463	216	125	167	78	15	270
2	......	265	220	139	118	6.5	30	17	437	355	70	147	11	0.8	175
3	......	135	235	132	18	108	48	18	571	235	314	98	86	17	86
4	482	155	202	101	95	108	118	19	613	286	67	8	78	17	......
5	529	125	147	29	115	115	101	20	343	303	167	125	78	86	......
6	463	281	184	8	98	53	245	21	444	220	143	104	70	0.5	......
7	662	331	128	44	98	00	13	22	543	216	98	132	53	41	......
8	599	292	67	98	108	89	39	23	508	240	132	147	86	30	......
9	543	303	147	132	5	78	198	24	450	216	139	139	9	34	......
10	557	184	95	132	8	27	198	25	424	78	143	32	53	20	......
11	571	89	128	81	41	27	48	26	385	235	139	8	78	30	......
12	571	292	128	32	108	30	27	27	163	167	128	75	72	39	......
13	314	193	188	104	118	20	72	28	314	167	95	180	55	118	......
14	489	211	167	180	121	0	30	29	398	184	18	298	89	198	......
15	489	202	65	98	108	15	298	30	349	202	75	276	78	245	......
								31	......	167	104	......	00	......	......

NOTE.—Daily discharges were obtained from a well-defined rating curve based on 1909 and 1910 discharge measurements.

Monthly discharge of Millers River at Wendell, Mass., for 1909.

[Drainage area, 354 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 4-30	662	163	469	1.32	1.33	A.
July	355	78	221	.624	.72	A.
August	314	18	133	.376	.43	A.
September	298	8	113	.319	.36	A.
October	245	0	76.7	.217	.25	B.
November	245	0	55.4	.156	.17	B.
December	298	13	89.2	.252	.29	C.

NOTE.—Mean discharge Dec. 19 to 31 estimated as 50 second-feet.

DEERFIELD RIVER BASIN.

DESCRIPTION.

Deerfield River, the second largest tributary of Connecticut River, rises in the towns of Stratton and Somerest, Vt., follows a generally southerly course for about 45 miles, receiving several tributary streams, the most important of which are the East Branch, at Searsburg, Vt.; the North Branch, at Wilmington, Vt.; and the West Branch, at Readsboro, Vt. The river enters Massachusetts at Monroe Bridge and then flows southward to Hoosac Tunnel, where it turns to the southeast, and unites with Connecticut River near Greenfield, Mass.

The greater portion of the basin is wooded and but little land is under cultivation. In the lower part, however, there is considerable cultivated land. The slopes are for the most part steep, and upper portions of the basin attain elevations of over 3,800 feet above sea level. The average elevation of the basin at Shelburne Falls, Mass., is about 1,800 feet; at Hoosac Tunnel, Mass., 2,300 feet; and at Searsburg, Vt., 2,500 feet.

The mean annual precipitation for the upper part of the basin is probably about 48 inches; in the lower part it is probably several inches less. Winters are fairly severe. The average depth of snowfall for January and February at Jacksonville, Vt., is about 25 inches, and the mean temperature for these months is about 18°.

Several power sites have already been developed, but there are many undeveloped sites. The river throughout its course is quick falling and rapid.

On account of the steep slopes and the rocky formation of this basin the river is extremely flashy. The present storage is very small.

DEERFIELD RIVER AT HOOSAC TUNNEL, MASS.

This station, which is located at the highway bridge near the Hoosac Tunnel railroad station, was established July 17, 1909. With the other stations in this State it is being carried on in cooperation with the State of Massachusetts.

The bed of the river is rough, the current is very swift, and there is no danger of any artificial backwater. During the winter ice forming around the rocks on the bottom of the river and on the sides causes backwater and contracted channels.

Discharge measurements are made from the highway bridge to which the chain gage is attached. The datum of the gage has not been changed. A fairly good discharge curve has been developed from 1909 and 1910 measurements.

Discharge measurements of Deerfield River at Hoosac Tunnel, Mass., in 1906 and 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 29	F. E. Pressey	125	130	[a] 1.5	66.0
1909.					
July 17	D. M. Wood	150	171	1.75	159.
Aug. 7	do	153	209	1.95	211.
27	do	83	76	1.12	34.7
Oct. 5	do	152	196	1.94	207.
5	T. W. Norcross	154	225	1.94	209.
Dec. 16[b]	D. M. Wood	157	228	2.69	272.

[a] Gage height uncertain, as it was obtained by comparing soundings with those of subsequent measurements.
[b] Partial ice cover.

Daily gage height, in feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909.

[F. J. Barber, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.05	2.50	1.93	2.00	16	2.20	1.00	1.88	1.32	2.80
2		1.14	2.39	1.64	1.82	17	2.80	1.48	1.88	1.65	2.60
3		1.10	2.10	1.64	1.86	18	3.35	1.30	1.40	2.36	2.55
4		1.08	1.80	1.83	2.12	19	2.94	1.38	1.85	1.80	2.58
5		1.00	1.40	1.63	1.65	20	2.18	1.26	1.74	1.84	2.70
6		1.03	1.75	1.55	1.78	21	1.75	1.20	1.68	1.74	2.65
7		1.92	1.80	1.10	1.56	22	1.46	1.15	1.88	1.75	2.45
8	1.75	1.72	1.65	1.43	1.68	23	1.42	1.20	2.62	1.94	2.55
9	1.52	1.44	1.52	1.50	1.88	24	1.37	1.90	2.59	1.82	2.58
10	1.20	1.50	1.75	1.65	1.48	25	1.22	1.85	2.55	1.70	2.52
11	1.05	1.34	1.40	1.55	2.05	26	1.05	1.52	2.12	2.02	2.50
12	1.15	1.14	1.62	1.52	1.95	27	1.00	1.45	2.06	1.75	2.11
13	1.30	1.65	1.88	1.62	1.48	28	1.02	4.15	2.15	2.08	2.02
14	1.05	1.50	1.85	1.46	2.05	29	1.04	3.74	1.95	2.39	2.08
15	1.10	1.42	1.76	1.44	2.68	30	1.40	3.01	1.66	2.22	2.08
						31	1.27		1.05		2.05

NOTE.—Ice conditions prevailed from about Dec. 11 to 31.

Daily discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		26	425	202	224	16	290	20	187	62	
2		37	376	125	170	17	610	89	187	128	
3		32	257	125	181	18	1,040	59	75	362	
4		30	165	173	264	19	705	72	178	165	
5		20	75	122	128	20	283	53	150	176	
6		24	152	104	160	21	152	45	135	150	
7		198	165	32	106	22	86	38	187	152	
8	162	145	128	79	135	23	79	45	493	205	
9	97	82	97	93	187	24	70	192	474	170	
10	45	93	152	128	89	25	48	178	452	140	
11	26	65	75	104		26	26	97	264	231	
12	38	37	120	97		27	20	84	244	152	
13	59	128	187	120		28	22	1,820	274	250	
14	26	93	178	86		29	25	1,390	208	376	
15	32	79	155	82		30	75	758	130	299	
						31	55		26		

NOTE.—Daily discharge based on a rating curve which is well defined above discharge 150 second-feet.

Monthly discharge of Deerfield River at Hoosac Tunnel, Mass., for 1909.

[Drainage area, 257 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Aug. 8-31	1,040	20	170	0.661	0.59	A.
September	1,820	20	201	.782	.87	A.
October	493	26	206	.802	.92	A.
November	376	32	156	.607	.68	B.
December			138	.537	.62	C.

NOTE.—Discharge during ice conditions, Dec. 11 to 31, estimated as 125 second-feet.

DEERFIELD RIVER AT SHELBURNE FALLS, MASS.

This station, which is located at the plant of the Greenfield Electric Light & Power Co., was established October 7, 1909.

Records have been kept at the power plant since the early part of 1907, but the early data were too incomplete for computation of daily discharge. Since the fall of 1908, when the dam was raised about 3 feet, the records have improved materially and the results are considered excellent.

The dam is of concrete, of ogee section, and is similar in form to one that has been rated. The flow through the wheels is computed from the gate openings and power readings made at half-hour intervals. The total electrical output is also measured twice a day. Readings are made three times daily of the height of water on the dam, in the forebay, in the tailrace, and at the wasteways.

Two units are now installed. Ratings have been made of one of these units by the Survey for use in conjunction with the Holyoke ratings of the wheels.

Owing to the extreme care with which the readings are made, winter and summer, this station should prove to be very valuable.

Daily discharge, in second-feet, of Deerfield River at Shelburne Falls, Mass., for 1907–1909.

Days.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	......	......	......	......	......	253	......	174	86	866	2,380	250
2	......	......	......	......	......	214	......	206	63	648	2,390	287
3	......	......	......	......	......	251	......	165	118	470	7,680	295
4	......	......	......	......	......	246	......	216	210	800	3,580	267
5	......	......	......	......	......	246	......	209	1,190	1,370	2,380	192
6	......	......	......	......	......	252	......	199	620	1,060	1,980	247
7	......	......	......	......	......	256	......	202	417	553	16,300	351
8	......	......	......	......	......	255	......	181	235	1,090	3,540	357
9	......	......	......	......	......	222	......	193	220	1,360	1,970	452
10	......	......	......	......	......	258	......	138	228	978	1,630	2,350
11	......	......	......	......	......	251	......	60	231	867	1,220	2,320
12	......	......	......	......	......	249	......	104	421	872	857	1,870
13	......	......	......	......	......	247	......	67	244	730	644	955
14	......	......	......	......	......	253	......	92	258	675	647	967
15	......	......	......	......	......	254	......	104	220	406	557	833
16	......	......	......	......	......	225	......	33	156	396	477	728
17	......	......	......	......	......	254	......	71	312	331	341	633
18	......	......	......	......	......	256	......	108	173	241	405	632
19	......	......	......	......	......	247	......	108	147	264	397	544
20	......	......	......	......	......	241	......	77	139	252	408	552
21	......	......	......	......	......	204	......	99	133	296	411	535
22	......	......	......	......	......	227	432	129	134	279	397	432
23	......	......	......	......	......	199	255	92	305	283	436	2,370
24	......	......	......	......	......	189	258	99	1,980	284	368	1,680
25	......	......	......	......	......	240	554	106	1,370	288	435	1,920
26	......	......	......	......	......	433	1,370	87	771	278	434	1,360
27	......	......	......	......	......	408	817	84	765	237	483	1,080
28	......	......	......	......	......	320	368	105	404	3,360	408	1,080
29	......	......	......	......	......	251	233	113	4,100	10,100	398	1,070
30	......	......	......	......	......	834	231	53	1,370	5,010	342	1,080
31	......	......	......	......	......	......	162	114	......	3,600	......	1,670
1908.												
1	1,080	599	742	2,740	7,190	3,630	170	200	99	......	158	196
2	1,080	400	718	2,350	2,500	2,500	159	177	138	......	189	204
3	776	237	944	1,810	2,090	1,840	137	92	139	......	173	90
4	599	215	958	1,290	1,650	1,230	146	132	102	......	127	93
5	490	344	968	1,290	1,430	1,100	136	113	118	......	151	102
6	318	730	646	1,350	848	1,080	195	337	143	......	180	89
7	381	383	954	2,440	878	554	284	328	135	......	155	169
8	1,090	485	826	2,730	8,910	295	248	266	130	......	142	757
9	723	718	729	6,590	5,220	289	157	372	120	......	150	528
10	625	599	730	3,340	3,110	259	135	558	110	......	185	303
11	624	599	1,240	4,360	2,350	257	130	272	100	......	167	343
12	793	774	969	2,910	1,590	259	98	275	90	......	206	297
13	1,380	581	1,250	2,170	1,830	288	98	332	80	......	282	320
14	1,340	583	1,660	1,490	2,140	235	106	273	70	......	257	232
15	1,360	1,470	1,850	1,440	3,410	187	139	268	67	......	221	263
16	908	7,020	2,260	4,280	2,500	983	94	179	79	......	161	378
17	1,020	2,650	1,250	1,820	1,960	576	101	150	65	......	193	179
18	719	1,560	1,250	1,810	1,670	419	79	1,110	88	......	170	219
19	815	974	1,120	4,730	1,520	258	279	419	58	......	121	193
20	433	1,100	1,250	2,920	1,670	269	213	298	40	......	177	218
21	443	848	1,250	1,960	1,520	179	242	258	77	......	239	337
22	628	994	1,550	1,230	2,670	182	221	252	55	55	212	271
23	731	844	1,500	1,490	6,090	182	495	239	......	50	179	155
24	537	485	1,430	2,350	3,400	178	373	248	......	60	208	132
25	383	218	4,410	2,160	2,660	409	573	206	......	76	247	149
26	383	293	1,910	3,080	1,820	221	3,160	235	......	129	268	163
27	914	1,010	7,730	2,730	1,520	174	1,850	265	......	390	348	295
28	597	769	5,760	3,140	1,520	230	640	208	......	471	352	178
29	830	506	10,600	2,740	998	153	326	183	......	405	373	147
30	479	......	6,580	1,820	1,100	186	235	144	......	411	205	152
31	184	......	3,550	......	6,080	......	250	111	......	271	......	156
1909.												
1	150	150	933	771	2,000	559	177	99	121	448	220	362
2	228	286	903	1,700	3,140	442	172	77	101	311	350	309
3	171	308	742	2,400	2,200	475	245	57	88	292	355	290
4	350	260	687	1,680	2,780	467	270	120	64	237	377	288
5	371	386	751	2,460	2,580	466	253	113	114	252	311	275

Daily discharge, in second-feet, of Deerfield River at Shelburne Falls, Mass., for 1907–1909—Continued.

Days.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
6	6,400	685	608	3,340	1,990	1,670	234	273	66	229	223	231
7	1,700	1,680	665	9,040	3,850	863	205	264	127	207	228	249
8	909	1,120	596	8,140	2,210	648	151	219	138	161	240	259
9	711	542	594	4,610	1,650	511	152	112	122	179	228	219
10	744	526	640	2,830	1,380	555	136	115	115	145	240	193
11	619	765	1,280	1,860	1,240	1,100	146	101	219	150	171	87
12	550	528	1,280	1,540	1,100	755	85	76	288	191	215	129
13	342	479	898	2,610	857	522	182	113	133	261	212	287
14	229	577	885	18,900	743	535	85	90	153	282	196	222
15	492	463	667	21,300	646	550	119	82	140	222	196	474
16	407	742	630	8,460	596	468	118	212	130	194	188	385
17	279	404	586	7,290	847	408	133	1,140	106	189	250	317
18	365	473	535	6,660	1,230	3,830	150	1,580	130	191	294	287
19	237	410	580	5,850	970	1,370	136	606	74	244	344	265
20	261	4,830	555	9,350	852	830	131	415	90	267	245	238
21	297	3,390	564	4,600	743	643	141	361	47	270	250	245
22	381	2,140	541	5,610	633	417	136	246	99	300	281	239
23	553	1,370	539	3,620	815	534	128	181	92	598	292	215
24	735	2,240	633	2,620	688	473	127	190	222	698	306	206
25	1,780	4,290	1,230	2,190	638	341	165	167	219	565	266	196
26	1,000	2,460	2,980	2,250	624	345	152	125	212	612	368	185
27	619	1,740	1,530	1,910	551	241	134	104	179	565	386	189
28	593	1,280	1,220	3,470	1,100	212	138	136	3,780	482	337	179
29	417	......	1,390	2,430	1,360	242	118	112	1,430	322	423	192
30	464	......	1,250	2,250	1,080	194	111	119	578	306	526	118
31	287	......	1,120	......	845	......	91	110	......	372	......	160

Monthly discharge of Deerfield River at Shelburne Falls, Mass., for 1907–1909.

[Drainage area, 501 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1907					
June	834	189	274	0.547	0.61
July 22–31	1,370	162	468	.934	.35
August	216	33	122	.244	.28
September	4,100	63	567	1.13	1.26
October	10,100	237	1,230	2.46	2.84
November	16,300	341	1,800	3.59	4.00
December	2,370	192	947	1.89	2.18
1908					
January	1,380	184	731	1.46	1.68
February	7,020	215	965	1.93	2.08
March	10,600	646	2,210	4.41	5.08
April	6,590	1,230	2,550	5.09	5.68
May	8,910	848	2,700	5.39	6.21
June	3,630	153	620	1.24	1.38
July	3,160	79	370	.739	.85
August	1,110	92	274	.547	.63
September 1–22	143	40	95.6	.191	.16
October 22–31	471	50	232	.463	.17
November	373	121	207	.413	.46
December	757	89	236	.471	.54
1909					
January	6,400	150	730	1.46	1.68
February	4,830	150	1,230	2.46	2.56
March	2,980	535	904	1.80	2.08
April	21,300	771	5,060	10.1	11.27
May	3,850	551	1,350	2.69	3.10
June	3,830	194	689	1.38	1.54
July	270	85	152	.303	.35
August	1,580	57	249	.497	.57
September	3,780	47	313	.625	.70
October	698	145	314	.627	.72
November	526	171	284	.567	.63
December	474	87	242	.483	.56
The year	21,300	47	960	1.92	25.76

WARE RIVER NEAR WARE, MASS.

Ware River is formed in the town of Barre by the union of several small streams. The surrounding country is hilly and largely cleared. The total drainage area comprises about 162 square miles and is tributary to Chicopee River, which drains a large section of central Massachusetts and is the largest tributary of the Connecticut in respect to drainage area, its basin containing 730 square miles. Chicopee River is formed at Three Rivers by the union in that vicinity of Ware, Swift, and Quaboag rivers; thence runs westward about 15 miles, joining the Connecticut at Chicopee. Chicopee River and its tributaries are quite important water-power streams, and expensive developments have been made on them.

The gaging station, which is located at the steel highway bridge about 2 miles above the village of Ware, was established September 15, 1904, in cooperation with the Otis Co. and the George H. Gilbert Manufacturing Co. of Ware, to obtain general information regarding the daily distribution of flow of the river.

The nearest dam downstream is that of the Otis Co. at Ware, and at times there is backwater effect from this dam. Upstream the nearest dam is at Gilbertville, a little over a mile.

A chain gage is attached to the bridge, from which discharge measurements are made. The gage datum has remained the same during the maintenance of the station. During the winter months the discharge is usually affected for short periods by ice. Conditions for making discharge measurements are good, but the measurements do not plot well on the rating curve because of backwater influence from the dam at Ware and changes in condition of the channel due to growth of grass and weeds during the summer.

Computations of monthly discharge are withheld pending the collection of more information regarding the conditions of flow at this point.

Discharge measurements of Ware River near Ware, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 2[a]	D. M. Wood	78	110	2.83	160
July 14	.....do	69	86.0	2.47	115
Aug. 5	.....do	67.5	81.9	2.50	111
Aug. 24	.....do	71	88.3	2.51	123
Oct. 9	.....do	69	85.2	2.60	130
Dec. 20[b]	F. F. Henshaw	85	120	3.03	67.1

[a] Some anchor ice. [b] Ice jam below station.

Daily gage height, in feet, of Ware River near Ware, Mass., for 1909.

[Miss Corinne Bousquet, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.75	3.25	3.62	3.60	4.25	3.05	2.52	2.13	2.16	2.62	2.51	2.50
2	2.98	3.60	3.70	3.52	4.50	2.95	1.95	2.50	1.58	2.25	2.25	2.62
3	2.50	4.15	3.65	3.65	4.30	2.90	2.40	2.46	2.06	2.20	2.35	2.30
4	2.68	4.25	3.25	3.38	3.90	3.00	1.95	2.51	2.02	2.15	2.25	2.62
5	2.82	4.25	3.25	3.62	3.55	3.00	2.30	2.42	1.98	2.14	2.35	2.15
6	4.15	4.15	3.25	3.62	3.60	3.00	2.25	2.51	2.32	2.65	2.51	2.35
7	3.60	3.98	2.75	3.65	3.30	3.25	2.70	2.25	2.25	2.22	2.15	2.38
8	3.92	2.92	2.90	3.70	3.45	3.20	2.45	2.12	2.42	2.18	2.34	2.36
9	3.75	3.12	3.05	3.62	3.00	3.10	2.65	2.51	2.30	2.15	2.10	3.30
10	2.52	3.70	3.35	3.38	3.42	2.95	2.20	2.51	2.25	1.90	2.10	2.80
11	3.22	5.20	3.78	3.20	3.45	2.88	2.05	2.53	1.98	2.32	2.12	2.79
12	2.80	4.05	3.55	3.42	3.45	2.70	2.50	2.46	1.95	2.35	1.92	2.80
13	3.15	3.40	3.45	3.25	3.20	2.30	2.62	2.55	1.95	2.46	2.20	3.00
14	3.28	3.22	3.10	3.40	3.30	3.05	2.35	2.10	1.83	2.45	1.90	3.20
15	2.78	3.40	3.22	6.90	2.50	2.70	2.50	1.81	2.12	2.19	2.16	2.86
16	2.85	3.45	3.35	6.65	2.40	2.70	2.52	2.45	2.20	1.78	2.15	3.02
17	4.40	3.52	3.28	5.92	3.25	3.10	2.28	2.55	2.10	2.46	2.08	2.98
18	4.90	3.25	3.20	5.10	3.15	3.02	1.80	2.60	2.11	2.40	2.10	2.78
19	4.35	3.05	3.18	4.70	3.20	2.88	2.40	2.90	2.26	2.35	2.12	2.48
20	4.00	5.90	2.80	4.62	3.25	2.30	2.66	2.82	2.26	2.12	1.80	2.85
21	4.05	5.80	3.00	4.35	3.00	2.90	2.68	2.92	2.35	2.10	1.85	3.70
22	3.65	4.48	3.20	4.35	3.05	2.70	2.63	2.41	2.42	2.12	2.20	3.31
23	3.75	4.10	3.00	4.05	2.90	2.60	2.63	2.55	2.25	1.78	2.12	2.65
24	2.80	4.75	3.10	4.15	3.10	2.50	2.31	2.48	2.11	2.31	2.12	2.39
25	3.90	6.95	3.60	3.85	3.15	2.72	2.26	2.05	2.25	2.05	2.32	2.68
26	3.05	5.70	6.30	3.70	3.10	2.30	2.54	2.10	2.00	2.31	2.25	2.15
27	3.15	4.65	5.92	3.80	3.00	1.85	2.46	2.35	2.40	2.38	2.25	2.68
28	2.80	3.80	4.90	4.00	3.30	2.48	2.48	2.28	2.32	2.55	2.25	2.55
29	2.85	......	4.65	4.10	3.10	2.52	2.46	2.15	2.40	2.12	2.40	2.60
30	3.30	......	4.08	3.95	3.30	2.35	2.55	2.32	2.20	2.68	2.45	2.70
31	2.25	......	3.82	......	3.02	......	2.47	2.16	......	2.60	......	2.60

NOTE.—Extent of ice conditions during 1909 not determined.

BURNSHIRT RIVER NEAR TEMPLETON, MASS.

This station, which is located just below Brown Pond, in the southwestern part of Templeton on the Phillipston line, and about 3 miles above Williamsville, where there is over 50 feet fall in a short distance, was established May 24, 1909. The river affords excellent power and storage sites which were formerly used, but are practically abandoned at present.

The only storage reservoir above the station now in use is Phillipston Pond, which controls the run-off from a small portion of the drainage area. The Stonebridge dam, 1 mile above the station, although out of repair and leaking badly, is intact and tends to reduce and prolong the crest of floods.

The natural flow from the Brown Pond dam, 150 feet above the station, is seldom interfered with, either by changing flashboards or the use of water through the wheel of the mill.

A staff gage is located just below the junction of the spillway and tailrace of the Brown Pond dam. The datum has remained unchanged. Discharge measurements are made by wading below the gage; velocities are low, but conditions otherwise are good.

Discharge measurements of Burnshirt River near Templeton, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	F. F. Henshaw	21	19.7	1.16	14.0
Nov. 15	....do	13	5.5	.49	1.78
27	....do	18	9.5	.75	4.33
30	....do	18	12.0	.86	6.31
Dec. 1	....do	9.2	1.7	[a] .40	1.0
16	W. Henshaw	18	13.0	[a] .92	6.94
17	F. F. Henshaw	26	38.0	[b] 1.91	30.4
18	....do	23	19.6	1.14	11.1

[a] Gage height probably affected by ice. [b] Gage height increased by released water at dam.

Daily gage height, in feet, of Burnshirt River near Templeton, Mass, for 1909.

[M. K. Powers, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.2	0.55	0.4	0.35	0.95	0.55	0.35
2		1.15	.5	.4	.35	.9	.55	1.4
3		1.15	.4	.4	.35	.85	.6	.75
4		1.1	.4	.7	.35	.8	.6	.75
5		1.05	.4	.6	.35	.75	.6	.75
6		1.05	.5	.5	.35	.7	.6	.7
7		1.0	.55	.45	.4	.65	.6	.7
8		.95	.5	.4	.35	.6	.55	.75
9		.95	.5	.4	.35	.55	.5	.75
10		.92	.4	.4	.35	.55	.45	.75
11		.95	.35	.4	.35	.7	.5	.75
12		.95	.35	.35	.35	.65	.5	.7
13		.9	.35	.35	.35	.6	.5	.6
14		.9	.35	.4	.35	.6	.5	.7
15		.85	.35	.4	.35	.55	.5	.8
16		.8	.35	.4	.42	.55	.5	.9
17		.75	.6	.4	.35	.55	.55	.95
18		.85	.6	.4	.35	.5	.55	1.15
19		.8	.55	.4	.35	.55	.6	.7
20		.8	.5	.35	.35	.55	.6	.75
21		.78	.5	.35	.35	.55	.6	.7
22		.75	.45	.35	.48	.6	.55	.7
23		.7	.4	.35	.35	.65	.6	.6
24		.7	.35	.38	.35	.7	.6	.55
25		.62	.35	.35	.35	.7	.7	.55
26	1.0	.65	.35	.35	.4	.65	.65	
27	1.15	.65	.35	.38	.55	.65	.7	.5
28	1.25	.6	.4	.35	.7	.65	.75	.5
29	.75	.55	.55	.35	.95	.65	.9	.5
30	1.3	.55	.4	.35	1.15	.6	.9	.45
31	1.25		.4	.35		.5		.45

NOTE.—There was probably relatively little effect from ice during Deccember. Water shut off at dam Dec. 1 and released Dec. 2.

Daily discharge, in second-feet, of Burnshirt River near Templeton, Mass., for 1909.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		13.0	2.2	1.1	0.85	7.8	2.2	0.85
2		11.9	1.8	1.1	.85	6.8	2.2	17.8
3		11.9	1.1	1.1	.85	6.0	2.7	4.5
4		10.8	1.1	3.8	.85	5.2	2.7	4.5
5		9.8	1.1	2.7	.85	4.5	2.7	4.5
6		9.8	1.8	1.8	.85	3.8	2.7	3.8
7		8.7	2.2	1.4	1.1	3.2	2.7	3.8
8		7.8	1.8	1.1	.85	2.7	2.2	4.5
9		7.8	1.8	1.1	.85	2.2	1.8	4.5
10		7.2	1.1	1.1	.85	2.2	1.4	4.5
11		7.8	.85	1.1	.85	3.8	1.8	4.5
12		7.8	.85	.85	.85	3.2	1.8	3.8
13		6.8	.85	.85	.85	2.7	1.8	2.7
14		6.8	.85	1.1	.85	2.7	1.8	3.8
15		6.0	.85	1.1	.85	2.2	1.8	5.2

Daily discharge, in second-feet, of Burnshirt River near Templeton, Mass., for 1909—Con.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	....	5.2	0.85	1.1	1.2	2.2	1.8	6.8
17	....	4.5	2.7	1.1	.85	2.2	2.2	7.8
18	....	6.0	2.7	1.1	.85	1.8	2.2	11.9
19	....	5.2	2.2	1.1	.85	2.2	2.7	3.8
20	....	5.2	1.8	.85	.85	2.2	2.7	4.5
21	....	4.9	1.8	.85	.85	2.2	2.7	3.8
22	....	4.5	1.4	.85	1.7	2.7	2.2	3.8
23	....	3.8	1.1	.85	.85	3.2	2.7	2.7
24	....	3.8	.85	1.0	.85	3.8	2.7	2.2
25	....	2.9	.85	.85	.85	3.8	3.8	2.2
26	8.7	3.2	.85	.85	1.1	3.2	3.2	2.0
27	11.9	3.2	.85	1.0	2.2	3.2	3.8	1.6
28	14.2	2.7	1.1	.85	3.8	3.2	4.5	1.8
29	4.5	2.2	2.2	.85	7.8	3.2	6.8	1.8
30	15.4	2.2	1.1	.85	11.9	2.7	6.8	1.4
31	14.2	....	1.1	.85	....	1.8	....	1.4

NOTE.—Daily discharge based on a rating curve which is well defined below discharge 30 second-feet. No correction made for possible ice effect during December.

Monthly discharge of Burnshirt River near Templeton, Mass., for 1909.

[Drainage area, 8.4 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May 26-31	15.4	4.5	11.5	1.37	0.31	B.
June	13.0	2.2	6.45	.768	.86	B.
July	2.7	.85	1.41	.168	.19	B.
August	3.8	.85	1.17	1.39	.16	B.
September	11.9	.85	1.65	.196	.22	B.
October	7.8	1.8	3.31	.394	.45	B.
November	6.8	1.4	2.77	.330	.37	B.
December	17.8	.85	4.29	.511	.59	B.

QUABOAG RIVER AT WEST BRIMFIELD, MASS.

Quaboag River is formed near East Brookfield, in central Massachusetts, by the union of a number of small streams that drain a series of small ponds, and takes a general southwesterly course to Three Rivers, where it joins Ware and Swift rivers, to form Chicopee River. The tributaries of the Quaboag are small.

The river is one of the best-controlled streams in Massachusetts as the natural pond area is large, and these ponds, with the artificial ponds formed at the numerous power plants, materially retard floods and equalize the flow through the year.

The country is rolling and the soil is of sand and clay. Very little of the drainage area is forested. As a rule winters in this stream are not severe. The average rainfall is probably about 45 inches.

This station, which is located at a highway bridge near the West Brimfield station of the Boston & Albany Railroad, was established August 23, 1909, in cooperation with the State of Massachusetts, to obtain information regarding the daily distribution of flow of the river, During periods of low water gage heights show marked variations during the day owing to the operation of the mills at and above West Warren. The gage is read twice daily, with and without the mills running.

Discharge measurements are made from the bridge to which the staff gage is attached, or by wading. The gage datum remained the same during the year. Conditions for making measurements are good, except for the period during the winter months when ice interferes with the flow.

Discharge measurements of Quaboag River at West Brimfield, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 23	D. M. Wood	45	80.2	2.26	113
Do[a]	.....do	50	106	2.15	95.0
Oct. 12	.....do	45	79.8	2.28	117

[a] Measurement made from upstream side of bridge.

Daily gage height, in feet, and discharge in second-feet of Quaboag River, near West Brimfield, Mass., for 1909.

[Mrs. W. E. Holland, observer.]

Day.	August.		September.		October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.91	55	1.90	54	2.01	70	1.81	43
2			1.98	65	1.62	21	1.98	65	2.04	74
3			1.88	52	2.00	68	1.94	60	1.95	61
4			2.01	70	2.41	150	1.94	60	1.76	37
5			1.88	52	1.80	42	1.96	62	1.65	24
6			2.28	120	2.01	70	1.62	21	2.12	88
7			2.12	88	2.05	76	1.70	30	1.95	61
8			1.95	61	1.96	62	2.45	160	1.95	61
9			1.85	48	1.71	31	1.90	54	2.08	81
10			1.80	42	2.18	99	2.00	68	2.10	84
11			1.60	19	2.24	111	2.15	94	1.90	54
12			1.80	42	2.06	78	1.75	36	1.95	61
13			2.09	82	2.03	73	1.61	20	2.35	136
14			1.85	48	2.02	71	1.65	24	3.30	473
15			1.95	61	1.94	60	2.40	147	3.10	377
16			1.88	52	1.65	24	2.00	68	2.75	246
17			2.00	68	1.75	36	1.76	37	2.50	173
18			1.75	36	2.06	78	1.86	49	2.22	107
19			1.82	44	1.95	61	1.82	44	1.82	44
20			2.20	103	1.92	57	1.76	37	3.26	
21			1.95	61	1.92	57	1.60	19	3.15	
22			1.90	54	1.99	67	1.95	61	2.55	
23	2.21	105	1.85	48	1.80	42	1.86	49	2.59	
24	1.99	67	1.92	56	1.91	55	1.82	44	2.25	
25	1.98	65	1.76	37	2.26	116	1.75	36	2.08	
26	1.99	67	1.80	42	2.00	68	2.12	88		
27	2.00	68	2.16	95	1.99	67	1.95	61	3.00	
28	1.82	44	2.30	124	1.95	61	1.65	24	2.60	
29	1.80	42	2.76	249	1.92	57	2.30	124	2.60	
30	2.14	92	2.56	189	1.71	31	2.00	68	2.62	
31	1.95	61			1.58	17			2.64	

NOTE.—Ice conditions prevailed from about Dec. 20 to 31. The daily discharge is based on a well-defined rating curve, but, owing to the great diurnal variation in gage heights due to control at the mills above, the daily values of gage height and discharge are subject to large errors.

Monthly discharge of Quaboag River near West Brimfield, Mass., for 1909.

[Drainage area, 150 square miles.]

Month.	Discharge in second-feet.		Run-off depth in inches on drainage area.	Accuracy.
	Mean.	Per square mile.		
Aug. 23-31	67.9	0.453	0.15	D.
September	72.1	.481	.54	D.
October	63.2	.421	.49	D.
November	59.3	.395	.44	D.
December	98.9	.659	.76	D.

NOTE.—Maximum and minimum discharges are too uncertain to warrant publication. See footnote to preceding table. Discharge Dec. 20 to 31 estimated 0.65 second-feet, due to ice conditions.

WESTFIELD RIVER AT KNIGHTVILLE, MASS.

The main branch of Westfield River rises in the Berkshire Hills, in the northeastern part of Berkshire County, Mass., and flows in a southeasterly direction to its junction with Swift River. Its course is then generally southward to Huntington, the tributary streams from the west being the Middle Branch and West Branch of Westfield River, and from the east the East Branch.

The Middle Branch of Westfield River rises in the hills near East Windsor, flows southeast, and enters Westfield River above Huntington, its total length being about 24 miles.

The West Branch of Westfield River rises near Washington, flows nearly parallel to the Middle Branch, and enters the Westfield at Huntington, about 2 miles below the Middle Branch. Its total length is about 22 miles.

From Huntington the Westfield flows in a general southeasterly direction, receiving from the west Freeland Brook and Westfield Little River. Where it flows through the town of Agawam it is known as Agawam River. It enters Connecticut River about half a mile below Springfield. Its total length is made up of a series of rapids and quick water. The amount of storage in the basin is insignificant. Several important power plants are installed at Agawam, West Springfield, Westfield, and Woronoco, and there are smaller ones farther up the river. The opportunities for further development are numerous. The average rainfall in this area is over 40 inches.

The gaging station, which is located at the steel highway bridge at Knightville, about 4½ miles north of the town of Huntington, locally known as the Pitcher Bridge, 1 mile north of the outlet of Norwich Lake and about 3 miles north of the junction with the Middle Branch of Westfield River, was established August 26, 1909, in cooperation with the State of Massachusetts to obtain information regarding the daily distribution of flow of the river.

The Westfield at this point is quick falling. The bed is rough, being formed of large gravel and ledge. There is no danger of artificial backwater, as the fall between this station and the nearest dam, that at Huntington, is great.

A chain gage is attached to the highway bridge. Discharge measurements are made from the highway bridge, where the conditions are fairly good. During the winter anchor ice and ice cover interfere materially with the flow. For open-water periods the data are reliable.

The rating curve has been fairly well defined from 1909–10 discharge measurements. During the year no change was made in the gauge datum.

Discharge measurements of Westfield River at Knightville, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 4[a]	D. M. Wood			0.83	24.0
26[b]	do	99	83.6	1.01	27.7
Oct. 11[c]	Norcross and Wood	102	112	1.15	37.3

[a] Section was measured below Middle Branch and Norwich Lake outlet giving a total discharge of 30.7 second-feet. The two tributaries were then measured, giving by subtraction 24.0 second-feet at the gaging station.
[b] Downstream side of highway bridge.
Upstream side of highway bridge.

Daily gage height, in feet, of Westfield River at Knightville, Mass., for 1909.

[W. M. and G. A. Fisk, observers.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.96	1.49	1.20	1.26	16		1.06	1.19	1.30	2.60
2		.94	1.44	1.20	1.26	17		1.15	1.20	1.45	2.28
3		.94	1.42	1.35	1.24	18		1.12	1.27	1.45	1.70
4		.91	1.40	1.40	1.24	19		1.02	1.25	1.40	1.62
5		.98	1.39	1.30	1.26	20		.96	1.25	1.40	1.55
6		.92	1.41	1.30	1.24	21		.98	1.28	1.30	1.60
7		.94	1.28	1.20	1.40	22		.98	1.45	1.30	1.70
8		.98	1.17	1.20	1.42	23		1.03	1.45	1.30	1.80
9		1.01	1.26	1.20	1.38	24		1.23	1.28	1.30	2.05
10		.98	1.35	1.20	1.41	25		1.79	1.28	1.28	2.15
11		1.04	1.40	1.30	1.42	26	1.00	1.53	1.45	1.26	2.10
12		1.31	1.45	1.30	1.34	27	1.00	2.88	1.41	1.25	2.14
13		1.02	1.40	1.30	1.42	28	.98	2.43	1.41	1.25	2.14
14		1.11	1.30	1.30	2.12	29	1.01	1.86	1.31	1.26	2.14
15		1.12	1.29	1.30	2.22	30	1.02	1.59	1.30	1.28	2.14
						31	1.10		1.20		2.14

NOTE.—Ice conditions probably prevailed from about Dec. 16 to 31.

Daily discharge, in second-feet, of Westfield River at Knightville, Mass., for 1910.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		25	98	48	57	16		33	47	63	
2		24	88	48	57	17		42	48	90	
3		24	84	72	54	18		39	58	90	
4		22	80	80	54	19		30	56	80	
5		27	78	63	57	20		25	56	80	
6		22	82	63	54	21		27	60	63	
7		24	60	48	80	22		27	90	63	
8		27	45	48	84	23		31	90	63	
9		29	57	48	77	24		52	60	63	
10		27	72	48	82	25		172	60	60	
11		32	80	63	84	26	28	107	90	57	
12		65	90	63	70	27	28	610	82	56	
13		30	80	63	84	28	27	402	82	56	
14		38	63	63	280	29	29	193	65	57	
15		39	62	63	318	30	30	120	63	60	
						31	37		48		

NOTE.—Daily discharge based on a fairly well-defined rating curve.

Monthly discharge of Westfield River at Knightville, Mass., for 1909.

[Drainage area, 162 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Aug. 26-31	37	27	29.8	0.184	0.04	C.
September	610	22	78.8	.486	.54	B.
October	98	45	70.1	.433	.50	B.
November	90	48	62.7	.387	.43	B.
December	318	40	95.7	.591	.68	C.

NOTE.—Discharge estimated 92 second-feet during ice conditions Dec. 16 to 31.

WESTFIELD LITTLE RIVER NEAR BLANDFORD, MASS.

Westfield Little River is formed by the union of Peebles and Borden brooks in the southern part of the town of Blandford. The headwaters of Peebles Brook are in North Blandford, at an elevation of about 1,400 feet above sea level; at its junction with Borden Brook it has an elevation of about 850 feet—a fall of 550 feet in a distance of about 8 miles. Below Borden Brook the river also falls rapidly, reaching an elevation of 200 feet above sea level in the vicinity of West Parish, a distance of 6 miles from Borden Brook. The drainage area at the junction of Peebles and Borden brooks is about 43 square miles; at the mouth of the river, 83.6 square miles. The slopes are very steep and in places precipitous. The greater part of the basin above West Parish is in forest.

The city of Springfield, Mass., has begun to use this river as a source of water supply. A large storage reservoir has been built in the upper part of Borden Brook and a concrete diversion dam near the corners of Russell, Westfield, and Granville. The water is then carried by a tunnel through the mountain, a distance of about a mile, to the filter plant at Mundale. There it is taken through a steel pipe line to Springfield. A distributing reservoir about 5 miles from Springfield is provided at Provin Mountain, Westfield.

The gaging station, which is located a short distance below Borden Brook, at Cobble Mountain, near Blandford, Mass., was established July 13, 1905, and has been maintained since that time in cooperation with the water board of the city of Springfield through its engineer, E. E. Lochridge.

Staff gages and a chain gage have been used to obtain gage heights. All gages have been referred to the same datum, which has remained the same during the maintenance of the station. Discharge measurements are made from a car and cable, or by wading. During the winter months the discharge is affected by ice. Conditions for obtaining accurate discharge data are good, and an excellent rating curve has been developed.

On August 10, 1906, a sharp-crested weir, with crest about 30 feet long, capable of carrying a depth of flow of 1½ feet, was installed a short distance downstream from the current-meter station. This was maintained with some interruptions until September, 1907, when it was destroyed by high water. Estimates of flow over the weir as given are based on the coefficients given on page 36 of Water-Supply Paper 200. The weir gage was read at approximately the same time as the current-meter gage, and considerable comparative information upon the accuracy at this station has been obtained.[1]

Discharge measurements of Westfield Little River near Blandford, Mass., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec-ft.*
Jan. 1[a]	D. M. Wood	29	37.8	2.40	21.8
7[b]	.....do	51	113	3.54	221
21[c]	.....do	30	27.0	2.61	22.7
Feb. 10[d]	.....do	36	70.8	3.53	86.9
Feb. 24[e]	.....do	74	170	4.61	618
Mar. 9[f]	.....do	41	65.3	2.71	53.6
Apr. 2	.....do	52	106	3.52	226
June 2	.....do	40	63.5	2.60	45.1
Aug. 25	.....do	21.5	18.5	1.96	9.3
Oct. 9	T. W. Norcross	33.5	36.3	1.92	5.3

[a] Measurement made under ice cover; conditions poor; gage height to water surface.
[b] Anchor ice.
[c] Measurement made under ice cover; average thickness of ice 0.75 foot. Water surface averaged 0.3 foot below top of ice. Some water over ice and some anchor ice.
[d] Measurement made under ice cover. Average ice thickness 0.5 foot. Water and slush 0.1 to 0.3 foot deep on ice.
[e] Discharge not affected by ice.
[f] Ice near shores.

[1] See Water-Supply Papers 201, pp. 105–110, and 241, pp. 164–168.

Daily gage height, in feet, of Westfield Little River near Blandford, Mass., for 1909.

[W. V. Bodurtha, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.35	2.62	......	......	4.13	2.68	1.93	1.61	1.75	2.31	1.93	2.31
2	2.30	2.72	......	......	......	2.58	1.91	1.59	1.73	2.25	1.91	2.33
3	2.24	2.60	......	3.53	......	2.45	1.87	1.58	1.74	2.17	1.90	2.27
4	2.20	2.50	......	3.38	3.23	2.39	1.83	1.57	1.73	2.13	2.09	2.28
5	3.95	2.80	......	3.43	3.13	2.53	1.83	2.23	1.73	2.07	1.99	2.35
6	5.04	4.25	......	3.73	3.11	2.47	1.83	2.25	1.77	2.03	1.95	2.29
7	3.53	3.68	......	4.03	3.05	2.45	1.85	2.18	1.71	1.95	1.94	2.25
8	2.95	3.42	......	3.78	2.99	2.41	1.83	2.09	1.69	1.93	1.92	2.21
9	2.80	3.25	2.71	3.58	2.83	2.35	1.93	1.97	1.68	1.92	1.93	2.21
10	2.84	3.45	3.50	3.28	2.79	2.69	1.85	1.83	1.75	1.91	1.93	2.15
11	2.72	4.20	3.28	3.08	2.75	2.61	1.87	1.79	2.05	2.17	1.91	2.13
12	2.52	3.70	3.10	3.03	2.69	2.47	1.89	1.71	1.85	2.11	1.93	2.13
13	2.45	3.48	2.95	2.98	2.68	2.43	1.85	1.67	1.78	2.03	1.95	2.20
14	2.40	3.62	2.90	5.60	2.63	2.39	1.85	1.83	1.75	1.98	1.91	3.63
15	2.90	3.48	2.82	6.80	2.55	2.33	1.87	1.77	1.75	1.95	1.91	3.51
16	2.68	3.33	3.00	4.03	2.53	2.31	1.91	1.97	1.73	1.93	1.90	3.29
17	2.75	3.44	2.72	3.68	2.51	2.35	2.15	2.33	1.89	1.90	2.25	3.11
18	3.00	3.35	2.80	3.38	2.81	2.97	2.21	2.97	1.97	1.89	2.13	2.88
19	3.16	3.04	2.62	3.08	2.73	2.75	2.05	2.61	1.81	1.89	2.09	2.75
20	2.90	5.80	2.72	3.01	2.67	2.53	1.97	2.55	1.73	1.91	2.07	2.69
21	2.52	4.30	2.82	3.05	2.61	2.38	1.93	2.41	1.71	1.91	2.03	2.65
22	2.50	......	2.72	3.38	2.88	2.33	1.93	2.18	1.67	1.89	2.02	2.58
23	3.10	......	2.80	3.63	2.81	2.29	2.13	2.05	1.68	1.87	2.05	2.55
24	3.16	4.61	2.75	3.35	2.69	2.24	2.21	1.97	1.79	2.13	2.08	2.33
25	3.28	4.45	6.80	3.21	2.61	2.19	2.05	1.91	2.23	2.11	2.15	2.29
26	3.20	3.85	4.78	3.03	2.58	2.11	2.00	1.88	2.55	2.08	2.31	......
27	3.08	3.52	3.95	2.88	3.33	2.05	1.95	1.85	2.49	2.05	2.29	......
28	3.00	3.32	3.90	3.41	3.23	2.01	1.91	1.83	2.43	2.04	2.31	......
29	2.90	......	3.70	3.13	3.43	1.97	1.83	1.83	2.38	2.01	2.35	......
30	2.82	......	......	3.41	3.21	1.95	1.75	1.81	2.35	1.98	2.33	......
31	2.70	......	......	......	2.88	......	1.69	1.78	......	1.94	......	......

NOTE.—Ice conditions prevailed Jan. 1 to Feb. 19, and for short periods during December.

Daily discharge, in second-feet, of Westfield Little River near Blandford, Mass., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	19.3	19.7	149	254	440	51.0	7.6	2.6	4.4	21.1	7.6	21.1
2	17.1	24.3	137	242	340	40.9	7.2	2.4	4.1	18.2	7.2	22.2
3	14.8	18.4	125	230	238	29.9	6.4	2.3	4.3	14.8	7.0	19.2
4	13.3	14.2	113	180	136	25.8	5.7	2.2	4.1	13.3	11.9	19.6
5	340	27.2	101	196	115	36.4	5.7	17.3	4.1	11.2	9.0	23.3
6	721	198	90	300	111	31.5	5.7	18.2	4.7	10.0	8.0	20.1
7	218	113	78	406	100	29.9	6.0	15.2	3.8	8.0	7.8	18.2
8	80.8	77.3	66	318	90.9	27.1	5.7	11.9	3.6	7.6	7.4	16.4
9	61.5	55.0	54.4	248	68.5	23.3	7.6	8.5	3.4	7.4	7.6	16.4
10	66.2	77.1	220	149	63.5	52.0	6.0	5.7	4.4	7.2	7.6	14.0
11	52.5	204	149	105	58.7	43.8	6.4	5.0	10.6	14.8	7.2	13.3
12	33.7	145	109	97.0	52.0	31.5	6.8	3.8	6.0	12.6	7.6	13.3
13	28.4	119	85.0	89.4	51.0	28.5	6.0	3.3	4.9	10.0	8.0	16.0
14	25.1	165	77.9	955	45.8	25.8	6.0	5.7	4.4	8.5	7.2	266
15	74.0	147	67.3	1,380	38.1	22.2	6.4	4.7	4.4	8.0	7.2	224
16	48.5	123	92.4	406	36.4	21.1	7.2	8.5	4.1	7.4	7.0	152
17	30.5	162	55.3	283	34.7	23.3	14.0	22.2	6.8	7.0	18.2	111
18	48.0	150	64.7	180	66.0	88.0	16.4	88.0	8.5	6.8	13.3	75.2
19	63.0	92.6	44.8	105	56.5	58.7	10.6	43.8	5.3	6.8	11.9	58.7
20	40.5	1,020	55.3	93.9	49.9	36.4	8.5	38.1	4.1	7.2	11.2	52.0
21	18.5	500	67.3	100	43.8	25.1	7.6	27.1	3.8	7.2	10.0	47.8
22	17.2	536	55.3	180	75.2	22.2	7.6	15.2	3.3	6.8	9.8	40.9
23	55.6	574	64.7	266	66.0	20.1	13.3	10.6	3.4	6.4	10.6	38.1
24	60.5	609	58.7	170	52.0	17.8	16.4	8.5	5.0	13.3	11.6	22.2
25	73.0	552	1,380	131	43.8	15.6	10.6	7.2	17.3	12.6	14.0	20.1
26	62.0	342	668	97.0	40.9	12.6	9.2	6.6	38.1	11.6	21.1	20
27	50.4	227	378	75.2	164	10.6	8.0	6.0	33.0	10.6	20.1	20
28	43.4	161	360	189	136	9.5	7.2	5.7	28.5	10.3	21.1	20
29	35.8	......	290	115	196	8.5	5.7	5.7	25.1	9.5	23.3	18
30	30.9	......	278	189	131	8.0	4.4	5.3	23.3	8.7	22.2	16
31	23.9	......	266	......	75.2	......	3.6	4.9	......	7.8	......	16

NOTE.—Daily discharge during the period of open flow are based on a well-defined rating curve during the periods of ice conditions on measurements made during ice conditions and climatological data.

Monthly discharge of Westfield Little River near Blandford, Mass., for 1909.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	721	13.3	79.6	1.85	2.13	B.
February	1,020	14.2	230	5.35	5.57	B.
March	1,380	44.8	187	4.35	5.02	A.
April	1,380	75.2	258	6.00	6.69	A.
May	440	34.7	104	2.42	2.79	A.
June	88.0	8.0	29.2	.679	.76	A.
July	16.4	3.6	7.92	.184	.21	A.
August	88.0	2.2	13.3	.309	.36	A.
September	38.1	3.3	9.36	.218	.24	A.
October	21.1	6.4	10.1	.235	.27	A.
November	23.3	7.0	11.5	.268	.30	A.
December	266	13.3	46.8	1.09	1.26	B.
The year	1,380	2.2	82.2	1.91	25.30	

HOUSATONIC RIVER DRAINAGE BASIN.

DESCRIPTION.

Housatonic River rises in Berkshire County, Mass., and flows southward, entering Long Island Sound near the west end of Connecticut. It is about 125 miles long, and drains a total area of about 1,930 square miles. Its most important tributaries are Tenmile River, a stream lying almost entirely in New York State and entering the river near Gaylordsville, and Naugatuck River, with a drainage area of 313 square miles, which enters at Birmingham and is entirely in the State of Connecticut. In the vicinity of Pittsfield the Housatonic reaches an elevation of about 1,500 feet, this being a hilly and mountainous region. Through Connecticut the river in general runs through a wide valley, much of which is in farm land. In most places the bed of the river is of gravel, but in a few localities there are falls over ledges of limestone and granite. The basin is to some extent in forest cover, especially in its upper portions, but as a whole it may be said to consist largely of farm lands.

The mean annual precipitation is probably about 43 inches. In the upper portion of the basin the winters are severe, but as a whole the area is sufficiently far south so that the river is open during a considerable part of the winter season.

In the whole drainage basin there are some 15 square miles of lake and pond surface, but generally speaking, storage has been very little developed and there are numerous opportunities for improvements of this nature.

Power has been developed at Birmingham, New Milford, and recently at Bulls Bridge above Gaylordsville, and at a number of other places, but there remains considerable unutilized power both on the main river and its tributaries.

A gaging station has been maintained at Gaylordsville on the main river since 1900, and during this period the driest year was 1908 and the wettest 1903, the total flow during these two years being about in the ratio of 1 to 2.03.

HOUSATONIC RIVER AT GAYLORDSVILLE, CONN.

This station, which is located at the covered wooden highway bridge at Gaylordsville, about 2 miles below the mouth of Tenmile River, was established October 24, 1900, to obtain information regarding the daily distribution of flow of the river.

Downstream the nearest dam is at New Milford, about 7 miles below the station; a few miles upstream, at Bulls Bridge, is a recently constructed dam. No backwater is caused by the dam below the station at low and medium stages, but there may be a slight effect at high stages.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. The observer is paid by the United States Weather Bureau from November to April. On account of the poor cross-section at the bridge discharge measurements are made from a cable 1¼ miles below, or by wading. The discharge is affected by ice during short periods of the winter. Conditions for obtaining accurate discharge data are good and a good rating curve has been developed. No measurements were made in 1909 but a low-water measurement made in 1910 indicates that no change has occurred in conditions of flow.

Daily gage height, in feet, of Housatonic River at Gaylordsville, Conn., for 1909.

[G. H. Munroe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.2	4.1	5.6	5.8	6.0	4.9	3.9	3.2	3.4	4.0	3.0	3.4
2	3.5	3.9	5.5	5.6	6.3	4.7	3.8	3.4	3.2	3.7	3.2	3.4
3	2.7	4.3	5.6	5.7	6.0	4.6	4.2	3.2	3.3	3.4	3.4	3.4
4	3.7	4.2	5.5	5.6	5.7	4.6	3.5	3.2	3.1	3.4	3.4	3.3
5	3.7	3.9	5.1	5.6	5.7	4.7	3.4	4.0	2.4	3.4	3.4	2.8
6	6.7	4.0	4.8	5.5	5.6	4.4	3.3	4.8	2.7	3.4	3.3	3.6
7	6.5	4.9	4.9	5.5	5.5	4.0	3.2	4.6	3.2	3.4	2.4	3.6
8	5.3	4.8	4.9	5.6	5.7	3.8	3.2	4.4	3.3	3.4	3.1	3.4
9	5.2	4.9	4.9	5.6	5.6	4.3	3.2	4.0	3.2	3.4	3.1	3.5
10	5.0	4.85	5.0	5.6	5.3	4.2	3.2	3.8	3.3	2.5	3.1	3.3
11	4.7	6.0	5.9	5.7	5.3	4.3	3.1	3.9	3.3	3.4	3.1	3.3
12	4.5	5.5	5.8	5.6	5.2	4.2	3.2	3.5	2.8	3.4	3.3	2.8
13	4.0	5.1	5.5	5.3	5.2	4.3	3.2	3.3	3.2	3.5	3.3	3.4
14	4.1	4.9	5.5	5.95	5.0	4.2	3.3	3.2	3.3	3.3	2.6	5.0
15	4.0	5.0	5.2	8.05	5.0	4.2	3.4	3.1	3.3	3.3	3.3	4.9
16	4.2	4.8	4.7	7.9	5.0	4.4	3.3	3.3	3.3	3.3	3.3	4.6
17	4.2	5.9	5.0	7.7	5.0	4.4	3.4	3.8	3.3	2.7	3.3	4.3
18	4.5	5.4	4.9	7.4	5.0	5.0	3.3	4.0	3.3	3.3	3.4	4.1
19	4.2	5.0	4.8	6.7	5.0	5.2	3.5	3.9	2.7	3.2	3.4	3.8
20	4.2	8.6	4.8	6.5	4.9	4.9	3.3	4.0	3.3	3.4	3.3	3.8
21	4.3	7.9	4.7	6.1	4.8	4.5	3.5	3.9	3.3	3.3	2.5	3.4
22	4.0	7.2	4.7	6.0	4.8	4.4	3.2	3.4	3.4	3.0	3.1	3.3
23	4.0	6.5	4.7	5.5	5.2	4.4	3.5	3.6	3.2	3.0	3.1	3.3
24	4.2	6.5	4.7	6.0	5.0	4.4	3.7	3.4	3.7	2.5	3.3	3.4
25	4.7	7.3	4.8	5.8	4.7	4.2	3.0	3.3	3.6	3.0	2.8	3.4
26	4.6	6.4	7.0	5.5	4.7	4.2	3.6	3.2	3.0	3.3	3.3	3.4
27	4.4	6.5	6.4	5.5	4.7	4.0	3.4	3.5	3.6	3.3	3.4	3.4
28	4.3	6.4	6.5	5.6	4.8	3.9	3.3	3.5	3.6	3.3	2.7	3.5
29	4.2	....	6.1	5.5	5.3	3.6	3.2	2.8	4.2	3.3	3.4	3.5
30	4.2	....	6.1	5.5	5.5	3.5	3.7	3.3	4.3	3.3	3.3	3.6
31	4.2	....	6.0	....	5.1	....	3.6	3.4	....	3.1	....	3.6

NOTE.—Ice conditions prevailed and affected the discharge more or less from Jan. 1 to about Feb. 6, and from about Dec. 24 to 31.

Daily discharge, in second-feet, of Housatonic River at Gaylordsville, Conn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	401	....	3,060	3,450	3,860	1,900	816	a 401	505	890	305	505
2	561	....	2,870	3,060	a4,520	1,620	747	505	401	682	401	505
3	a 182	....	3,060	3,250	3,860	1,490	1,060	401	452	a 505	505	505
4	682	....	2,870	a3,060	3,250	1,490	a 561	401	352	505	505	452
5	682	....	2,200	3,060	3,250	1,620	505	890	a 83	505	505	a 220
6	5,450	890	1,760	2,870	3,060	a1,260	452	1,760	182	505	452	620
7	4,980	a 1,900	a1,900	2,870	2,870	890	401	1,490	401	505	a 83	620
8	2,520	1,760	1,900	3,060	3,250	747	401	a1,260	452	505	352	505
9	2,360	1,900	1,900	3,060	a3,060	1,160	401	890	401	505	352	561
10	a2,050	1,830	2,050	3,060	2,520	1,060	401	747	452	a 114	352	452
11	1,620	3,860	3,650	a3,250	2,520	1,160	a 352	816	452	505	352	452
12	1,370	2,870	3,450	3,060	2,360	1,060	401	561	a 220	505	452	a 220
13	890	2,200	2,870	2,520	2,360	a1,160	401	452	401	561	452	505
14	970	a 1,900	a2,870	3,760	2,050	1,060	452	401	452	452	a 147	2,050
15	890	2,050	2,360	8,940	2,050	1,060	505	a 352	452	452	452	1,900
16	....	1,760	1,620	8,530	a2,050	1,260	452	452	452	452	452	1,490
17	....	3,650	2,050	7,990	2,050	1,260	505	747	452	a 182	452	1,160
18	....	2,690	1,900	a7,210	2,050	2,050	a 452	890	452	452	505	970
19	....	2,050	1,760	5,450	2,050	2,360	561	816	a 182	401	505	a 747
20	....	10,400	1,760	4,980	1,900	a1,900	452	890	452	505	452	747
21	....	a 8,530	a1,620	4,080	1,760	1,370	561	816	452	452	a 114	505
22	....	6,690	1,620	3,860	1,760	1,260	401	a 505	505	305	352	452
23	....	4,980	1,620	2,870	a2,360	1,260	561	620	401	305	352	452
24	....	4,980	1,620	3,860	2,050	1,260	682	505	682	a 114	452	....
25	....	6,950	1,760	a3,450	1,620	1,060	a 305	452	620	305	220	....
26	....	4,750	6,180	2,870	1,620	1,060	620	401	a 305	452	452	....
27	....	4,980	4,750	2,870	1,620	a 890	505	561	620	452	505	....
28	....	a 4,750	a4,980	3,060	1,760	816	452	561	620	452	a 182	....
29	....	....	4,080	2,870	2,520	620	401	a 220	1,060	452	505	....
30	....	....	4,080	2,870	a2,870	561	682	452	1,160	452	452	....
31	....	....	3,860	....	2,200	....	620	505	....	a 352	....	....

a Sunday. Low discharge occurring on Sunday due to storage of water at power plant above the station.

NOTE.—Daily discharge during periods of free flow based on a well-defined rating curve.

Monthly discharge of Housatonic River at Gaylordsville, Conn., for 1909.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Per square mile.	Run-off (depth in inches on drainage area).	Accuracy.
January	5,450	a 182	1,250	1.23	1.42	C.
February	10,400	....	3,270	3.21	3.34	B.
March	6,180	1,620	2,710	2.66	3.07	B.
April	8,940	2,520	3,970	3.89	4.34	B.
May	4,520	1,620	2,490	2.44	2.81	B.
June	2,360	561	1,260	1.24	1.38	B.
July	1,060	a 305	518	.508	.59	B.
August	1,760	a 220	668	.655	.76	B.
September	1,160	a 83	469	.460	.51	B.
October	890	a 114	445	.436	.50	B.
November	505	a 83	387	.379	.42	B.
December	2,050	a 220	632	.620	.71	B.
The year	10,400	a 83	1,510	1.48	19.85	

a These minima are low on account of storage of water at power plant above the station.

NOTE.—Discharge during the assumed periods when discharge was affected by ice conditions estimated on the basis of climatological data.

Mean discharge Jan. 16 to 31, estimated, 819 second-feet; Feb. 1 to 5, estimated, 650 second-feet; Dec. 24 to 31, estimated, 375 second-feet.

HUDSON RIVER DRAINAGE BASIN.

DESCRIPTION.

The principal sources of Hudson River lie in the wildest portion of the Adirondack Mountains, in Essex County, northeastern New York. A number of branches, any one of which might possibly be considered the main stream, form its upper waters; but if the highest collected and permanent body of water be assumed as the true head, then the source of the Hudson becomes Lake Tear-of-the-Clouds, which lies at an elevation of 4,322 feet above tide, in the center of the triangle formed by Mounts Marcy and Skylight and Gray Peak.

The river flows rather irregularly southward until it reaches the northern boundary of Saratoga County, where it makes a sharp turn and flows eastward for about 12 miles, passing through the mountains and forming, as it cuts across the rocky strata, several falls of great height and beauty. At Sandy Hill, just below Glens Falls, it makes another abrupt turn and flows southward, continuing in this direction until it empties into New York Bay.

From Lake Tear-of-the-Clouds to the mouth of the river the distance by water is probably about 300 miles. The total area drained is 13,366 square miles. The river is tidal to Troy, which is also at the head of navigation.

The headwater region is mountainous in character, is in general heavily wooded, and is dotted with numerous lakes and ponds. The rocks, belonging to the oldest formation and mainly granitic, are either bare or covered only with a layer of spruce duff, humus, and forest litter. The river emerges from the mountain region a few miles west of Glens Falls, and thence to Troy the topography is moderately rolling and the surface soil is chiefly sand. Below Troy the river follows the great depression which extends almost due north and south between New York Bay and the St. Lawrence, flowing in an open valley bordered by well-cultivated lands, which rise with moderate slope from the stream. The Catskill Mountain region is reached 20 or 30 miles below Albany, and thence to the mouth of the river the immediate valley is flanked by high hills, the Highlands of Orange County and the precipitous Palisades being especially noticeable.

The fall in the upper portion of the course is very rapid, amounting to about 64 feet per mile from Lake Tear-of-the-Clouds to the mouth of North Creek, a distance of about 52 miles. From the mouth of North Creek to the mouth of the Sacandaga the descent is nearly 14 feet per mile, distributed among rapids which diminish in frequency as the Sacandaga is approached. In the succeeding 26 miles to Fort

Edward the river descends 418 feet more, but of this 175 feet is comprised within the three abrupt pitches at Palmer, Glens, and Bakers falls, while most of the remainder occurs in the rapids between Jessups Landing and the oxbow above Glens Falls. Between Glens Falls and Troy nearly the entire fall of the river is utilized for the development of water power.

The tributaries of the Hudson are numerous, and many of them are large and important. Indian River, Schroon River, and the Sacandaga unite with the main stream above Glens Falls, and between the latter point and Troy the river receives Battenkill River, Fish Creek, Hoosic River, and the Mohawk, the latter having several important tributaries, including West and East Canada and Schoharie creeks. The tributaries below Troy include Catskill, Esopus, and Rondout creeks, and Wallkill River from the west, and Kinderhook Creek, Jansen Kill, Wappinger Creek, Fishkill Creek, and Croton River from the east.

The mean annual precipitation on the total basin of the Hudson is probably about 43 inches. It reaches a maximum of more than 55 inches in the heights of the Adirondacks, while in the eastern portion of the drainage area in southern Vermont the mean annual total is only about 39 inches. Conditions during the winter period range from the extreme cold and deep snow of the Adirondacks to the frequent winter thaws in the southern part of the basin.

The flow of the upper Hudson is controlled to some extent during the dry season by the use of Indian Lake storage reservoir, and the natural storage facilities in the Adirondack region are unsurpassed, including many large ponds and lakes fed from extensive drainage areas. Comprehensive plans for vast storage projects on the Sacandaga, Schroon, and upper Hudson are receiving the attention of the New York State Water-Supply Commission. It is probable that on the various tributaries of the Hudson an increase in storage capacity of some 75 billion cubic feet is possible, and if this were developed the Hudson would be probably the most important water-power stream in the country. Although a large amount of power has been developed in the Hudson drainage area vast quantities are still unutilized, and the importance of this river basin is apparent when it is considered that in proportion to its size it contains a greater population than any other important drainage basin in the United States with the single exception of that of the Delaware River.

The longest run-off record in the Hudson River drainage basin is that obtained at Mechanicsville, which extends back to 1888.

HUDSON RIVER AT NORTH CREEK, N. Y.

This station is located on the steel highway bridge at North Creek. It was established, in cooperation with the New York State Water Supply Commission, September 21, 1907, to obtain general statistical and comparative data in regard to the flow of the Hudson.

North Creek, a small tributary of the Hudson, enters from the right a short distance below this point.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. During the winter months the discharge is affected by the ice. Conditions for obtaining accurate discharge are good and a very good rating curve has been developed. All discharge measurements are made from the bridge.

The regimen of flow of the upper Hudson, especially during the low-water season, has been considerably affected by storage in Indian Lake reservoir. (See Indian Lake reservoir at Indian Lake.)

Information in regard to this station is contained in the annual reports of the State Water-Supply Commission of New York.

Discharge measurements of Hudson River at North Creek, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 1[a]	C. R. Adams	215	427	2.88	419
20[b]	.....do	225	463	3.46	452
Mar. 27[c]	C. C. Covert	248	598	4.12	990
Apr. 14	.....do	250	1,990	8.35	14,200
16	E. F. Weeks	250	1,740	7.74	11,400
18	.....do	250	1,660	7.40	10,200
May 9	.....do	250	1,390	6.32	7,040
21	C. C. Covert	250	1,010	4.78	3,510
June 17	Covert and Cooper	230	549	3.00	865
Aug. 24	W. G. Hoyt	245	524	2.73	653
25	.....do	245	566	2.95	796
Dec. 9[d]	Hoyt and James	243	386	2.32	277
11[d]	.....do	237	448	2.48	373

[a] Measurement made under partial ice cover. Gage height to top of ice, 2.98 feet; average thickness of ice, 0.72 foot.

[b] Measurement made under complete ice cover. Gage height to top of ice, 3.56 feet; average thickness of ice, 0.98 foot.

[c] Measurement made under partial ice cover. Gage height to top of ice, 4.22 feet; average thickness of ice, 0.88 foot.

[d] Measurement made under ice conditions.

Daily gage height, in feet, of Hudson River at North Creek, N. Y., for 1909.

[Gilbert Dean, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.87				5.32	3.44	2.38	2.84	3.02	2.99	2.73	2.72
2	2.87	4.20			5.88	3.42	2.24	2.81	3.00	2.95	2.72	2.75
3	2.86	3.90			5.78	3.66	2.30	2.77	3.00	2.92	2.80	2.76
4	2.76				5.60	3.67	2.35	2.73	3.00	2.89	2.80	2.68
5	2.75	3.90			6.00	3.42	2.37	2.74	3.01	2.78	2.80	2.62
6	3.10		4.30		5.32	3.95	2.26	2.74	2.97	2.72	2.79	2.52
7	3.35			5.35	5.80	4.12	2.28	2.87	2.95	2.70	2.82	2.52
8	3.44			6.48	6.98	4.03	2.36	3.06	2.96	2.78	2.95	2.42
9	3.59			6.35	6.04	3.78	2.30	3.06	2.94	2.92	2.95	2.29
10	3.80	4.50		5.88	6.75	3.48	2.25	3.05	2.94	2.85	3.08	2.40

Daily gage height, in feet, of Hudson River at North Creek, N. Y., for 1909—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	3.55			5.38	7.81	4.12	2.48	3.05	2.94	2.86	3.05	2.52
12	3.50			4.72	8.75	4.04	2.70	3.05	2.92	2.85	2.98	2.90
13	3.48	4.35	4.05	4.60	6.62	3.53	2.78	3.05	2.92	2.60	2.82	3.02
14	3.43			8.05	6.60	3.42	2.82	3.03	2.90	2.65	2.72	3.35
15	3.22			8.40	5.28	3.36	2.85	3.02	2.90	2.82	2.66	3.32
16	3.35			7.85	4.98	3.12	2.85	3.09	2.91	2.82	2.65	3.20
17				7.44	5.08	3.10	2.86	3.09	2.87	2.77	2.70	3.00
18	3.40			7.26	5.58	3.20	2.88	3.05	2.84	2.80	3.25	2.95
19		4.20		6.95	5.08	4.08	3.20	2.65	2.89	2.80	2.92	2.90
20	3.40			7.56	4.60	3.32	3.20	2.31	2.89	2.80	2.66	2.80
21				7.20	4.64	3.55	3.36	2.20	2.82	2.80	2.65	2.75
22				6.48	4.98	3.08	3.42	2.16	2.85	2.80	2.65	2.74
23				6.18	4.48	2.90	3.26	2.20	2.85		2.68	2.75
24	3.57			5.65	4.03	2.82	3.20	2.48	2.90		2.72	2.72
25	4.60			5.08	4.08	2.78	2.96	3.02	2.89		2.86	2.72
26	4.95	5.95	4.10	5.80	3.87	2.70	2.74	3.06	2.84	2.85	3.15	2.80
27	5.15		4.12	4.92	3.58	2.60	2.74	3.06	2.82	2.84	3.00	2.92
28	5.15			5.38	3.57	2.55	2.67	3.05	2.90	2.84	2.92	2.93
29	5.05			4.80	4.62	2.51	2.69	3.04	2.90	2.85	2.81	2.95
30				4.80	4.18	2.45	2.94	3.04	2.92	2.88	2.74	3.00
31			3.65		3.42		2.90	3.04		2.74		3.02

NOTE.—Ice conditions prevailed Jan. 1 to Apr. 6, and from about Dec. 1 to 31.

Daily discharge, in second-feet, of Hudson River at North Creek, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	417	600	2,300	1,290	4,790	1,400	388	736	910	880	637	556
2	410	600	2,100	1,860	6,130	1,380	310	709	890	840	628	580
3	398	500	1,900	2,420	5,880	1,710	340	673	890	810	700	588
4	349	500	1,700	2,990	5,440	1,720	370	637	890	781	700	512
5	338	500	1,450	3,550	6,430	1,380	382	646	900	682	700	484
6	505	600	1,350	4,110	4,790	2,160	320	646	860	628	691	414
7	642	1,070	1,320	4,860	5,930	2,430	330	763	840	610	718	414
8	686	1,300	1,300	7,710	9,140	2,290	376	950	850	682	840	352
9	775	1,100	1,280	7,360	6,530	1,890	340	950	830	810	840	277
10	898	900	1,260	6,130	8,480	1,450	315	940	830	745	970	340
11	718	850	1,240	4,920	11,700	2,430	448	940	830	754	940	373
12	702	800	1,200	3,520	14,700	2,300	610	940	810	745	870	385
13	642	820	1,180	3,290	8,110	1,520	682	940	810	530	718	451
14	598	840	1,140	12,400	8,050	1,380	718	920	790	570	628	640
15	471	860	1,090	13,600	4,700	1,300	745	910	790	718	578	625
16	510	880	1,030	11,800	4,050	1,010	745	980	800	718	570	610
17	498	900	980	10,500	4,260	990	754	980	763	673	610	440
18	486	940	940	9,970	5,390	1,100	772	940	736	700	1,160	412
19	459	940	900	9,060	4,260	2,370	1,100	570	781	700	810	385
20	432	1,600	860	10,900	3,290	1,250	1,100	346	781	700	578	345
21	432	2,100	840	9,790	3,370	1,550	1,300	290	718	700	570	325
22	432	2,500	820	7,710	4,050	970	1,380	272	745	700	570	321
23	432	2,300	800	6,900	3,060	790	1,170	290	745	700	594	325
24	432	2,100	856	5,560	2,290	718	1,100	448	790	722	628	313
25	1,040	2,400	900	4,260	2,370	682	850	910	781	745	754	313
26	1,290	2,500	948	5,930	2,030	610	646	950	736	745	1,040	345
27	1,200	2,500	948	3,920	1,590	530	646	950	718	736	890	396
28	1,000	2,400	950	4,920	1,580	495	586	940	790	736	810	402
29	800		950	3,680	3,330	467	602	930	790	745	709	412
30	700		950	3,680	2,540	430	830	930	810	772	646	440
31	600		950		1,380		790	930		646		451

NOTE.—Daily discharge during the frozen periods determined on the basis of measurements made under ice conditions, climatological reports, and intercomparison with the discharge obtained at other stations. A well-defined rating curve has been used for the open-water period.

Monthly discharge of Hudson River at North Creek, N. Y., for 1909.

[Drainage area, 804 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,290	338	622	0.774	0.89	C.
February	2,500	500	1,280	1.59	1.66	C.
March	2,300	800	1,180	1.47	1.70	C.
April	13,600	1,290	6,290	7.82	8.72	A.
May	14,700	1,380	5,150	6.41	7.39	A.
June	2,430	430	1,360	1.69	1.89	A.
July	1,380	310	679	.845	.97	A.
August	980	272	773	.961	1.11	A.
September	910	718	807	1.00	1.12	A.
October	880	530	717	.892	1.03	A.
November	1,160	570	737	.917	1.02	A.
December	640	277	427	.531	.61	C.
The year	14,700	272	1,670	2.08	28.11	

HUDSON RIVER AT THURMAN, N. Y.

This station is located on the Delaware & Hudson Railroad bridge leading from Thurman to Warrensburg, about 950 feet below the highway bridge to Warrensburg, and some 2,000 feet below the entrance of Schroon River into the Hudson. It was established, in cooperation with the New York State Water-Supply Commission, September 22, 1907, to obtain general statistical and comparative data regarding the flow of the Hudson River.

There is a dam on Schroon River at Warrensburg, about 3 miles above the station. On the Hudson there is a dam at Luzerne, about 12 miles below. During the winter months the discharge is affected by ice, and the station discontinued.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. Conditions for obtaining accurate discharge data are excellent, and a very good rating curve has been developed. All discharge measurements are made from the bridge.

The regimen of flow of the upper Hudson, especially during the low-water season, has been considerably affected by storage in Indian Lake reservoir. (See Indian Lake reservoir at Indian Lake.)

Information in regard to this station is contained in the annual reports of the State Water-Supply Commission of New York.

Discharge measurements of Hudson River at Thurman, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 21	C. C. Covert	305	1,360	4.98	6,900
Aug. 25	W. G. Hoyt	255	688	2.50	886

Daily gage height, in feet, of Hudson River at Thurman, N. Y., for 1909.

[S. H. Spencer, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	3.52	5.22	3.75	2.85	2.44	2.63	2.61	2.35	2.48
2	....	3.68	5.57	3.43	2.83	2.46	2.62	2.64	2.38	2.51
3	....	3.77	5.51	3.64	2.79	2.46	2.59	....	2.39	2.49
4	....	3.90	5.38	3.35	2.70	2.38	2.56	2.55	2.46	2.49
5	....	4.15	5.65	3.56	2.71	2.37	2.61	2.48	2.44	....
6	....	4.41	5.58	....	2.66	2.42	2.57	2.36	2.41	2.42
7	....	6.00	6.13	4.18	2.62	2.40	2.52	2.36	2.34	2.34
8	....	6.52	6.52	4.14	2.54	2.53	2.54	2.32	2.47	2.29
9	....	6.38	5.80	3.95	2.54	2.68	2.52	2.53	2.51	2.33
10	4.35	6.18	6.08	3.76	2.56	2.70	2.54	2.48	2.48	2.28
11	4.41	5.68	6.98	4.30	2.34	2.66	2.54	2.52	2.48	3.22
12	4.07	4.42	7.92	3.79	2.66	2.67	2.53	2.48	2.42	....
13	4.11	4.44	6.39	3.62	2.64	2.67	2.54	2.34	2.38	....
14	4.03	7.96	6.28	3.54	2.73	2.65	2.52	2.19	2.40	....
15	3.91	8.45	5.52	3.57	2.74	2.63	2.52	2.43	2.41	....
16	3.74	8.10	5.34	3.34	2.74	2.72	2.51	2.47	2.42	....
17	3.65	7.82	5.44	3.28	2.73	2.79	2.52	2.22	2.53	....
18	3.53	7.78	5.66	3.42	2.62	2.82	2.51	2.38	2.41	....
19	3.43	7.34	5.34	4.06	2.68	2.64	2.40	2.34	2.41	....
20	3.43	7.75	5.03	3.58	2.70	2.74	2.52	2.34	2.42	....
21	3.23	7.37	4.93	3.41	2.97	2.38	2.46	2.34	....	....
22	3.58	6.86	5.18	3.36	3.02	....	2.44	2.40	....	....
23	3.50	6.47	4.74	3.16	2.86	2.02	2.46	2.43	....	....
24	3.57	6.11	4.48	3.15	2.85	2.00	2.54	2.40	2.40	....
25	3.66	5.55	4.32	3.08	2.72	2.58	2.47	2.48	2.25	....
26	3.85	5.77	4.17	3.04	2.52	2.66	2.42	2.45	2.76	....
27	3.83	5.22	3.82	2.96	2.44	2.68	2.48	2.44	2.69	....
28	3.67	5.39	3.64	2.92	2.47	2.67	2.63	2.44	2.64	....
29	3.58	4.99	3.71	2.97	2.34	2.66	2.58	2.42	2.65	....
30	3.48	5.25	4.44	2.85	2.50	2.64	2.58	2.37	2.64	....
31	3.48	....	3.55	....	2.56	2.64	....	....	....	....

NOTE.—Ice conditions prevailed from about Jan. 1 to Mar. 31 and about Dec. 11 to 31.

Daily discharge, in second-feet, of Hudson River at Thurman, N. Y., for 1909.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	2,800	7,580	3,360	1,380	806	1,040	1,010	710	852
2	....	3,180	8,630	2,590	1,350	829	1,030	1,060	740	888
3	....	3,400	8,450	3,090	1,280	829	988	999	750	864
4	....	3,740	8,060	2,400	1,140	740	950	938	829	864
5	....	4,430	8,870	2,890	1,160	730	1,010	852	806	824
6	....	5,180	8,660	3,700	1,080	783	962	720	772	783
7	....	9,920	10,300	4,510	1,030	760	900	720	700	700
8	....	11,500	11,500	4,400	925	912	925	680	840	652
9	....	11,100	9,320	3,880	925	1,110	900	912	888	690
10	3,100	10,500	10,200	3,380	950	1,140	925	852	852	643
11	2,600	8,960	12,900	4,860	700	1,080	925	900	852	....
12	2,800	5,210	15,700	3,460	1,080	1,100	912	852	783	....
13	2,700	5,270	11,100	3,040	1,060	1,100	925	700	740	....
14	2,600	15,800	10,800	2,850	1,190	1,070	900	568	760	....
15	2,500	17,300	8,480	2,920	1,200	1,040	900	794	772	....
16	2,400	16,200	7,940	2,380	1,200	1,170	888	840	783	....
17	2,200	15,400	8,240	2,250	1,190	1,280	900	592	912	....
18	2,100	15,300	8,900	2,570	1,030	1,330	888	740	772	....
19	2,000	13,900	7,940	4,180	1,110	1,060	760	700	772	....
20	2,000	15,200	7,010	2,940	1,140	1,200	900	700	783	....
21	1,900	14,000	6,710	2,540	1,600	740	829	700	783	....
22	1,800	12,500	7,460	2,430	1,700	594	806	760	772	....
23	1,700	11,300	6,140	1,990	1,400	448	829	794	760	....
24	1,800	10,200	5,380	1,960	1,380	435	925	760	760	....
25	1,900	8,570	4,920	1,820	1,170	975	840	852	618	....
26	2,100	9,230	4,490	1,740	900	1,080	783	818	1,230	....
27	2,100	7,580	3,530	1,580	806	1,110	852	800	1,130	....
28	2,100	8,090	3,090	1,510	840	1,100	1,040	800	1,060	....
29	2,200	6,890	3,260	1,600	700	1,080	975	783	1,070	....
30	2,200	7,670	5,270	1,380	875	1,060	975	730	1,060	....
31	2,300	....	2,870	....	950	1,060	....	720	....	....

NOTE.—Daily discharge Mar. 10 to 31 taken as the sum of the daily discharge at North Creek and Riverbank plus an estimated inflow.

The rating used for the open period is well defined below discharge of 6,900 second-feet.

Monthly discharge of Hudson River at Thurman, N. Y., for 1909.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			1,100	0.710	0.82	C.
February			2,700	1.74	1.81	C.
March		1,700	2,610	1.68	1.94	C.
April	17,300	2,800	9,680	6.25	6.97	B.
May	15,700	2,870	7,860	5.07	5.84	A.
June	4,860	1,380	2,810	1.81	2.02	A.
July	1,700	700	1,110	.716	.83	A.
August	1,330	435	960	.619	.71	A.
September	1,040	760	913	.589	.66	A.
October	1,060	568	795	.513	.59	A.
November	1,230	618	835	.539	.60	A.
December			800	.516	.59	C.
The year	17,300	435	2,680	1.73	23.38	

NOTE.—The mean discharge for January, February, March, and December was determined from the sum of the corresponding discharge for North Creek and Riverbank plus an estimated inflow.

HUDSON RIVER AT MECHANICVILLE, N. Y.

This station is located at the dam of the West Virginia Pulp & Paper Co. at Mechanicville, a few miles downstream from the entrance of Hoosic River into the Hudson. Records have been kept at this point by this company since 1888, and the results for 1909 have been furnished by R. P. Bloss, engineer of the company. The dam at Mechanicville was rebuilt in 1904 and now has a rounded or ogee section. A discharge curve has been calculated, using a coefficient of discharge derived from United States Geological Survey experiments on models of dams of ogee cross section, as published in Water-Supply Paper 200.

The discharge of the Hudson at Mechanicville is diminished somewhat by water required in operating the Champlain Canal.

Records at this station are under careful supervision and are considered as good.

Information in regard to this station is contained in the annual reports of the State Water-Supply Commission of New York and of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Hudson River at Mechanicville, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,874	6,879	15,672	11,867	18,524	7,243	2,389	a1,404	1,379	1,778	1,935	1,868
2	1,589	5,690	12,458	11,485	a21,185	6,618	2,293	1,783	1,578	1,753	1,549	2,550
3	a1,836	4,790	12,654	12,216	21,493	5,598	2,327	1,010	1,736	a1,566	1,554	1,955
4	1,887	4,436	11,452	a13,753	22,566	5,362	a2,682	1,463	1,665	2,274	1,470	1,601
5	1,700	3,973	10,068	14,326	23,523	5,540	2,031	1,759	a674	1,501	1,472	a2,105
6	10,054	6,611	8,867	15,778	21,770	a6,894	2,941	1,245	1,187	1,906	1,551	1,764
7	10,269	a8,057	a8,001	20,423	19,817	9,564	2,401	1,213	2,140	1,711	a718	1,991
8	8,098	8,443	8,017	30,501	19,617	8,331	2,399	a612	1,473	1,677	1,561	2,172
9	6,566	7,471	6,465	34,889	a23,252	7,436	1,824	1,318	1,476	1,334	1,580	1,678
10	a7,084	6,652	6,740	31,585	18,708	7,016	3,100	1,115	1,476	a1,406	1,769	1,718

a Sunday.

Daily discharge, in second-feet, of Hudson River at Mechanicville, N. Y., for 1909—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	6,462	7,551	10,752	[a]28,234	21,082	6,509	[a]1,492	1,731	1,684	1,931	1,505	2,036
12	4,705	6,994	9,871	22,471	24,794	8,436	1,781	1,526	[a]1,501	1,697	1,594	[a]601
13	4,561	7,368	8,273	19,659	28,154	[a]6,801	1,785	933	1,524	950	1,585	1,675
14	3,823	[a]6,386	[a]6,367	20,410	22,696	7,747	1,764	1,077	1,548	1,516	[a]856	1,612
15	4,028	7,518	6,484	37,324	20,490	6,520	1,688	[a]740	1,579	1,503	2,357	1,664
16	1,968	8,147	7,573	46,299	[a]17,031	6,136	1,683	1,819	1,473	[a]1,504	2,283	1,722
17	[a]3,506	7,445	7,490	44,847	17,511	5,126	1,859	1,769	1,515	720	1,525	1,725
18	3,239	7,566	6,420	[a]40,771	17,104	5,814	[a]1,569	1,344	1,653	1,716	1,188	1,486
19	2,412	6,874	6,106	36,910	16,996	6,396	1,481	2,189	[a]430	1,453	1,195	[a]400
20	2,326	27,591	6,144	34,091	15,656	[a]8,009	1,481	3,209	1,482	2,001	1,402	1,815
21	2,347	[a]24,515	[a]6,293	37,736	14,777	7,093	2,109	2,704	1,482	1,806	[a]1,731	1,433
22	3,296	20,683	6,262	33,665	13,370	5,292	1,814	[a]1,032	883	1,496	1,955	1,520
23	1,995	18,376	5,641	29,977	[a]13,150	4,941	1,801	2,573	1,517	1,492	2,092	1,489
24	[a]6,328	16,719	7,013	27,855	10,039	4,075	1,935	2,146	1,697	[a]531	2,140	1,470
25	10,244	29,655	7,849	[a]23,500	12,607	4,069	[a]1,712	1,907	1,738	1,589	1,652	873
26	9,634	22,897	13,483	21,187	9,469	3,748	1,809	1,717	[a]742	1,579	1,534	[a]557
27	9,421	19,865	12,488	19,146	8,373	[a]4,647	3,387	1,774	1,702	1,505	1,564	1,447
28	8,990	[a]16,346	[a]13,784	17,202	7,747	3,914	1,779	1,479	1,513	1,748	[a]2,014	1,473
29	8,155	....	14,215	18,917	7,231	3,270	1,752	[a]235	1,512	1,571	2,451	1,546
30	6,956	....	11,875	17,080	[a]8,784	2,496	1,206	1,027	1,765	1,448	2,617	1,412
31	[a]6,104	....	11,049	....	9,298	....	1,222	1,126	....	[a]1,549	....	1,424

[a] Sunday.

Monthly discharge of Hudson River at Mechanicville, N. Y., for 1909.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	10,300	1,590	5,210	1.16	1.34
February	29,700	3,970	11,600	2.58	2.69
March	15,700	5,640	9,220	2.05	2.36
April	46,300	11,500	25,800	5.73	6.39
May	28,200	7,230	17,000	3.78	4.36
June	9,560	2,500	6,020	1.34	1.50
July	3,390	1,210	1,980	.441	.51
August	3,210	235	1,520	.338	.39
September	2,140	430	1,460	.324	.36
October	2,270	531	1,560	.347	.40
November	2,620	718	1,680	.373	.42
December	2,550	400	1,570	.349	.40
The year	46,300	235	7,050	1.57	21.12

INDIAN LAKE RESERVOIR AT INDIAN LAKE, N. Y.

This station is located at a masonry storage dam at the outlet of Indian Lake. It was established July 22, 1900, to determine the total outflow from this reservoir. The drainage area at this point is 131 square miles, including about 9.3 square miles of water surface of Indian Lake at the elevation of the spillway of the dam.

The flow of the upper Hudson has been controlled to a considerable extent during the dry season by the use of Indian Lake reservoir, since its completion in 1899. The total storage provided is about 4,700,000,000 cubic feet, which affords a discharge of nearly 600 second-feet for a period of 90 to 130 days each year.

The record at this station includes the elevation of the water surface in the reservoir, the depth of water flowing over the spillway or flashboards, the depth of opening and the head on the main and subsidiary logways, and the depth of the opening and the affective head on each of the 5-foot sluice gates. A meteorological station has also been established at the dam by the United States Weather Bureau, and records are kept of the rainfall, temperature, etc.

The crest of the dam is 106.05 feet long in the clear. To facilitate the calculation of discharge over the spillway, a series of experiments was made at Cornell University in 1899 on a full-sized model of the spillway section, 6.58 feet long, from which the coefficient of discharge has been determined.

No computations of discharge have been made, pending some current meter measurements to rate discharge through the gates, and at present the record of reservoir level alone is available.

The datum of the staff gage has remained the same during the maintenance of the station. The elevation of the spillway crest above mean tide is 1,650 feet and 33.23 feet above the datum of the gage. Gage heights are obtained from the staff gage or by measuring down from a bench mark, which is at an elevation of 36 feet above the gage datum.

The maximum gage height of Indian Lake reservoir since the establishment of the station occurred April 27, 1908, and was 37 feet. The minimum gage height was 2 feet, and occurred from March 9 to 18, 1907.

Information in regard to this station is contained in reports of the State engineer and surveyor, State of New York.

Daily gage height, in feet, of Indian Lake reservoir at Indian Lake, N. Y., for 1909.

[Lester Sevarie, jr., observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.00	8.46	16.83	18.33	34.67	34.25	33.92	30.58	22.67	13.75	7.33	4.00
2	3.92	8.58	17.00	18.42	34.58	34.25	33.88	30.46	22.33	13.50	7.17	4.00
3	3.83	8.71	17.13	18.50	34.50	34.25	33.83	30.25	22.00	13.25	7.00	4.00
4	3.71	8.83	17.33	18.67	34.29	34.21	33.83	30.04	21.67	13.08	6.83	4.00
5	3.67	8.96	17.58	18.79	34.13	34.25	33.83	29.83	21.33	12.92	6.67	4.00
6	4.04	9.25	17.75	19.00	34.17	34.33	33.79	29.67	21.00	12.79	6.50	4.00
7	4.33	9.50	17.92	19.58	34.75	34.42	33.75	29.29	20.67	12.67	6.33	3.96
8	4.67	9.75	18.00	20.42	35.08	34.38	33.71	28.92	20.33	12.42	6.17	3.92
9	5.00	10.00	18.08	21.17	35.33	34.38	33.67	28.54	20.00	12.17	6.00	3.83
10	5.17	10.38	18.17	21.58	35.58	34.33	33.67	28.17	19.67	11.92	5.83	3.75
11	5.33	10.63	18.21	21.96	36.17	34.33	33.58	27.79	19.33	11.67	5.67	3.67
12	5.50	10.88	18.25	22.21	36.17	34.33	33.50	27.42	19.00	11.42	5.50	3.58
13	5.63	11.08	18.25	22.67	36.00	34.38	33.33	27.04	18.67	11.17	5.33	3.50
14	5.71	11.29	18.25	23.83	35.67	34.42	33.08	26.71	18.38	10.92	5.17	3.42
15	5.79	11.54	18.29	25.33	35.50	34.38	32.92	26.38	18.13	10.67	5.00	3.42
16	5.92	11.83	18.33	26.33	35.29	34.33	32.75	26.17	17.88	10.46	4.83	3.42
17	6.00	12.08	18.42	27.25	35.17	34.33	32.58	25.92	17.63	10.25	4.67	3.42
18	6.08	12.29	18.50	28.17	35.00	34.38	32.42	25.79	17.33	9.96	4.50	3.33
19	6.17	12.50	18.54	29.00	34.04	34.38	32.21	25.83	17.00	9.67	4.33	3.25
20	6.25	13.00	18.54	30.00	34.92	34.38	32.00	25.83	16.67	9.42	4.17	3.17

Daily gage height, in feet, of Indian Lake reservoir at Indian Lake, N. Y., for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	6.21	13.63	18.38	30.79	34.83	34.33	31.88	25.83	16.33	9.21	4.00	3.17
22	6.13	14.17	18.25	31.54	34.75	34.29	31.67	25.83	16.04	9.00	4.17	3.08
23	6.17	14.67	18.13	32.25	34.67	34.25	31.50	25.79	15.75	8.83	3.83	2.92
24	6.29	15.08	18.04	32.83	34.58	34.21	31.38	25.58	15.50	8.67	4.00	2.83
25	6.83	15.58	18.00	33.29	34.54	34.17	31.42	25.25	15.25	8.50	4.00	2.75
26	7.17	16.00	17.96	33.58	34.50	34.08	31.38	24.92	15.00	8.33	4.00	2.67
27	7.50	16.38	17.96	34.00	34.46	34.00	31.38	24.54	14.75	8.17	4.00	2.58
28	7.79	16.63	18.08	34.42	34.42	33.96	31.38	24.17	14.50	8.00	4.00	2.50
29	8.08	....	18.17	34.67	34.42	33.92	31.17	23.79	14.25	7.83	4.00	2.42
30	8.29	....	18.21	34.75	34.33	33.92	31.00	23.42	14.00	7.67	4.00	2.33
31	8.33	....	18.25	....	34.25	....	30.79	23.04	....	7.50	....	2.25

Gate openings at Indian Lake reservoir at Indian Lake, N. Y., for 1909.

Date.	Sluice gate A open.	Sluice gate B open.	Date.	Sluice gate A open.	Sluice gate B open.
	Feet.	*Feet.*		*Feet.*	*Feet.*
January 1-5, 21-23	....	5.0	July 28	....	2.5
March 20-27	....	5.0	July 29-31	....	5.0
April 30	2.5	5.0	August 6-17	2.5	....
May 1-5	5.0	5.0	August 1-17	....	5.0
May 6-11	....	2.0	August 23-31	5.0	....
May 12-13	....	4.0	August 24-31	....	2.5
May 14-15	....	2.5	September 1-30	5.0	2.5
May 16-17	....	1.5	October 1-3, 7-31	5.0	....
May 18-19	....	.75	October 1-3	....	2.5
July 10-11	....	2.5	October 4-31	....	5.0
July 12-23	....	5.0	November 1-30	5.0	5.0
July 24-27	....	.75	December 1-31	5.0	5.0

NOTE.—The reservoir gates were shut on days not included in this list.

SCHROON RIVER BASIN.

DESCRIPTION.

Schroon River rises in Essex County, along the southern slopes of the highest mountains in the Adirondack group, flows in a general southerly direction for about 45 miles through Essex and Warren counties, and joins the Hudson near Thurman. Its total drainage area is 550 square miles. Its headwaters reach an elevation of about 600 feet.

Its basin is largely forested and contains considerable wild land and numerous lakes and ponds. The most important of these is Schroon Lake, through which the river flows, which has a water-surface area of about 6.3 square miles. The river affords excellent opportunities for storage and power development, which are under investigation by the New York State Water Supply Commission. The only power developments are at Warrensburg.

SCHROON LAKE NEAR POTTERSVILLE, N. Y.

This station is located at the outlet of Schroon Lake, 1 mile from Pottersville post office, and is at the steamboat wharf. It was established July 8, 1908, in cooperation with the New York State Water Supply Commission, to obtain information concerning fluctuations in the level of Schroon Lake in connection with the gaging station on Schroon River at Riverbank. The station was discontinued December 5, 1908; reestablished July 1, 1909; discontinued December 4, 1909; and reestablished April 17, 1910. The gage datum was originally placed at elevation 803.75 feet above mean sea level. The gage was raised 0.17 foot by ice action during the winter of 1908–9. The 1909 gage heights have been reduced to the original datum by making a plus correction of 0.17 foot.

Information in regard to this station is contained in the annual reports of the State Water Supply Commission of New York.

Daily gage height, in feet, of Schroon Lake near Pottersville, N. Y., for 1909

[Asel Galusha, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.87	1.57	1.87	1.77	1.57	1.27	16	.87	1.57	1.57	1.77	1.47	......
2	2.67	1.57	1.87	1.77	1.57	1.27	17	.87	1.67	1.57	1.67	1.37	......
3	2.47	1.62	1.87	1.77	1.57	1.27	18	.87	1.67	1.57	1.57	1.37	......
4	2,37	1.67	1.87	1.77	1.62	1.27	19	.97	1.72	1.57	1.57	1.42	......
5	2.17	1.67	1.87	1.77	1.62	......	20	.97	1.77	1.57	1.57	1.47	......
6	1.97	1.67	1.82	1.77	1.67	......	21	1.17	1.82	1.57	1.57	1.47	......
7	1.87	1.67	1.77	1.77	1.67	......	22	1.17	1.82	1.57	1.57	1.47	......
8	1.67	1.67	1.77	1.77	1.62	......	23	1.27	1.87	1.57	1.57	1.47	......
9	1.57	1.67	1.82	1.77	1.62	......	24	1.37	1.87	1.57	1.62	1.42	......
10	1.37	1.57	1.72	1.77	1.57	......	25	1.37	1.87	1.57	1.62	1.37	......
11	1.27	1.57	1.72	1.82	1.57	......	26	1.47	1.77	1.57	1.62	1.32	......
12	1.17	1.47	1.62	1.82	1.57	......	27	1.47	1.77	1.52	1.62	1.32	......
13	1.07	1.47	1.62	1.77	1.57	......	28	1.47	1.77	1.57	1.57	1.32	......
14	.97	1.57	1.62	1.77	1.52	......	29	1.47	1.82	1.67	1.57	1.27	......
15	.97	1.57	1.57	1.77	1.47	......	30	1.47	1.82	1.77	1.57	1.27	......
							31	1.57	1.87	......	1.57	......	......

SCHROON RIVER AT RIVERBANK, N. Y.

This station is located on the steel highway bridge near Riverbank post office, between the towns of Warrensburg and Bolton, about 9 miles north of the village of Warrensburg, and about 10 miles downstream from the outlet of Schroon Lake. It was established September 23, 1907, in cooperation with the New York State Water Supply Commission, to obtain general statistical data in regard to the flow of Schroon River.

There are several dams at the village of Warrensburg which are used for power development. During September, 1907, a timber crib dam for storage was constructed at Starbuckville, about 6 miles above the gaging station. This dam affords a head of about 8 feet and ponds water to Schroon Lake. Tumble Head Falls begin about 1 mile above the gaging station and extend upstream for about a mile farther, affording a total fall of some 30 feet.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. During the winter months the discharge is affected by ice. Conditions for obtaining accurate discharge are good, and a very good rating curve has been developed. All discharge measurements are made from the bridge.

Since 1907 the regimen of flow of Schroon River during the low-water season has been considerably affected by the storage held in Schroon Lake.

Information in regard to this station is contained in the annual reports of the State Water Supply Commission of New York.

Discharge measurements of Schroon River at Riverbank, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 21[a]	C. R. Adams	65	150	2.11	287
June 18	Covert and Cooper	75	260	3.28	1,040
Dec. 11[b]	Hoyt and James	64	193	1.71	184

[a] Measurement made under partial ice cover. Gage height to top of ice, 2.22 feet; average thickness of ice, 0.67 foot.
[b] Ice along the shores affected the discharge.

Daily gage height, in feet, of Schroon River at Riverbank, N. Y., for 1909.

[J. H. Roberts, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.50	......	4.21	3.17	4.62	3.28	2.95	1.15	1.15	1.30	1.30	1.85
2	1.55	2.95	3.96	3.32	4.57	3.13	2.95	1.15	1.10	1.15	1.45	1.80
3	1.40	3.00	3.81	3.42	4.72	3.13	2.80	1.10	1.20	1.35	1.50	1.80
4	......	3.00	3.76	3.42	4.82	3.03	2.70	1.30	1.10	1.35	1.50	1.75
5	1.55	......	3.61	3.82	4.72	3.38	2.65	1.30	1.10	1.35	1.45	1.75
6	......	2.95	3.46	3.82	4.62	3.63	2.60	1.30	1.10	1.35	1.45	1.70
7	1.80	......	3.41	4.42	4.72	4.08	2.55	1.35	1.15	1.40	.95	1.70
8	......	2.70	3.46	5.77	4.98	4.03	2.45	1.15	1.15	1.30	1.55	1.70
9	2.00	......	3.51	6.47	5.03	3.83	2.40	1.25	1.10	1.30	1.45	1.70
10	2.00	2.95	3.71	6.50	5.03	3.83	2.30	1.25	1.10	1.25	1.50	1.70
11	2.10	......	3.21	6.32	5.48	3.78	2.10	1.30	1.15	1.30	1.45	1.70
12	......	2.71	3.51	5.97	6.03	3.68	2.20	1.20	1.10	1.00	1.40	1.75
13	2.05	2.76	3.41	5.87	6.03	3.48	2.20	1.20	1.35	1.50	1.45	1.75
14	......	......	3.31	6.37	5.83	3.63	2.10	1.20	1.30	1.50	1.00	1.70
15	2.10	2.81	3.26	8.12	5.58	3.53	2.10	1.15	1.25	1.50	1.40	1.70
16	2.10	......	3.21	8.67	5.53	3.63	2.00	1.30	1.30	.95	1.50	1.70
17	......	2.96	3.11	8.34	5.58	3.03	1.90	1.20	1.30	.85	1.65	1.70
18	2.10	......	3.01	8.12	5.53	3.33	1.20	1.25	1.35	1.05	1.55	1.65
19	......	2.96	2.96	7.97	5.33	3.20	1.35	1.20	1.40	.90	1.50	1.60
20	2.25	3.21	2.96	7.77	5.28	3.10	1.50	1.20	1.30	1.00	1.50	1.70
21	2.11	3.41	2.81	7.57	5.13	3.15	1.20	1.15	1.30	1.30	1.50	1.70
22	1.95	3.36	2.81	7.34	4.98	3.05	1.25	1.10	1.25	1.30	1.50	1.50
23	2.10	3.51	2.71	6.94	4.83	3.30	1.30	1.25	1.25	1.30	1.55	1.60
24	2.25	3.91	2.71	6.47	4.58	3.20	1.30	1.30	1.30	1.30	1.50	1.60
25	2.20	3.96	2.81	6.12	4.38	3.05	1.20	1.20	1.30	1.25	1.60	1.60
26	2.10	4.51	3.02	5.77	4.38	3.00	1.20	1.20	1.20	1.25	1.80	......
27	......	4.21	2.97	5.42	3.43	2.90	1.25	1.20	1.20	1.30	1.85	1.60
28	2.50	4.21	3.02	5.22	3.43	3.20	1.15	1.15	1.50	1.30	1.85	1.60
29	2.85	......	3.07	4.97	3.53	3.00	1.15	1.15	1.40	1.30	1.95	1.60
30	2.95	......	3.12	4.72	3.38	3.00	1.25	1.15	1.40	1.10	1.95	1.60
31	2.90	......	3.12	......	3.38	......	1.20	1.20	......	1.05	......	1.60

NOTE.—Ice conditions prevailed from about Jan. 1 to Feb. 12 and Dec. 12 to 31.

Daily discharge, in second-feet, of Schroon River at Riverbank, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	130	300	1,890	946	2,350	1,030	806	86	86	122	122	294
2	140	300	1,630	1,060	2,290	920	806	86	74	86	164	276
3	110	300	1,480	1,140	2,470	920	721	74	97	136	178	276
4	130	300	1,440	1,140	2,580	855	668	122	74	136	178	259
5	140	420	1,300	1,490	2,470	1,100	643	122	74	136	164	259
6	170	550	1,170	1,490	2,350	1,320	618	122	74	136	164	242
7	200	500	1,130	2,120	2,470	1,760	593	136	86	149	44	242
8	220	480	1,170	3,720	2,780	1,710	545	86	86	122	194	242
9	255	500	1,210	4,560	2,840	1,500	522	110	74	122	164	242
10	255	550	1,390	4,600	2,840	1,500	476	110	74	110	178	242
11	284	600	973	4,380	3,380	1,460	390	122	86	122	164	242
12	280	650	1,210	3,960	4,040	1,360	432	97	74	53	149	250
13	270	700	1,130	3,840	4,040	1,180	432	97	136	178	164	250
14	280	713	1,050	4,440	3,800	1,320	390	97	122	178	53	242
15	284	726	1,010	6,540	3,500	1,230	390	86	110	178	149	242
16	284	769	973	7,200	3,440	1,320	350	122	122	44	178	242
17	284	812	907	6,930	3,500	855	312	97	122	28	226	242
18	284	812	842	6,540	3,440	1,060	97	110	136	64	194	226
19	300	812	812	6,360	3,200	966	136	97	149	35	178	210
20	330	973	812	6,120	3,140	900	178	97	122	53	178	200
21	287	1,130	726	5,880	2,960	933	97	86	122	122	178	190
22	241	1,090	726	5,610	2,780	868	110	74	110	122	178	178
23	184	1,210	673	5,130	2,600	1,040	122	110	110	122	194	170
24	331	1,580	673	4,560	2,300	966	122	122	122	122	178	165
25	315	1,630	726	4,140	2,080	868	97	97	122	110	210	165
26	284	2,230	849	3,720	2,080	836	97	97	97	110	276	165
27	290	1,890	818	3,300	1,140	776	110	97	97	122	294	163
28	300	1,890	849	3,060	1,140	966	86	86	178	122	294	160
29	350	....	881	2,760	1,230	836	86	86	149	122	331	160
30	350	....	913	2,470	1,100	836	110	86	149	74	331	160
31	350	....	913	....	1,100	....	97	97	....	64	....	160

NOTE.—Daily discharge during the ice periods estimated on the basis of two measurements made under ice conditions.

Discharge during the open period based on a rating which is well defined below gage height, 6 feet.

Monthly discharge of Schroon River at Riverbank, N. Y., for 1909.

[Drainage area, 534 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	350	110	255	0.478	0.55	C.
February	2,230	300	872	1.63	1.70	C.
March	1,890	673	1,040	1.95	2.25	B.
April	7,200	946	3,970	7.43	8.29	A.
May	4,040	1,100	2,630	4.93	5.68	A.
June	1,760	776	1,110	2.08	2.32	A.
July	806	86	343	.642	.74	A.
August	136	74	100	.187	.22	A.
September	178	74	108	.202	.23	A.
October	178	28	110	.206	.24	A.
November	331	44	188	.352	.39	A.
December	294	160	218	.408	.47	C.
The year	7,200	28	912	1.71	23.08	

SACANDAGA RIVER BASIN.

DESCRIPTION.

Sacandaga River is formed by three principal branches which unite in the southeastern part of Hamilton County in the Adirondack region. The West Branch is the outlet of Piseco Lake; the Middle Branch is the outlet of Sacandaga and Pleasant lakes; the East and principal branch issues from a series of small ponds and lakes in the southwestern part of Warren County. The East and Middle branches unite a few miles north of Wells and are joined by the West Branch a short distance below Wells. The river then flows southeasterly to about 5 miles below Northville, where it turns and runs northeasterly to the Hudson River at Hadley. Its total drainage area comprises about 1,050 square miles.

Sacandaga Lake, the highest of the tributary lakes in the headwaters, is about 1,700 feet above mean tide; at its entrance into the Hudson the Sacandaga is at an elevation of about 550 feet. Between Northville and the mouth of the river there is a fall of about 180 feet (chiefly concentrated in the 5 miles below Conklingville) entirely unutilized. There are, in fact, no power developments on the Sacandaga.

The drainage area of this river is largely in forest. Precipitation is high, the mean for the year being about 49 inches, whereas that of the whole Hudson drainage area above Mechanicville is only about 43 inches. Possibilities for storage on the Sacandaga are great and the State Water-Supply Commission of New York propose a high dam at Conklingville, the reservoir storing about 25,000,000,000 cubic feet of water, with a water surface of about 40 square miles, and controlling practically the entire flow of the Sacandaga basin. Their plan proposes also to develop the total fall obtained between Conklingville and the Hudson—approximately 200 feet—which will afford 25,000 to 30,000 continuous horsepower.

SACANDAGA RIVER AT WELLS, N. Y.

This station is located on the steel highway bridge over the East Branch of Sacandaga River in the southern part of the village of Wells, about 2½ miles above the junction of the East and West branches. It was established August 26, 1907, in cooperation with the New York State Water-Supply Commission, to obtain general statistical and comparative data regarding the flow of this river.

The datum of the chain gage attached to the bridge has been the same during the maintenance of the station. During the winter months the discharge is usually affected by ice. Conditions for obtaining accurate discharge are good, and a fairly good rating curve has been developed. All discharge measurements are made from the bridge.

Information in regard to this station is contained in the annual reports of the State Water-Supply Commission of New York.

Discharge measurements of Sacandaga River at Wells, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 23[a]	C. R. Adams	68	184	5.10	174
Feb. 10[b]	do	70	238	5.92	637
June 30	C. C. Covert	77	120	4.28	124
30	do	77	150	4.29	133

[a] Partial ice cover. All chopped away before measurement. Average thickness of ice, 0.6 foot. Gage height to top of ice, 5.20 feet.
[b] Discharge affected by ice.

Daily gage height, in feet, of Sacandaga River at Wells, N. Y., for 1909.

[Roscoe R. Stanyon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.49	5.88	6.08	5.32	6.82	5.32	4.22	3.86	3.70	3.85	3.76	4.09
2	4.48	5.85	5.85	5.48	7.70	5.28	4.19	3.81	3.70	3.80	3.76	4.07
3	4.45	5.95	5.68	5.85	6.85	5.18	4.42	3.81	3.69	3.76	3.76	4.02
4	4.49	5.85	5.58	5.95	7.30	5.18	4.34	3.79	3.68	3.74	3.78	4.02
5	4.65	5.68	5.55	5.90	6.85	5.35	4.24	3.78	3.70	3.72	3.80	3.98
6	6.85	5.42	5.52	6.48	7.70	6.12	4.19	3.77	3.70	3.71	3.80	4.02
7	6.28	6.72	5.38	8.52	8.98	5.80	4.14	3.76	3.68	3.70	3.75	4.05
8	5.98	6.48	5.35	8.92	7.78	5.45	4.09	3.75	3.66	3.68	3.71	4.00
9	5.95	6.25	5.32	8.38	6.52	5.25	4.06	3.74	3.64	3.66	3.67	4.10
10	5.82	6.42	5.26	7.48	7.75	5.28	4.04	3.74	3.66	3.66	3.68	4.32
11	5.78	6.72	5.28	6.68	8.55	5.78	4.02	3.72	3.70	3.67	3.75	4.12
12	5.42	6.40	5.26	6.52	7.55	5.40	3.99	3.71	3.68	3.68	3.78	4.08
13	5.30	6.10	5.19	7.28	7.38	5.35	3.95	3.70	3.67	3.69	3.78	4.08
14	5.41	5.82	5.24	10.38	7.42	5.38	3.94	3.70	3.65	3.70	3.78	4.28
15	5.58	5.70	5.28	9.58	7.20	5.22	3.94	3.75	3.64	3.71	3.78	4.25
16	5.65	6.44	5.30	8.75	6.85	4.98	3.91	3.88	3.64	3.75	3.78	4.28
17	6.05	6.35	5.18	8.40	6.42	4.82	3.94	4.25	3.62	3.78	3.84	4.30
18	6.08	6.08	5.12	8.68	6.15	4.98	3.95	4.28	3.62	3.78	3.88	4.30
19	6.06	6.15	5.22	8.68	6.25	5.02	3.96	4.20	3.62	3.78	3.90	4.28
20	5.96	8.02	5.15	9.58	6.22	5.15	3.94	4.08	3.62	3.78	3.92	4.25
21	6.14	8.18	5.05	8.08	6.18	4.98	3.94	4.00	3.61	3.76	3.94	4.24
22	6.00	7.68	5.05	8.92	6.05	4.82	3.96	3.96	3.60	3.92	3.94	4.22
23	5.22	6.82	5.05	8.70	5.75	4.72	4.12	3.94	3.60	3.98	4.10	4.18
24	5.28	6.55	5.02	8.50	5.45	4.62	4.28	3.88	3.70	3.91	4.21	4.18
25	7.28	7.85	4.98	7.50	5.38	4.54	4.31	3.79	3.72	3.86	4.21	4.14
26	6.85	7.00	5.18	7.88	5.42	4.48	4.22	3.75	3.72	3.84	4.26	4.12
27	6.43	6.48	5.16	8.40	5.42	4.45	4.08	3.74	3.74	3.84	4.38	4.18
28	6.09	6.42	5.22	8.50	5.48	4.40	4.00	3.71	3.80	3.80	4.25	4.18
29	6.02	......	5.28	8.58	5.52	4.31	3.96	3.72	3.86	3.82	4.15	4.12
30	5.72	......	5.16	7.35	5.42	4.24	3.92	3.70	3.88	3.75	4.12	4.12
31	5.56	......	5.18	......	5.36	......	3.91	3.70	......	3.76	......	4.12

NOTE.—Ice conditions prevailed from about Jan. 6 to Feb. 28 and Dec. 13 to 31.
Gage heights Apr. 20 to 29 affected about 0.5 foot by backwater from log jam.

Daily discharge, in second-feet, of Sacandaga River at Wells, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	192	300	1,170	552	2,090	552	120	44	24	42	31	90
2	189	300	945	656	3,490	528	113	36	24	35	31	85
3	180	300	804	945	2,130	470	171	36	23	31	31	74
4	192	300	726	1,040	2,820	470	150	34	23	28	33	74
5	242	300	705	990	2,130	570	125	33	24	26	35	66
6	1,050	300	684	1,630	3,490	1,210	113	32	24	25	35	74
7	700	1,000	588	4,880	5,670	900	101	31	23	24	30	81
8	500	800	570	5,560	3,630	635	90	30	21	23	25	70
9	500	700	552	4,650	1,690	510	83	28	20	21	22	92
10	400	640	516	3,120	3,580	528	79	28	21	21	23	145
11	440	800	528	1,890	4,940	884	74	26	24	22	30	97
12	310	700	516	1,690	3,240	600	68	25	23	23	33	88
13	280	600	475	2,790	2,950	570	59	24	22	23	33	76
14	300	550	504	8,050	3,010	588	58	24	20	24	33	65
15	360	650	528	6,690	2,660	492	58	30	20	25	33	65
16	390	700	540	5,280	2,130	372	52	47	20	25	33	65
17	340	600	470	4,680	1,560	308	58	128	18	33	41	65
18	300	600	440	5,160	1,240	372	59	135	18	33	47	65
19	260	500	492	5,160	1,360	390	62	115	18	33	50	65
20	230	1,500	455	5,840	1,320	455	58	88	18	33	54	65
21	200	2,800	405	3,290	1,280	372	58	70	18	31	58	65
22	175	2,250	405	4,710	1,140	308	62	62	17	54	58	65
23	175	1,350	405	4,340	860	268	97	58	17	66	92	65
24	250	1,120	390	4,000	635	232	135	47	24	52	118	65
25	1,400	2,400	372	2,350	588	207	142	34	26	44	118	65
26	1,400	1,600	470	2,950	614	189	120	30	26	41	130	65
27	1,000	1,200	460	3,830	614	180	88	28	28	41	160	65
28	700	1,200	492	4,000	656	165	70	25	35	35	128	65
29	600	....	528	4,140	684	142	62	26	44	38	103	65
30	500	....	460	2,900	614	125	54	24	47	30	97	65
31	400	....	470	....	576	....	52	24	....	31	....	65

NOTE.—Daily discharge during the ice periods, based on measurements made under ice conditions, on climatological reports, and on an intercomparison of discharge of Sacandaga River stations. Daily discharge during the open period based on a fairly well-defined rating below 4,000 second-feet.

Monthly discharge of Sacandaga River at Wells, N. Y., for 1909.

[Drainage area, 263 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,400	175	457	1.74	2.01	D.
February	2,800	300	931	3.54	3.69	D.
March	1,170	372	550	2.09	2.41	A.
April	8,050	552	3,590	13.7	15.29	B.
May	5,670	576	2,040	7.76	8.95	A.
June	1,210	125	453	1.72	1.92	B.
July	171	52	86.8	.330	.38	B.
August	135	24	45.2	.172	.20	C.
September	47	17	23.7	.090	.10	C.
October	66	21	32.7	.124	.14	C.
November	160	22	58.2	.221	.25	C.
December	145	65	73.6	.280	.32	D.
The year	8,050	17	695	2.65	35.66	

SACANDAGA RIVER AT NORTHVILLE, N. Y.

This station is located about three-fourths of a mile upstream from the steel highway bridge at Northville, and was established August 26, 1907. It has been maintained in cooperation with the New York State Water Supply Commission to obtain general statistical and comparative data regarding the flow of the Sacandaga.

The station is about 1 mile below the outlet of East Stony Creek and about 2 miles below West Stony Creek. It is about 1¼ miles above a low storage dam at Sacandaga Park in Northville. Pondage from this dam extends to the highway bridge at certain stages.

A chain gage attached to a cantilever arm fastened to a tree on the left bank is read once daily. Discharge measurements are made during high water from the steel highway bridge in the village of Northville. Medium and low water measurements are made by wading a short distance above the gage.

The datum of the gage has remained the same during the maintenance of the station. The United States Weather Bureau maintains a river and flood station at the steel highway bridge. During the winter months the discharge is usually affected by ice to such an extent that gage readings are discontinued. Conditions for obtaining the accurate discharge for the remainder of the year are very good and an excellent rating curve has been developed.

Information in regard to this station is contained in the annual reports of the State Water Supply Commission of New York, and of the State engineer and surveyor, State of New York.

Discharge measurements of Sacandaga River at Northville, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 11 [a]	C. R. Adams	250	1,120	6.80	2,330
27 [b]	D. M. Wood	225	1,900	8.33	4,740
Apr. 16 [c]	C. C. Covert	284	2,180	7.95	12,200
17 [c]	.....do	270	2,180	7.70	11,600

[a] Measurement made under complete ice cover; average thickness of ice 1.90 feet. Gage height to top of ice 6.90 feet.
[b] Measurement made under complete ice cover; average thickness of ice 2.10 feet. Gage height to top of ice 8.43 feet; anchor ice running.
[c] Measurement made from highway bridge.

Daily gage height, in feet, of Sacandaga River at Northville, N. Y., for 1909.

[E. E. Parkes, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.62	5.65	2.90	1.40	1.00	0.88	1.00	1.10	2.15
2		4.60	6.42	2.85	1.40	.95	.82	.98	1.15	2.35
3		4.75	5.55	2.62	1.48	1.00	.80	1.00	1.25	2.00
4		4.70	5.98	2.55	1.55	.92	.80	.92	1.20	1.80
5		4.40	5.50	2.55	1.42	.90	.85	.90	1.10	1.65
6		5.00	5.50	4.00	1.32	.90	.88	.91	1.10	1.42
7		7.60	5.38	3.48	1.30	.95	.88	.98	1.00	1.48
8		8.80	5.28	3.10	1.32	.92	.80	.88	1.08	1.40
9		7.62	4.80	2.80	1.15	.88	.80	.95	1.10	1.42
10		7.00	5.28	2.60	1.10	.82	.82	.88	1.15	1.45
11		5.45	7.28	3.70	1.10	.80	.90	.82	1.12	1.50
12		4.72	6.52	3.38	1.10	.90	.80	.85	1.10	
13		5.40	5.62	2.98	1.75	.80	.80	.90	1.10	
14		10.25	5.25	3.48	1.00	.78	.78	.91	1.10	
15		10.40	4.62	3.18	1.00	.70	.80	.90	1.10	
16		8.55	4.52	2.90	1.12	.85	.85	.88	1.10	
17		7.70	4.78	2.40	1.12	2.38	.80	1.10	1.10	
18		7.60	4.52	3.18	1.72	2.00	.78	1.20	1.15	
19		7.75	4.30	3.35	1.10	2.10	.75	1.16	1.20	
20		10.50	4.30	3.10	1.00	1.70	.78	1.16	1.30	
21		7.58	4.00	2.80	1.50	1.50	.72	1.10	1.35	
22		7.75	3.70	2.32	1.10	1.32	.60	1.58	1.40	
23		7.25	3.50	2.20	1.10	1.20	.70	1.50	1.80	
24		6.40	3.32	2.10	1.80	1.18	.90	1.55	1.90	
25		6.22	3.25	2.50	1.70	1.50	.88	1.55	2.00	
26		6.00	3.20	2.00	1.52	1.75	.80	1.50	1.90	
27		5.68	3.00	1.82	1.40	1.00	.80	1.48	1.80	
28	4.75	5.58	3.25	1.75	1.20	1.00	1.25	1.42	1.85	
29	4.72	5.45	3.32	1.65	1.15	.78	1.00	1.30	1.75	
30	4.75	6.00	3.50	1.55	1.50	.85	1.10	1.25	2.10	
31	4.80		3.25		1.50	.90		1.15		

NOTE.—Ice conditions prevailed from about January to March and Nov. 23 to Dec. 31.

Daily discharge, in second-feet, of Sacandaga River at Northville, N. Y., for 1909.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3,900	5,950	1,400	245	112	83	112	140
2	3,860	7,760	1,340	245	100	69	107	155
3	4,130	5,730	1,100	281	112	65	112	188
4	4,040	6,700	1,040	315	92	65	92	170
5	3,520	5,620	1,040	254	87	76	87	140
6	4,600	5,620	2,910	213	87	83	90	140
7	11,200	5,370	2,120	205	100	83	107	112
8	15,200	5,160	1,630	213	92	65	83	134
9	11,200	4,220	1,290	155	83	65	100	140
10	9,350	5,160	1,080	140	69	69	83	155
11	5,520	10,200	2,440	140	65	87	69	146
12	4,080	8,010	1,980	140	87	65	76	140
13	5,410	5,880	1,490	425	65	65	87	140
14	20,500	5,100	2,120	112	61	61	90	140
15	21,100	3,900	1,730	112	47	65	87	140
16	14,300	3,720	1,400	146	76	76	83	140
17	11,500	4,180	900	146	883	65	140	140
18	11,200	3,720	1,730	407	590	61	170	155
19	11,600	3,360	1,940	140	660	56	158	170
20	21,500	3,360	1,630	112	395	61	158	205
21	11,100	2,890	1,290	290	290	51	140	225
22	11,600	2,440	832	140	213	32	330	245
23	10,100	2,150	735	140	170	47	290	250
24	7,710	1,910	660	455	164	87	315	250
25	7,270	1,820	990	395	290	83	315	250
26	6,750	1,750	590	300	425	65	290	250
27	6,020	1,510	468	245	112	65	281	250
28	5,800	1,820	425	170	112	188	254	250
29	5,520	1,910	368	155	61	112	205	250
30	6,750	2,150	315	290	76	140	188	250
31		1,820		290	87		155	

NOTE.—Daily discharge based on a well-defined rating.

Monthly discharge of Sacandaga River at Northville, N. Y., for 1909.

[Drainage area, 740 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			1,130	1.53	1.76	C.
February			2,650	3.58	3.73	C.
March			1,580	2.14	2.47	C.
April	21,500	3,520	9,210	12.4	13.83	A.
May	10,200	1,510	4,220	5.70	6.57	A.
June	2,910	315	1,300	1.76	1.96	A.
July	455	112	226	.305	.35	A.
August	883	47	189	.255	.29	A.
September	188	32	75.2	.102	.11	B.
October	330	69	157	.212	.24	A.
November	250	112	182	.246	.27	B.
December			250	.338	.40	D.
The year	21,500	32	1,760	2.38	31.98	

NOTE.—Monthly discharge for January, February, March, and December determined from discharge at Wells and Hadley.

SACANDAGA RIVER NEAR HADLEY, N. Y.

This station is located on the steel highway bridge about 2½ miles west of Hadley, where the Sacandaga enters the Hudson, between the towns of Corinth and Hadley. It was established September 13, 1907, in cooperation with the New York State Water-Supply Commission, to obtain general statistical and comparative data regarding the flow of Sacandaga River, which has important storage and power possibilities.

The nearest dam is at Conklingville, about 3½ miles upstream, and is partly washed away and not in use at present. Occasional log jams occur in the vicinity of this station, causing backwater. The discharge is somewhat affected by ice during the winter months.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. Conditions for obtaining the accurate discharge are fair, except during the existence of log jams. The rating curve is fairly well developed. Discharge measurements are made from the bridge.

Information in regard to this station is contained in the annual report of the State Water-Supply Commission of New York.

Discharge measurements of Sacandaga River near Hadley, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
Jan. 19[a]	C. R. Adams	98	575	7.18	913
Mar. 1[b]	D. M. Wood	288	1,820	7.30	7,220
Apr. 15	C. C. Covert	274	1,470	6.45	14,900
17	E. F. Weeks	285	1,780	7.46	19,700
19	....do	289	1,520	6.55	15,500
May 8	....do	282	1,000	4.70	7,680
10	....do	282	986	4.62	6,740
20	C. C. Covert	254	954	4.45	5,880

[a] Partial ice cover, about 15 feet wide along shore. Very little flow under ice.
[b] Discharge greatly affected by ice and logs.

NOTE.—See list of measurements of Sacandaga River at lower bridge at Union Bag & Paper Co.'s mill at Hadley.

Daily gage height, in feet, of Sacandaga River near Hadley, N. Y., for 1909.

[W. W. Jeffers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.60	6.40	6.60	3.90	5.20	3.00	1.68	1.50	1.20	1.45	1.45	2.00
2	2.65	6.32	6.10	4.00	5.15	2.98	1.60	1.45	1.15	1.40	1.45	2.00
3	2.70	6.30	5.55	4.10	5.10	2.88	1.68	1.40	1.15	1.35	1.40	1.95
4	2.70	6.25	4.90	4.18	5.00	2.80	1.70	1.40	1.10	1.35	1.40	1.82
5	2.90	6.20	4.20	4.40	4.90	2.80	1.65	1.35	1.10	1.30	1.35	1.80
6	3.90	6.12	3.65	4.70	4.90	2.85	1.60	1.30	1.10	1.30	1.32	1.80
7	....	6.00	3.50	5.10	4.82	2.90	1.55	1.25	1.10	1.25	1.30	1.75
8	....	6.15	3.45	5.50	4.80	2.92	1.50	1.20	1.15	1.25	1.40	1.70
9	....	6.35	3.40	5.92	4.72	2.98	1.50	1.20	1.15	1.20	1.40	1.65
10	....	6.85	3.30	6.15	4.62	3.00	1.45	1.15	1.20	1.20	1.40	1.65
11	....	6.75	3.20	5.95	4.70	3.50	1.40	1.12	1.20	1.20	1.45	1.60
12	....	6.45	3.12	6.20	4.85	3.12	1.35	1.10	1.20	1.25	1.45	1.60
13	....	6.25	3.75	6.55	5.30	3.20	1.35	1.10	1.20	1.25	1.45	1.65
14	....	6.00	2.95	6.85	5.15	3.15	1.35	1.05	1.25	1.25	1.40	1.70
15	....	6.20	2.90	7.15	4.95	3.08	1.40	1.05	1.25	1.30	1.40	1.78
16	....	6.35	2.78	7.35	4.80	2.92	1.40	1.15	1.25	1.30	1.40	1.82
17	....	6.40	2.70	7.45	4.72	2.90	1.45	1.45	1.25	1.32	1.40	1.88
18	....	6.50	2.60	7.10	4.68	2.95	1.45	2.15	1.25	1.35	1.45	1.92
19	7.17	6.60	2.55	6.90	4.45	3.02	1.50	2.3	1.20	1.40	1.50	2.00
20	7.15	6.80	2.50	6.75	4.45	3.10	1.50	2.15	1.15	1.40	1.58	2.10
21	7.15	....	2.50	6.58	4.25	3.25	1.48	1.95	1.10	1.45	1.60	2.18
22	7.10	....	2.50	6.45	4.00	2.88	1.45	1.88	1.05	1.50	1.65	2.32
23	7.10	....	2.65	6.15	3.82	2.65	1.50	1.80	1.12	1.58	1.70	2.40
24	7.10	....	2.85	5.95	3.80	2.48	1.58	1.72	1.20	1.75	1.75	2.52
25	7.45	....	3.25	5.85	3.70	2.38	1.75	1.68	1.25	1.75	1.82	2.62
26	8.50	11.35	3.70	5.78	3.62	2.25	1.88	1.58	1.25	1.70	1.92	2.82
27	8.20	11.60	3.70	5.65	3.48	2.08	1.90	1.45	1.30	1.65	2.00	2.90
28	7.65	7.15	3.62	5.58	3.38	1.98	1.82	1.32	1.38	1.62	2.00	3.02
29	7.20	....	3.62	5.45	3.28	1.88	1.72	1.30	1.45	1.55	2.00	3.10
30	6.75	....	3.70	5.30	3.18	1.78	1.58	1.25	1.50	1.50	2.00	3.25
31	6.48	....	3.78	....	3.10	....	1.50	1.22	....	1.45	....	3.40

NOTE.—Discharge affected by ice conditions and logs January to March and December 13 to 31. Observer unable to read gage January 7 to 18 and February 21 to 25 on account of obstruction from ice and logs. Log jam also affected discharge from May 20 to about June 26.

Daily discharge, in second-feet, of Sacandaga River near Hadley, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	450	1,800	7,220	4,460	9,320	1,920	448	340	210	315	315	670
2	450	1,600	4,560	4,770	9,100	1,880	400	315	195	290	315	670
3	450	1,500	3,480	5,090	8,470	1,710	448	290	195	270	290	630
4	450	1,400	3,490	5,350	8,470	1,570	460	290	180	270	290	534
5	600	1,300	1,800	6,110	8,050	1,570	430	270	180	250	270	520
6	4,000	1,200	1,660	7,240	8,050	1,660	400	250	180	250	258	520
7	4,500	1,200	1,660	8,890	7,680	1,740	370	230	180	230	250	490
8	3,250	3,350	1,670	10,600	7,640	1,780	340	210	195	230	290	460
9	2,500	2,950	1,660	12,500	7,280	1,880	340	210	195	210	290	430
10	2,000	2,500	1,580	13,600	6,930	1,920	315	195	210	210	290	430
11	1,750	3,000	1,500	12,700	7,240	3,060	290	186	210	210	315	400
12	1,600	2,850	1,440	13,800	7,840	2,160	270	180	210	230	315	400
13	1,400	2,950	2,500	15,400	9,750	2,340	270	180	210	230	315	420
14	1,250	2,250	1,300	16,800	9,100	2,230	270	165	230	230	290	420
15	1,130	2,600	1,270	18,300	8,260	2,080	290	165	230	250	290	420
16	1,050	2,500	1,170	19,200	7,640	1,780	290	195	230	250	290	420
17	980	2,350	1,100	19,700	7,280	1,740	315	315	230	258	290	420
18	930	2,200	1,020	18,000	7,160	1,830	315	815	230	270	315	420
19	910	2,200	984	17,100	6,290	1,960	340	990	210	290	340	420
20	900	6,000	932	16,400	5,940	2,120	340	815	195	290	388	420
21	900	9,000	983	15,600	5,260	2,460	330	630	180	315	400	420
22	900	7,600	1,000	15,000	4,460	1,710	315	576	165	340	430	420
23	900	6,000	1,220	13,600	3,930	1,340	340	520	186	388	460	420
24	900	5,000	1,540	12,700	3,870	1,090	388	472	210	490	490	420
25	2,160	10,000	2,330	12,200	3,590	966	490	448	230	490	534	420
26	2,930	8,000	3,380	11,900	3,370	815	576	388	230	460	606	420
27	3,000	7,000	3,380	11,300	3,010	742	590	315	250	430	670	420
28	2,800	6,740	3,220	11,000	2,760	654	534	258	282	412	670	420
29	2,600	....	3,300	10,400	2,520	576	472	250	315	370	670	420
30	2,300	....	3,580	9,750	2,300	508	388	230	340	340	670	420
31	2,000	....	3,870	....	2,120	....	340	218	....	315	....	420

NOTE.—Daily discharge during the periods which were not affected by ice or logs based on a somewhat poorly defined rating curve. During the remainder of the year the discharge was estimated on the basis of measurements made during ice and log conditions and intercomparisons with other stations in the Hudson River drainage.

Monthly discharge of Sacandaga River near Hadley, N. Y., for 1909.

[Drainage area, 1,050 square miles.]

Month.	Discharge, in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	4,500	450	1,680	1.60	1.84	C.
February	10,000	1,200	3,820	3.64	3.79	C.
March	7,220	932	2,250	2.14	2.47	C.
April	19,700	4,460	12,300	11.7	13.05	C.
May	9,750	2,120	6,280	5.98	6.89	C.
June	3,060	508	1,660	1.58	1.76	C.
July	590	270	378	.360	.42	C.
August	990	165	352	.335	.39	C.
September	340	165	216	.206	.23	C.
October	490	210	303	.289	.33	C.
November	670	250	387	.369	.41	C.
December	680	400	456	.434	.50	C.
The year	19,700	165	2,510	2.39	32.08	

SACANDAGA RIVER AT UNION BAG & PAPER CO.'S MILLS AT HADLEY, N. Y.

This station, which is located on the steel highway bridge near the Union Bag & Paper Co. mills at Hadley, N. Y., was established in cooperation with the New York State Water-Supply Commission September 24, 1909, to determine the daily distribution of flow of the Sacandaga and to eliminate discrepancies due to log jams occurring at the Hadley station.

No important tributaries enter the river between this station and the one on the upper highway bridge near Hadley, N. Y. A chain gage is attached to the bridge, from which the measurements are made. Gage heights observed twice daily are furnished through the courtesy of the Union Bag & Paper Co. At times the gage heights are affected by backwater from the Hudson.

Conditions for making discharge measurements are good, and such measurements have been used in connection with those taken at the Hadley station to develop a fairly good rating curve for the upper station.

Discharge measurements of Sacandaga River at Union Bag & Paper Co.'s mills at Hadley, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
Feb. 8[b]	C. R. Adams	118	815	7.35	7.84	3,350
Mar. 26[c]	C. C. Covert	129	868	3.70	7.82	3,380
June 17	.....do	121	715	2.90	6.82	1,770
July 21	W. G. Hoyt	99	482	1.50	4.66	365
21	.....do	96	468	1.50	4.66	355
Sept. 24	.....do	92	413	1.20	4.01	237
Dec. 13[d]	.....do	118	565	2.59	5.40	407

[a] Gage heights referred to gage on Sacandaga at upper bridge near Hadley.
[b] Measurement greatly affected by ice and logs.
[c] Measurement slightly affected by ice and logs.
[d] Large amounts of slush ice running.

Daily gage height, in feet, of Sacandaga River at Union Bag & Paper Co.'s mills at Hadley, N. Y., for 1909.

Day.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	4.50	4.38	5.20	16		4.10	4.38	5.02
2	4.30	4.38	5.10	17		4.15	4.42	4.90
3	4.35	4.52	5.25	18		4.18	4.45	5.05
4	4.35	4.38	5.18	19		4.30	4.65	5.05
5	4.25	4.38	4.98	20		4.40	4.48	5.25
6	4.20	4.40	4.92	21		4.40	4.42	5.50
7	4.08		4.78	22		4.50	4.48	5.50
8	4.05	4.40	4.80	23		4.60	4.48	5.50
9	4.05	4.30	4.80	24	4.0	4.80	4.68	5.40
10	4.10	4.40	4.90	25	4.02	4.80	5.05	
11	4.05	4.40	4.80	26	4.0	4.80	5.20	
12	3.98	4.38	5.10	27	4.05	4.82	5.30	5.40
13	3.90	4.38	5.00	28	4.10	4.72	5.15	5.50
14	3.92		5.25	29	4.50	4.70	5.20	5.40
15	4.05	4.42	5.10	30	4.40	4.52	5.40	5.38
				31		4.50		5.40

HOOSIC RIVER BASIN.

DESCRIPTION.

Hoosic River rises on the west slope of the Hoosac Mountains in Vermont and Massachusetts. Two head branches, one flowing southward and the other northward along the west slope of this range, unite at North Adams, Mass., and the stream then flows northwestward, entering the Hudson 3 miles north of Mechanicville. Above Buskirk the drainage basin is rugged and precipitous, the distribution of tributaries affording rapid concentration of the run-off from the steep rock slopes. The ridges are sparsely wooded. The soil in the valleys is generally firm and tenacious. The general elevation of the valley at the junction of the headwaters is 1,000 feet. Numerous dams, affording power for textile, agricultural implement, and other industries, are scattered throughout the length of the stream from North Adams to Schaghticoke. The drainage basin contains no important lakes and but one storage reservoir, at Farnam, near the head of the South Branch.

South of Hoosic River the State boundary follows the Taconic Ridge, which forms the divide between the Hoosic in Massachusetts and the Little Hoosic in New York.

HOOSIC RIVER AT BUSKIRK, N. Y.

This station, which is located at the highway bridge in Buskirk, N. Y., was established September 25, 1903, to obtain data regarding the flow of this stream, the records being of especial value because of the considerable amount of water power, both developed and unutilized.

Walloomsac River enters about 5 miles above this station; but there are no large tributaries downstream in a distance of about 17 miles to the mouth, except Tomhannock Creek.

The first dam above Buskirk is at Hoosic Falls, 7 miles distant. The recent construction of the Schenectady Power Co.'s dam at Johnsonville produced backwater at the station and it has been discontinued. Discharge measurements only are published. These include those made at Eagle Bridge, 2 miles above Buskirk, where the discharge is the same as at Buskirk.

Discharge measurements of Hoosic River at Buskirk, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 22[a]	D. M. Wood	126	462	2.91	419
Mar. 2	.....do	129	513	2.94	1,080
Aug. 10[b]	C. C. Covert	52	57	1.73	203
	HOOSIC RIVER AT EAGLE BRIDGE, N. Y.				
July 5	W. G. Hoyt	139	336	[c] 1.30	289
Aug. 27	Covert and Hoyt	137	290	[d] 1.01	153

[a] Ice conditions; average thickness of ice 0.58 foot.
[b] By wading 600 feet below highway bridge.
[c] Gage height for the day at Buskirk was 1.88 feet.
[d] Gage height for the day at Buskirk was 6.20 feet.

MOHAWK RIVER BASIN.

DESCRIPTION.

Mohawk River, the largest tributary of the Hudson, rises in the sandy hills south of Booneville, in western New York, about 40 miles from the east end of Lake Ontario. Its uppermost tributaries are fed by large springs. The river receives also considerable water brought in from the adjacent Black River drainage basin for the supply of Black River and Erie canals. The Mohawk flows southward until it reaches the city of Rome, at which point it turns toward the east, flowing across the State in a course nearly east until it enters the Hudson at Cohoes, a few miles above Troy. Its total length is about 140 miles, and its drainage area comprises 3,470 square miles. The immediate valley of the Mohawk is broad and open, at many places a mile or two in width, and the flats which border the stream have a rich alluvial soil, finely adapted to the raising of grass, grains, and broom corn. Back from the flats there is a rise, in most places gradual but locally abrupt, to hills which attain altitudes several hundred feet above the stream. The more elevated lands are covered with sandy and gravelly loam. Toward the mouth of the river the valley becomes more contracted and the meadows disappear.

Above Rome the Mohawk flows through a deep gorge in shale rock. From Rome eastward to Little Falls the valley is deeply filled with alluvial deposits, and the flood plains on either side become submerged during freshets, thus acting to some extent as storage reservoirs. At Little Falls the river cuts through a rocky gorge, whose walls rise precipitously 500 or 600 feet.

Below Rome the fall of the river is small and rather uniform and the river is characterized by long, quiet reaches with slight riffles, but at Little Falls this uniformity is broken and the stream descends in a succession of falls about 45 feet in half a mile. The average fall between Rome and the lower aqueduct at Crescent, a distance of 110.7 miles, is 2.43 feet per mile; thence to the level of slack water above Troy dam there is a farther descent of 149.5 feet in 4.4 miles, but of this 105 feet is included within the improved power at Cohoes.

The Erie Canal parallels Mohawk River and derives a part of its water supply from it. The new barge canal, at present under construction by the State of New York, will utilize by canalization the greater portion of the river between Albany and Utica. The water supply for the new canal in the section between Syracuse and Utica will to a large extent come from the Mohawk. A high dam is to be placed across the Mohawk at Delta, 6 miles north of Rome, forming a large reservoir to supply the summit level of the canal near Rome. This supply will be supplemented by a reservoir on West Canada Creek at Hinckley, discharging by a conduit into Ninemile Creek and thence to the Rome summit level.

Important tributaries of the Mohawk are West and East Canada and Schoharie creeks.

West Canada Creek rises in West Canada Lake, in southwest-central Hamilton County and flows in a southerly direction into the Mohawk at Herkimer. Its drainage area, comprising approximately 583 square miles, contains about 50 small lakes and ponds and a small amount of artificial storage, which, with the numerous swamps and marshes in the region of the headwaters, serve to make the regimen of flow fairly uniform. A considerable part of the basin is timber covered. The underlying rock is granitic gneiss in the upper portion of the basin, with limestone in some places. Heavy accumulations of snow occur during the winter. At Trenton Falls is an important plant of the Utica Gas & Electric Co. There is much undeveloped power on this stream.

East Canada Creek rises in Hamilton County and flows southward between Herkimer and Fulton counties, joining the Mohawk at East Creek. In a general way its drainage basin is similar to that of West Canada Creek, although its flow is less sustained and regular.

Schoharie Creek has its source in the Catskills, about 2 miles east of Tannersville, at an elevation of 1,940 feet. The drainage basin is generally irregular. In places its slopes are almost precipitous, and it is extensively forest covered. The overlying rocks are slaty and allow but a slight depth of percolation. The soil is generally of clay. The total drainage area is 909 square miles.

MOHAWK RIVER AT LITTLE FALLS, N. Y.

There are three dams at Little Falls: The upper one is the State dam diverting water for the supply of the Erie Canal; the lower two are used for water-power development. Records of flow have been kept at the lower (Gilbert's) dam since 1898 by the United States Geological Survey in cooperation with the State engineer department, the results for 1908–9 being furnished by the latter. The dam is of masonry, planned in the form of a circular arch, and furnishes power for the Astoronga Knitting Mill and the mill of the Little Falls Paper Co. As the gage record is kept at the lower dam the results do not include the diversion at the State dam above the gaging station.

Conditions for obtaining accurate discharge data are fair, and the results are considered to be fairly good.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Mohawk River at Little Falls, N. Y., for 1908–9.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5,817	997	a 974	6,756	8,892	5,115	727	763	684	873	a 729	1,729
2	5,337	a 675	1,387	6,223	9,186	3,383	593	a 449	518	684	918	2,204
3	3,899	965	2,361	5,369	a7,348	2,747	657	678	607	657	947	2,885
4	2,320	1,109	2,830	4,068	6,130	2,206	527	806	641	a 596	911	1,236
5	a 1,668	1,197	2,722	a3,198	4,508	1,758	a 596	729	451	547	860	1,314
6	1,600	1,275	2,312	5,421	3,948	1,432	873	1,091	a 297	576	794	a 725
7	1,600	1,275	2,132	5,840	4,516	a1,116	753	1,327	449	489	764	1,275
8	1,546	1,243	a 2,177	6,802	6,930	1,368	824	994	576	522	a 561	2,218
9	1,906	a 878	2,424	9,351	7,087	1,457	1,799	a 632	684	522	940	2,409
10	1,642	1,275	2,042	8,455	a6,255	1,670	1,288	1,000	547	424	940	1,461
11	1,436	1,315	1,878	7,964	4,514	1,400	754	867	576	a 759	1,188	1,173
12	a 1,769	1,275	3,274	a7,599	3,586	1,338	a 596	933	480	990	1,973	1,260
13	3,421	1,275	4,978	5,894	2,884	1,198	836	867	a 384	1,030	2,466	a 1,362
14	3,555	1,447	7,720	4,370	3,945	a 798	836	867	607	824	1,743	1,550
15	2,598	6,298	a 9,717	4,914	4,664	1,062	735	792	547	972	a 1,103	1,820
16	2,084	a18,387	10,838	5,993	3,836	1,635	752	a 492	493	953	1,321	2,437
17	1,837	16,091	7,891	5,074	a3,763	1,500	817	787	464	704	1,087	2,496
18	1,678	9,586	7,109	3,995	3,255	1,333	1,702	2,077	493	a 583	1,086	1,893
19	a 1,457	6,106	6,146	a5,271	2,406	1,140	a5,454	1,374	329	679	1,078	1,547
20	1,232	4,870	4,599	5,922	2,398	1,542	4,170	1,094	a 449	732	1,355	a 1,619
21	1,586	4,172	3,290	5,019	1,818	a2,605	2,282	1,051	493	676	1,702	1,839
22	2,052	3,787	a 3,417	4,108	1,868	1,721	2,285	934	427	635	a 1,424	1,419
23	2,542	a 2,726	4,685	3,683	3,016	1,245	2,458	a 601	427	488	1,665	1,262
24	2,052	2,219	7,204	4,789	a2,933	1,245	1,583	641	427	502	1,975	923
25	1,345	1,920	6,768	6,786	1,977	1,237	1,212	684	464	a 411	2,414	789
26	a 1,408	1,973	6,684	a7,246	2,828	1,128	a1,358	607	366	488	3,273	1,166
27	1,500	2,085	9,031	7,517	3,447	1,068	1,449	684	a 368	694	3,200	a 921
28	1,397	1,821	9,541	7,315	2,871	a 458	1,224	641	493	913	2,597	1,213
29	1,451	1,510	a13,342	7,126	1,906	1,016	1,008	393	912	1,446	1,769	1,262
30	1,351	....	11,784	4,869	1,997	1,016	973	a 384	1,295	1,497	a 1,500	1,142
31	1,232	....	9,252	....	a2,871	....	908	518	....	1,244	....	1,081

a Sunday.

Daily discharge, in second-feet, of Mohawk River at Little Falls, N. Y., for 1908–9—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	1,096	1,400	5,003	6,625	6,628	1,492	688	a 816	729	824	1,120	1,963
2	1,026	1,540	3,738	7,177	a 8,825	1,443	792	924	848	946	1,042	1,664
3	a 1,022	1,531	3,457	7,664	8,081	1,404	900	886	753	a 990	1,042	1,621
4	1,227	1,486	3,331	a 8,062	7,318	1,245	a 637	834	657	1,085	1,120	1,569
5	2,091	1,622	2,258	8,091	5,701	1,855	838	766	a 492	1,000	1,085	a 1,033
6	6,201	5,133	1,892	10,036	5,782	a 4,541	916	933	1,404	911	1,154	1,514
7	6,135	a 5,761	a 1,728	13,788	6,133	3,686	959	808	1,122	662	a 887	1,391
8	4,748	6,108	1,988	16,327	6,599	2,236	894	a 691	936	629	1,154	1,391
9	3,548	5,516	1,762	13,488	a 5,478	1,790	733	628	733	679	1,189	1,353
10	a 4,956	3,520	2,128	8,895	5,464	2,000	658	645	791	a 720	1,313	1,090
11	2,518	3,206	4,442	a 5,823	8,675	2,640	a 774	828	547	816	1,189	660
12	2,121	3,260	4,831	4,915	8,370	2,664	894	688	a 561	777	1,189	a 947
13	1,555	3,159	4,044	6,490	5,767	a 1,839	852	688	732	800	977	1,135
14	1,352	a 2,866	a 4,601	13,688	4,164	2,281	928	448	861	676	a 846	1,135
15	1,663	2,541	2,955	16,184	3,452	2,152	749	a 415	754	769	919	1,301
16	1,381	3,078	2,708	14,279	a 4,402	1,796	799	951	580	704	977	1,505
17	a 841	2,881	2,546	10,482	5,065	1,570	882	1,383	493	a 838	1,225	1,326
18	1,141	3,133	1,944	a 10,089	4,312	2,210	a 708	1,591	555	1,563	2,287	1,116
19	1,029	2,688	1,883	8,883	3,430	2,532	834	1,396	a 563	1,387	2,340	a 1,163
20	1,138	8,144	1,838	9,992	2,808	a 1,895	1,011	1,196	714	1,348	1,665	1,213
21	1,195	a 9,541	a 1,505	8,290	2,139	1,748	895	1,114	641	1,116	a 1,726	1,213
22	1,439	9,926	1,398	7,184	1,964	1,483	895	a 838	890	1,387	1,976	1,217
23	1,979	7,758	1,349	6,754	a 2,366	1,365	1,154	906	800	2,448	2,865	1,146
24	a 5,509	8,152	2,150	5,955	2,012	1,206	1,740	906	777	a 2,313	3,288	924
25	8,800	10,553	6,004	a 4,486	1,705	1,206	a 2,361	877	794	2,001	2,688	1,017
26	10,377	8,801	6,797	4,338	1,443	1,206	2,053	906	a 837	1,606	2,220	a 919
27	7,414	7,949	7,026	3,629	1,398	a 1,353	1,514	632	754	1,309	1,820	1,034
28	5,729	a 6,665	a 6,657	5,020	2,049	1,073	1,119	549	666	1,309	a 1,526	1,077
29	3,801		6,006	4,721	1,808	962	1,051	a 692	800	1,274	2,224	1,146
30	2,540		5,400	4,960	a 1,769	702	915	661	589	1,154	2,665	936
31	a 2,163		5,650		1,888		828	706		a 918		842

a Sunday.

Monthly discharge of Mohawk River at Little Falls, N. Y., for 1908–9.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1908.					
January	5,820	1,230	2,140	1.63	1.88
February	18,400	675	3,440	2.63	2.84
March	13,300	974	5,500	4.20	4.84
April	9,350	3,200	5,900	4.50	5.02
May	9,190	1,820	4,120	3.15	3.63
June	5,120	458	1,600	1.22	1.36
July	5,450	527	1,360	1.04	1.20
August	2,080	384	831	.634	.73
September	1,300	297	532	.406	.45
October	1,500	411	745	.569	.66
November	3,270	561	1,480	1.13	1.26
December	2,880	725	1,540	1.18	1.36
The year	18,400	297	2,430	1.86	25.23
1909.					
January	10,400	841	3,150	2.40	2.77
February	10,600	1,400	4,930	3.76	3.92
March	7,030	1,350	3,520	2.69	3.10
April	16,300	3,630	8,540	6.52	7.27
May	8,820	1,400	4,420	3.37	3.88
June	4,540	702	1,850	1.41	1.57
July	2,360	637	999	.763	.80
August	1,590	415	848	.647	.75
September	1,400	492	746	.569	.63
October	2,450	629	1,130	.863	1.00
November	3,290	846	1,590	1.21	1.35
December	1,960	660	1,210	.924	1.07
The year	16,300	415	2,740	2.09	28.19

MOHAWK RIVER AT DUNSBACH FERRY, N. Y.

This station was established March 12, 1898, in connection with a system of levels by the United States Board of Engineers on Deep Waterways, by D. J. Howell, who has furnished the earlier portion of the record.

The station is located at the dam of the West Troy Water Co., a short distance above Dunsbach Ferry bridge, 9 miles from the mouth of the river. Records for 1909 have been furnished by the State engineer department.

The dam is of granite masonry, with a flat crest, and is in two sections, situated on opposite sides of an island of Hudson River shale. Total length of crest, 560 feet. The dam was rebuilt in 1903.

Conditions for obtaining accurate discharge data are fair, and the records are fairly good. During the winter period ice causes some obstruction.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Mohawk River at Dunsbach Ferry, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,871	5,921	12,801	15,371	14,351	3,761	1,641	a951	621	1,411	1,464	2,931
2	1,871	6,171	10,681	16,741	a19,611	3,261	1,521	841	676	1,411	1,344	3,101
3	a2,101	6,171	9,841	17,318	16,741	3,101	1,641	951	731	a1,521	1,234	3,101
4	1,981	5,491	9,001	a18,871	13,731	2,601	a1,761	951	841	1,641	1,234	3,431
5	1,871	5,271	8,441	21,861	10,681	2,431	1,761	1,066	a896	1,732	1,344	a3,261
6	4,621	5,491	7,681	20,351	10,121	a3,261	1,641	951	1,066	1,658	1,464	2,931
7	9,827	a12,171	a7,181	22,251	9,001	5,701	1,521	951	896	1,308	a1,658	2,761
8	12,759	14,691	6,421	24,621	7,431	4,841	1,411	a1,066	896	1,308	1,871	2,761
9	13,090	10,681	6,931	21,461	a5,701	3,591	1,521	1,066	1,181	1,641	1,981	2,601
10	a10,681	9,281	7,941	20,721	5,061	3,981	1,641	852	1,411	a1,521	2,271	2,431
11	7,941	8,441	11,241	a16,401	8,721	5,032	a1,411	738	1,521	1,411	2,431	2,101
12	6,931	6,931	10,912	13,421	22,641	5,598	1,181	683	a1,871	1,181	2,101	a1,871
13	5,701	6,931	9,477	12,171	19,241	a5,271	1,181	687	1,761	1,181	1,871	1,761
14	5,271	a7,431	a8,142	19,241	14,691	5,701	951	731	1,411	1,301	a1,871	1,641
15	4,191	7,181	7,660	35,581	12,171	6,171	1,066	a621	1,411	1,641	1,871	1,871
16	3,761	6,931	7,431	37,481	a12,171	5,491	1,301	621	1,301	1,538	1,981	2,101
17	a3,761	7,402	6,931	31,401	13,711	5,061	1,641	621	1,411	a1,234	2,931	2,101
18	3,431	7,504	5,921	a24,621	10,961	4,621	a1,411	731	1,181	1,344	3,261	2,101
19	3,981	7,764	5,672	18,871	8,721	3,761	1,301	1,301	a1,181	1,464	3,261	a2,431
20	3,591	27,675	5,017	16,401	7,431	a3,761	1,181	2,931	1,301	1,694	3,101	2,761
21	3,101	a39,798	a4,444	14,691	6,171	3,761	1,181	2,931	1,411	1,694	a3,101	2,214
22	2,760	28,321	3,584	12,801	5,491	3,431	1,181	a2,101	1,641	1,808	1,261	2,017
23	3,261	21,861	3,782	11,551	a5,061	2,931	1,066	1,871	1,521	1,924	3,431	2,017
24	a8,191	19,241	4,191	10,401	4,621	2,761	1,181	1,641	1,411	a2,424	3,101	1,787
25	27,901	36,422	5,491	a10,121	4,621	2,431	a1,761	1,641	1,181	3,254	3,101	1,787
26	25,411	29,300	18,131	9,281	4,411	2,431	3,261	1,521	a1,301	3,254	3,431	a1,843
27	18,131	20,286	18,871	8,721	3,761	a2,101	2,931	1,181	1,521	2,924	3,261	1,871
28	13,421	a15,371	a19,241	8,191	3,981	1,981	2,271	896	1,641	2,584	a3,101	2,101
29	10,121	....	21,091	8,721	5,061	1,871	1,641	a786	1,871	2,244	2,761	1,871
30	7,681	....	18,501	8,561	a5,061	1,871	1,301	621	1,761	1,924	2,761	1,641
31	a6,421	....	17,081	....	4,411	....	951	621	....	a1,584	....	1,411

a Sunday.

Monthly discharge of Mohawk River at Dunsbach Ferry, N. Y., for 1909.

[Drainage area, 3,440 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	27,900	1,870	7,600	2.21	2.55
February	39,800	5,270	13,800	4.01	4.18
March	21,100	3,580	9,670	2.81	3.24
April	37,500	8,190	17,600	5.12	5.71
May	22,600	3,760	9,530	2.77	3.19
June	6,170	1,870	3,750	1.09	1.22
July	3,260	951	1,530	.445	.51
August	2,930	621	1,130	.328	.38
September	1,870	621	1,290	.375	.42
October	3,250	1,180	1,770	.515	.59
November	3,430	1,230	2,400	.698	.78
December	3,430	1,410	2,280	.663	.76
The year	37,500	621	6,030	1.75	23.52

WEST CANADA CREEK[1] AT TWIN ROCK BRIDGE, N. Y.

This station, which is located at the highway bridge about 2 miles above Hinkley and about one-half mile below the outlet of Black Creek, was established September 7, 1900, to obtain data regarding the flow of West Canada Creek. Data on discharge are obtained by the current-meter method. The gage datum has remained the same during the maintenance of the station.

Several dams on this stream in the vicinity of the gaging station are used for power development, one at Hinckley, about 2 miles downstream, and one near the head of Trenton Falls, about midway between the villages of Prospect and Trenton Falls. The discharge is affected at times by backwater from log jams and the dam at Hinckley. Ice obstructs the channel in the winter months and during this period a special rating curve is used for computing the flow.

The records at this station for 1909 have been furnished by the State engineer department.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

Discharge measurements of West Canada Creek at Twin Rock Bridge, N. Y., in 1909.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
Jan. 21[a]	Newton and Niles		31.41	366
Feb. 12[a]	Gehring and Clark		33.18	1,120
Mar. 2[a]	Gehring and Patchke		32.34	948
Apr. 19[a]	Clark and Niles	1,430	35.47	6,000
May 4[a]	Niles and Patchke	1,060	34.12	2,420
4[b]	do	1,260	34.40	2,810
May 25[b]	Clark and Angus	786	31.48	539
July 9[c]	Gehring and Clark	910	30.10	191
14[c]	J. P. Newton	849	29.96	182
Aug. 23[c]	Clark and Niles	888	30.04	230
Sept. 8[c]	Clark and Robbins	931	30.25	234
15[c]	E. C. Niles	894	30.03	208
27[c]	Gehring and Clark	882	29.87	140

[a] Ice measurement; gauge read to water surface.
[b] Made at bridge.
[c] Made at boat section, about 1,000 feet above bridge.

[1] For description of this creek, see general description of Mohawk River basin, p. 193.

Daily discharge, in second-feet, of West Canada Creek at Twin Rock Bridge, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	330	240	1,195	1,165	3,320	395	225	225	170	265	305	210
2	325	198	1,042	1,375	5,118	350	212	221	182	325	290	208
3	355	126	904	1,890	3,290	332	262	195	180	295	320	210
4	322	[a] 194	860	2,700	2,390	318	392	188	170	265	335	185
5	370	[a] 262	721	2,490	2,048	600	315	182	336	230	340	180
6	4,370	330	693	3,205	3,615	1,555	265	180	365	205	315	160
7	5,220	1,460	683	5,400	4,960	860	232	180	272	190	290	140
8	4,500	1,610	645	7,665	5,880	625	218	190	231	300	298	165
9	2,172	1,325	617	3,670	4,800	505	210	170	205	220	350	190
10	2,243	1,054	761	1,275	5,680	498	200	157	190	185	375	138
11	1,954	1,110	1,174	768	8,630	965	275	152	182	180	345	170
12	1,701	1,096	1,236	370	5,000	833	192	148	195	195	320	172
13	1,109	985	1,114	835	5,485	618	190	145	185	210	300	145
14	1,070	753	1,006	7,700	2,400	740	178	149	173	220	280	160
15	1,148	733	948	7,920	2,200	630	180	148	187	205	270	165
16	842	925	860	5,118	2,045	515	198	241	171	198	260	175
17	636	1,688	849	3,890	2,025	435	199	357	173	335	350	170
18	597	1,671	805	4,510	1,710	775	210	360	162	455	590	168
19	502	1,430	761	4,768	1,355	833	222	318	158	365	475	180
20	431	2,524	827	7,540	955	670	230	255	160	290	420	170
21	371	4,475	750	4,985	785	540	223	268	161	280	398	160
22	323	3,448	805	3,498	880	415	200	248	188	610	635	150
23	382	2,456	772	5,340	945	350	231	202	150	965	830	142
24	858	2,104	806	2,942	600	330	390	182	198	745	775	145
25	3,340	3,957	1,018	3,435	525	310	[b] 365	170	220	560	1,255	162
26	2,900	3,349	2,425	2,138	395	310	[b] 340	168	200	442	520	175
27	1,740	2,567	2,145	4,455	425	300	315	170	185	380	310	152
28	1,290	1,710	1,570	4,155	800	265	272	155	180	345	240	141
29	801	....	1,570	2,970	710	245	255	163	225	320	285	140
30	736	....	1,400	2,585	605	238	250	175	230	295	320	138
31	518	....	1,110	....	539	....	235	168	....	350	....	139

[a] Probably needle ice obstruction; discharge interpolated. [b] Discharge interpolated.

Monthly discharge of West Canada Creek at Twin Rock Bridge, N. Y., for 1909.

[Drainage area, 364 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	5,220	322	1,400	3.85	4.44
February	4,480	126	1,560	4.29	4.47
March	2,420	617	1,030	2.83	3.26
April	7,920	370	3,690	10.1	11.27
May	8,630	395	2,580	7.09	8.17
June	1,560	238	545	1.50	1.67
July	392	178	248	.681	.79
August	360	145	201	.552	.64
September	365	150	199	.547	.61
October	965	180	336	.923	1.06
November	1,260	240	413	1.13	1.26
December	210	138	165	.453	.52
The year	8,630	126	1,030	2.85	38.15

WEST CANADA CREEK[1] AT KAST BRIDGE, N. Y.

This station, which is located on the highway bridge about 4 miles above the outlet of West Canada Creek and about 3 miles above the village of Herkimer, N. Y., was established May 15, 1905, to obtain

[1] For description of this creek, see general description of Mohawk River basin, p. 193.

data regarding the flow of West Canada Creek. Data on discharge are obtained by the current-meter method.

Records for 1909 have been furnished by the State engineer department.

About 20 miles above the gaging station is the dam of the Utica Gas & Electric Co., which develops power for transmission to Utica and other places in this vicinity. Water is diverted from West Canada Creek near the village of Hinckley, for domestic and commercial uses at Utica, by the Consolidated Water Co. of Utica, N. Y.

No important tributaries enter the creek between this station and that at Twin Rock Bridge. Conditions for determining accurate discharge are fair and a fairly good rating table has been developed.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

Discharge measurements of West Canada Creek at Kast Bridge, N. Y., in 1909.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
May 24	Clark and Angus	465	29.28	1,080
July 28	Niles and Angus	454	29.14	1,080
Sept. 14	E. C. Niles	302	28.29	351

Daily discharge, in second-feet, of West Canada Creek at Kast Bridge, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	a 562	a 811	1,875	2,648	5,238	723	333	285	276	423	489	840
2	a 680	v 891	1,595	2,978	6,790	636	351	285	188	456	497	621
3	a 658	a 797	1,525	4,295	4,802	518	428	333	338	489	518	694
4	a 665	a 767	1,385	3,796	3,324	456	475	276	342	437	456	701
5	a 1,095	a 804	993	4,875	3,265	993	541	295	446	399	606	701
6	a 4,295	a 4,032	1,044	6,620	2,878	1,945	437	351	621	257	526	665
7	4,585	2,786	942	11,248	4,948	1,324	390	304	(b)	328	474	621
8	4,150	3,265	891	13,700	6,025	942	295	267	(b)	319	548	577
9	2,142	2,372	891	8,470	4,585	782	304	215	(b)	409	606	428
10	1,735	1,910	1,044	5,165	5,092	891	304	276	(b)	390	614	404
11	1,700	1,805	1,665	2,978	8,665	1,299	361	252	394	200	606	482
12	a 1,299	1,665	1,595	2,694	6,535	1,095	361	276	252	394	562	489
13	[1] 891	1,595	1,385	4,802	3,914	993	314	285	267	361	465	497
14	[1] 760	1,324	1,197	15,840	2,280	955	238	243	248	314	475	708
15	a 1,018	1,455	1,146	17,120	2,015	942	276	248	285	390	423	636
16	a 782	1,324	1,095	10,425	2,878	811	342	399	299	418	504	643
17	a 504	1,910	942	8,275	2,648	694	333	518	342	465	497	591
18	a 636	1,840	853	8,860	2,326	1,070	323	651	215	797	891	606
19	(a)	1,630	804	7,885	1,875	1,095	285	614	165	782	881	518
20	a 7,130	7,495	811	12,440	1,490	993	328	489	204	606	730	562
21	a 5,600	6,450	737	8,178	1,248	797	257	351	285	489	701	548
22	a 4,222	5,685	782	6,365	1,299	687	257	304	295	752	811	591
23	a 3,914	4,032	745	6,025	1,560	497	541	380	314	1,525	1,560	651
24	a 4,875	6,705	942	(b)	968	465	752	390	342	1,455	1,805	446
25	6,450	7,788	2,786	(b)	853	533	1,172	230	257	983	1,406	562
26	5,770	6,195	2,418	(b)	723	394	1,018	319	428	737	1,186	504
27	3,324	4,368	1,700	4,585	687	518	680	243	267	628	866	497
28	2,372	2,694	1,735	5,238	1,018	394	461	309	333	651	811	614
29	1,630	....	1,980	4,585	1,120	428	342	280	342	621	1,070	475
30	1,420	....	1,770	5,165	853	356	418	314	375	518	1,044	446
31	a 1,070	....	1,840	....	866	....	399	262	....	584	....	(b)

a Excessive ice obstruction. b No record.

Monthly discharge of West Canada Creek at Kast Bridge, N. Y., for 1909.

[Drainage area, 574 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January (30 days)	7,130	562	2,530	4.41	4.92
February	7,790	767	3,020	5.26	5.48
March	2,790	737	1,330	2.32	2.68
April (27 days)	17,100	2,650	7,230	12.6	12.65
May	8,660	687	2,990	5.21	6.01
June	1,940	356	808	1.41	1.57
July	1,170	257	430	.749	.86
August	651	215	330	.575	.66
September (26 days)	621	165	312	.544	.53
October	1,520	200	567	.988	1.14
November	1,800	423	754	1.31	1.46
December (1-30)	840	404	577	1.01	1.13

EAST CANADA CREEK [1] AT DOLGEVILLE, N. Y.

This station, which was established September 23, 1898, for the purpose of obtaining data regarding the flow of East Canada Creek, is located at the dam of the Herkimer County Light & Power Co., about 7 miles above the outlet of the stream at High Falls, near the village of Dolgeville, N. Y.

The record is kept of the flow over the dam and through the wheels. The discharge over the dam is computed from a discharge curve based on United States Geological Survey experiments at Cornell University. The discharge through the wheels is computed from current-meter measurements in the tailrace. Records for 1909 have been furnished by the State engineer department.

Spruce Creek, the principal tributary to East Canada Creek, enters about 1 mile above Dolgeville. Water is diverted from this creek and from Beaver Brook, one of its tributaries, at Diamond Hill, for use at Little Falls, N. Y. Water is also diverted from Cold Brook, a tributary to East Canada Creek, for use at Dolgeville, N. Y. No allowance is made for these diversions in computing the discharge at the gaging station.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

[1] For description of this creek see general description of Mohawk River basin, p. 193.

Daily discharge, in second-feet, of East Canada Creek at Dolgeville, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	234	383	785	962	2,483	274	206	a 105	147	200	262	378
2	149	347	578	1,204	a 2,690	218	196	124	154	225	261	333
3	a 228	334	713	1,746	2,120	304	204	123	147	a 113	265	309
4	257	298	578	a 1,921	1,970	256	a 128	134	195	175	228	269
5	282	284	339	2,127	2,134	396	169	139	a 167	187	208	a 143
6	743	628	558	3,167	1,985	a 779	173	150	185	165	184	293
7	1,140	a 864	a 474	5,136	2,374	588	186	121	163	175	a 147	219
8	948	1,126	425	5,540	1,994	811	174	a 85	162	197	325	248
9	806	1,083	360	3,571	a 1,635	525	157	105	212	167	297	210
10	a 781	933	401	2,752	1,674	779	144	115	256	a 95	293	202
11	758	1,054	684	a 1,804	2,720	1,203	a 99	105	294	155	250	166
12	891	725	816	1,677	1,741	1,049	140	111	a 179	161	240	a 142
13	202	800	621	2,860	1,267	a 788	129	105	165	178	216	206
14	376	a 566	a 438	7,537	1,141	714	143	163	169	184	a 154	228
15	416	1,338	365	6,717	825	611	207	a 327	164	165	205	232
16	312	1,055	317	4,576	a 1,139	402	209	350	165	113	207	276
17	a 294	758	348	3,946	1,127	667	179	554	161	a 159	338	199
18	247	1,307	334	a 3,815	892	634	a 119	631	297	414	461	233
19	155	2,151	408	3,671	622	643	237	516	a 463	441	399	a 320
20	561	1,598	558	4,755	481	a 491	172	344	356	317	372	180
21	382	a 2,905	a 629	2,745	606	414	145	258	156	324	a 234	204
22	343	2,299	606	2,816	521	404	147	a 182	151	768	456	195
23	388	2,538	327	2,899	a 388	377	272	190	151	618	374	185
24	a 1,373	2,361	497	2,283	417	269	763	148	288	a 428	434	192
25	1,948	2,360	700	a 2,005	380	218	a 576	154	217	257	417	185
26	1,596	2,414	782	1,939	419	216	429	173	a 129	439	280	a 170
27	1,081	2,050	664	2,278	438	a 210	297	152	189	381	324	202
28	591	a 1,587	a 415	2,085	455	283	230	338	218	283	a 255	190
29	480		510	2,227	582	234	195	a 263	218	300	443	179
30	569		691	1,880	a 485	212	190	134	218	302	460	190
31	a 563		654		480		201	156		a 162		160

a Sunday.

Monthly discharge of East Canada Creek at Dolgeville, N. Y., for 1909.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Per square mile.	Run-off (depth in inches).
January	1,950	149	616	2.41	2.78
February	2,900	284	1,290	5.04	5.25
March	816	317	535	2.09	2.41
April	7,540	962	3,090	12.1	13.50
May	2,720	380	1,230	4.80	5.53
June	1,200	210	499	1.95	2.18
July	763	99	220	.859	.99
August	631	85	211	.824	.95
September	463	129	205	.801	.89
October	768	95	266	1.04	1.20
November	461	147	300	1.17	1.30
December	378	142	221	.863	.99
The year	7,540	85	724	2.83	37.97

SCHOHARIE CREEK [1] AT PRATTSVILLE, N. Y.

This gaging station was established November 7, 1902, by the United States Geological Survey on the highway bridge. On May 7, 1907, it was assumed by the Board of Water Supply of the city of

[1] For description of this creek see general description of Mohawk River basin, p. 193.

New York, by whom the following tables of discharge were supplied. On May 7, 1907, a new standard board of water supply chain gage was established in place of the old one, which was dilapidated and unwieldy. The old datum was preserved and the present readings conform to those already obtained.

The bridge is a single-span steel highway bridge 187.8 feet between abutments, and all the water passes between them at all but the very highest stages.

In high water measurements are made from the bridge; at low-water stages they may be made by wading at a point about 500 feet below the bridge.

The gage is attached to the floor of the bridge on the upstream side near the left bank. The chain length is 27.05 feet. The elevation of the datum of the gage is 1,130.03 feet (U. S. G. S. bench mark). The gage datum is referred to a bench mark—a circle of white paint marked on a bowlder at the right end of the downstream side of the bridge; elevation 1,151 feet, or 20.97 feet above the datum of the gage.

Gage readings are made each morning and evening by Miss Edna M. Snyder, of Prattsville, N. Y.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Schoharie Creek at Prattsville, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	225	565	551	470	945	177	118	19	31	43	31	48
2	145	670	512	452	990	138	106	15	29	35	29	19
3	185	881	440	488	945	153	85	17	35	41	29	29
4	250	849	392	579	1,380	193	80	19	29	35	27	23
5	670	a 769	1,170	452	1,017	205	80	19	23	35	33	23
6	2,675	1,233	1,215	530	1,380	235	73	23	10	35	27	21
7	990	1,053	691	1,323	929	193	66	19	10	23	25	50
8	530	446	410	1,350	881	153	73	19	10	23	29	37
9	300	428	335	1,125	691	177	57	17	8	31	29	24
10	275	1,450	2,725	705	670	315	43	17	12	23	27	10
11	250	1,400	2,325	452	1,520	512	50	15	19	23	29	50
12	350	849	1,500	392	881	335	43	10	19	23	35	50
13	275	593	600	380	691	265	43	10	29	23	27	50
14	275	428	500	6,340	551	512	50	10	23	23	25	195
15	670	881	452	4,128	551	392	61	10	35	23	23	440
16	275	1,341	392	2,300	635	335	50	21	29	29	19	237
17	300	1,305	335	1,260	721	265	43	31	25	29	19	165
18	410	905	305	1,053	670	990	43	181	23	31	19	175
19	565	905	275	905	530	649	35	138	21	35	23	92
20	705	6,500	275	769	470	470	39	90	19	29	27	67
21	565	2,350	265	649	410	380	39	66	23	29	25	83
22	530	1,170	217	621	410	325	35	50	19	31	23	95
23	745	929	177	691	452	265	43	52	15	29	27	95
24	2,350	2,175	118	600	380	235	43	43	23	39	25	95
25	1,680	1,380	2,388	512	325	193	29	46	29	37	23	95
26	691	1,053	1,450	488	285	153	35	43	19	37	23	95
27	621	929	990	452	265	106	21	37	23	35	27	83
28	565	721	881	649	440	128	19	31	61	31	41	83
29	530	....	849	621	350	153	23	29	106	23	39	83
30	452	....	635	621	265	138	21	29	66	25	43	89
31	428	....	530	....	250	....	23	23	....	27	....	116

a Ice went out Feb. 5.

Monthly discharge of Schoharie Creek at Prattsville, N. Y., for 1909.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,675	145	628	2.62	3.019
February	6,500	428	1,220	5.09	5.294
March	2,725	118	771	3.21	3.701
April	6,340	380	1,045	4.35	4.859
May	1,520	250	674	2.81	3.235
June	990	106	291	1.21	1.355
July	118	19	51	.21	.242
August	181	10	37	.15	.179
September	106	8	27	.11	.127
October	43	23	30	.12	.145
November	43	19	28	.12	.127
December	440	10	91	.37	.440
The year	6,500	8	408	1.70	22.723

KINDERHOOK CREEK AT ROSSMAN, N. Y.

Kinderhook Creek is an interstate stream, with total drainage area of 337 square miles, having its source in Hancock Mountains in western Massachusetts, at an elevation reaching nearly to 1,500 feet above tide, and flowing southwesterly through Columbia and Rensselaer counties, N. Y., joining Claverack Creek, about 2 miles from Hudson River, to form Stockport Creek, through which it discharges into the Hudson, 4 miles north of the village of Hudson. Kinderhook Creek is an important stream for power, with considerable amounts unutilized, and affords also some opportunities for storage.

The gaging station, which was established March 17, 1906, to obtain data regarding the total flow of the creek, is located at the highway bridge near Rossman post office, New York, about 7 miles northeast of Hudson.

The only important tributary above the station—Valatie Kill—enters at Valatie, about 7 miles distant.

About one-eighth mile above the station, at Chittenden Falls, are two mills, only one of which is at present in use. The river has also been developed at two points above Rossman—at Stuyvesant Falls and Kinderhook, distant, respectively, about 2 and 5 miles.

During the winter months the discharge is affected slightly for short periods by the presence of ice.

A box gage of the tape-and-weight type is located on the highway bridge and is read three times daily. The datum of the gage has remained unchanged during the maintenance of the station. Discharge measurements are made from the bridge or by wading. Conditions for obtaining accurate discharge are good, and a very good rating curve has been developed.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Discharge measurements of Kinderhook Creek at Rossman, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 28	D. M. Wood	154	394	28.11	960
June 8	Covert and James	155	138	26.86	210
Oct. 27	Covert and Hoyt	141	99	26.67	124

Daily gage height, in feet, of Kinderhook Creek at Rossman, N. Y., for 1909.

[Lester Allen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	26.34	27.29	27.73	28.56	28.12	26.92	26.78	26.40	26.31	26.66	26.56	26.60
2	26.38	27.19	27.70	28.36	28.32	26.88	26.81	26.45	26.37	26.62	26.54	26.58
3	26.47	27.23	27.66	28.42	28.15	27.03	26.74	26.31	26.42	26.46	26.48	26.59
4	26.59	27.35	27.67	28.37	28.27	27.04	26.50	26.38	26.39	26.53	26.56	26.56
5	26.83	26.94	27.59	28.23	28.37	26.99	26.46	26.61	26.37	26.54	26.63	26.43
6	29.61	28.42	27.27	28.27	28.18	26.76	26.62	27.22	26.37	26.50	26.43	26.55
7	28.19	28.56	27.41	28.72	28.03	26.91	26.59	26.84	26.39	26.48	26.29	26.49
8	27.82	27.96	27.43	28.86	27.90	27.10	26.54	26.60	26.41	26.50	26.40	26.58
9	27.81	27.84	27.29	28.42	27.80	26.81	26.62	26.64	26.47	26.52	26.56	26.56
10	27.52	27.86	27.93	28.22	27.66	26.91	26.51	26.57	26.44	26.46	26.46	26.57
11	27.46	28.36	29.54	27.89	27.55	27.06	26.27	26.62	26.51	26.43	26.41	26.46
12	27.52	27.88	28.41	27.82	27.52	26.93	26.55	26.48	26.32	26.48	26.44	26.25
13	27.17	27.64	28.25	27.75	27.46	26.66	26.58	26.34	26.48	26.49	26.35	26.57
14	27.81	27.56	27.88	28.18	27.35	26.76	26.52	26.45	26.48	26.51	26.27	26.70
15	27.36	27.54	27.86	30.22	27.35	26.89	26.54	26.38	26.49	26.50	26.40	26.86
16	27.53	27.72	27.79	29.64	27.38	26.85	26.55	26.60	26.50	26.50	26.41	26.88
17	27.56	28.14	27.72	28.95	27.52	26.84	26.53	26.52	26.42	26.38	26.49	26.85
18	27.48	27.71	27.61	28.58	27.60	28.21	26.40	26.62	26.36	26.50	26.35	26.80
19	27.45	27.65	27.52	28.31	27.55	27.93	26.22	26.59	26.31	26.40	26.36	26.47
20	27.41	34.14	27.56	28.15	27.34	27.52	26.42	26.59	26.31	26.37	26.36	26.48
21	27.32	30.30	27.36	28.03	27.19	27.38	26.46	26.70	26.26	26.40	26.37	26.40
22	27.17	29.18	27.42	27.92	27.28	27.15	26.43	26.42	26.29	26.47	26.64	26.44
23	26.92	28.57	27.35	27.92	27.30	27.03	26.44	26.56	26.27	26.46	26.57	26.56
24	27.40	28.67	27.31	27.99	27.16	27.12	26.45	26.50	26.41	26.30	26.56	26.53
25	28.18	30.05	27.48	27.74	27.01	27.18	26.37	26.46	26.31	26.59	26.42	26.49
26	28.11	28.50	29.59	27.80	26.92	26.99	26.56	26.52	26.30	26.67	26.49	26.40
27	27.89	28.42	28.68	27.78	26.97	26.72	26.54	26.38	26.42	26.63	26.58	26.62
28	27.66	28.27	28.82	27.66	27.12	26.90	26.48	26.37	26.66	26.61	26.37	26.69
29	27.86	....	29.37	27.90	27.35	27.02	26.52	26.42	27.00	26.58	26.61	26.86
30	27.34	....	28.78	27.84	27.35	26.83	26.51	26.37	26.78	26.56	26.56	26.83
31	27.68	....	28.58	....	27.22	....	26.51	26.42	....	26.44	....	26.49

NOTE.—This stream rarely freezes at the gage; it is probable, however, that the relation of stage to discharge was more or less affected during the winter periods for brief intervals, due to backwater from ice below the gage.

Daily discharge, in second-feet, of Kinderhook Creek at Rossman, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	40	354	623	1,310	922	195	147	50	36	111	84	94
2	47	306	602	1,130	1,090	180	156	60	45	100	80	89
3	64	325	575	1,180	947	237	134	36	54	62	66	92
4	92	386	582	1,140	1,050	241	70	47	48	77	84	84
5	163	202	528	1,010	1,140	221	62	97	45	80	102	56
6	2,470	1,180	344	1,050	972	141	100	320	45	70	56	82
7	980	1,310	418	1,460	850	191	92	167	48	66	33	68
8	688	795	429	1,600	748	265	80	94	52	70	50	89
9	680	703	354	1,180	673	156	100	105	64	75	84	84
10	483	718	771	1,010	575	191	72	87	58	62	62	87
11	447	1,130	2,380	740	502	249	30	100	72	56	52	62
12	483	733	1,170	688	483	198	82	66	37	66	58	28
13	296	561	1,030	638	447	111	89	40	66	68	42	87
14	680	508	733	972	386	141	75	60	66	72	30	122
15	391	496	718	3,310	386	184	80	47	68	70	50	173
16	489	616	666	2,510	401	170	82	94	70	70	52	180
17	508	939	616	1,700	483	167	77	75	54	47	68	170
18	458	609	541	1,320	534	997	50	100	44	70	42	153
19	441	568	483	1,080	502	771	24	92	36	50	44	64
20	418	10,200	508	947	380	483	54	92	36	45	44	66
21	370	3,430	391	850	306	401	62	122	29	50	45	50
22	296	1,950	424	764	349	288	56	54	33	64	105	58
23	195	1,320	386	764	359	237	58	84	30	62	87	84
24	412	1,410	364	818	292	274	60	70	52	34	84	77
25	972	3,070	458	630	229	301	45	62	36	92	54	68
26	914	1,250	2,450	673	195	221	84	75	34	114	68	50
27	740	1,180	1,420	659	214	128	80	47	54	102	89	100
28	575	1,050	1,560	575	274	187	66	45	111	97	45	119
29	718	......	2,170	748	386	233	75	54	225	89	97	173
30	380	......	1,520	703	386	163	72	45	147	84	84	163
31	588	......	1,320	......	320	......	72	54	......	58	......	68

NOTE.—The above daily discharges are based on a rating curve well defined below 1,720 second-feet. Open-water rating curve has been used for the entire year.

Monthly discharge of Kinderhook Creek at Rossman, N. Y., for 1909.

[Drainage area, 331 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	2,470	40	532	1.61	1.86	A.
February	10,200	202	1,330	4.02	4.19	B.
March	2,450	344	856	2.59	2.99	A.
April	3,310	575	1,110	3.35	3.74	A.
May	1,140	195	541	1.63	1.88	A.
June	997	111	264	.798	.89	A.
July	156	24	77.0	.233	.27	A.
August	320	36	82.0	.248	.29	A.
September	225	29	59.8	.181	.20	A.
October	114	34	72.0	.218	.25	A.
November	105	30	64.7	.195	.22	A.
December	180	28	94.8	.286	.33	A.
The year	10,200	24	416	1.28	17.11	

ESOPUS CREEK BASIN.

DESCRIPTION.

Esopus Creek has its source in northwestern Ulster County and enters Hudson River near Saugerties. The course of the upper portion of the stream is southeastward, but at Binnewater it turns abruptly to the northeast and for a distance of about 20 miles the course of the creek lies parallel to that of Hudson River, though the two streams flow in opposite directions. At Kingston the creek is 2.5 miles from the Hudson and at an elevation of 140 feet above tide.

The stream is characterized by a number of precipitous falls, which occur chiefly at points where it passes from one geologic formation to another. At Olivebridge it falls 28 feet, at Glen Erie 56 feet, and at Saugerties it makes its descent to the tide-water level of the Hudson in an abrupt fall of about 40 feet.

Esopus Creek is to be used as a source of water supply by New York City by placing a masonry dam 210 feet in maximum height near Browns station, where the drainage area is 255 square miles. The Ashokan reservoir, so formed, will have a storage capacity of about 17,000,000,000 cubic feet, and a present quantity of about 250,000,000 gallons of water per day will be carried through the Catsskill aqueduct to New York City, about 100 miles distant. Eventually portions of Rondout, Catskill, and Schoharie creeks are to be included in the supply, raising this to 500,000,000 gallons daily.

ESOPUS CREEK NEAR OLIVEBRIDGE, N. Y.

During 1906 a weir for the purpose of measuring the flow of Esopus Creek was constructed near Olivebridge, N. Y., by the Board of Water Supply of the City of New York. It is located about 1 mile below the Olivebridge post office. The following description and discharge data have been furnished by the Board of Water Supply of the City of New York.

The weir is constructed of concrete, having a cross section similar to that experimented on in the hydraulic laboratory at Cornell University by the United States Geological Survey, in series 30, described in Water-Supply Paper 150.

The average height of this weir above the rock on which it is founded, for its entire length, is 7.54 feet; length between abutments, 193.90 feet. In order to form a channel of approach the abutments have been extended upstream at right angles with the axis of the weir for a distance of 16 feet, and the area of the channel of approach below the crest of the weir is 1,462 square feet. The abutments extend 14 feet above the level of the crest, and it is estimated that a flow of 40,000 cubic feet per second can be taken care of.

Measurements of the head on the weir are made in a well 24 inches in diameter, situated 53 feet upstream from the crest of the weir. Water is admitted to this well through a $\frac{3}{4}$-inch pipe extending 16 feet out into the stream in which, spaced 6 inches apart, are $\frac{1}{8}$-inch holes bored vertically through the pipe. The center of this pipe is placed 18 inches above the bed of the stream. A continuous record of the head at this point is kept by means of a Friez automatic water-stage register, geared 1 to 1 and running 24 hours. Observations of the flow were first begun on October 17, 1906, though the automatic gage register was not installed until December 5. Prior to this latter date heads were read three times daily and reduced in the usual manner.

Computations of the discharge over this weir are made from a formula which has been deduced from the results of the experiments made by the United States Geological Survey and referred to above. During the winter the ice which forms between the wing walls which form the channel of approach is kept cut away so that there may be no change in the conditions of flow due to this cause.

The drainage area of Esopus Creek above the weir is 239 square miles, as measured on the topographic maps of the United States Geological Survey.

Information in regard to this station is contained in the reports of the New York State engineer and surveyor.

Daily discharge, in second-feet, of Esopus Creek near Olivebridge, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	172	363	918	769	1,296	306	150	64	44	78	53	52
2	164	541	852	743	1,498	286	122	84	44	67	53	70
3	226	516	818	766	1,280	271	110	78	44	62	55	75
4	276	466	686	909	1,433	269	100	72	36	64	62	67
5	1,581	570	563	814	1,259	461	89	62	36	67	57	72
6	4,735	1,170	527	830	1,154	380	84	62	33	62	53	67
7	2,279	659	491	1,554	1,069	314	75	60	33	62	48	72
8	1,336	485	440	1,616	1,191	282	72	42	33	57	48	136
9	944	380	429	1,192	978	267	72	36	33	53	44	80
10	625	1,266	1,028	958	953	323	67	33	74	53	44	94
11	522	1,197	1,128	775	1,080	465	67	29	132	48	42	92
12	447	836	868	687	886	358	67	28	78	57	33	73
13	379	816	802	642	798	322	62	26	62	62	33	89
14	332	751	725	4,840	716	374	62	28	53	57	29	608
15	532	787	652	4,768	682	515	62	23	48	53	33	454
16	438	1,754	566	2,975	749	371	62	134	48	48	29	310
17	489	2,030	536	2,003	1,022	446	62	656	62	44	33	248
18	416	1,408	452	1,517	841	1,152	48	406	62	40	36	211
19	300	1,742	401	1,250	764	753	81	248	53	36	34	168
20	418	[a] 9,376	389	1,072	700	615	76	184	48	33	33	136
21	393	3,375	333	953	658	515	48	156	44	40	29	205
22	368	2,120	317	888	692	436	36	128	36	44	29	162
23	474	1,606	296	854	630	410	64	110	40	48	33	162
24	908	2,299	278	797	551	342	140	94	57	53	29	162
25	1,130	2,416	2,782	675	480	308	105	84	67	62	37	162
26	1,262	1,619	2,382	702	434	271	89	72	48	67	48	162
27	1,076	1,367	1,456	612	481	235	78	72	48	72	46	162
28	887	1,168	1,356	660	550	222	67	62	111	72	44	162
29	757	......	1,164	664	429	201	62	53	124	62	53	126
30	714	......	984	885	374	175	62	53	89	57	70	105
31	563	......	807	......	338	......	57	48	......	53	......	154

[a] Maximum discharge at 3 a. m. Feb. 20 was 14,600 second-feet.

Monthly discharge of Esopus Creek near Olivebridge, N. Y., for 1909.

[Drainage area, 239 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	4,735	164	811	3.39	3.922
February	9,376	363	1,539	6.44	6.703
March	2,782	278	820	3.43	3.955
April	4,840	612	1,279	5.35	5.970
May	1,498	338	838	3.51	4.040
June	1,152	175	388	1.62	1.812
July	150	36	78	.33	.374
August	656	23	106	.44	.511
September	132	33	57	.24	.267
October	78	33	56	.23	.271
November	70	29	42	.18	.199
December	608	52	158	.66	.760
The year	9,376	23	514	2.15	28.784

ESOPUS CREEK AT KINGSTON, N. Y.

The Kingston gaging station was established July 5, 1901, by the United States Geological Survey, and was taken over on April 28, 1907, by the Board of Water Supply of the City of New York, by whom this description and the following tables of discharge were supplied for 1909. A continuous record of gage heights has been kept by John Douglas, of Kingston, who reads the gage each night and morning. The station was discontinued April 30, 1909.

The station is located on the upstream side of the steel highway bridge on Washington Avenue, Kingston, N. Y. There is a clear span of 115 feet between the abutments, which are nearly vertical. In addition to the main channel there is an overflow channel 19 feet wide on the left bank, through which water flows at a gage height of about 12 feet. The station is valueless at the highest stages of the stream.

The station was originally equipped by the United States Geological Survey with the standard chain gage, located on the upstream side of the bridge near the right abutment. This gage was dilapidated and so was replaced on June 19, 1908, by a board of water supply standard chain gage. The length of the chain is 31.04 feet from end of weight to marker.

Measurements are made from the bridge at high water and by wading or boat at lower stages. A sharp bend in the creek about 500 feet above the bridge causes considerable eddying and the current is uneven and irregular; at low water the velocities are more regular.

The bench mark is located on the coping stone at the upstream corner of the right abutment and has an elevation of 31.84 feet above the zero of the datum of the gage.

This station was expensive to maintain and required much attention. At flood stages the stream overflowed the flats to the west of the bridge and its channel changed so as to require new sets of observations. Sharp bends in the channel caused a somewhat irregular current which required more detail and care in the measurements than at other stations.

For these reasons it was found more expedient and economical to continue Mount Marion as the principal station on the lower Esopus.

Information in regard to this station is contained in the report of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Esopus Creek at Kingston, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	279	660	1,360	1,010	16	890	1,608	738	3,814
2	223	750	1,074	922	17	890	2,435	698	3,030
3	262	770	1,010	910	18	994	1,740	660	1,530
4	334	666	946	1,090	19	690	1,425	615	1,270
5	684	684	1,162	990	20	660	2,050	600	882
6	6,150	1,860	706	922	21	710	4,625	564	874
7	2,725	1,500	684	1,440	22	648	2,910	486	994
8	2,060	1,158	615	1,710	23	714	1,440	269	1,046
9	1,620	978	606	1,250	24	1,050	2,340	269	1,058
10	1,054	1,375	954	1,058	25	2,200	3,350	2,220	850
11	874	2,470	1,512	910	26	2,140	2,172	3,726	858
12	714	1,710	1,674	778	27	1,626	1,752	2,112	534
13	882	1,668	1,098	990	28	1,405	1,536	1,992	854
14	874	1,572	990	4,930	29	1,114	....	1,860	802
15	914	1,350	882	5,405	30	1,034	....	1,310	1,090
					31	914	....	1,090	....

Monthly discharge of Esopus Creek at Kingston, N. Y., for 1909.

[Drainage area, 324 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	6,150	223	1,204	3.72	4.292
February	20,500	660	2,393	7.39	7.705
March	3,726	269	1,112	3.43	3.961
April	5,405	534	1,460	4.51	5.039

ESOPUS CREEK AT MOUNT MARION, N. Y.

The Mount Marion station was established April 4, 1907, by the Board of Water Supply of the City of New York. A continuous record of gage heights has been kept by John Sauer, of Saugerties, who reads the gage morning and evening. The description and following records of discharge were supplied by the Board of Water Supply of the City of New York.

This station is located on the single-span steel highway bridge at a place called Pleasant Valley, on the Esopus Creek. It is on the

Saugerties Road and 1 mile east of the Mount Marion station of the West Shore Railroad.

The banks of the creek on both sides are high, steep, and rocky. The right bank is about 40 feet above water level; the left is at least 100 feet high.

The bed of the stream is rocky and clean, forming one channel which is straight above the station for about 1,000 feet and below the station for about 600 feet.

At the station the bed is ledge rock with the strata steeply inclined, giving jagged corners and an irregular but permanent cross section.

A standard board of water supply gage is located on the downstream side of the bridge. The length of the chain from end of weight to marker is 49.01 feet. The bench mark is a chisel draft on the bridge seat of the left abutment, downstream side near the lower chord. The elevation of the bench mark is 46.30 feet above the zero of the gage. The initial point of soundings is located on the handrail of the bridge near the left bank of the stream, downstream side, and is marked with black paint.

In May, 1908, the flooring of the bridge was renewed, but provisions were made for the accurate continuance of gage heights during this short period.

For very low stages of the creek the water is too sluggish at the bridge station for good meter measurements. A wading station was therefore established about three-fourths mile above the bridge and about three-fourths mile below Glenerie Falls. The Kingston-Saugerties road runs parallel to the creek on the right bank and the station is 200 feet from the road. The banks on both sides are of the same character as at the bridge. The bed of the stream is gravelly and liable to some change; under certain conditions there may be two channels. This station is used only when the depth of water does not exceed 3 feet. The current is swift and good measurements are obtained at this point; gage heights are referred to the bridge gage.

In May, 1902, several measurements were taken at this bridge by the United States Geological Survey. It was then called the Glasco Bridge near Glenerie.

Daily discharge, in second-feet, of Esopus Creek at Mount Marion, N. Y., for 1907–1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1					850	601	329	75	27	2,025	2,280	678
2					785	728	254	75	29	1,425	2,000	660
3					728	1,460	190	75	39	1,120	8,000	589
4				880	1,136	1,240	171	69	79	1,350	4,625	580
5				805	1,500	1,258	145	63	2,125	1,460	3,190	595
6				728	1,258	1,850	150	69	838	1,120	2,660	430
7				660	1,310	1,524	298	71	487	924	8,800	430
8				660	1,390	1,240	190	63	329	1,216	6,100	410
9				698	1,200	1,040	177	59	260	1,634	3,850	430
10				770	1,104	931	134	59	487	1,310	2,910	3,100

Daily discharge, in second-feet, of Esopus Creek at Mount Marion, N. Y., for 1907–1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
11				740	1,028	770	127	50	862	1,160	2,425	5,650
12				880	898	698	145	46	2,960	1,136	1,975	4,325
13				961	820	610	185	44	1,500	961	1,610	2,350
14				972	752	550	177	46	972	862	1,425	1,850
15				880	678	505	120	44	710	752	1,200	1,850
16				805	910	418	127	41	580	660	961	1,563
17				805	1,746	379	141	39	450	589	862	1,270
18				698	1,286	371	290	41	362	550	795	1,104
19				660	1,286	379	298	39	322	487	785	987
20				678	1,080	329	185	37	290	460	710	862
21				597	910	379	156	39	290	589	698	805
22				565	820	322	120	39	245	505	898	752
23				540	758	284	123	39	390	430	770	924
24				820	710	245	134	44	1,850	418	710	4,500
25				1,425	610	245	115	46	1,160	379	961	3,075
26				1,270	610	209	111	48	820	362	972	2,350
27				1,216	820	209	106	41	660	329	862	1,906
28				1,040	780	199	94	48	580	4,310	785	1,794
29				945	650	190	84	39	3,025	6,130	752	2,280
30				862	601	402	75	39	3,050	4,330	728	2,170
31					540		84	37		2,930		2,750
1908.												
1	2,170	a 345	750	2,530	8,550	880	145	170	68	150	618	150
2	1,800	345	695	2,230	4,590	880	150	150	62	116	a 520	150
3	1,500	340	775	1,720	2,830	770	310	128	57	101	440	140
4	1,260	340	725	1,500	1,980	760	325	132	a 45	92	400	120
5	1,300	340	645	1,260	1,600	a 715	925	120	43	92	360	120
6	895	335	605	1,290	1,350	640	a 560	128	41	86	322	120
7	930	330	590	1,210	1,375	530	360	128	39	80	285	137
8	1,290	a 326	590	1,290	a 7,000	495	250	124	38	80	278	530
9	1,260	325	590	3,200	4,000	455	210	98	37	74	240	440
10	930	325	a 550	a 2,530	2,630	380	190	95	36	74	240	402
11	840	330	590	2,075	1,980	390	175	112	35	74	230	220
12	1,390	330	590	1,790	1,575	330	155	120	34	65	225	315
13	3,740	a 330	1,260	1,540	1,300	295	140	108	33	71	210	300
14	a 2,800	a 330	2,830	a 1,350	1,150	280	145	98	32	80	195	270
15	1,870	a 4,070	2,910	1,190	1,230	310	140	92	a 31	74	210	315
16	1,600	9,980	a 4,630	1,300	1,000	715	135	92	31	68	195	330
17	1,375	4,960	2,830	1,175	880	480	125	92	31	68	185	315
18	1,150	a 2,310	1,980	1,075	790	340	120	92	31	62	175	246
19	1,025	1,950	2,530	1,050	725	285	125	86	31	57	165	240
20	930	1,700	a 2,550	1,050	680	250	115	a 86	31	62	165	292
21	880	1,350	1,840	995	800	215	110	83	31	68	170	246
22	840	1,320	1,700	900	4,210	200	155	80	30	62	165	216
23	a 800	950	1,790	830	7,430	205	155	74	a 30	57	165	180
24	680	840	2,430	790	4,050	185	135	68	30	a 62	160	140
25	730	730	3,050	a 840	2,430	a 200	130	57	30	62	160	202
26	680	800	2,300	925	1,800	195	740	62	30	137	175	294
27	840	a 944	a 3,510	925	1,530	180	410	92	30	1,320	160	224
28	860	975	5,400	950	1,150	165	280	86	30	815	175	190
29	680	830	7,000	1,360	770	160	225	80	46	1,012	160	190
30	680		5,270	1,320	800	155	195	68	230	950	141	150
31	725		3,360		1,980		175	68		730		216
1909.												
1	288	735	1,470	1,158	1,882	515	239	80	94	169	80	138
2	288	635	1,350	1,052	2,700	443	239	74	87	141	77	134
3	288	685	1,259	1,035	2,107	427	210	68	80	130	80	126
4	303	828	1,161	1,175	2,040	395	195	70	80	122	80	126
5	600	912	1,035	1,088	1,747	525	173	91	74	125	80	115
6	7,350	1,486	951	1,035	1,590	615	159	94	68	115	87	115
7	4,100	1,486	912	1,122	1,470	515	177	83	68	111	80	118
8	2,380	1,259	810	1,570	1,770	403	159	74	63	105	74	150
9	1,770	979	840	1,470	1,550	387	146	68	63	101	71	168
10	1,300	852	1,210	1,122	1,370	455	146	68	70	94	80	130

a Meter measurement.

NOTE.—Discharge from Feb. 2 to 12, 1908, estimated because of ice cover.

Daily discharge, in second-feet, of Esopus Creek at Mount Marion, N. Y., for 1907–1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
11	1,090	[a]2,880	2,580	1,000	1,770	650	135	68	111	87	68	130
12	950	1,680	1,860	915	1,410	600	122	63	146	97	74	112
13	735	1,635	1,454	855	1,175	500	122	58	119	101	68	115
14	700	1,617	1,245	5,970	1,052	525	122	58	101	101	74	900
15	725	1,534	1,119	7,410	1,000	575	122	58	87	105	77	1,702
16	600	2,103	1,021	4,825	1,035	615	115	155	87	101	71	1,035
17	550	4,010	965	2,940	1,510	685	108	840	87	91	80	725
18	750	2,430	840	2,107	1,430	2,844	115	768	94	87	80	637
19	810	2,380	768	1,770	1,157	1,707	115	455	94	78	80	475
20	725	17,850	750	1,470	1,052	1,189	108	312	87	87	77	345
21	625	7,500	685	1,280	982	979	115	247	74	83	74	260
22	550	4,150	650	1,350	948	780	108	206	80	87	80	247
23	600	3,036	585	1,210	965	685	108	173	87	87	68	260
24	870	3,590	575	1,262	840	600	138	155	105	80	77	240
25	2,130	5,300	3,216	1,158	750	515	138	146	119	83	94	205
26	2,040	3,190	6,870	1,070	665	435	135	138	111	91	94	179
27	1,550	2,330	3,320	1,000	625	363	122	130	108	105	115	189
28	1,315	1,995	2,604	1,140	1,000	335	111	122	115	97	112	189
29	1,000	....	2,103	1,018	780	312	94	111	210	87	112	199
30	870	....	1,725	1,175	665	265	94	97	195	83	130	170
31	810	....	1,406	....	585	....	87	87	....	80	....	155

[a] Ice went out Feb. 11.

Monthly discharge of Esopus Creek at Mount Marion, N. Y., for 1907–1909.

[Drainage area, 378 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1907.					
April 4–30	1,425	540	836	2.21	2.22
May	1,746	540	953	2.52	2.91
June	1,850	190	652	1.72	1.92
July	329	75	162	.43	.50
August	75	37	50	.13	.16
September	3,050	27	859	2.27	2.53
October	6,130	329	1,352	3.58	4.12
November	8,800	698	2,177	5.76	6.43
December	5,650	410	1,681	4.45	5.12
1908.					
January	3,740	680	1,240	3.28	3.785
February	9,980	325	1,323	3.50	3.775
March	7,000	550	2,157	5.70	6.579
April	3,200	790	1,406	3.72	4.158
May	8,550	680	2,392	6.33	7.304
June	880	155	401	1.06	1.176
July	925	110	242	.64	.734
August	170	57	99	.26	.304
September	230	30	43	.11	.132
October	1,320	57	223	.59	.678
November	618	141	243	.64	.717
December	530	120	239	.63	.729
The year	9,980	30	834	2.21	30.071
1909.					
January	7,350	288	1,247	3.30	3.804
February	17,850	635	2,824	7.47	7.780
March	6,870	575	1,527	4.04	4.661
April	7,410	855	1,757	4.65	5.190
May	2,700	592	1,278	3.38	3.904
June	2,844	265	661	1.75	1.954
July	239	87	138	.37	.422
August	840	58	168	.44	.514
September	210	63	99	.26	.292
October	169	78	100	.26	.308
November	130	68	83	.22	.248
December	1,702	112	316	84	.966
The year	17,850	58	850	2.25	30.043

RONDOUT CREEK BASIN.

DESCRIPTION.[1]

Rondout Creek rises in the timber-covered mountain group forming the Wittemberg Chain, flows southeastward to Naponach, where it encounters the foot of the Shawangunk Range, turns abruptly to the northeast, and enters the Hudson at Rondout. On the south its basin is separated from that of Wallkill River only by the narrow Shawangunk Mountain. Notable falls occur at Honk Falls and Naponach, and on Good Beer Kill above Ellenville. On Good Beer Kill there is a fall of 870 feet from the cape, 3 miles above Ellenville, to Ellenville. Of this about 200 feet is concentrated in a series of cascades called Hanging Rock Falls. Above its junction with Sandberg Creek, at Naponach, Rondout Creek is a mountain stream. At Honk Falls a natural declivity affords a fall of 125 feet.

RONDOUT CREEK AT ROSENDALE, N. Y.

The Rosendale gaging station is located on the highway bridge and was established by the United States Geological Survey on July 6, 1901. It was assumed by the Board of Water Supply of the City of New York on June 1, 1907, at which time a new standard board of water supply chain gage was put in to replace the old one. This description and the following tables of discharge for 1909 were furnished by the Board of Water Supply of the City of New York.

Measurements are taken from the bridge at high and medium stages and by wading at a point about 1,000 feet below the bridge at low stages.

The gage is located on the downstream side of the bridge in the middle panel. The length of the chain from end of weight to marker is 34.53 feet.

The bench mark is a circular cut on rock on upstream corner, right abutment. The elevation is 33.56 feet above the datum.

The water is confined to one channel under the single-span steel bridge, which is 135.7 feet between abutments at all stages.

A portion of the water of the creek is diverted by a dam below High Falls and sent through the Delaware & Hudson Canal and is discharged into the creek below the gaging station. At Rock Locks, which is about 1½ miles below Rosendale, there is an overflow weir, from which the approximate discharge of the canal may be obtained. The weir, which has a crest of 3.8 feet, is located at the left end of the lock and is equipped with a standard board of water supply staff gage.

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[1] Abstracted from Bull. 85, New York State Mus. Nat. Hist., 1905, pp. 258-259.

Information in regard to this station is contained in the report of the State engineer and surveyor, State of New York.

Daily discharge, in second-feet, of Rondout Creek at Rosendale, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	232	693	1,320	1,217	2,918	325	255	57	75	208	106	207
2	256	677	1,217	1,073	3,808	304	232	40	101	179	111	243
3	250	645	1,109	933	3,665	268	245	47	78	158	101	220
4	292	605	957	869	2,642	266	189	54	69	145	88	192
5	869	565	837	821	1,892	380	152	86	57	135	78	166
6	7,400	805	709	773	1,422	377	118	73	52	118	71	162
7	4,150	877	629	789	1,063	341	102	66	50	98	64	160
8	2,344	789	549	950	2,277	315	119	56	53	91	93	160
9	4,200	805	605	838	1,949	285	102	49	48	81	87	160
10	2,474	1,127	1,413	761	1,341	304	85	40	81	86	88	205
11	1,457	1,787	2,000	663	1,120	563	77	33	176	81	87	205
12	821	1,360	1,500	584	1,013	467	72	24	129	100	90	178
13	340	1,271	1,280	506	953	465	81	33	106	87	92	170
14	292	1,163	1,037	1,462	865	430	81	35	96	82	86	3,225
15	821	1,330	941	3,362	803	387	81	34	87	152	82	2,539
16	1,055	1,280	869	2,125	769	363	79	153	75	129	90	208
17	933	1,820	805	1,604	864	736	93	865	64	113	83	135
18	1,163	1,952	749	1,293	777	4,112	110	738	67	100	90	104
19	1,091	2,024	677	1,113	722	1,446	105	504	68	97	84	100
20	821	18,300	629	905	642	831	94	327	61	99	94	108
21	821	5,200	581	961	592	671	87	231	64	93	101	129
22	797	3,100	533	1,131	671	504	80	153	77	118	100	139
23	933	2,526	493	1,395	631	424	121	159	127	173	72	312
24	1,820	4,050	437	1,282	558	402	190	158	152	156	78	333
25	3,595	3,475	2,910	1,163	478	361	134	140	152	141	75	333
26	2,700	2,192	5,500	1,075	449	325	97	111	127	131	88	317
27	1,235	1,820	2,840	1,168	456	301	102	77	151	118	89	306
28	957	1,534	2,192	1,315	617	290	91	72	268	107	121	295
29	629	......	1,868	1,827	481	316	85	69	256	99	159	311
30	741	......	1,555	2,377	415	279	79	60	231	93	190	339
31	709	......	1,391	......	360	......	79	61	......	99	......	339

NOTE.—These discharges include the flow of the Delaware & Hudson Canal, which was open for the year on Apr. 4.

Monthly discharge of Rondout Creek at Rosendale, N. Y., for 1909.

[Drainage area, 380 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	7,400	232	1,490	3.92	4.518
February	18,300	565	2,278	6.00	6.245
March	5,500	437	1,295	3.42	3.930
April	3,362	506	1,211	3.19	3.553
May	3,808	360	1,201	3.16	3.646
June	4,112	266	561	1.48	1.647
July	255	72	117	.31	.356
August	865	24	149	.39	.450
September	268	48	106	.28	.314
October	741	81	118	.31	.360
November	190	64	95	.25	.281
December	3,225	100	387	1.02	1.181
The year	18,300	24	751	1.98	26.481

PASSAIC RIVER DRAINAGE BASIN.

DESCRIPTION.

Passaic River rises in Somerset and Morris counties, N. J. Above its confluence with Pompton River, its main tributary, it meanders through a flat country of Triassic red sandstone, to which in large measure must be attributed the turbidity of its waters. In contrast with the sluggish, muddy Passaic, the Pompton is a rapid stream and its waters are clear. It drains parts of Sussex, Passaic, Morris, and other adjoining counties, and traverses for a large part of its course a country of hard crystalline rocks and heavy forests, the general level of which is several hundred feet above that of the Passaic. At their confluence the Pompton enters with a current which carries it well toward the right bank of the Passaic, and at times of flood causes much backwater in the latter.

The highest recorded flood which has occurred in this drainage basin was that of October, 1903. The flood began at 6.30 p. m. October 8 and lasted until midnight October 18, the maximum height being reached at 9 p. m. October 10. There was a total rainfall of 11.74 inches between October 8 and 11. The estimated maximum discharge at the Dundee dam was 35,800 second-feet. This flood is fully described in Water-Supply Paper No. 92.

PASSAIC RIVER NEAR CHATHAM, N. J.

This station was established February 10, 1903, and is maintained by the United States Weather Bureau. It is located at the second bridge, about 1½ miles upstream from Chatham.

No important tributaries enter in the immediate vicinity of the station. Canoe Brook enters from the east about 3 miles below the station.

This stream is important because many large cities draw their water supply from it and also because many cities on the lower portion throw their sewage into it. Records of discharge are also valuable in connection with power development and studies for the prevention of excessive floods in the basin.

The datum of the chain gage attached to the bridge has remained the same since the station was established. Discharge measurements were made from the bridge or by wading.

The discharge is affected by ice during the winter months. Conditions of flow have changed somewhat during the period of maintenance of the station, but the rating curves developed for low and medium stages are considered good.

The following discharge measurement was made by Bolster and Rice by wading below the bridge:

September 5, 1905: Gage height, 2.01 feet; discharge, 9.0 second-feet.

Daily gage height, in feet, of Passaic River near Chatham, N. J., for 1909.

[Miss M. A. Butler, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	2.7	3.8	3.3	4.3	2.2	2.2	2.2	2.2	2.2	2.0	2.3
2	......	2.6	3.6	3.1	4.5	2.2	2.2	2.2	2.2	2.2	2.0	2.2
3	......	2.5	3.6	3.0	4.3	2.2	2.2	2.2	2.1	2.2	2.1	2.2
4	......	2.5	3.5	2.9	4.0	2.2	2.2	2.2	2.1	2.2	2.1	2.2
5	2.8	2.6	3.4	2.8	3.6	2.4	2.2	2.2	2.1	2.2	2.1	2.2
6	4.5	2.9	3.2	2.7	3.3	2.4	2.2	2.2	2.1	2.1	2.0	2.2
7	4.3	3.2	3.0	2.6	3.1	2.3	2.2	2.2	2.0	2.1	2.0	2.2
8	4.1	3.1	2.9	2.5	2.8	2.3	2.2	2.2	2.0	2.1	2.0	2.4
9	3.9	2.9	3.0	2.4	2.6	2.3	2.2	2.2	2.0	2.1	2.0	2.3
10	3.6	3.3	3.3	2.3	2.5	2.3	2.1	2.2	2.0	2.1	2.0	2.3
11	3.3	4.0	3.2	2.3	2.4	2.3	2.1	2.1	2.2	2.1	2.0	2.2
12	3.1	3.7	3.0	2.2	2.4	2.2	2.1	2.1	2.2	2.1	2.0	2.2
13	2.9	3.5	2.9	2.2	2.3	2.2	2.1	2.1	2.1	2.0	2.0	2.2
14	3.2	3.4	2.8	2.3	2.3	2.3	2.1	2.1	2.0	2.0	2.0	4.5
15	3.5	3.4	2.8	4.7	2.3	2.3	2.1	2.1	2.0	2.0	2.0	4.3
16	3.5	3.6	2.7	4.5	2.2	2.2	2.1	2.2	2.0	2.0	2.0	3.9
17	3.5	4.0	2.6	4.2	2.2	2.2	2.1	3.3	2.1	2.0	2.0	3.5
18	3.5	3.9	2.5	4.0	2.2	2.3	2.1	3.1	2.1	2.0	2.0	3.3
19	3.4	3.7	2.4	3.8	2.2	2.3	2.1	2.7	2.0	2.0	2.0	......
20	3.3	4.3	2.4	3.4	2.2	2.3	2.1	2.5	2.0	2.0	2.0	......
21	3.1	4.2	2.3	3.7	2.2	2.2	2.1	2.3	2.0	2.0	2.0	......
22	2.9	4.1	2.3	4.0	2.3	2.2	2.2	2.3	2.0	2.0	2.0	......
23	2.7	3.9	2.3	3.8	2.5	2.2	2.3	2.3	2.1	2.0	2.0	......
24	2.6	4.5	2.2	3.9	2.4	2.2	2.3	2.2	2.1	2.0	2.1	......
25	2.9	5.5	3.0	3.6	2.4	2.2	2.3	2.2	2.4	2.0	2.2	......
26	3.8	5.0	4.0	3.4	2.3	2.3	2.1	2.1	2.3	2.0	2.3	......
27	3.5	4.6	4.1	3.2	2.3	2.3	2.2	2.2	2.3	2.0	2.5	......
28	3.3	4.2	4.1	3.1	2.3	2.2	2.2	2.2	2.4	2.0	2.4	......
29	3.1	......	3.8	2.9	2.3	2.2	2.1	2.2	2.3	2.0	2.4	......
30	3.0	......	3.6	4.0	2.2	2.2	2.2	2.2	2.3	2.0	2.3	......
31	2.9	......	3.5	......	2.2	......	2.2	2.1	......	2.0	......	......

NOTE.—Ice conditions prevailed about as follows: Jan. 1 to 4, 14 to 23, 26 to 31, Feb. 1 to 9, and Dec. 19 to 31.

Daily discharge, in second-feet, of Passaic River near Chatham, N. J., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	......	480	271	725	20	20	20	20	20	8	31
2	......	......	390	202	825	20	20	20	20	20	8	20
3	......	......	390	172	725	20	20	20	12	20	12	20
4	......	......	350	144	575	20	20	20	12	20	12	20
5	119	......	310	119	390	45	20	20	12	20	12	20
6	825	......	235	97	271	45	20	20	12	12	8	20
7	725	......	172	77	202	31	20	20	8	12	8	20
8	625	......	144	60	119	31	20	20	8	12	8	45
9	525	......	172	45	77	31	20	20	8	12	8	31
10	390	271	271	31	60	31	12	20	8	12	8	31
11	271	575	235	31	45	31	12	12	20	12	8	20
12	202	435	172	20	45	20	12	12	20	12	8	20
13	144	350	144	20	31	20	12	12	12	8	8	20
14	......	310	119	31	31	31	12	12	8	8	8	825
15	......	310	119	925	31	31	12	12	8	8	8	725
16	......	390	97	825	20	20	12	20	8	8	8	525
17	......	575	77	675	20	20	12	271	12	8	8	350
18	......	525	60	575	20	31	12	202	12	8	8	271
19	......	435	45	480	20	31	12	97	8	8	8	......
20	......	725	45	310	20	31	12	60	8	8	8	......
21	......	675	31	435	20	20	12	31	8	8	8	......
22	......	625	31	575	31	20	20	31	8	8	8	......
23	......	525	31	480	60	20	31	31	12	8	8	......
24	77	825	20	525	45	20	31	20	12	8	12	......
25	144	1,360	172	390	45	20	31	20	45	8	20	......
26	......	1,090	575	310	31	31	12	12	31	8	31	......
27	......	875	625	235	31	31	20	20	31	8	60	......
28	......	675	625	202	31	20	20	20	45	8	45	......
29	......	......	480	144	31	20	12	20	31	8	45	......
30	......	......	390	575	20	20	20	20	31	8	31	......
31	......	......	350	......	20	......	20	12	......	8	......	......

NOTE.—These discharges are based on a rating curve that is well defined below 575 second-feet.

Monthly discharge of Passaic River near Chatham, N. J., for 1909.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	825	....	182	1.80	2.08	C.
February	1,360	....	438	4.34	4.52	A.
March	625	20	237	2.35	2.71	A.
April	925	20	299	2.96	3.30	A.
May	825	20	149	1.48	1.71	A.
June	45	20	26.1	.258	.29	A.
July	31	12	17.5	.173	.20	B.
August	271	12	37.0	.366	.42	A.
September	45	8	16.3	.161	.18	B.
October	20	8	10.8	.107	.12	B.
November	60	8	14.0	.139	.16	B.
December	825	....	129	1.28	1.48	B.
The year	1,360	8	128	1.28	17.17	

NOTE.—Discharge during the periods of ice conditions based on climatological data.

Discharge Jan. 1 to 4, estimated, 40 second-feet; Jan. 14 to 23, estimated, 66 second-feet; Jan. 26 to 31, estimated, 130 second-feet; Feb. 1 to 9, estimated, 78 second-feet; Dec. 19 to 31, estimated, 76 second-feet.

RARITAN RIVER DRAINAGE BASIN.

DESCRIPTION.

Raritan River, the largest stream in New Jersey except the Delaware, is formed by two chief branches, North and South, which have their sources a few miles apart in the highlands of Morris County, flow southward, and unite near Somerville, from which point the course of the river is southeastward to Raritan Bay. The river is tidal to a point about 2 miles above New Brunswick, and is navigable to that city, about 12 miles from the mouth.

The total area of the drainage basin is 1,105 square miles, about 10 per cent of which is forested. The highlands consist mostly of trap rock and contain a large proportion of the wooded areas of the basin. The area outside of the highlands consists either of trap rock or red sandstone. Of the 800 square miles of drainage area above the gaging station at Boundbrook, about 150 square miles are in the cultivated part of the highlands and on the trap ridges; the remainder is mostly on the low, level, red sandstone plain.

The valley of the Raritan is populous and highly cultivated, and a large amount of water power is utilized on its various branches. North Branch is considered a valuable source for gravity supply, the elevation of the upper portion ranging from 750 to 1,100 feet. Millstone River, an important stream which unites with the Raritan a few miles west of Boundbrook, differs from the other branches, having its rise in sand hills and flowing northwestward through a sandy soil. It has large ground storage, and is better suited for power than for water supply, being very muddy at high stages.

The Raritan is paralleled on the south by the Delaware & Raritan Canal.

RARITAN RIVER AT BOUNDBROOK, N. J.

The station, which was established September 12, 1903, and discontinued March 31, 1909, was located at the highway bridge just back of the Lehigh Valley Railroad station at Boundbrook, N. J. The locality is 2½ miles below Millstone River and about 1,000 feet above Boundbrook, which enters from the northeast.

The records at this point are of value for determining the regimen of flow of Raritan River and, in conjunction with the record of the Finderne station, for determining the flow of Millstone River and solving problems connected with power, navigation, municipal water supply, and sewage disposal.

About 1½ miles below the station a dam diverts water into the Delaware & Raritan Canal for power plants about 5 miles below Boundbrook. The discharge of the canal near the gaging station is but a few second-feet each day—only the amount necessary for the lockage of canal boats. It is stated that the headgates below are regulated only at times of freshets and remain open during low and medium stages. It is probable, however, that the relation between discharge and gage heights is at times affected by this controlled flow.

The datum of the chain gage attached to the bridge has remained the same since the establishment of the station. Discharge measurements are made from the bridge. During the winter period the discharge is affected by ice. Conditions of flow are probably constant except for the effect of regulation at the dam below. A very good rating curve has been developed except for some measurements which plot a few per cent away from the curve. It seems probable that this deviation is caused by the controlled flow below

Daily gage height, in feet, of Raritan River at Boundbrook, N. J., for 1909.

[J. K. Tantum, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	1.75	1.6	3.1	11	1.8	3.5	2.35	21	1.6	3.05	1.65
2	1.5	1.6	3.35	12	1.8	2.5	2.05	22	1.6	2.75	1.55
3	1.55	1.6	2.9	13	1.65	2.05	2.05	23	1.65	2.35	1.5
4	1.5	1.55	2.6	14	1.75	2.1	2.15	24	2.15	7.1	1.5
5	2.15	1.5	2.3	15	1.7	2.5	2.05	25	2.8	6.6	3.05
6	5.9	2.3	2.2	16	1.7	3.0	1.9	26	2.4	3.85	3.7
7	3.0	2.15	2.25	17	2.1	3.95	1.9	27	2.15	3.2	2.65
8	2.15	1.8	2.4	18	2.3	2.7	1.75	28	1.8	3.1	2.5
9	2.15	1.6	2.5	19	1.95	2.45	1.7	29	1.65	......	2.4
10	1.95	3.25	2.55	20	1.9	5.35	1.7	30	1.7	......	2.2
								31	1.8	......	2.2

NOTE.—River frozen over from about Jan. 16 to 20.

Daily discharge, in second-feet, of Raritan River at Boundbrook, N. J., for 1909.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	990	820	3,060	11	1,050	3,800	1,810	21	820	2,970	875
2	715	820	3,520	12	1,050	2,050	1,370	22	820	2,460	768
3	768	820	2,710	13	875	1,370	1,370	23	875	1,810	715
4	715	768	2,210	14	990	1,440	1,510	24	1,510	12,500	715
5	1,510	715	1,730	15	930	2,050	1,370	25	2,540	11,100	2,970
6	9,240	1,730	1,580	16	800	2,880	1,170	26	1,890	4,500	4,200
7	2,880	1,510	1,660	17	1,000	4,700	1,170	27	1,510	3,240	2,290
8	1,510	1,050	1,890	18	1,200	2,370	990	28	1,050	3,060	2,050
9	1,510	820	2,050	19	900	1,970	930	29	875		1,890
10	1,240	3,330	2,130	20	700	7,860	930	30	930		1,580
								31	1,050		1,580

NOTE.—Daily discharge estimated Jan. 16-20.

Monthly discharge of Raritan River at Boundbrook, N. J., for 1909.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,240	*a* 700	1,430	1.79	2.06	C.
February	12,500	715	3,020	3.78	3.94	B.
March	4,200	715	1,770	2.21	2.55	B.

a Estimated.

DELAWARE RIVER DRAINAGE BASIN.

DESCRIPTION.

The headwaters of Delaware River are found in Delaware, Greene, and Schoharie counties, N. Y. The East Branch, which may be considered the main stream, rises at Grand Gorge in northeastern Delaware County; the West Branch [1] has its source in a small lake almost on the line of Schoharie and Delaware counties, at an elevation of 1,886 feet above tide; the two streams unite at Hancock. From this junction point the river flows southeastward until it reaches Port Jervis, where it turns to the southwest and flows for a distance of about 40 miles along the base of the Shawangunk Range until it passes through the water gap, from which point it flows in an irregular southerly direction to Trenton. Below Trenton its course is in general southwestward to Delaware Bay. Between Hancock and Port Jervis it forms the dividing line between New York and Pennsylvania; south of Port Jervis it separates Pennsylvania from New Jersey and, for a few miles, Delaware from New Jersey.

[1] This branch was formerly described as the main stream, but recent careful measurements show the drainage area of the East Branch to be considerably larger than that of the West Branch.

The drainage area of Delaware River, measured at Philadelphia and including that of Schuylkill River, is about 10,100 square miles, of which about 2,580 square miles lie in New York, 5,720 in Pennsylvania, and 1,800 in New Jersey. The river is tidal to Trenton, which lies also at the head of navigation.

The Delaware receives a number of important tributaries, among which may be mentioned Mongaup and Navesink rivers and Callicoon Creek from New York; Lackawaxen, Lehigh, and Schuylkill rivers and numerous creeks from Pennsylvania; and Rancocas Creek, Musconetcong River, and Maurice River from New Jersey.

EAST BRANCH DELAWARE RIVER AT HANCOCK, N. Y.

This station, which is located at the highway bridge half a mile southeast of the Erie Railroad station at Hancock, N. Y., and about 1 mile above the junction of the East and West branches of Delaware River, was established October 14, 1902, and has since been maintained in cooperation with the New York State engineer department, and with the United States Weather Bureau since January 1, 1908. The Erie Railroad bridge is just below the gaging station.

Beaver Kill, which drains a portion of Sullivan and Ulster counties, is the nearest important tributary to East Branch of Delaware River. It enters from the left about 10 miles above the gaging station.

The datum of the chain gage attached to the bridge has remained the same since the establishment of the station. Discharge measurements are made from the bridge or by wading.

Conditions for accurate ratings can not be considered good. The high-water stage of East Branch is probably affected by backwater due to gorging at its junction with West Branch. Low-water discharge is controlled by a rift just below the Erie Railroad bridge, but frequent changes in conditions of flow may require many measurements and new ratings each year. During the winter months the discharge is affected by needle ice jamming on these rifts causing backwater at the station.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

Discharge measurements of East Branch Delaware River at Hancock, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 22	Covert and James	267	290	2.64	222
Nov. 18	Hoyt and Covert	120	89	2.53	138

NOTE.--Measurements made by wading.

Daily gage height, in feet, of East Branch Delaware River at Hancock, N. Y., for 1909.

[David Van Etten, observer.]

Day.	Jan.	Feb.	Mar	Apr	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.5	4.7	4.7	5.3	3.3	3.0	2.7	2.6	2.7	2.7	3.0
2	3.8	3.5	4.7	4.7	6.3	3.3	3.0	2.7	2.5	2.6	2.6	3.0
3	4.2	3.5	4.5	4.8	5.5	3.2	2.9	2.6	2.5	2.6	2.5	2.9
4	4.7	3.9	4.4	5.0	6.2	3.2	2.9	2.6	2.6	2.7	2.6	3.0
5	5.8	3.8	4.2	4.9	6.0	3.3	2.9	2.7	2.5	2.5	2.5	2.7
6	13.3	3.9	3.9	4.8	5.5	3.6	2.8	2.5	2.5	2.5	2.5	2.7
7	8.1	5.3	4.1	5.4	5.2	3.5	2.8	2.5	2.6	2.6	2.6	3.1
8	5.8	4.5	3.9	5.8	5.1	3.3	2.8	2.6	2.5	2.5	2.5	2.7
9	5.2	4.2	3.8	5.4	4.8	3.2	2.7	2.5	2.5	2.5	2.6	3.0
10	4.9	4.0	3.9	4.9	4.5	3.2	2.7	2.5	2.6	2.6	2.7	3.0
11	4.6	5.7	5.9	4.7	8.1	3.5	2.7	2.5	2.5	2.5	2.5	2.9
12	4.5	4.5	4.9	4.4	6.1	3.6	2.7	2.4	2.6	2.6	2.5	2.9
13	4.1	4.5	4.8	4.3	5.4	3.4	2.6	2.4	2.6	2.7	2.6	3.0
14	3.9	4.6	4.5	4.8	5.0	3.8	2.6	2.5	2.5	2.6	2.5	3.2
15	4.1	4.4	4.4	7.1	4.9	3.8	2.6	2.4	2.5	2.6	2.5	4.2
16	4.1	5.3	4.2	7.0	4.7	3.9	2.6	2.5	2.6	2.6	2.6	3.7
17	3.9	7.0	4.1	6.0	4.6	3.6	2.7	2.7	2.5	2.5	2.5	3.8
18	3.9	5.7	4.1	5.5	4.7	3.8	2.6	3.5	2.5	2.5	2.5	3.7
19	3.8	5.2	3.9	5.1	4.4	4.1	2.7	3.0	2.6	2.6	2.6	3.7
20	3.6	11.1	3.9	4.9	4.3	3.8	2.7	2.9	2.5	2.5	2.6	3.3
21	3.9	8.2	3.7	4.7	4.1	3.7	2.7	2.9	2.5	2.5	2.5	3.6
22	3.8	6.4	3.8	4.6	4.1	3.6	2.6	2.8	2.6	2.7	2.6	3.7
23	3.7	5.7	3.6	4.5	4.0	3.5	2.7	2.8	2.5	2.6	2.5	3.6
24	4.0	5.6	3.6	4.7	3.9	3.5	2.8	2.6	2.6	2.6	2.6	3.9
25	6.1	7.9	3.8	4.4	3.8	3.4	3.0	2.6	2.7	2.7	3.1	3.9
26	5.7	5.9	6.4	4.4	3.7	3.3	2.9	2.7	2.6	2.7	2.8	3.8
27	5.0	5.6	5.1	4.4	3.6	3.2	2.9	2.7	2.5	2.6	2.9	3.8
28	4.7	5.3	5.4	4.4	3.7	3.2	2.8	2.6	2.7	2.6	2.9	3.8
29	4.4	......	5.4	4.5	3.7	3.1	2.7	2.7	2.6	2.7	2.8	3.7
30	4.4	......	5.0	4.5	3.6	3.1	2.9	2.6	2.7	2.6	3.1	3.7
31	4.1	......	4.7	......	3.4	......	2.7	2.5	......	2.6	......	3.7

NOTE.—Ice conditions existed during greater part of Jan. and Dec. 17 to 31.

Daily discharge, in second-feet, of East Branch Delaware River at Hancock, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	250	970	3,230	3,230	4,740	725	440	248	198	248	248	440
2	250	970	3,230	3,230	7,690	725	440	248	153	198	198	440
3	300	970	2,780	3,470	5,280	620	367	198	153	198	153	367
4	300	1,590	2,560	3,960	7,360	620	367	198	198	248	198	440
5	5,000	1,420	2,150	3,710	6,740	725	367	248	153	153	153	248
6	22,000	1,590	1,590	3,470	5,280	1,110	304	153	153	153	153	248
7	14,600	4,740	1,960	5,010	4,480	970	304	153	198	198	198	525
8	6,140	2,780	1,590	6,140	4,220	725	304	198	153	153	153	248
9	4,480	2,150	1,420	5,010	3,470	620	248	153	153	153	198	440
10	3,710	1,770	1,590	3,710	2,780	620	248	153	198	198	248	440
11	3,000	5,850	6,440	3,230	14,600	970	248	153	153	153	153	367
12	2,000	2,780	3,710	2,560	7,040	1,110	248	113	198	198	153	367
13	1,200	2,780	3,470	2,350	5,010	840	198	113	198	248	198	440
14	1,100	3,000	2,780	3,470	3,960	1,420	198	153	153	198	153	620
15	900	2,560	2,560	10,600	3,710	1,420	198	113	153	198	153	2,150
16	1,500	4,740	2,150	10,200	3,230	1,590	198	153	198	198	198	1,260
17	1,100	10,200	1,960	6,740	3,000	1,110	248	248	153	153	153	800
18	1,000	5,850	1,960	5,280	3,230	1,420	198	970	153	153	153	700
19	800	4,480	1,590	4,220	2,560	1,960	248	440	198	198	198	500
20	800	30,100	1,590	3,710	2,350	1,420	248	367	153	153	198	400
21	1,200	15,800	1,260	3,230	1,960	1,260	248	367	153	153	153	400
22	1,420	8,020	1,420	3,000	1,960	1,110	198	304	198	248	198	400
23	1,200	5,850	1,110	2,780	1,770	970	248	304	153	198	153	300
24	1,770	5,560	1,110	3,230	1,590	970	304	198	198	198	198	300
25	7,040	13,800	1,420	2,560	1,420	840	440	198	248	248	525	300
26	5,850	6,440	8,020	2,560	1,260	725	367	248	198	248	304	250
27	3,960	5,560	4,220	2,560	1,110	620	367	248	153	198	367	250
28	3,230	4,740	5,010	2,560	1,260	620	304	198	248	198	367	200
29	2,560	....	5,010	2,780	1,260	525	248	248	198	248	304	150
30	2,100	....	3,960	2,780	1,110	525	367	198	248	198	525	150
31	1,960	....	3,230	....	840	....	248	153	....	198	....	150

NOTE.—Daily discharge Jan. 1 to 6, 12 to 21, 23, and 30, also Dec. 17 to 31, estimated on the basis of discharge at other Delaware River stations. Daily discharge for the remainder of the year based on a well defined rating curve.

Monthly discharge of East Branch Delaware River at Hancock, N. Y., for 1909.

[Drainage area, 920 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	22,000	250	3,310	3.60	4.15	C.
February	30,100	970	5,610	6.10	6.35	A.
March	8,020	1,110	2,780	3.02	3.48	A.
April	10,600	2,350	4,040	4.39	4.90	A.
May	14,600	840	3,750	4.08	4.70	A.
June	1,960	525	963	1.05	1.17	A.
July	440	198	289	.314	.36	A.
August	970	113	240	.261	.30	A.
September	248	153	180	.196	.22	A.
October	248	153	196	.213	.25	A.
November	525	153	223	.242	.27	A.
December	2,150	150	461	.501	.58	C.
The year	30,100	113	1,810	1.97	26.73	

DELAWARE RIVER AT PORT JERVIS, N. Y.

This station, which is located at the toll bridge over Delaware River at Port Jervis, was established for the United States Weather Bureau by Irving Righter, city engineer, Port Jervis, N. Y., October 12, 1904, and is maintained to obtain data for flood predictions. The records of gage heights are supplied to the Geological Survey for the purpose of determining the regimen of flow of the upper Delaware drainage.

Mongaup River enters the Delaware from the north, about 6 miles above the station, and Neversink River, also from the north, enters about 1 mile below the station.

The gaging section is affected by ice to a greater or less extent each winter.

The chain gage is attached to the toll bridge, from which discharge measurements are made. Considerable difficulty has been experienced in maintaining the datum of the gage constant. September 4, 1908, a careful investigation was made, and in order to avoid negative readings a change in the original datum, as nearly as it could be determined, of about 2 feet was made. The elevation of the datum of the gage is 414.89 feet above mean sea level. A correction varying from +1.7 to +2.0 feet has been applied to gage heights prior to September 4, 1908, so that all gage heights published by the Survey refer to the same datum.

Conditions of flow at this point are constant, and a good rating curve has been developed for low and medium stages. Careful comparisons of the records of this station with those obtained at the Riegelsville and the two Hancock stations indicate that the corrections applied to the gage heights were essentially correct and that the discharge data can be fully relied on.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

Discharge measurements of Delaware River at Port Jervis, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 6	K. C. Grant	529	1,610	1.85	1,010
Aug. 23	W. G. Hoyt	498	1,590	1.65	879
Nov. 16	Hoyt and Covert	264	610	95	354
17	.....do	263	689	1 07	432

Daily gage height, in feet, of Delaware River at Port Jervis, N. Y., for 1909.

[J. M. Dolph, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	3.4	5.6	5.0	6.5	2.8	2.5	1.5	1.0	1.1	1.1	1 5
2	2.5	2.9	5.1	4.8	8.5	2.8	2.4	1.5	1.0	1.0	1.1	1.5
3	2.5	2.8	4.7	4.4	7.5	2.4	2.2	1.4	.9	1.0	1.1	1.5
4	2.4	3.2	4.7	4.0	7.2	2.0	2.1	1.4	.9	1.0	1.1	1.4
5	2.8	3.2	4.4	5.1	7.5	2.7	1.9	1.4	.9	.8	1.0	1.4
6	9.6	3.4	4.1	4.4	7.5	3.6	1.7	1.4	.9	.8	1.0	1.4
7	10.0	6.2	4.0	4.1	7.0	3.6	1.7	1.3	.9	.8	1.0	1.3
8	6.8	5.1	4.0	5.5	7.4	3.4	1.7	1.2	.9	.8	1.0	1.5
9	5.6	4.4	3.8	5.2	6.8	2.8	1.7	1.2	.9	.8	.9	1.4
10	5.2	4.0	3.8	5.0	5.4	3.0	1.6	1.2	.9	.8	.9	1.3
11	4.7	4.8	6.8	4.6	6.6	3.2	1.6	1.3	1.2	.8	.9	1.3
12	4.5	5.3	5.8	4.1	7.0	3.6	1.4	1.3	1.1	.8	.8	1.3
13	4.3	4.5	5.2	3.9	6.0	3.4	1.4	1.3	1.0	1.0	.8	1.5
14	3.8	4.7	5.0	3.9	5.2	4.0	1.4	1.2	1.0	1.0	.8	2.3
15	3.5	5.0	4.7	7.6	4.8	4.0	1.4	1.2	1.0	1.2	1.0	3.0
16	3.7	5.5	4.5	8.4	5.0	4.0	1.4	1.2	1.0	1.2	1.0	3.3
17	3.9	8.4	4.2	7.6	4.7	3.8	1.8	1.4	1.2	1.1	1.1	3.1
18	3.1	7.5	4.0	7.0	4.5	4.1	1.5	1.8	1.1	1.0	1.1	2.8
19	2.8	6.7	4.0	6.8	4.3	4.8	1.5	2.2	1.0	.9	1.1	2.7
20	2.7	9.2	3.8	6.4	4.0	4.2	1.8	2.0	.9	.9	1.1	2.7
21	2.7	17.7	3.6	5.6	3.6	4.0	1.6	1 9	.9	.9	.9	2.7
22	3.1	8.4	3.5	5.1	3.8	3.6	1.5	1 8	.9	1.0	.9	2.6
23	3.2	7.1	3.2	5.0	3.6	3.2	1.7	1 6	.9	1.0	.8	2.6
24	3.2	7.2	3.0	5.3	3.4	3.0	1.8	1.6	1.0	1.0	.8	2.5
25	6.7	9.3	3.5	5.0	3.0	2.7	1.9	1.4	1.0	1.2	1.4	2.5
26	6.8	7.8	7.5	4.5	2.7	2.7	1.9	1.3	1.0	1.2	1.4	2.5
27	5.8	6.6	6.5	4.5	3.2	2.7	1.9	1.3	1.0	1.2	1.0	2.3
28	5.2	6.2	6.4	4.4	3.2	2.7	1.7	1.3	1.2	1.1	1.0	2.3
29	4.6	....	6.0	4.2	3.4	2.5	1.6	1.2	1.3	1.1	1.5	2.1
30	4.2	....	5.7	5.0	3.2	2.5	1.6	1.2	1.2	1.1	1.3	2.1
31	4.0	....	5.3	....	3.0	....	1.5	1.0	....	1.0	....	2.3

NOTE.—Ice conditions Jan. 1 to 5 and Dec. 19 to 31.

Daily discharge, in second-feet, of Delaware River at Port Jervis, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,000	4,360	12,500	9,830	17,400	2,840	2,190	765	390	455	455	765
2	1,000	3,070	10,200	9,020	31,200	2,840	2,000	765	390	390	455	765
3	1,000	2,840	8,630	7,520	23,900	2,000	1,650	680	330	390	455	765
4	1,200	3,820	8,630	6,140	21,800	1,340	1,490	680	330	390	455	680
5	1,800	3,820	7,520	10,200	23,900	2,610	1,200	680	330	275	390	680
6	39,600	4,360	6,470	7,520	23,900	4,920	960	680	330	275	390	680
7	42,800	15,700	6,140	6,470	20,500	4,920	960	600	330	275	390	600
8	19,200	10,200	6,140	12,100	23,200	4,360	960	525	330	275	390	765
9	12,500	7,520	5,510	10,700	19,200	2,840	960	525	330	275	330	680
10	10,700	6,140	5,510	9,830	11,600	3,310	855	525	330	275	330	600
11	8,630	9,020	19,200	8,250	18,000	3,820	855	600	525	275	330	600
12	7,880	11,100	13,500	6,470	20,500	4,920	680	600	455	275	275	600
13	7,160	7,880	10,700	5,820	14,600	4,360	680	600	390	390	275	765
14	5,510	8,630	9,830	5,820	10,700	6,140	680	525	390	390	275	1,820
15	4,640	9,830	8,630	23,900	9,020	6,140	680	525	390	525	390	3,310
16	5,210	12,100	7,880	30,500	9,830	6,140	680	525	390	525	390	4,090
17	5,820	30,500	6,810	24,600	8,630	5,510	1,080	680	525	455	455	3,560
18	3,560	23,900	6,140	20,500	7,880	6,470	765	1,080	455	390	455	2,840
19	2,840	18,600	6,140	19,200	7,160	9,020	765	1,650	390	330	455	2,200
20	2,610	36,500	5,510	16,800	6,140	6,810	1,080	1,340	330	330	455	1,700
21	2,610	108,000	4,920	12,500	4,920	6,140	855	1,200	330	330	330	1,400
22	3,560	30,500	4,640	10,200	5,510	4,920	765	1,080	330	390	330	1,200
23	3,820	21,200	3,820	9,830	4,920	3,820	960	855	330	390	275	1,200
24	3,820	21,800	3,310	11,100	4,360	3,310	1,080	855	390	390	275	1,000
25	18,600	37,300	4,640	9,830	3,310	2,610	1,200	680	390	525	680	1,000
26	19,200	26,000	23,900	7,880	2,610	2,610	1,200	600	390	525	680	1,000
27	13,500	18,000	17,400	7,880	3,820	2,610	1,200	600	390	525	390	800
28	10,700	15,700	16,800	7,520	3,820	2,610	960	600	525	455	390	800
29	8,250	....	14,600	6,810	4,360	2,190	855	525	600	455	765	800
30	6,810	....	13,000	9,830	3,820	2,190	855	525	525	455	600	700
31	6,140	....	11,100	....	3,310	....	765	390	....	390	....	600

NOTE.—Daily discharges Jan. 1 to 5 and Dec. 19 to 31 estimated on the basis of an intercomparison of discharge at Delaware River stations. Daily discharges for open-water conditions obtained from a rating curve which is well defined below discharge of 27,500 second-feet.

Monthly discharge of Delaware River at Port Jervis, N. Y., for 1909.

[Drainage area, 3,250 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	42,800	1,000	9,090	2.80	3.23	B.
February	108,000	2,840	18,200	5.60	5.83	A.
March	23,900	3,310	9,350	2.88	3.32	A.
April	30,500	5,820	11,500	3.54	3.95	A.
May	31,200	2,610	12,100	3.72	4.29	A.
June	9,020	1,340	4,140	1.27	1.42	A.
July	2,190	680	1,030	.317	37	A.
August	1,650	390	725	.223	26	A.
September	600	330	395	122	14	A.
October	525	275	387	.119	14	A.
November	765	275	417	.128	14	A.
December	4,090	600	1,260	.388	.45	B.
The year	108,000	275	5,620	1.73	23.54	

DELAWARE RIVER AT RIEGELSVILLE, N. J.

This station, which is located at the toll suspension bridge between Riegelsville, N. J., and Riegelsville, Pa., was established July 3, 1906, to take the place of the station at Lambertville, N. J., where conditions of flow were unfavorable for obtaining accurate results.

The records of discharge at this point and at Lambertville form a basis for estimates of the total flow of the river to tidewater, necessary for the solution of navigation problems, and, in conjunction with records obtained at other stations in the drainage area, are valuable in estimating the quantity of water flowing in the Delaware at any point for canalization and power development.

Lehigh River enters the Delaware from the west about 9 miles above Riegelsville, and Musconetcong comes in from the east about 600 feet below the measuring section. The Musconetcong does not, however, materially affect the relation of gage height to discharge, except at rare intervals.

The Delaware division of the Pennsylvania Canal, running from Easton, Pa., to Bristol, Pa., utilizes part of the total flow of the river at Riegelsville. It diverts water from the Lehigh at its mouth, and at low stages takes practically the entire discharge of this tributary. The water is turned out of this canal during the winter period, or from about the middle of December to the last of March, but throughout the remainder of the year the discharge averages about 250 to 300 second-feet.

The datum of the chain gage attached to the bridge has remained the same during the continuance of the station. Discharge measurements are made from the bridge. The discharge is affected by ice only during severe winters. Conditions for obtaining accurate discharge data are very good, and an excellent rating curve has been developed. Comparisons of the records of flow with those at Port Jervis, N. Y., and Hancock, N. Y., show that full reliance can be placed in the estimates of monthly discharge at Riegelsville.

Discharge measurements of Delaware River at Riegelsville, N. J., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 22	Kenneth Grant	508	6,130	8.01	21,900
July 9	....do	449	3,480	2.60	2,710
Sept. 4[a]	Bolster and Rice	437	3,160	1.82	1,360

[a] Strong wind blowing upstream.

Discharge measurements of Delaware division, Pennsylvania Canal, at Riegelsville, N. J., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 22	Kenneth Grant	......	....	8.01	222
July 9	....do	......	....	2.60	257
Sept. 4	R. H. Bolster	34	214	1.90	261

[a] River gage.

Daily gage height, in feet, of Delaware River at Riegelsville, N. J., for 1909.

[John H. Deemer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.81	4.31	8.88	7.01	9.85	4.12	3.32	2.41	1.95	2.16	1.92	2.18
2	2.64	4.05	8.00	6.71	12.75	3.86	3.11	2.34	1.91	2.11	1.96	2.20
3	2.89	4.06	7.54	6.50	12.59	3.81	3.00	2.36	1.92	1.99	2.01	2.22
4	3.21	3.94	7.22	6.58	10.95	3.74	2.85	2.26	1.86	1.99	1.95	2.21
5	3.48	4.09	6.65	6.76	11.44	3.85	2.76	2.26	1.86	2.08	1.96	2.05
6	8.65	4.41	6.14	6.55	10.40	4.20	2.78	2.22	1.81	2.00	1.86	2.19
7	16.55	5.56	5.86	6.38	9.20	4.81	2.71	2.18	1.89	1.90	1.78	2.24
8	10.80	7.29	6.02	6.56	8.85	4.49	2.62	2.10	1.86	1.95	1.89	2.19
9	8.26	6.22	5.95	6.84	8.91	4.22	2.55	2.14	1.78	1.94	1.96	2.21
10	7.12	5.65	6.10	6.26	7.90	4.10	2.52	2.12	1.78	1.86	1.88	2.01
11	6.62	7.78	6.60	5.85	7.98	4.05	2.48	2.06	2.16	1.89	1.88	2.01
12	6.08	7.68	8.90	5.49	9.86	4.05	2.52	2.12	2.11	2.01	1.90	1.92
13	5.54	6.96	7.54	5.21	8.60	4.34	2.42	2.10	2.11	2.29	1.88	2.11
14	5.00	6.61	7.05	5.78	7.62	4.26	2.44	2.00	2.10	2.05	1.81	7.04
15	4.66	7.01	6.68	9.62	7.06	4.21	2.42	1.99	2.06	2.05	1.84	5.62
16	4.44	8.42	6.29	12.09	6.72	4.78	2.62	2.12	2.05	2.06	1.90	4.89
17	3.98	13.19	6.01	10.72	6.46	4.64	2.58	2.41	2.10	2.04	1.74	4.38
18	4.05	12.74	5.60	9.12	6.08	4.85	2.44	2.48	2.31	1.99	1.81	3.94
19	4.02	10.29	5.32	8.18	6.02	5.89	2.46	2.79	2.04	2.08	1.85	3.32
20	3.64	12.70	5.22	7.50	5.69	5.78	2.38	2.80	2.08	1.92	1.89	3.22
21	3.90	19.48	4.98	7.88	5.34	5.09	2.30	2.79	2.00	1.98	1.79	3.04
22	3.86	14.28	4.80	8.00	5.24	4.72	2.41	2.58	1.96	2.01	1.91	2.92
23	4.06	11.34	4.68	7.79	5.01	4.39	2.64	2.50	1.98	1.95	1.98	2.81
24	4.30	12.46	4.54	8.49	4.99	4.12	3.26	2.48	2.10	2.04	1.94	2.98
25	5.06	14.38	5.11	8.06	4.79	4.04	3.01	2.28	2.32	2.21	2.12	2.86
26	9.32	13.60	9.62	7.44	4.51	3.86	2.94	2.26	2.18	2.15	2.24	2.98
27	7.98	11.52	10.52	6.99	4.40	3.66	2.88	2.16	2.16	2.08	2.14	2.58
28	6.75	9.82	8.80	6.79	4.50	3.59	2.76	2.09	2.22	2.05	2.00	2.66
29	5.86	......	8.49	6.70	4.66	3.50	2.82	1.98	2.05	2.01	2.16	2.49
30	5.31	......	8.14	8.34	4.48	3.38	2.60	2.00	2.15	1.99	2.14	2.32
31	4.92	......	7.56	......	4.32	......	2.54	1.99	......	1.92	......	2.20

NOTE.—Some ice running and slush ice in the first part of January. Ice conditions Dec. 26–31: River frozen over Dec. 30 and 31. No water flowing in canal Jan. 1 to Mar. 18 and Dec. 20–31.

Daily discharge, in second-feet, of Delaware River at Riegelsville, N. J., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,050	7,220	26,000	17,100	31,300	6,620	4,310	2,220	1,420	1,760	1,380	1,800
2	2,680	6,400	21,600	15,900	49,400	5,830	3,780	2,090	1,360	1,680	1,440	1,830
3	3,240	6,440	19,500	15,000	48,300	5,680	3,500	2,120	1,380	1,480	1,520	1,870
4	4,030	6,070	18,000	15,400	37,800	5,480	3,140	1,940	1,290	1,480	1,420	1,850
5	4,750	6,530	15,600	16,100	40,800	5,800	2,940	1,940	1,290	1,630	1,440	1,580
6	24,800	7,540	13,600	15,200	34,500	6,870	2,990	1,870	1,220	1,500	1,290	1,810
7	76,700	11,500	12,600	14,600	27,700	8,850	2,830	1,800	1,340	1,350	1,170	1,900
8	36,900	18,400	13,200	15,300	25,800	7,800	2,640	1,660	1,290	1,420	1,340	1,810
9	22,900	13,900	12,900	16,400	26,100	6,930	2,500	1,730	1,170	1,410	1,440	1,850
10	17,600	11,800	13,500	14,100	21,100	6,560	2,440	1,690	1,170	1,290	1,320	1,520
11	15,500	20,600	15,400	12,500	21,500	6,400	2,360	1,600	1,760	1,340	1,320	1,520
12	13,400	20,100	26,100	11,200	31,300	6,400	2,440	1,690	1,680	1,520	1,350	1,380
13	11,400	16,900	19,500	10,200	24,500	7,320	2,240	1,660	1,680	1,990	1,320	1,680
14	9,500	15,500	17,300	12,300	19,800	7,060	2,280	1,500	1,660	1,580	1,220	17,300
15	8,360	17,100	15,800	30,000	17,400	6,900	2,240	1,480	1,600	1,580	1,260	11,700
16	7,640	23,600	14,200	45,000	15,900	8,750	2,640	1,690	1,580	1,600	1,350	9,130
17	6,190	52,400	13,100	36,400	14,900	8,290	2,560	2,220	1,660	1,560	1,120	7,450
18	6,400	49,300	11,600	27,200	13,400	8,990	2,280	2,360	2,030	1,480	1,220	6,070
19	6,310	33,800	10,600	22,500	13,200	12,700	2,320	3,010	1,560	1,630	1,280	4,310
20	5,190	49,100	10,300	19,300	11,900	12,300	2,160	3,030	1,630	1,380	1,340	4,050
21	5,950	99,100	9,430	21,000	10,700	9,810	2,010	3,010	1,500	1,470	1,190	3,600
22	5,830	60,100	8,820	21,600	10,300	8,560	2,220	2,560	1,440	1,520	1,360	3,310
23	6,440	40,200	8,420	20,600	9,530	7,480	2,680	2,400	1,470	1,420	1,470	3,050
24	7,190	47,500	7,960	24,000	9,470	6,620	4,160	2,360	1,660	1,560	1,410	3,450
25	9,700	60,800	9,880	21,900	8,790	6,370	3,520	1,970	2,050	1,850	1,690	3,170
26	28,300	55,300	30,000	19,000	7,860	5,830	3,360	1,940	1,800	1,740	1,900	3,100
27	21,500	41,300	35,200	17,100	7,510	5,250	3,210	1,760	1,760	1,630	1,730	2,100
28	16,100	31,100	25,600	16,200	7,830	5,050	2,940	1,640	1,870	1,580	1,500	2,460
29	12,600	....	24,000	15,800	8,360	4,800	3,080	1,470	1,580	1,520	1,760	2,140
30	10,600	....	22,300	23,200	7,770	4,480	2,600	1,500	1,740	1,480	1,730	1,840
31	9,230	....	19,600	....	7,250	....	2,480	1,480	....	1,380	....	1,650

NOTE.—These discharges are based on a rating curve that is well defined between 1,100 and 80,000 second-feet. Discharges Dec. 26 to 31 reduced 10 per cent from open-channel rating because of ice conditions.

Monthly discharge of Delaware River at Riegelsville, N. J., for 1909.

[Drainage area, 6,430 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	76,700	2,680	13,500	2.10	2.42	A.
February	99,100	6,070	29,600	4.60	4.79	A-
March	35,200	7,960	16,800	2.63	3.03	A.
April	45,000	10,200	19,400	3.06	3.41	A.
May	49,400	7,250	20,100	3.17	3.66	A.
June	12,700	4,480	7,190	1.16	1.29	A.
July	4,310	2,010	2,800	.477	.55	A.
August	3,030	1,470	1,980	.350	.40	A-
September	2,050	1,170	1,550	.283	.32	A.
October	1,990	1,290	1,540	.281	.32	A.
November	1,900	1,120	1,410	.261	.29	A.
December	17,300	1,380	3,630	.589	.68	A.
The year	99,100	1,120	9,830	1.53	21.16	

NOTE.—In order to obtain the discharge per square mile and the run-off depth in inches 270 second-feet were added Mar. 19 to Dec. 19, 1909, before computing the discharge per square mile. Hence the first three columns contain the actual discharge available in the river, while the remaining two columns represent the actual run-off from the drainage area above Riegelsville, including the discharge of the canal. See description, p. 226.

WEST BRANCH DELAWARE RIVER AT HANCOCK, N. Y.

This station, which is located at the toll suspension bridge, half a mile west of the Erie Railroad station at Hancock, N. Y., and about 1 mile above the junction of East and West branches of Delaware River, was established October 15, 1902, and has since been maintained in cooperation with the New York State engineer department and with the United States Weather Bureau since January 1, 1908.

Oquaga Creek, which drains the eastern portion of Broome County, is the nearest important tributary to West Branch Delaware River. It enters from the right, about 10 miles upstream from the gaging station.

The datum of the chain gage attached to the toll bridge has remained the same since the establishment of the station. Discharge measurements are made from the suspension bridge or by wading. Conditions for accurate ratings can not be considered good. The high-water stage is probably affected by backwater from East Branch Delaware River. The low-water stage is controlled by riffles about 800 feet below the station, but frequent changes in conditions of flow require many measurements and new ratings each year. During the winter months the discharge is affected considerably by ice.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

Discharge measurements of West Branch Delaware River at Hancock, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 21[a]	Covert and James	190	168	2.75	155
Nov. 18[a]	Hoyt and Covert	72	74	2.48	51

[a] Measurement made at wading section.

Daily gage height, in feet, of West Branch Delaware River at Hancock, N. Y., for 1909.

[David Pulver, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.3	3.9	4.7	4.8	5.9	3.2	3.2	2.7	2.6	2.4	2.5	2.6
2	4.0	3.2	4.6	4.8	6.4	3.2	3.1	2.6	2.5	2.4	2.5	2.5
3	4.2	3.9	4.6	5.0	5.8	3.2	3.1	2.6	2.4	2.3	2.6	2.7
4	4.5	3.9	4.4	5.1	6.6	3.1	3.0	2.7	2.5	2.4	2.5	2.9
5	5.1	4.0	3.9	4.8	6.3	3.3	3.1	2.6	2.4	2.4	2.4	2.8
6	9.5	4.6	3.8	4.8	5.8	3.8	3.1	2.9	2.5	2.5	2.5	2.8
7	7.2	6.0	4.0	5.2	5.6	3.5	2.8	2.6	2.4	2.5	2.5	2.5
8	5.7	4.7	3.8	5.2	5.2	3.3	2.9	2.5	2.5	2.4	2.6	2.8
9	5.2	4.4	3.8	5.0	4.4	3.2	2.8	2.7	2.5	2.5	2.4	2.7
10	5.1	4.0	3.8	4.8	4.7	3.2	2.7	2.5	2.5	2.4	2.5	2.5
11	4.6	5.5	6.9	4.5	5.1	4.7	2.9	2.5	2.8	2.6	2.6	2.8
12	4.6	4.4	5.1	4.3	5.5	4.3	2.8	2.5	2.6	2.7	2.4	2.5
13	3.8	4 3	4.8	4.3	5.0	4.0	2.6	2.4	2.5	2.9	2.5	2.7
14	3.7	4.5	4.7	5.1	4.8	5.0	2.6	2.5	2.4	2.7	2.4	3.5
15	3.2	4.5	4.5	7.3	5.0	4.7	2.7	2.5	2.6	2.6	2.5	3.9
16	4.0	5.3	4.2	7.0	5.7	4.4	2.5	2.8	2.6	2.6	2.4	3.7
17	4.1	7.0	4.1	6.1	4.5	4.2	2.6	3.2	2.4	2.5	2.5	3.3
18	3.6	5.6	3.9	5.6	4.7	5.9	3.0	3.1	2.5	2.6	2.5	3.3
19	3.6	5.2	3.8	5.2	4.4	5.2	3.0	2.9	2.5	2.5	2.4	3.3
20	3.6	9.0	3.8	5.3	4.2	4.8	2.8	3.0	2.4	2.5	2.5	3.1
21	4.2	8.0	3.6	4.9	4.0	4.4	2.7	2.9	2.3	2.5	2.4	3.0
22	4.1	6.4	3.7	5.0	4.0	4.2	2.7	2.6	2.4	2.5	2.6	3.5
23	4.1	5.8	3.6	4.7	3.9	4.2	2.9	2.7	2.4	2.6	2.5	3.4
24	4.4	6.0	3.4	4.6	3.8	4.3	3.0	2.6	2.4	2.5	2.5	3.1
25	7.6	7.8	4.1	4.4	3.8	3.9	3.0	2.7	2.6	2.6	2.6	3.2
26	6.3	6.0	6.2	4.4	3.6	3.8	3.2	2.7	2.4	2.5	2.7	3.2
27	5.7	5.6	5.2	4.4	3.4	3.5	2.8	2.6	2.5	2.6	2.6	3.1
28	5.0	5.4	5.6	4.2	3.6	3.5	2.7	2.7	2.4	2.6	2.9	3.1
29	4.5	....	5.6	4.3	3.7	3.3	2.6	2.6	2.4	2.5	2.7	3.2
30	4.0	....	5.1	4.4	3.5	3.2	2.7	2.6	2.5	2.6	2.8	3.3
31	4.0	....	5.0	....	3.4	....	2.6	2.5	....	2.5	....	3.1

NOTE.—Probable ice conditions during the greater part of January and February, also Dec. 19 to 31.

Daily discharge, in second-feet, of West Branch Delaware River at Hancock, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	150	890	1,970	2.130	4,440	348	348	127	95	46	67	95
2	150	348	1,810	2,130	5,780	348	297	95	67	46	67	67
3	200	890	1,810	2,470	4,190	348	297	95	46	30	95	127
4	200	890	1,520	2,650	6,340	297	250	127	67	46	67	204
5	2,650	1,000	890	2,130	5,500	404	297	95	46	46	46	163
6	14,000	1,810	790	2,130	4,190	790	297	204	67	67	67	163
7	8,120	4,700	1,000	2,840	3,700	538	163	95	46	67	67	67
8	3,940	1,970	790	2,840	2,840	404	204	67	67	46	95	163
9	2,840	1,520	790	2,470	1,520	348	163	127	67	67	46	127
10	2,650	1,000	790	2,130	1,970	348	127	67	67	46	67	67
11	1,810	3,470	7,210	1,660	2,650	1,970	204	67	163	95	95	163
12	1,200	1,520	2,650	1,380	3,470	1,380	163	67	95	127	46	67
13	790	1,380	2,130	1,380	2,470	1,000	95	46	67	204	67	127
14	700	1,660	1,970	2,650	2,130	2,470	95	67	46	127	46	538
15	348	1,660	1,660	8,430	2,470	1,970	127	67	95	95	67	890
16	1,000	3,040	1,250	7,510	3,940	1,520	67	163	95	95	46	700
17	800	7,510	1,120	4,960	1,660	1,250	95	348	46	67	67	404
18	615	3,700	890	3,700	1,970	4,440	250	297	67	95	67	404
19	500	2,840	790	2,840	1,520	2,840	250	204	67	67	46	300
20	500	14,100	790	3,040	1,250	2,130	163	250	46	67	67	200
21	800	10,700	615	2,300	1,000	1,520	127	204	30	67	46	200
22	1,000	5,780	700	2,470	1,000	1,250	127	95	46	67	95	200
23	900	4,190	615	1,970	890	1,250	204	127	46	95	67	150
24	1,520	4,700	468	1,810	790	1,380	250	95	46	67	67	150
25	5,000	10,000	1,120	1,520	790	890	250	127	95	95	95	100
26	4,000	4,700	5,230	1,520	615	790	348	127	46	67	127	100
27	2,500	3,700	2,840	1,520	468	538	163	95	67	95	95	100
28	2,100	3,250	3,700	1,250	615	538	127	127	46	95	204	100
29	1,660	....	3,700	1,380	700	404	95	95.	46	67	127	75
30	1,000	....	2,650	1,520	538	348	127	95	67	95	163	75
31	1,000	....	2,470	....	468	....	95	67	....	67	....	75

NOTE.—Daily discharges for open water conditions based on a fairly well-defined rating curve. Discharges for Jan. 1 to 6, 12, 17, 19 to 23, 24 to 28, and Dec. 19 to 31 corrected for ice conditions by comparison of discharge at Delaware River stations. Other days in January and Feb. 1 to 5 were probably more or less affected by ice.

Monthly discharge of West Branch of Delaware River at Hancock, N. Y., for 1909.

[Drainage area, 680 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	14,000	150	2,090	3.07	3.54	C.
February	14,100	348	3,680	5.41	5.63	B.
March	7,210	468	1,830	2.69	3.10	B.
April	8,430	1,250	2,620	3.85	4.30	B.
May	6,340	468	2,320	3.41	3.93	B.
June	4,440	297	1,140	1.68	1.87	B.
July	348	67	189	.278	.32	B.
August	348	46	127	.187	.22	B.
September	163	30	65.2	.096	.11	B.
October	204	30	78.2	.115	:13	B.
November	204	46	79.5	.117	.13	B.
December	890	67	205	.301	.35	B.
The year	14,100	30	1,180	1.74	23.63	

MONGAUP RIVER NEAR RIO, N. Y.

This station, which is located at the steel highway bridge at Partridge ranch, near Rio, about 6 miles above Mongaup village and about 14 miles from Port Jervis, N. Y., was established December 8, 1906. The station is maintained by Charles H. Cooke, civil engineer, of New York City, in cooperation with the United States Geological Survey and the State engineer's department of New York. On account of inability to obtain reliable gage readings, earlier observations at this station have not been published.

The bridge, to which the chain gage is attached, has a span of 140 feet. The stream flows in one channel at all stages and measurements are made from the downstream side of the bridge, or by wading. The channel above the station is straight for about 500 feet and during low and medium stages is divided into two parts by a small island just above the bridge. The channel below the bridge is straight for about 200 feet when it makes an abrupt turn to the right. The banks on either side are of medium height and overflow only during extreme high stages.

Conditions for measuring at this point are fairly good except in low stages when the current becomes rather sluggish. Low-water measurements are usually made by wading at the ripples below the bridge. A fairly good rating curve has been developed for stages below 3 feet.

Discharge measurements of Mongaup River near Rio, N. Y., for 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 24	Covert and James	138	157	1.12	150
Nov. 19[a]	C. C. Covert	72	60	.74	51

[a] Measurement made at wading section.

Daily gage height, in feet, of Mongaup River near Rio, N. Y., for 1909.

[Mrs. C. S. Rolles, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	0.72	0.74	0.68	0.80	16	0.92	0.69	0.66	0.70	1.30
2	....	.74	.68	.69	.78	17	1.09	.76	.75	.65	1.15
3	....	.72	.69	.64	.85	18	1.56	.75	.69	.65	1.25
4	....	.69	.64	.69	.78	19	1.14	.66	.68	.64	1.25
5	....	.72	.68	.72	.78	20	1.02	.69	.68	.66	1.25
6	....	.69	.65	.74	.72	21	.95	.69	.68	.64	1.40
7	....	.66	.62	.70	.62	22	.89	.69	.69	.64	1.42
8	0.66	.66	.59	.68	.74	23	.84	.62	.72	.66	....
9	.69	.66	.62	.68	.65	24	.76	.72	.78	.68	....
10	.70	.78	.70	.69	.78	25	.79	.80	.78	.70	....
11	.74	.86	.74	.70	.75	26	.75	.68	.80	.78	....
12	.66	.82	.79	.70	.88	27	.74	.66	.80	.88	....
13	.69	.78	.82	.69	.90	28	.74	.72	.79	.91	....
14	.69	.72	.80	.68	1.80	29	.74	.75	.78	.78	....
15	.80	.72	.69	.70	1.60	30	.75	.76	.76	.78	....
						31	.74	....	.74	....	....

NOTE.—Ice conditions prevailed during the greater part of December.

Daily discharge of Mongaup River near Rio, N. Y., for 1909.

[Drainage area, 189 square miles.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	49	52	42	63	16	92	44	39	45	220
2	....	52	42	44	50	17	146	56	54	38	168
3	....	49	44	36	74	18	327	54	44	38	150
4	....	44	36	44	59	19	164	39	42	36	150
5	....	49	42	49	59	20	122	44	42	39	140
6	....	44	38	52	49	21	100	44	42	36	130
7	....	39	33	45	33	22	84	44	44	36	120
8	39	39	29	42	52	23	72	33	49	39	....
9	44	39	33	42	38	24	56	49	59	42	....
10	45	59	45	44	59	25	61	63	59	45	....
11	52	77	52	45	54	26	54	42	63	59	....
12	39	68	61	45	81	27	52	39	63	81	....
13	44	59	68	44	86	28	52	49	61	89	....
14	44	49	63	42	445	29	52	54	59	59	....
15	63	49	44	45	345	30	54	56	56	59	....
						31	52	....	52	....	....

NOTE.—The above daily discharges are based on a well-defined rating curve. Discharges for Dec. 18 to 22 are estimated because of ice conditions.

Monthly discharge of Mongaup River near Rio, N. Y., for 1909.

[Drainage area, 189 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Aug. 8-31	327	.39	79.7	0.422	0.38	A.
September	77	.33	49.2	.260	.29	A.
October	68	.29	48.7	.258	.30	A.
November	89	.36	46.7	.247	.28	A.
Dec. 1-22	445	.33	119	.630	.52	B.

NEVERSINK RIVER AT GODEFFROY, N. Y.

Neversink River is formed by the confluence of the East and West branches of Neversink Creek, in the western part of Ulster County, and flows southward across Sullivan and Orange counties into Delaware River at Port Jervis.

Its principal tributaries are Sheldrake Creek, which comes in from the west through a chain of lakes and joins the river at Thompsonville, about 25 miles from the mouth; and Bush Kill, a small tributary from the same side, joining at Oakland Valley, some 12 miles farther downstream. From the east Basher Kill, a tributary of considerable importance, formed by Pine Kill and Gamauer Brook, flows into the Neversink near Godeffroy, about 9 miles from Port Jervis, and just above the gaging station which is located at the suspension highway bridge at this point.

The river drains a narrow valley along the southern slope of the Catskill Mountains. There are several reservoirs in the upper watershed, two of which are now in use. The principal power is located at Roses Point, near Cuddybackville, in the vicinity of the old Delaware and Hudson Canal. About half a mile above this point a low concrete dam diverts water through the old feeder ditch to the plant. This plant supplies Port Jervis, Middletown, and other small places in the vicinity with electric light and power.

The gaging station is located at the suspension highway bridge about half a mile east of the town of Godeffroy and 8 miles above the mouth of the river. A staff gage was established at this point August 4, 1903, and was washed out October 9 in the same year. The station was reestablished August 22, 1909, to obtain general and statistical data regarding the flow of the Neversink, and is maintained in cooperation with the State engineer's department.

An enameled iron staff gage was bolted to the river face, downstream end of the left abutment. This gage was removed by a flood January 21, 1910, and a chain gage was fastened to the left hand downstream tower on August 1, 1910, at the same datum. This datum is 0.98 foot lower than that of the gage of 1903; therefore all previously published gage heights for this station should have 0.98 foot added in order to apply to the present datum. The new gage datum has remained the same during the maintenance of the station Conditions are good for accurate discharge measurements at the suspension bridge during the open-water period, except for extreme low water, when wading measurements at various sections have to be resorted to, or a bridge about 1 mile farther downstream used. The area of the drainage basin above the station is 314 square miles;[1] area above mouth is 346 square miles.[1] Information in regard to this station is contained in the annual reports of the State engineer and surveyor, State of New York.

[1] Taken from Bien's Atlas of New York.

Discharge measurements of Neversink River at Godeffroy, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of action.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 21	C. C. Covert	157	495	2.84	298
22	Covert and Hoyt	154	532	2 70	202
Nov. 20[a]	C. C. Covert	40	32	2.10	31

[a] Measurement made at wading section 800 feet below mouth of Basher Kill.

NOTE.—See also miscellaneous measurements, p. 294.

Daily gage height, in feet, of Neversink River at Godeffroy, N. Y., for 1909.

[Mrs. Wm. Morgan, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.40	2.60	2.75	2.65	16		2.55	2.55	2.75	2.60
2		2.52	2.50	2.65	2.45	17		2.50	2.55	2.75	2.55
3		2.48	2.60	2.75	2.50	18		2.50	2.50	2.65	2.45
4		2.40	2.60	2.75	2.50	19		2.50	2.55	2.80	2.55
5		2.42	2.70	2.70	2.35	20		2.55	2.60	2.60	2.40
6		2.48	2.55	2.70	2.55	21	2.85	2.60	2.60	2.50	2.65
7		2.40	2.55	2.75	2.45	22	2.72	2.65	2.55	2.50	2.65
8		2.45	2.60	2.70	2.60	23	2.55	2.65	2.55	2.65	2.55
9		2.45	2.60	2.75	2.65	24	2.78	2.60	2.70	2.65	2.55
10		2.52	2.55	2.75	2.65	25	2.35	2.60	2.65	2.75	2.55
11		2.50	2.55	2.65	2.65	26	2.35	2.55	2.75	2.70	
12		2.55	2.60	2.75	2.65	27	2.40	2.60	2.60	2.60	
13		2.48	2.60	2.65	3.20	28	2.42	2.55	2.80	2.70	
14		2.60	2.60	2.75	3.94	29	2.58	2.55	2.75	2.60	
15		2.55	2.55	2.75	3.68	30	2.42	2.50	2.60	2.65	
						31	2.50				

NOTE.—River reported frozen over Dec. 25.

PAULINS KILL AT COLUMBIA, N. J.

Paulins Kill rises on the east slope of Kittatinny Mountain, in central Sussex County, N. J., and flows southwestward into the Delaware at Columbia. Its length is about 36 miles. Its total drainage area comprises about 180 square miles, of which 25 per cent is in forest. For the first 10 miles from the mouth the fall averages 7 feet per mile, with little variation; for 20 miles above this it is 8.5 feet per mile, also very uniform. The bottom of the valley is blue limestone; the higher portions are mainly slate. Lakes on the watershed, including Swartswood and Culvers, have been utilized as reservoirs for mills. The mean annual rainfall is about 45 inches.

The gaging station was established August 1, 1908, by Messrs. Meikleham & Dinsmore, through whose courtesy records have been furnished for publication.

Daily gage height, in feet, of Paulins Kill River at Columbia, N. J., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1....	1.00	1.57	2.45	1.87	3.62	1.22	0.93	16....	1.60	3.10	2.02	2.81	1.78	1.02	0.92
2....	1.01	1.35	2.23	1.83	3.85	1.11	.91	17....	1.65	3.93	1.88	2.11	1.75	1.00	.93
3....	1.10	1.30	1.91	1.78	3.45	1.23	.93	18....	1.62	3.15	1.79	2.05	1.71	1.42	.94
4....	1.13	1.15	1.74	1.76	3.08	1.20	.90	19....	1.56	2.92	1.74	2.00	1.76	1.59	.98
5....	1.19	1.13	1.51	1.77	2.82	1.45	.94	20....	1.52	3.16	1.73	2.11	1.75	1.21	.99
6....	3.28	1.31	1.50	1.75	2.62	1.52	.92	21....	1.54	5.90	1.70	2.60	1.72	1.19	.96
7....	3.95	1.95	1.98	1.74	2.57	1.42	.90	22....	1.55	8.30	1.70	2.91	1.73	1.16	.97
8....	2.02	1.62	2.05	1.59	2.30	1.43	.94	23....	1.56	2.90	1.71	2.68	1.60	1.14	.99
9....	2.12	1.48	2.04	1.53	2.24	1.32	.95	24....	1.56	3.54	1.68	3.01	1.57	1.11	1.00
10....	1.80	1.52	2.35	1.50	2.17	1.21	1.01	25....	1.61	4.30	1.67	2.74	1.55	1.12	.96
11....	1.68	3.18	2.60	1.42	2.28	1.12	.96	26....	2.18	3.81	2.78	2.45	1.53	.98	.93
12....	1.65	2.35	2.36	1.40	2.22	1.00	.90	27....	1.81	3.18	2.15	2.25	1.47	.97	.91
13....	1.62	1.98	2.31	1.38	2.12	1.05	.87	28....	1.70	2.95	2.08	2.22	1.50	.96	.97
14....	1.58	1.96	2.10	1.40	1.91	1.08	1.84	29....	1.64	......	1.84	2.20	1.46	.93	.98
15....	1.41	2.05	2.06	2.80	1.78	1.06	1.82	30....	1.62	......	1.90	3.11	1.39	.92	1.00
								31....	1.58	......	1.88	......	1.32	......	.99

Daily discharge, in second-feet, of Paulins Kill at Columbia, N. J., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1....	103	256	595	353	1,150	150	85	16....	264	885	410	750	326	105	84
2....	104	188	500	340	1,270	126	83	17....	278	1,280	360	450	312	103	85
3....	123	176	370	325	1,054	152	85	18....	270	910	328	425	300	210	90
4....	130	138	310	323	880	148	82	19....	252	800	310	405	314	260	100
5....	148	130	237	324	756	218	90	20....	240	915	305	450	312	150	102
6....	1,000	178	234	313	665	240	84	21....	247	1,830	295	660	302	146	93
7....	1,300	387	400	310	645	210	82	22....	250	3,250	295	800	304	140	94
8....	412	270	425	260	530	212	90	23....	252	795	300	700	265	133	102
9....	450	230	420	245	500	180	92	24....	252	1,095	290	845	255	126	103
10....	330	240	550	235	470	150	104	25....	267	1,450	288	720	250	127	93
11....	290	930	660	210	540	127	93	26....	440	1,230	740	595	245	100	85
12....	278	550	553	200	495	103	82	27....	334	930	465	505	223	94	83
13....	270	400	533	198	450	113	75	28....	295	818	440	495	235	93	94
14....	260	390	445	200	370	120	343	29....	276	.....	340	487	221	85	100
15....	205	425	430	747	326	115	334	30....	270	......	365	890	200	84	103
								31....	260	......	363	......	180	......	102

NOTE.—These discharges are based on a rating curve that is fairly well defined between 20 and 600 second-feet.

Monthly discharge of Paulins Kill at Columbia, N. J., for 1909.

[Drainage area, 179 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	1,300	103	331	1.85	2.13
February	3,250	130	753	4.21	4.38
March	740	234	405	2.26	2.61
April	890	198	459	2.57	2.87
May	1,270	180	463	2.59	2.99
June	260	84	144	.805	.90
July	343	75	107	.598	.69

LEHIGH RIVER DRAINAGE BASIN.

DESCRIPTION.

Lehigh River at South Bethlehem, exclusive of Monocacy Creek, drains 1,235 square miles, and including Monacacy Creek at high stages drains 1,286 square miles of territory in nine counties of Pennsylvania. The river rises in the Pocono Mountains at an elevation of approximately 2,000 feet above sea level and its slope is steep throughout its course, falling in the lower 45 miles from Mauch Chunk to Easton, where it joins Delaware River, about 8 feet to the mile; for the 40 miles above Mauch Chunk the slope is about 24 feet to the mile. It is crossed between Easton and Mauch Chunk by nine dams of the Lehigh Coal & Navigation Co., erected to deflect the water into the Lehigh Canal.

The river and its tributaries are much used for domestic and industrial water supplies and the canal for water power. Its head-water region is thinly inhabited in the eastern portion of the basin and contains much second-growth timber. On the west side the basin lies in the anthracite coal field and is much deforested; the tributaries from this side bring in large quantities of sand and culm from washeries and mine water.

The lower tributaries, particularly the Little Lehigh, Jordan, Monocacy, and Saucon creeks, drain limestone regions and are largely instrumental, in addition to mine water, in maintaining a high minimum flow.

LEHIGH RIVER AT SOUTH BETHLEHEM, PA.

This station was established by the United States Geological Survey September 22, 1902, on the New Street Bridge, connecting Bethlehem and South Bethlehem, and was until February 13, 1905, under the supervision of Prof. Mansfield Merriman, of Lehigh University. On that date the station was discontinued, to be reestablished by the Water Supply Commission of Pennsylvania at the same point on April 26, 1909. The present equipment consists of a standard chain and weight gage, similar to that previously employed, the new datum being 0.09 foot higher than the old. The elevation of the zero of the present gage is 210.64 feet above mean tide, referred to the following bench marks. All gage heights have been corrected to correspond to the new datum.

Bench mark No. 1. Shelf in fourth course from bottom on right-hand downstream corner, third pier from left bank. Elevation 223.55 feet above sea level, or 12.91 feet above zero of gage.

Bench mark No. 2. No. 72 of Lehigh Valley Railroad. Iron pin set in south pier of New Street Bridge. Elevation, 232.87 feet above sea level, or 22.23 feet above zero of gage.

The proper length of the chain from the end of the weight to the marker is 43.05 feet.

The initial point for soundings is a point on the handrail over the center of the pier between the third and fourth trusses from the left bank.

The channel is straight for one-third mile above station and for several hundred feet below the station. A low rubble dam crosses a portion of the channel a few hundred feet below the bridge, having been placed late in the fall of 1902, causing an alteration in the rating curve. Changes in this dam caused a further slight change in the rating curve between 1905 and 1909.

The left bank is low and overflows at high stages; the right bank is high and does not overflow. The river bed consists of sand, gravel, and bowlders and seems to be fairly permanent, with good velocity at low stages.

The ice effect at this station is probably usually negligible.

The Lehigh Canal follows the left bank and passes over Monocacy Creek and under the left span of the bridge; the creek also passes under the bridge, entering the river a short distance below. An ice plant and grist mill takes water from the canal and returns it to the river above the bridge. The canal is measured at Main Street Bridge, one-third of a mile above the station, and the discharge, reduced by the amount of tail-race flow of ice plant and grist mill, is added to the river discharge.

At high stages the river overflows into the canal and creek.

The original observer was H. E. Edmonds; since 1909 John E. Santee, toll taker on the New Street Bridge, has been the observer.

Excessive floods are known to have occurred on the Lehigh in 1862 and 1869, when the stage reached about 21.48 feet and 20.5 feet respectively, as based on the present datum. The discharges were approximately 66,000 and 62,000 second-feet, respectively, or 53.4 and 50.2 second-feet per square mile. On account of the congestion of industry between Allentown and the mouth, considerable damage has been done by these floods on the Lehigh.

This station since its reestablishment has been operated by the Water-Supply Commission of Pennsylvania, and many of the measurements have been made by students of Lehigh University, under the direction of the civil-engineering department.

Discharge measurements of Lehigh River at South Bethlehem, Pa., in 1902–1904 and 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1902.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec. ft.*
Sept. 22	E. G. Paul	340	787	2.22	1,171
Nov. 14	H. A. Rice		879	2.7	1,696
20	do		880	2.5	1,436
1903.					
June 26	J. C. Hoyt	308	1,160	3.41	2,480
Aug. 3	do	287	969	2.78	1,583
Oct. 12	W. C. Sawyer	363	2,180	6.46	10,536
1904.					
July 21	R. J. Taylor	279	760	2.20	838
Nov. 7	H. D. Comstock	293	923	2.60	1,276
1908.					
Feb. 17	R. H. Bolster	339	1,940	5.48	8,050
Sept. 14	Kenneth Grant	268	674	1.92	456
1909.					
Mar. 26	do	330	1,739	5.29	6,059
Apr. 17	W. S. Com	334	1,920	4.66	5,980
21	Kenneth Grant	331	1,518	4.54	4,304
24	Greenough			4.85	5,708
May 1	Water Supply Commission	333	2,147	6.25	9,054
2	do	333	2,296	6.68	10,007
2	do	333	2,244	6.60	9,669
3	do	331	2,084	6.03	8,154
3	do	333	2,058	5.90	7,855
15	C. E. Ryder	320	1,219	3.60	2,606
June 29	Kenneth Grant	285	876	2.56	1,019
Sept. 29	Poole	277	693	1.87	494
Oct. 2	do	278	675	1.80	414
6	do	278	674	1.80	384
13	do	282	752	2.13	666
Nov. 18	do	273	660	1.78	359
Dec. 15	do	330	1,318	3.96	3,353
16	do			3.69	1,675
17	do			3.09	1,419
1910.					
Jan. 8	do	286	796	2.29	768
22	do	352	4,523	13.34	30,586
Feb. 21	do	338	1,521	4.54	4,293
23	do	341	1,907	5.74	6,745
Mar. 1	do	345	2,908	8.64	14,209
Apr. 18	do	340	1,908	5.70	7,056
25	do	348	2,835	7.44	11.261
25	do	348	2,675	7.95	12,843
27	do	347	2,219	6.64	9,308

NOTE.—All gage heights refer to datum established by Water-Supply Commission of Pennsylvania in 1909.

Daily gage height, in feet, of Lehigh River at South Bethlehem, Pa., for 1902–1905 and 1909.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.[a]					1902.[a]					1902.[a]				
1		6.0	3.65	2.5	11		3.65	2.8	2.5	21		3.3	2.5	4.8
2		6.0	3.55	2.5	12		5.57	2.75	2.6	22	2.2	3.15	2.5	12.2
3		5.2	3.40	2.8	13		5.75	2.7	2.65	23	2.1	3.1	2.5	8.25
4		4.65	3.30	2.9	14		4.95	2.7	2.7	24	2.07	2.95	2.5	6.35
5		4.55	3.20	2.9	15		4.45	2.7	2.7	25	2.7	2.9	2.5	5.55
6		5.45	3.3	2.9	16		4.15	2.65	4.3	26	8.35	2.9	2.5	5.0
7		4.95	3.25	2.9	17		3.85	2.65	8.6	27	8.0	2.85	2.5	4.6
8		4.50	3.1	2.9	18		3.7	2.55	5.9	28	6.1	5.15	2.5	4.2
9		4.30	2.95	2.45	19		3.65	2.55	5.0	29	5.75	4.8	2.5	4.0
10		3.9	2.85	2.45	20		3.55	2.5	4.5	30	5.6	4.3	2.5	3.9
										31		3.9		3.8

[a] Canal closed during 1902 on account of flood during that year.

NOTE.—Above gage heights reduced 0.10 foot to conform with change in datum made by Water-Supply Commission of Pennsylvania in 1909.

Daily gage height, in feet, of Lehigh River at South Bethlehem, Pa., for 1902–1905 and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.[a]												
1	3.5	4.4	10.2	4.2	3.0	2.2	3.3	3.9	3.4	2.4	2.6	2.4
2	3.4	4.3	7.0	3.9	2.9	2.1	3.0	2.9	3.2	2.3	2.6	2.3
3	5.25	4.1	5.6	3.9	2.9	2.1	2.9	2.8	3.1	2.3	2.6	2.3
4	4.72	5.0	4.9	3.9	2.9	2.0	2.8	2.7	2.9	2.3	2.5	2.3
5	4.4	5.0	4.6	3.7	2.9	2.0	2.7	3.1	2.8	2.3	2.6	2.4
6	4.15	5.0	4.4	3.6	2.8	1.9	2.7	3.9	2.7	2.3	2.6	2.4
7	3.9	4.9	4.2	3.6	2.8	1.9	2.7	4.6	2.7	2.3	2.5	2.4
8	3.8	4.7	4.2	4.4	2.7	2.3	2.7	4.4	2.6	2.3	2.5	2.4
9	3.35	4.4	4.8	6.1	2.7	2.7	2.6	3.9	2.6	5.6	2.5	2.4
10	3.20	3.8	4.6	5.6	2.6	2.6	2.6	3.4	2.7	11.9	2.5	2.3
11	3.10	3.8	4.6	4.9	2.6	2.4	2.5	3.3	2.7	7.9	2.5	2.3
12	3.05	5.0	4.4	4.8	2.6	4.0	2.5	3.1	2.7	6.1	2.5	2.3
13	2.90	4.7	4.2	4.7	2.5	4.2	2.5	3.0	2.6	5.3	2.4	2.5
14	3.05	4.4	4.0	5.4	2.5	3.7	2.4	2.9	2.6	4.8	2.4	3.1
15	3.20	4.1	3.8	6.4	2.4	3.6	2.4	2.9	3.7	4.4	2.4	2.5
16	3.30	4.2	3.8	5.9	2.4	3.3	2.3	2.9	3.7	3.8	2.3	2.5
17	3.20	3.4	3.7	5.5	2.5	3.1	2.3	2.9	3.3	3.8	2.5	2.6
18	3.05	3.3	3.6	4.9	2.4	3.1	2.5	2.9	3.0	3.9	3.8	2.5
19	3.00	3.3	2.4	4.4	2.4	3.0	3.9	2.8	2.9	3.9	3.2	2.3
20	2.70	3.4	2.4	4.3	2.4	2.9	3.8	2.7	2.7	3.7	3.0	4.4
21	4.70	3.4	2.4	4.0	2.4	3.4	3.5	2.7	2.7	3.5	2.8	6.1
22	4.80	3.4	4.9	3.8	2.3	3.2	3.3	2.6	2.6	3.4	2.9	4.5
23	4.00	3.4	6.0	3.7	2.3	3.4	3.2	2.6	2.5	3.3	2.9	4.05
24	3.40	3.4	9.2	3.6	2.3	3.9	3.2	2.5	2.4	3.2	2.7	3.6
25	3.15	3.3	6.8	3.5	2.3	3.6	3.4	2.5	2.4	3.1	2.7	3.5
26	3.30	3.3	5.8	3.4	2.2	3.4	3.5	2.4	2.4	3.0	2.5	3.4
27	3.20	3.2	5.1	3.3	2.2	3.2	3.5	2.4	2.3	2.9	2.4	3.3
28	3.30	9.3	4.6	3.3	2.2	3.0	3.5	2.4	2.4	2.8	2.2	3.2
29	4.30	......	4.2	3.2	2.2	3.6	3.5	3.3	2.4	2.7	2.4	2.6
30	4.20	......	3.9	3.1	2.1	3.3	3.7	3.1	2.4	2.6	2.5	2.6
31	4.50	......	4.5	......	2.1	......	4.1	3.8	......	2.6	......	2.7
1904.[b]												
1	2.7	2.9	3.2	6.5	2.9	2.7	2.5	2.4	2.1	2.3	2.7	2.7
2	2.7	2.7	3.3	6.65	2.9	2.7	2.4	2.3	2.1	2.2	2.7	2.6
3	2.4	2.7	3.9	5.6	2.8	2.9	2.3	2.5	2.2	2.2	2.7	2.5
4	2.8	2.6	4.42	4.6	2.7	2.6	2.2	2.6	2.0	2.2	2.6	2.4
5	2.6	2.7	3.4	4.4	2.7	3.1	2.1	2.5	2.1	2.2	2.6	2.4
6	2.6	2.8	3.4	4.2	2.6	3.1	2.0	2.4	2.0	2.2	2.6	2.5
7	2.6	2.8	10.15	4.2	2.5	3.0	2.5	2.2	2.1	2.2	2.6	2.5
8	2.7	4.0	9.05	4.2	2.5	2.9	3.85	2.3	2.0	2.2	2.5	2.5
9	2.6	3.8	6.5	4.3	2.5	3.0	3.0	2.3	2.0	2.2	2.5	2.4
10	2.5	3.4	5.7	4.2	2.5	3.8	3.0	2.3	2.3	2.2	2.5	2.4
11	2.5	3.0	5.2	3.9	2.6	......	2.8	2.9	2.1	2.2	2.5	2.4
12	2.6	2.9	4.5	3.8	2.5	......	2.6	2.5	2.0	2.4	2.5	2.4
13	2.7	2.8	4.2	3.7	2.3	3.7	2.6	2.3	2.0	2.6	2.5	2.4
14	2.7	2.7	4.0	3.6	2.3	......	2.45	2.3	2.25	2.6	3.1	2.3
15	2.6	2.7	3.9	3.4	......	3.0	2.2	2.4	3.4	2.6	3.1	2.4
16	2.5	2.7	3.8	3.3	2.9	2.9	2.15	2.3	3.6	2.5	3.0	2.4
17	2.4	2.6	3.6	3.2	2.7	2.8	2.1	2.2	3.1	2.5	2.8	2.3
18	2.3	2.6	3.6	3.1	2.6	2.6	2.3	2.2	2.7	2.4	2.7	2.3
19	2.3	2.5	3.5	3.0	2.6	2.5	2.6	2.1	2.7	2.3	2.7	2.4
20	2.6	2.5	4.2	3.0	2.6	2.4	2.5	2.3	2.6	2.3	2.6	2.4
21	2.3	2.5	4.2	3.0	2.5	2.4	2.1	3.05	2.5	2.4	3.1	2.4
22	2.7	6.43	4.1	3.0	2.5	2.4	2.1	2.8	2.5	6.2	3.0	2.2
23	6.3	4.55	4.2	2.9	2.4	2.4	2.0	2.9	2.4	4.6	3.0	2.3
24	5.3	4.2	4.3	2.9	2.4	2.3	2.2	2.7	2.4	4.0	2.9	2.5
25	4.05	4.0	4.6	2.8	2.4	2.3	2.3	2.5	2.2	3.7	2.8	2.5
26	3.7	3.2	5.2	2.8	2.5	2.3	2.5	2.4	2.2	3.5	2.7	2.7
27	3.6	3.15	5.0	2.9	2.6	2.2	3.5	2.3	2.2	3.3	2.7	2.6
28	3.2	3.0	4.8	3.1	2.5	2.1	3.1	2.2	2.2	3.1	2.7	3.4
29	3.2	3.2	4.2	3.1	2.3	2.25	2.9	2.2	2.2	3.0	2.7	4.3
30	3.1	......	4.0	3.0	2.3	2.5	2.7	2.2	2.4	2.9	2.7	3.5
31	3.0	......	4.0	......	2.7	......	2.5	2.1	......	2.8	......	3.3

[a] Canal in operation May 21 to Oct. 11, 1903.

[b] Canal in operation July 12 to Nov. 28, 1904.

NOTE.—Above gage heights reduced 0.10 foot to conform with change in datum made by Water-Supply Commission of Pennsylvania in 1909.

Daily gage height, in feet, of Lehigh River at South Bethlehem, Pa,, for 1902–1905 and 1909—Continued.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1905.[a]			1905.[a]			1905.[a]		
1	3.4	2.8	11	4.6	2.6	21	3.5	....
2	3.4	2.7	12	4.5	2.6	22	3.3	....
3	3.4	2.6	13	4.3	2.6	23	3.2	....
4	3.4	2.6	14	4.1	....	24	3.0	....
5	3.3	2.6	15	3.8	....	25	2.8	....
6	3.3	2.6	16	3.7	....	26	2.4	....
7	10.15	2.6	17	3.6	....	27	3.3	....
8	7.9	2.6	18	3.6	....	28	3.1	....
9	5.9	2.6	19	3.5	....	29	3.0	....
10	5.4	2.6	20	3.5	....	30	2.9	....
						31	2.9	....

[a] Canal in operation Apr. 18 to Nov. 28, 1905.

NOTE.—Above gage heights reduced 0.10 foot to conform with change in datum made by Water-Supply Commission of Pennsylvania in 1909.

NOTE.—Canal also in operation May 22, 1906, to Dec. 2, 1906; Apr. 16, 1907, to Dec. 13, 1907; Apr. 16, 1908, to Nov. 20, 1908.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.									
1	....	6.18	2.69	2.48	1.98	1.70	1.78	1.82	1.90
2	....	6.63	2.59	2.36	2.08	1.75	1.70	1.72	1.88
3	....	5.98	2.75	2.24	2.05	1.63	1.66	1.74	1.87
4	....	5.68	2.65	2.22	2.02	1.53	1.78	1.78	1.86
5	....	5.24	2.78	2.27	1.94	1.76	1.74	1.72	1.84
6	....	4.85	3.03	2.26	1.86	1.74	1.65	1.74	1.92
7	....	4.54	3.17	2.21	1.86	1.76	1.74	1.60	1.84
8	....	4.37	2.92	2.24	1.91	1.59	1.70	1.80	1.87
9	....	4.10	2.85	2.16	1.88	1.61	1.63	1.76	1.88
10	....	4.05	2.95	2.04	1.87	1.85	1.55	1.76	1.74
11	....	4.54	2.83	2.00	1.86	1.90	1.71	1.78	1.70
12	....	4.15	2.76	2.03	1.79	1.85	2.00	1.75	1.50
13	....	3.84	2.67	1.95	1.85	1.89	2.23	1.65	1.90
14	....	3.73	2.76	2.02	1.82	1.83	2.00	1.55	6.42
15	....	3.59	2.74	2.05	1.76	1.74	1.90	1.62	4.38
16	....	3.51	2.70	2.36	2.00	1.70	1.73	1.74	3.60
17	....	3.42	2.65	2.25	1.99	2.14	1.58	1.63	3.14
18	....	3.20	3.28	2.19	2.06	2.05	1.90	1.64	3.01
19	....	3.13	3.31	2.12	2.02	1.83	1.77	1.71	2.68
20	....	3.08	3.14	1.97	1.96	1.94	1.72	1.72	2.62
21	....	2.99	3.00	2.02	1.86	1.82	1.78	1.58	2.43
22	....	3.12	2.81	2.02	1.66	1.83	1.73	1.74	2.43
23	....	3.02	2.66	2.43	1.81	1.75	1.64	1.73	2.42
24	....	2.98	2.60	2.93	1.83	1.86	1.67	1.65	2.34
25	....	2.93	2.60	2.61	1.82	2.06	2.06	1.68	2.32
26	4.46	2.86	2.57	2.49	1.82	1.85	1.94	1.63	2.19
27	4.30	2.86	2.56	2.30	1.67	1.95	1.94	1.73	2.27
28	4.11	3.00	2.54	2.22	1.60	1.84	1.86	1.75	2.21
29	4.01	2.96	2.53	2.25	1.70	1.85	1.81	1.80	2.18
30	5.70	2.80	2.56	2.19	1.77	1.80	1.71	1.66	2.11
31	....	2.77	....	2.07	1.66	....	1.59	....	2.21

NOTE.—Water withdrawn from canal level below Lock No. 42 and just above New Street Bridge, Bethlehem, Jan. 1, 1909, and restored Mar. 13, 1909. It was again withdrawn on Dec. 17, 1909, and not restored during the remainder of the month.

Rating tables for Lehigh River at South Bethlehem, Pa.

Sept. 22 to Dec. 2, 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	615	3.00	2,210	4.30	4,740	6.20	9,420
1.80	700	3.10	2,370	4.40	4,970	6.40	9,940
1.90	790	3.20	2,540	4.50	5,200	6.60	10,470
2.00	885	3.30	2,710	4.60	5,430	6.80	11,010
2.10	985	3.40	2,890	4.70	5,670	7.00	11,550
2.20	1,100	3.50	3,070	4.80	5,910	7.20	12,100
2.30	1,220	3.60	3,260	4.90	6,150	7.40	12,660
2.40	1,340	3.70	3,450	5.00	6,390	7.60	13,220
2.50	1,470	3.80	3,650	5.20	6,880	7.80	13,780
2.60	1,610	3.90	3,860	5.40	7,380	8.00	14,360
2.70	1,750	4.00	4,070	5.60	7,880	8.20	14,940
2.80	1,900	4.10	4,290	5.80	8,380	8.40	15,520
2.90	2,050	4.20	4,510	6.00	8,900		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on three discharge measurements made during 1902 and the form of the later curves, and is well defined between gage heights 2.2 feet and 2.8 feet.

Dec. 3, 1902, to Feb. 13, 1905.

1.70	410	3.10	1,990	4.50	4,560	6.80	10,200
1.80	485	3.20	2,140	4.60	4,770	7.00	10,740
1.90	560	3.30	2,300	4.70	4,990	7.20	11,280
2.00	640	3.40	2,470	4.80	5,210	7.40	11,820
2.10	730	3.50	2,640	4.90	5,440	7.60	12,380
2.20	830	3.60	2,820	5.00	5,670	7.80	12,940
2.30	930	3.70	3,000	5.20	6,150	8.00	13,500
2.40	1,040	3.80	3,180	5.40	6,630	9.00	16,420
2.50	1,160	3.90	3,370	5.60	7,130	10.00	19,490
2.60	1,280	4.00	3,560	5.80	7,630	11.00	22,730
2.70	1,410	4.10	3,750	6.00	8,130	12.00	26,130
2.80	1,550	4.20	3,950	6.20	8,640		
2.90	1,690	4.30	4,150	6.40	9,160		
3.00	1,840	4.40	4,350	6.60	9,680		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on four discharge measurements made during 1903-4 and the form of later curves, and is well defined between gage heights 2.1 feet and 3.5 feet, and fairly well above gage height 3.5 feet.

Apr. 26 to Dec. 31, 1909.

1.50	205	3.20	1,920	4.90	5,200	9.00	16,120
1.60	260	3.30	2,075	5.00	5,430	10.00	19,180
1.70	320	3.40	2,235	5.20	5,910	11.00	22,400
1.80	385	3.50	2,400	5.40	6,390	12.00	25,780
1.90	455	3.60	2,570	5.60	6,880	13.00	29,330
2.00	530	3.70	2,745	5.80	7,380	14.00	33,040
2.10	615	3.80	2,925	6.00	7,880	15.00	36,890
2.20	705	3.90	3,105	6.20	8,380	16.00	40,860
2.30	800	4.00	3,290	6.40	8,900	17.00	44,950
2.40	900	4.10	3,480	6.60	9,420	18.00	49,150
2.50	1,010	4.20	3,680	6.80	9,940	19.00	53,450
2.60	1,125	4.30	3,880	7.00	10,470	20.00	57,850
2.70	1,245	4.40	4,090	7.20	11,010	21.00	62,350
2.80	1,370	4.50	4,300	7.40	11,550	22.00	66,950
2.90	1,500	4.60	4,520	7.60	12,100		
3.00	1,635	4.70	4,740	7.80	12,660		
3.10	1,775	4.80	4,970	8.00	13,220		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1908 to 1910, and is well defined below gage height 15 feet.

Daily discharge, in second-feet, of Lehigh River at South Bethlehem, Pa., for 1902–1905 and 1909.

Day.	Sept.	Oct.	Nov.	Dec.
1902.				
1	....	8,900	3,360	1,470
2	....	8,900	3,160	1,470
3	....	6,880	2,890	1,550
4	....	5,550	2,710	1,690
5	....	5,320	2,540	1,690
6	....	7,500	2,710	1,690
7	....	6,270	2,620	1,690
8	....	5,200	2,370	1,690
9	....	4,740	2,130	1,100
10	....	3,860	1,980	1,100
11	....	3,360	1,900	1,160
12	....	7,800	1,820	1,280
13	....	8,260	1,750	1,340
14	....	6,270	1,750	1,410
15	....	5,080	1,750	1,410
16	....	4,400	1,680	4,150
17	....	3,760	1,680	15,200
18	....	3,450	1,540	7,880
19	....	3,360	1,540	5,670
20	....	3,160	1,470	4,560
21	....	2,710	1,470	5,210
22	1,100	2,460	1,470	26,800
23	985	2,370	1,470	14,200
24	955	2,130	1,470	9,030
25	1,750	2,050	1,470	7,000
26	15,400	2,050	1,470	5,670
27	14,400	1,980	1,470	4,770
28	9,160	6,760	1,470	3,950
29	8,260	5,910	1,470	3,560
30	7,880	4,740	1,470	3,370
31	....	3,860	....	3,180

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.[a]												
1	2,640	4,350	20,100	3,950	1,840	875	2,340	3,420	2,520	1,080	1,280	1,040
2	2,470	4,150	10,700	3,370	1,690	775	1,880	1,740	2,180	975	1,280	930
3	6,270	3,750	7,130	3,370	1,690	775	1,740	1,600	2,040	975	1,280	930
4	5,030	5,670	5,440	3,370	1,690	685	1,600	1,460	1,740	975	1,160	930
5	4,350	5,670	4,770	3,000	1,690	685	1,460	2,040	1,600	975	1,280	1,040
6	3,850	5,670	4,350	2,820	1,550	605	1,460	3,420	1,460	975	1,280	1,040
7	3,370	5,440	3,950	2,820	1,550	605	1,460	4,820	1,460	975	1,160	1,040
8	3,180	4,990	3,950	4,350	1,410	975	1,460	4,400	1,320	975	1,160	1,040
9	2,380	4,350	5,210	8,380	1,410	1,460	1,320	3,420	1,320	7,180	1,160	1,040
10	2,140	3,180	4,770	7,130	1,280	1,340	1,320	2,520	1,460	25,800	1,160	930
11	1,990	3,180	4,770	5,440	1,280	1,080	1,200	2,340	1,460	13,300	1,160	930
12	1,920	5,670	4,350	5,210	1,280	3,600	1,200	2,040	1,460	8,380	1,160	930
13	1,690	4,990	3,950	4,990	1,160	4,000	1,200	1,880	1,320	6,390	1,040	1,160
14	1,920	4,350	3,560	6,630	1,160	3,040	1,080	1,740	1,320	5,210	1,040	1,990
15	2,140	3,750	3,180	9,160	1,040	2,860	1,080	1,740	3,040	4,350	1,040	1,160
16	2,300	3,950	3,180	7,880	1,040	2,340	975	1,740	3,040	3,180	930	1,160
17	2,140	2,470	3,000	6,880	1,160	2,040	975	1,740	2,340	3,180	1,160	1,280
18	1,920	2,300	2,820	5,440	1,040	2,040	1,200	1,740	1,880	3,370	3,180	1,160
19	1,840	2,300	1,040	4,350	1,040	1,880	3,420	1,600	1,740	3,370	2,140	930
20	1,410	2,470	1,040	4,150	1,040	1,740	3,220	1,460	1,460	3,000	1,840	4,350
21	4,990	2,470	1,040	3,560	1,080	2,520	2,680	1,460	1,460	2,640	1,550	8,380
22	5,210	2,470	5,440	3,180	975	2,180	2,340	1,320	1,340	2,470	1,690	4,560
23	3,560	2,470	8,130	3,000	975	2,520	2,180	1,320	1,200	2,300	1,690	3,660
24	2,470	2,470	17,000	2,820	975	3,420	2,180	1,200	1,080	2,140	1,410	2,820
25	2,060	2,300	10,200	2,640	975	2,860	2,520	1,200	1,080	1,990	1,410	2,640
26	2,300	2,300	7,630	2,470	875	2,520	2,680	1,080	1,080	1,840	1,160	2,470
27	2,140	2,140	5,910	2,300	875	2,180	2,680	1,080	975	1,690	1,040	2,300
28	2,300	17,300	4,770	2,300	875	1,880	2,680	1,080	1,080	1,550	830	2,140
29	4,150	....	3,950	2,140	875	2,860	2,680	2,340	1,080	1,410	1,040	1,280
30	3,950	....	3,370	1,990	775	2,340	3,040	2,040	1,080	1,280	1,160	1,280
31	4,560	....	4,560	....	775	....	3,790	3,220	....	1,280	....	1,410
1904.[b]												
1	1,410	1,690	2,140	9,420	1,690	1,410	1,160	1,080	775	975	1,460	1,410
2	1,410	1,410	2,300	9,810	1,690	1,410	1,040	975	775	875	1,460	1,280
3	1,040	1,410	3,370	7,130	1,550	1,690	930	1,200	875	875	1,460	1,160
4	1,550	1,280	4,390	4,770	1,410	1,280	830	1,320	685	875	1,320	1,040
5	1,280	1,410	2,470	4,350	1,410	1,990	730	1,200	775	875	1,320	1,040
6	1,280	1,550	2,470	3,950	1,280	1,990	640	1,080	685	875	1,320	1,160
7	1,280	1,550	20,000	3,950	1,160	1,840	1,160	875	775	875	1,320	1,160
8	1,410	3,560	16,600	3,950	1,160	1,690	3,280	975	685	875	1,200	1,160
9	1,280	3,180	9,420	4,150	1,160	1,840	1,840	975	685	875	1,200	1,040
10	1,160	2,470	7,380	3,950	1,160	3,180	1,840	975	975	875	1,200	1,040
11	1,160	1,840	6,150	3,370	1,280	3,120	1,550	1,740	775	875	1,200	1,040
12	1,280	1,690	4,560	3,180	1,160	3,060	1,320	1,200	685	1,080	1,200	1,040
13	1,410	1,550	3,950	3,000	930	3,000	1,320	975	685	1,320	1,200	1,040
14	1,410	1,410	3,560	2,820	930	2,420	1,140	975	925	1,320	2,040	930
15	1,280	1,410	3,370	2,470	1,310	1,840	975	1,080	2,520	1,320	2,040	1,040

[a] Canal in operation May 21 to Oct. 11, 1903, during which period 45 second-feet was added to the daily discharge.

[b] Forty-five second-feet added to the daily discharge July 12 to Nov. 28, 1904, while the canal was in operation. Daily discharge interpolated for days when the gage was not read.

Daily discharge, in second-feet, of Lehigh River at South Bethlehem, Pa., for 1902–1905 and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.[a]												
16	1,160	1,410	3,180	2,300	1,690	1,690	825	975	2,860	1,200	1,880	1,040
17	1,040	1,280	2,820	2,140	1,410	1,550	775	875	2,040	1,200	1,600	930
18	930	1,280	2,820	1,990	1,280	1,280	975	875	1,460	1,080	1,460	930
19	930	1,160	2,640	1,840	1,280	1,160	1,320	775	1,460	975	1,460	1,040
20	1,280	1,160	3,950	1,840	1,280	1,040	1,200	975	1,320	975	1,320	1,040
21	930	1,160	3,950	1,840	1,160	1,040	775	1,960	1,200	1,080	2,040	1,040
22	1,410	9,240	3,750	1,840	1,160	1,040	775	1,600	1,200	8,680	1,880	830
23	8,900	4,660	3,950	1,690	1,040	1,040	685	1,740	1,080	4,820	1,880	930
24	6,390	3,950	4,150	1,690	1,040	930	875	1,460	1,080	3,600	1,740	1,160
25	3,660	3,560	4,770	1,550	1,040	930	975	1,200	875	3,040	1,600	1,160
26	3,000	2,140	6,150	1,550	1,160	930	1,200	1,080	875	2,680	1,460	1,410
27	2,820	2,060	5,670	1,690	1,280	830	2,680	975	875	2,340	1,460	1,280
28	2,140	1,840	5,210	1,990	1,160	730	2,040	875	875	2,040	1,460	2,470
29	2,140	2,140	3,950	1,990	930	880	1,740	875	875	1,880	1,410	4,150
30	1,990	....	3,560	1,840	930	1,160	1,460	875	1,080	1,740	1,410	2,640
31	1,840	....	3,560	....	1,410	....	1,200	775	....	1,600	....	2,300

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1905.			1905.			1905.		
1	2,470	1,550	11	4,770	1,280	21	2,640	....
2	2,470	1,410	12	4,560	1,280	22	2,300	....
3	2,470	1,280	13	4,150	1,280	23	2,140	....
4	2,470	1,280	14	3,750	....	24	1,840	....
5	2,300	1,280	15	3,180	....	25	1,550	....
6	2,300	1,280	16	3,000	....	26	1,040	....
7	19,600	1,280	17	2,820	....	27	2,300	....
8	12,900	1,280	18	2,820	....	28	1,990	....
9	7,630	1,280	19	2,640	....	29	1,840	....
10	6,390	1,280	20	2,640	....	30	1,690	....
						31	1,690	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.[b]									
1	....	8,380	1,280	1,030	560	365	417	444	500
2	....	9,540	1,160	900	643	398	365	378	486
3	....	7,880	1,350	788	618	323	341	391	479
4	....	7,120	1,230	769	592	266	417	417	472
5	....	6,050	1,390	816	530	404	391	378	458
6	....	5,130	1,720	809	472	391	335	391	515
7	....	4,430	1,920	760	472	404	391	305	458
8	....	4,070	1,570	789	508	300	365	430	479
9	....	3,520	1,480	714	486	311	323	404	486
10	....	3,430	1,610	609	479	465	278	404	384
11	....	4,430	1,450	575	472	500	372	417	365
12	....	3,620	1,360	600	410	465	575	398	250
13	....	3,040	1,250	538	465	493	778	335	500
14	....	2,840	1,360	592	444	451	575	278	9,000
15	....	2,600	1,340	618	404	391	500	317	4,090
16	....	2,460	1,290	905	575	365	384	391	2,620
17	....	2,310	1,230	798	568	696	294	323	1,830
18	....	1,960	2,090	741	626	618	500	329	1,650
19	....	1,860	2,140	678	592	451	411	372	1,220
20	....	1,790	1,880	552	545	530	378	378	1,150
21	....	1,670	1,680	592	472	444	417	294	933
22	....	1,850	1,430	592	341	451	384	391	933
23	....	1,710	1,240	978	437	398	329	384	922
24	....	1,650	1,170	1,590	451	472	347	335	840
25	....	1,590	1,170	1,180	444	626	626	353	820
26	4,260	1,500	1,140	1,040	444	465	530	323	696
27	3,920	1,500	1,120	845	347	538	530	384	772
28	3,540	1,680	1,100	769	305	458	472	398	714
29	3,360	1,630	1,090	798	365	465	437	430	687
30	7,180	1,420	1,120	741	410	430	372	341	624
31	....	1,380	....	634	341	....	300	....	714

[a] Forty-five second-feet added to the daily discharge July 12 to Nov. 28, 1904, while the canal was in operation. Daily discharge interpolated for days when the gage was not read.
[b] Forty-five second-feet added to the daily discharge Apr. 26 to Dec. 16, 1909, while the canal was in operation.

Monthly discharge of Lehigh River at South Bethlehem, Pa., for 1902–1905 and 1909.

[Drainage area, 1,235 square miles.]

Month.	Discharge, in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1902.						
Sept. 22-30	15,400	955	6,650	5.38	1.80	B.
October	8,900	1,980	4,810	3.90	4.50	B.
November	3,360	1,470	1,940	1.57	1.75	B.
December	26,800	1,100	4,710	3.81	4.39	B.
1903.						
January	6,270	1,410	2,990	2.42	2.79	B.
February	17,300	2,140	4,160	3.37	3.51	B.
March	20,100	1,040	5,590	4.53	5.22	B.
April	9,160	1,990	4,300	3.48	3.88	B.
May	1,840	775	1,200	.972	1.12	A.
June	4,000	605	1,960	1.59	1.77	A.
July	3,790	975	1,970	1.60	1.84	A.
August	4,820	1,080	2,070	1.68	1.94	A.
September	3,040	975	1,590	1.29	1.44	A.
October	25,800	975	3,720	3.01	3.47	B.
November	3,180	830	1,330	1.08	1.20	A.
December	8,380	930	1,870	1.51	1.74	A.
The year	25,800	605	2,720	2.20	29.92	
1904.						
January	8,900	930	1,940	1.57	1.81	B.
February	9,240	1,160	2,220	1.80	1.94	B.
March	20,000	2,140	5,040	4.08	4.70	B.
April	9,810	1,550	3,270	2.65	2.96	B.
May	1,690	930	1,240	1.00	1.15	A.
June	3,180	730	1,600	1.30	1.45	A.
July	3,280	640	1,270	1.03	1.19	A.
August	1,960	775	1,110	.899	1.04	A.
September	2,860	685	1,080	.875	.98	A.
October	8,680	875	1,730	1.40	1.61	A.
November	2,040	1,200	1,500	1.21	1.35	A.
December	4,150	830	1,320	1.07	1.23	A.
The year	20,000	685	1,950	1.58	21.41	
1905.						
January	19,600	1,040	3,750	3.04	3.50	B.
Feb. 1-13	1,550	1,280	1,310	1.06	.51	B.
1909.						
Apr. 26-30	7,180	3,360	4,450	3.60	.67	A.
May	9,540	1,380	3,360	2.72	3.14	A.
June	1,920	1,090	1,410	1.14	1.27	A.
July	1,590	552	785	.636	.73	A.
August	643	305	478	.387	.45	A.
September	696	266	444	.360	.40	A.
October	626	300	424	.343	.40	A.
November	444	278	370	.300	.33	A.
December	9,000	250	1,170	.947	1.09	A.

LEHIGH RIVER AT EASTON, PA.

The following table of daily discharges formed a part of a thesis entitled "Gagings of the flow of the Lehigh River" by students in civil engineering, Lafayette College, Easton, Pa., and have been furnished for publication by Prof. William T. Lyle, of the college. The bulk of the work was done with a Price meter, and the check as made by a Haskell meter was very close. The daily discharges were obtained by means of a hydrograph.

Daily discharge, in second-feet, of Lehigh River at Easton, Pa., for 1909.

Day.	Feb.	Mar.	Apr.	May.	Day.	Feb.	Mar.	Apr.	May.
1		5,400	3,700	8,400	16	8,100	3,500	6,700	2,900
2		5,100	3,700	8,400	17	14,200	3,400	6,100	2,900
3		4,700	3,500	8,300	18	8,500	3,000	5,200	2,600
4		4,500	3,400	7,900	19	6,700	2,900	4,400	2,500
5		3,800	3,400	6,600	20	14,800	3,000	4,400	2,300
6		3,700	3,200	8,300	21	11,700	2,900	5,000	2,300
7		3,800	3,200	5,100	22	8,600	2,700	5,300	2,500
8		3,800	3,000	7,000	23	6,800	2,500	5,000	2,300
9		3,700	2,900	5,600	24	13,400	2,300	5,400	2,100
10		3,600	2,700	4,100	25	12,500	3,700	5,200	2,100
11		5,700	2,300	5,100	26	8,400	7,300	5,100	2,100
12		4,600	2,100	3,900	27	4,100	5,400	4,600	2,100
13		4,300	2,100	3,800	28	6,200	4,900	4,500	2,500
14		4,100	6,600	3,300	29		4,500	4,000	
15	4,800	3,800	7,700	2,900	30		4,300	8,300	
					31		4,100		

TOHICKON CREEK AT POINT PLEASANT, PA.

Tohickon Creek rises in the western part of Bucks County, Pa., and flows eastward into the Delaware at Point Pleasant. Its drainage area comprises about 102 square miles, the greater part being farm land under a high degree of cultivation, the original forest cover having been almost entirely cut away. The stream is subject to very sudden freshets, and during heavy rains large quantities of surface soil are eroded.

The gaging station is located about one-eighth mile above the mouth of the creek, and the records show the discharge of practically the entire drainage area. The fall of the stream from its source to the gaging station is about 600 feet in 28 miles. Continuous records of flow have been obtained each year since 1883, with the exception of 1900, by the Philadelphia bureau of water, department of public works, under the personal supervision of John E. Codman, by whom the following data have been furnished.

An automatic gage is used to obtain a continuous record of gage height. The lower part of the rating curve has been developed from the computed discharge over a weir, and the discharge at high stages is determined from a curve developed from current-meter measurements. The rating curve is well defined.

Daily discharge, in second-feet, of Tohickon Creek at Point Pleasant, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	42.3	56.5	102.5	86.9	367.5	28.7	9.0	4.5	2.3	3.2	3.6	26.0
2	39.6	48.7	338.7	62.4	432.5	30.7	11.7	4.2	2.5	2.7	7.9	18.4
3	32.6	48.7	302.5	64.5	258.5	27.2	12.7	3.7	2.1	2.5	9.3	15.7
4	34.6	48.7	216.0	67.6	134.0	25.2	8.4	5.2	1.8	2.6	5.9	11.7
5	1,422.8	53.4	122.0	56.5	90.3	29.8	6.3	6.8	1.8	2.7	6.9	7.9
6	2,383.5	64.6	115.5	46.8	72.9	34.0	7.1	2.9	2.3	2.6	6.8	7.9
7	495.0	89.0	130.0	45.0	97.6	34.8	6.3	4.4	2.5	5.9	5.1	9.0
8	124.5	82.5	358.5	44.5	142.5	26.8	6.2	3.2	2.2	4.3	7.0	9.0
9	97.6	53.4	610.5	36.0	119.5	24.6	6.5	2.7	2.3	3.0	7.3	9.0
10	58.7	872.9	787.5	24.7	79.5	27.4	5.9	2.4	2.4	2.5	5.4	9.0

Daily discharge, in second-feet, of Tohickon Creek at Point Pleasant, Pa., for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	58.7	810.0	600.0	23.9	85.5	29.7	4.7	2.0	2.8	2.6	6.5	9.0
12	56.5	201.0	106.0	23.6	76.9	28.3	3.6	2.7	2.9	3.8	11.7	7.0
13	46.3	156.0	150.0	27.2	51.9	24.6	3.9	3.1	2.8	6.0	10.8	793.3
14	44.0	86.4	176.5	513.4	46.0	24.6	4.2	2.6	2.7	5.2	4.5	2,823.5
15	46.3	393.0	145.5	1,247.0	37.8	24.6	4.2	2.6	2.6	2.7	3.6	388.0
16	53.4	1,375.5	91.2	374.5	30.2	21.4	5.0	4.3	2.6	2.2	5.1	142.0
17	72.5	1,145.0	66.8	154.0	30.2	18.3	9.0	8.2	2.3	2.4	8.1	79.0
18	87.0	287.5	54.1	102.7	30.6	488.0	9.1	7.2	2.4	2.4	8.0	66.4
19	87.0	398.5	49.0	79.2	30.6	139.7	6.1	4.3	5.5	2.6	9.1	47.0
20	87.0	1,140.5	33.5	1,108.5	23.7	63.6	5.1	4.4	3.4	3.1	7.0	30.1
21	87.0	2,038.0	35.9	981.5	20.0	40.4	5.4	6.0	2.7	6.3	3.7	30.1
22	72.5	261.5	43.8	846.0	70.5	28.4	5.9	6.4	3.3	3.8	3.0	31.1
23	106.0	639.5	39.0	578.5	163.5	25.3	10.3	4.1	2.8	3.6	10.4	30.1
24	335.5	3,047.5	39.0	432.5	74.3	25.3	11.5	3.4	2.6	6.8	6.5	26.6
25	579.5	1,392.0	620.7	198.5	52.6	20.7	10.9	2.9	2.5	3.7	22.5	21.4
26	470.0	306.5	810.0	114.5	40.1	67.4	7.0	2.7	2.5	2.7	34.1	18.3
27	241.0	162.0	220.0	85.5	34.8	112.5	9.0	2.8	2.6	5.2	16.3	14.5
28	135.5	127.5	198.5	77.0	107.0	61.9	7.1	3.9	2.4	5.2	28.3	12.2
29	72.6		193.0	79.3	126.7	14.5	4.9	4.6	5.6	3.2	34.7	13.3
30	58.1		224.5	724.0	60.8	10.6	5.6	3.4	6.3	4.4	37.1	14.5
31	61.2		112.5		41.8		5.7	2.4		4.3		13.3

Monthly discharge of Tohickon Creek at Point Pleasant, Pa., for 1909.

[Drainage area, 102 square miles.]

Month.	Discharge, in second-feet.				Run-off (depth in inches on drainage area.)
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,380	32.6	245	2.40	2.77
February	3,050	48.7	550	5.39	5.61
March	810	33.5	229	2.25	2.59
April	1,250	23.6	277	2.72	3.04
May	432	20.0	97.8	.959	1.11
June	488	10.6	52.0	.510	.57
July	12.7	3.6	7.04	.069	.08
August	8.2	2.0	4.00	.039	.C4
September	6.3	1.8	2.85	.028	.03
October	6.8	2.2	3.68	.036	.04
November	37.1	3.0	11.2	.110	.12
December	2,820	7.0	153	1.50	1.73
The year	3,050	1.8	136	1.33	17.73

NESHAMINY CREEK BELOW FORKS, PENNSYLVANIA.

Neshaminy Creek rises in the eastern part of Montgomery County, Pa., flows in a southeasterly and southerly course, and enters Delaware River at a point about 12 miles above Philadelphia. The drainage area, measured at the forks of the Big and Little Neshaminy, is 139 square miles, mostly farm land in a high state of cultivation, the original forest growth having been almost entirely cut away. The stream is subject to very sudden freshets, and during heavy rains large quantities of surface soil are eroded.

Continuous records of discharge have been obtained since 1884 by the Philadelphia bureau of water, department of public works, under the personal supervision of John E. Codman, by whom the records have been furnished. The station is located a short distance below the junction of Big and Little Neshaminy creeks, and the discharge represents about one-half of the total drainage area of the stream. The fall of the stream from its source to the gaging station is about 600 feet in 27 miles.

An automatic gage is used to obtain a continuous record of gage height. The lower part of the rating curve has been developed from the computed discharge over a weir, and the discharge at high stages is determined from a curve developed from current-meter measurements. The rating curve is well defined.

Daily discharge, in second-feet, of Neshaminy Creek, below forks, Pennsylvania, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	186.0	72.0	272.5	169.0	817.0	53.0	23.0	14.0	11.2	11.0	9.5	18.0
2	134.5	72.0	597.0	141.0	673.3	74.0	18.2	13.0	13.5	11.0	11.7	18.0
3	115.0	72.0	442.1	140.0	310.5	84.0	14.5	12.5	11.7	11.0	14.0	18.0
4	105.0	98.5	334.5	136.5	235.0	77.5	14.5	12.7	9.5	10.5	14.0	11.5
5	1,178.6	139.5	331.0	126.0	203.0	82.0	17.5	12.7	9.0	10.0	12.6	12.0
6	1,752 0	102.0	286.5	119.0	182.5	76.0	19.2	12 2	9.0	9.5	11.7	12.7
7	333.5	88.5	286.5	110.5	147.0	61.5	18.0	12.0	8.5	9.5	11.0	17.5
8	184.5	118.0	523.0	95.0	206.5	50.0	15.5	12.5	8.0	10.0	11.0	15.5
9	171.0	104.5	706.0	89.0	172.5	50.5	15.5	11.5	8.5	9.3	12.0	15.0
10	164.0	1,021.5	662.5	82.5	199.5	57.5	17.5	10.5	11.5	9.0	12.2	15.0
11	164.0	1,599.0	445.0	75.0	202.5	63.0	17.0	10.7	13.5	9.8	10.0	15.0
12	164.0	233.2	253.5	78.0	142.5	57.0	13.7	10.5	12.5	8.1	10.2	14.2
13	134.5	179.5	325.0	85.5	117.0	61.0	13.0	10.0	11.7	9.2	12.6	849.9
14	116.5	200.5	366.0	650.6	102.5	147.2	14.5	9.5	10.7	11.0	12.5	1,713.3
15	146.0	307.5	270.0	1,224.0	96.0	498.3	15.2	10.2	10.3	9.5	12.2	233.0
16	164.0	901.0	209.0	350.0	89.5	105.0	17.0	97.5	10.5	9.3	12.5	112.5
17	233.5	773 5	183.0	216.5	82.0	80 0	16.2	119.5	10.5	9.7	13.3	81.0
18	287.0	300 5	167.0	178.0	78.0	132.5	14.7	47.5	10.0	10.3	13.2	81.0
19	242 0	422 0	169.5	161.0	73.5	105.0	15.0	24.5	10.3	10.3	11.0	81.0
20	213.0	1,489.0	171.5	565.8	67.0	58.0	15.0	18.0	10.3	10.3	11.5	67.5
21	194.0	380.5	154.0	684.7	83.5	45.0	15.0	16.0	9.3	11.7	10.2	43.0
22	159.5	280.0	134.0	997.8	84.5	39 5	15.0	13.5	9.7	11.2	10.0	32 0
23	284 5	1,112.3	128.0	542.0	241.0	37.0	28.0	13.0	9.1	11.2	12.3	32.0
24	499.5	3,759.2	124.5	555.5	110.5	34.0	41.0	13 0	11.3	12.5	29.2	32.0
25	516 0	1,425.0	673.7	279.0	83.0	32.5	33.5	12.2	17.0	9.9	63.5	34.0
26	339 5	284.5	455.2	227.0	65.0	30 0	19.7	12.0	16.5	8.9	77.5	57.5
27	204.5	200.5	243.5	145.0	82.5	31.0	24.2	11.5	13.5	8.7	55.0	75.5
28	188 0	333.5	267.5	183.0	144.8	32 5	26.5	10.2	12 5	8.8	32.0	76.5
29	155 5	....	259.0	199 5	166.0	29.5	16.5	10.0	12 3	10.0	22 0	75.5
30	92 5	....	212 0	1,398.0	76.0	26.0	14.5	9.2	11.2	8.7	18.0	75.5
31	72 0	....	212.0	....	59.0	......	14.5	8.7	......	8.8	......	81.0

Monthly discharge of Neshaminy Creek, below forks, Pennsylvania, for 1909.

[Drainage area, 139 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	1,750	72.0	287	2.06	2.38
February	3,760	72.0	574	4.13	4.30
March	706	124	318	2.29	2.64
April	1,400	75.0	333	2.40	2.68
May	817	59.0	174	1.25	1.44
June	498	26.0	77.0	.554	.62
July	41.0	13.0	18.5	.133	.15
August	120	8.7	19.7	.142	.16
September	17.0	8.0	11.1	.080	.09
October	12.5	8.1	9.96	.072	.08
November	77.5	9.5	18.9	.136	.15
December	1,710	11.5	130	.935	1.08
The year	3,760	8.0	164	1.18	15.77

SCHUYLKILL RIVER NEAR PHILADELPHIA, PA.

Schuylkill River rises in the central part of Schuylkill County, Pa., flows southeastward, and unites with the Delaware at Philadelphia. Its length is about 100 miles and its drainage area measures about 1,920 square miles. The headwaters of the river lie in a mountainous, coal-bearing region, but 25 or 30 miles below its source it enters a more highly cultivated country and the slope becomes more gentle. There are no lakes in the basin, but there are three artificial reservoirs (Silver Creek and Lower and Upper Tumbling Run reservoirs) constructed for the benefit of navigation. The flow of the river is tolerably constant, but the freshets, notwithstanding the considerable storage, are severe. The Schuylkill is navigable for ocean-going vessels only as far as Fairmount, 8.4 miles from the mouth, where the first dam is built across the river. Above that point it is navigable for river boats as far as Schuylkill Haven.

With the exception of a small amount of water drawn from the Delaware, the entire water supply for the city of Philadelphia comes from the Schuylkill. The river receives a large amount of pollution from various sources, and a filtering plant for the city has been nearly completed.

Records of the height of the river at Fairmount Pool have been kept for many years, but not in such form as to be useful for the computation of daily discharges. Beginning with 1898, however, careful estimates have been prepared by the Philadelphia bureau of water, department of public works, under the personal supervision of John E. Codman, by whom the records have been furnished. The station is located at the Fairmount dam near Philadelphia.

The computed daily discharges represent the total flow of the river as determined from the amount wasted over the flashboards at the Fairmount dam, the pumpage from the river, the leakage, and the quantity used for power at Fairmount.

Daily discharge, in second-feet, of Schuylkill Creek near Philadelphia, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,031	757	3,593	2,854	6,824	652	192	177	210	226	196	220
2	1,031	739	3,827	2,503	7,669	560	192	177	210	226	226	199
3	1,031	737	3,722	2,152	5,714	490	192	177	210	226	226	196
4	1,058	729	2,853	2,152	4,405	490	192	177	210	226	196	188
5	1,345	730	2,498	1,976	3,763	799	192	177	210	226	226	188
6	11,617	754	2,250	1,896	3,118	929	192	177	210	226	226	199
7	5,219	1,201	2,104	1,640	3,587	778	192	177	210	226	196	188
8	2,857	1,257	2,775	1,602	3,587	560	192	177	210	226	196	188
9	1,986	946	3,607	1,059	2,400	690	192	177	210	226	196	188
10	1,801	2,543	4,249	996	2,038	490	192	177	210	226	196	188
11	1,479	6,975	4,670	933	2,038	820	192	177	210	226	226	188
12	1,443	4,720	2,958	805	2,212	690	192	177	210	226	226	188
13	1,250	3,026	2,648	805	2,038	690	192	177	210	226	196	837
14	1,168	2,833	2,648	1,949	1,701	560	192	177	210	226	196	15,448
15	1,083	3,136	2,467	5,356	1,394	490	192	177	210	291	196	6,680
16	1,089	4,602	2,064	4,352	1,320	490	192	177	210	226	196	5,061
17	1,089	9,176	1,882	2,613	1,250	458	192	204	297	226	196	1,442
18	1,089	7,353	1,625	2,543	1,056	1,268	192	177	210	226	196	956
19	1,089	5,458	1,405	2,160	934	1,268	192	177	309	226	226	736
20	1,089	9,501	1,238	3,071	844	743	192	177	210	226	196	531
21	1,089	7,523	1,238	6,379	824	512	192	177	210	226	196	531
22	1,089	5,243	1,238	5,562	1,546	490	192	177	210	226	196	564
23	1,035	7,679	1,238	4,689	1,876	490	192	177	210	226	192	531
24	1,326	15,998	1,166	4,524	1,395	431	192	177	210	226	226	531
25	2,053	16,179	2,798	3,814	1,065	380	192	177	210	226	196	478
26	2,596	9,479	6,133	3,364	831	351	388	177	210	226	371	376
27	2,436	7,079	4,618	2,946	644	351	205	177	210	254	226	333
28	2,003	5,333	3,819	2,340	1,681	490	192	177	210	226	221	333
29	1,578	....	3,278	1,791	2,064	643	192	177	210	226	539	333
30	1,384	....	2,836	4,905	1,216	458	192	177	210	279	371	333
31	1,222	....	2,742	....	785	....	192	177	......	226	......	333

NOTE.—Several consecutive days of constant values of discharge do not mean that there was no variation in flow, but that the discharge was computed by periods of several days and the total distributed uniformly. The variation during these periods was relatively small.

Monthly discharge of Schuylkill River near Philadelphia, Pa., for 1909.

[Drainage area, 1,920 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	11,600	1,030	1,890	0.984	1.13
February	16,200	729	5,060	2.64	2.75
March	6,130	1,170	2,780	1.45	1.67
April	6,380	805	2,790	1.45	1.63
May	7,670	644	2,320	1.21	1.40
June	1,270	351	617	.321	.36
July	388	192	199	.104	.12
August	204	177	178	.093	.11
September	309	210	216	.112	.12
October	291	226	231	.120	.14
November	539	196	229	.119	.13
December	15,400	188	1,240	.646	.74
The year	16,200	177	1,480	.771	10.30

PERKIOMEN CREEK NEAR FREDERICK, PA.

Perkiomen Creek rises in the western part of Bucks County, Pa., flows southward, and discharges into the Schuylkill about 7 miles above Norristown and 18 miles above Philadelphia. Its drainage area comprises about 345 square miles. The area is mostly in farm land under a high state of cultivation, the original forest growth having been almost entirely cut away. The stream is subject to very sudden freshets, and during heavy rains large quantities of surface soil are eroded.

Continuous records of discharge have been obtained since 1884 by the Philadelphia bureau of water, department of public works, under the personal supervision of John E. Codman, by whom the following records have been furnished. The station is located about 12 miles above the mouth of the creek and above the East Branch, and the discharge represents about one-third of the total area drained by the stream. The fall of the creek from its source to the gaging station is about 800 feet in 24 miles.

An automatic gage is used to obtain a continuous record of gage height. The lower part of the rating curve has been developed from the computed discharge over a weir, and the discharge at high stages is determined from a curve developed from current-meter measurements. The rating curve is well defined.

Daily discharge, in second-feet, of Perkiomen Creek near Frederick, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	66.5	101.0	242.5	191.5	703.5	86.5	53.0	23.3	18.2	21.8	20.0	64.0
2	58.0	76.0	418.1	158.0	632.0	75.5	48.5	25.4	26.3	24.0	28.6	49.3
3	54.3	61.1	366.6	155.0	333.5	73.5	36.7	27.7	45.8	19.8	21.9	49.3
4	58.8	52.5	292.5	152.5	406.0	81.0	36.7	30.0	40.6	16.8	52.0	44.5
5	1,318.7	62.8	245.1	138.5	352.5	99.0	56.3	30.9	24.3	16.8	34.9	22.7
6	2,027.7	177.0	263.0	129.0	188.0	110.0	69.0	27.7	13.5	19.8	40.7	28.1
7	366.0	206.5	275.5	127.0	192.0	99.0	42.1	20.3	13.9	28.8	26.5	34.0
8	157.8	122.5	376.2	117.5	240.8	82.0	21.8	16.5	12.0	25.8	21.6	24.1
9	153.0	103.5	687.0	94.0	198.5	88.0	47.1	21.6	10.2	21.2	24.7	33.9
10	119.5	1,119.3	973.0	88.5	204.0	108.5	27.4	28.6	12.0	21.9	19.1	36.1
11	119.5	642.0	734.3	87.5	281.0	104.0	28.7	28.6	12.1	21.9	17.6	30.9
12	128.0	303.0	357.0	90.5	188.5	85.5	24.1	25.8	10.9	20.1	26.5	28.7
13	108.0	222.0	320.0	97.5	137.5	78.0	26.3	21.1	17.6	15.7	31.8	1,460.0
14	95.0	322.0	320.0	771.3	123.0	83.5	21.2	22.5	30.0	24.2	17.8	3,181.2
15	100.0	404.7	265.5	839.8	113.5	82.5	25.8	25.0	35.5	37.3	32.8	325.0
16	102.5	1,112.7	205.0	365.5	100.5	81.0	33.2	18.3	28.7	37.7	42.1	154.5
17	90.0	1,040.2	186.0	233.0	91.0	89.5	27.6	16.2	19.8	29.9	26.3	86.5
18	95.5	387.0	158.0	191.0	87.0	185.5	42.1	38.2	17.6	26.3	26.3	67.0
19	123.7	301.0	143.0	176.0	81.5	130.0	42.1	29.8	15.7	19.2	26.3	58.8
20	50.3	1,808.7	168.0	676.7	77.0	75.0	26.3	30.8	15.7	12.8	36.1	37.4
21	48.8	470.0	143.0	835.2	108.5	51.9	36.0	21.5	19.8	15.5	30.9	22.8
22	57.9	320.5	123.0	866.5	297.3	51.9	38.3	30.0	22.0	24.1	35.5	26.3
23	97.5	750.2	111.5	616.2	184.5	56.1	27.6	23.5	17.9	41.5	26.5	26.3
24	261.5	3,371.5	112.5	559.0	151.0	51.9	26.3	13.9	29.8	31.6	26.5	26.3
25	600.2	1,173.5	1,072.3	316.5	108.0	48.8	40.3	10.1	39.1	31.6	49.8	55.0
26	435.0	418.0	654.6	249.5	86.0	44.4	38.1	13.2	27.3	49.5	58.5	157.0
27	262.3	348.0	333.5	212.0	90.5	43.2	36.7	26.5	24.1	38.8	63.5	60.6
28	175.3	283.0	404.5	211.0	593.7	51.9	32.7	30.0	23.2	33.6	43.1	47.8
29	138.3	....	315.5	221.5	236.5	50.8	32.7	21.1	49.6	39.6	69.4	75.0
30	123.0	....	261.5	997.5	141.0	51.8	33.2	13.9	27.1	32.3	82.0	83.5
31	118.0	....	243.5	......	104.0	......	27.8	10.2	......	10.0	......	64.0

Monthly discharge of Perkiomen Creek near Frederick, Pa., for 1909.

[Drainage area, 152 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,030	48.8	249	1.64	1.89
February	3,370	52.5	563	3.70	3.85
March	1,070	112	347	2.28	2.63
April	998	87.5	332	2.18	2.43
May	704	77.0	220	1.45	1.67
June	186	43.2	80.0	.526	.59
July	69.0	21.2	35.7	.235	.27
August	38.2	10.1	23.3	.153	.18
September	49.6	10.2	23.3	.153	.17
October	49.5	10.0	26.1	.172	.20
November	82.0	17.6	35.3	.232	.26
December	3,180	22.7	208	1.37	1.58
The year	3,370	10.0	179	1.17	15.72

SUSQUEHANNA RIVER DRAINAGE BASIN.

DESCRIPTION.

Susquehanna River rises in Otsego Lake, in northern Otsego County, N. Y., at an elevation of 1,193 feet above tide, and flows in a general southerly direction into Chesapeake Bay. Its course is in many places extremely tortuous, crossing the State boundary between New York and Pennsylvania three times. The entire length of the river is about 500 miles, and it drains an area of 27,400 square miles, of which 21,060 square miles lie in Pennsylvania, 6,080 in New York, and 260 in Maryland.

The topography of the basin varies widely in character. In New York the stream and its tributaries flow through a rolling and in places rather broken country, bounded on the north by a mountainous area. In this part of its course its bed is of gravel or sand, with occasional rock ledges, and its banks are moderately high and not extensively subject to overflow. In Pennsylvania the river enters a mountain region, its banks are high, and it winds and twists among the parallel ranges in a bed composed generally of drift materials, gravels, sand, and bowlders. In the lower part of its course, from Marietta to Havre de Grace, it occupies a broad, deep valley, ranging in width from a few hundred feet to more than a mile, and is for the most part bounded on either shore by rocky bluffs and table-lands elevated from 100 to 500 feet above its waters.

Above the mouth of the West Branch the fall of the stream is uniform and gradual; below that point the fall becomes more irregular, and there are at many places rapids where the stream flows over a rocky bottom. The elevation of the river at the mouth of the West Branch is 400 feet above mean sea level at Havre de Grace, the distance between the two points being 125 miles. The slope is, however, extremely variable.

The fall in the lower part of the river offers exceptional opportunities for power developments, the value of which is greatly enhanced by their proximity to an unlimited market in the adjacent large cities. The hydrographic investigations of the Geological Survey along Susquehanna River have been of great assistance to engineers in investigating these powers.

In early days a complete system of canals was built along the river from the New York State line to the bay, but these have been abandoned with the establishment of railroads. The head of navigation is at the fall line, near the mouth of the stream, but various stretches are navigable for flatboats.

All available hydrographic data for Susquehanna River basin prior to 1905 have been collected and published in Water-Supply Papers 108 and 109. No. 108 treats principally of the quality of the water, and No. 109 gives in detail information relative to fluctuations in stage and quantity of water flowing.

SUSQUEHANNA RIVER AT BINGHAMTON, N. Y.

This station, which is located on the Washington Street Bridge at Binghamton, was established July 31, 1901, and has since been maintained in cooperation with the New York State engineer department.

No important tributary enters Susquehanna River between the gauging station and the mouth of Unadilla River, about 50 miles upstream. Chenango River enters about 800 feet downstream, and causes backwater at high stages.

The Binghamton water-power dam is situated 2,800 feet upstream from the bridge, being a timber dam of 6-foot head.

The datum of the chain gage attached to the Washington Street Bridge has remained the same during the maintenance of the station. On account of the unfavorable conditions at the Washington Street Bridge discharge measurements have usually been made at the Exchange Street Bridge, 1,900 feet upstream. During the winter months the discharge is usually but little affected by ice. The rating curve for low and medium stages is fairly well developed. High-water measurements are liable to considerable error due to backwater from ice jams which form near Willow Point and also from high water in the Chenango.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

The following discharge measurement was made by C. C. Covert:

August 20, 1909: Width, 438 feet; area, 497 square feet; gage height, 2.43 feet; discharge, 1,640 second-feet.

Daily gage height, in feet, of Susquehanna River at Binghamton, N. Y., for 1909.

[H. L. Smith, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	2.75	5.2	5.05	7.65	2.6	2.3	2.0	1.9	1.8	1.95	2.0
2	2.05	3.15	4.65	5.1	8.75	2.45	2.2	2.05	1.9	1.85	2.0	2.1
3	2.1	3.0	4.5	5.6	7.0	2.4	2.2	2.1	1.9	1.8	2.0	2.15
4	2.3	3.0	4.45	5.7	7.45	2.4	2.2	2.05	1.9	1.85	1.95	2.1
5	3.65	2.95	3.95	5.55	7.0	2.5	2.2	2.05	1.9	1.9	2.0	2.1
6	8.4	4.7	3.4	5.3	6.05	3.15	2.1	2.05	1.85	1.8	2.0	2.1
7	7.05	6.6	3.65	5.9	6.45	3.02	2.0	2.0	1.95	1.8	1.85	2.1
8	4.85	5.7	3.52	6.55	5.8	2.75	2.1	1.9	1.88	1.8	2.0	2.1
9	3.58	4.3	3.42	6.1	5.3	2.6	2.15	2.0	1.85	1.8	2.0	2.1
10	3.4	3.75	5.0	5.25	4.6	2.55	2.15	2.0	1.9	1.8	2.05	2.2
11	3.4	4.65	7.65	4.85	5.85	3.95	2.1	2.0	1.95	1.9	1.95	2.1
12	3.2	4.3	6.8	4.35	6.02	3.25	2.0	1.9	1.85	1.85	1.9	2.0
13	2.8	4.0	5.2	4.05	5.0	3.0	2.0	1.85	1.95	2.0	1.9	2.1
14	2.6	3.92	4.9	6.0	4.45	3.7	1.95	1.95	2.0	1.85	1.85	2.25
15	2.75	5.0	4.4	9.7	4.7	3.6	2.0	1.85	1.9	1.85	1.85	2.3
16	3.05	6.2	3.95	8.8	4.4	3.2	2.0	1.9	1.9	1.8	1.95	2.5
17	3.0	7.55	3.7	7.3	4.12	2.8	2.0	1.95	1.9	1.8	1.9	2.3
18	2.6	6.2	3.45	6.4	4.3	3.5	2.15	2.1	1.95	1.8	2.0	2.4
19	2.5	4.8	3.4	5.55	3.9	3.3	2.1	2.5	1.85	1.9	1.95	2.2
20	2.6	11.95	3.2	5.3	3.6	3.1	2.1	2.4	1.85	1.8	1.95	2.1
21	2.58	12.35	3.2	5.05	3.4	2.8	2.0	2.35	1.95	1.8	1.8	2.4
22	2.7	10.0	2.95	4.9	3.2	2.7	2.0	2.2	1.85	1.85	1.9	2.1
23	2.75	7.05	2.95	4.7	3.1	2.6	2.0	2.15	1.8	1.9	1.95	2.1
24	3.55	8.5	2.85	4.3	3.0	2.5	2.0	2.15	1.9	1.9	2.0	2.1
25	10.6	11.1	3.75	4.0	2.85	2.55	2.1	2.1	1.85	2.0	2.0	2.1
26	9.35	9.9	7.9	3.7	2.75	2.5	2.2	2.1	1.8	2.0	1.95	2.0
27	6.7	7.1	6.85	3.75	2.7	2.7	2.2	2.05	1.8	2.1	2.0	2.05
28	5.0	6.35	6.4	3.6	2.68	2.55	2.2	2.0	1.9	2.1	1.95	2.0
29	4.05	......	6.3	3.5	2.7	2.35	2.2	2.0	1.8	2.0	2.0	2.15
30	3.9	......	5.95	5.6	2.7	2.3	2.15	2.1	1.8	2.0	2.0	2.25
31	3.5	......	5.4	......	2.6	......	2.1	2.0	......	1.9	......	2.15

NOTE.—Gage heights from Jan. 1 to Feb. 6 and Dec. 9 to 31 probably affected by anchor ice more or less.

Daily discharge, in second-feet, of Susquehanna River at Binghamton, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	810	2,450	8,880	8,430	16,800	2,090	1,380	700	500	335	600	700
2	810	3,440	7,320	8,580	20,600	1,730	1,150	810	500	418	700	920
3	920	3,070	6,920	10,100	14,600	1,610	1,150	920	500	335	700	920
4	1,380	3,070	6,780	10,400	16,100	1,610	1,150	810	500	418	600	920
5	4,700	2,940	5,470	9,960	14,600	1,850	1,150	810	500	500	700	1,040
6	19,400	7,460	4,070	9,180	11,600	3,440	920	810	418	335	700	920
7	14,800	13,300	4,700	11,100	12,800	3,120	700	700	600	335	418	920
8	7,860	10,400	4,370	13,200	10,800	2,450	920	500	467	335	700	920
9	4,520	6,380	4,120	11,700	9,180	2,090	1,040	700	418	335	700	800
10	4,070	4,950	8,280	9,030	7,190	1,970	1,040	700	500	335	810	700
11	4,070	7,320	16,800	7,860	10,900	5,470	920	700	600	500	600	700
12	3,570	6,380	14,000	6,520	11,500	3,700	700	500	418	418	500	700
13	2,570	5,600	8,880	5,730	8,280	3,070	700	418	600	700	500	800
14	2,090	5,390	8,000	11,400	6,780	4,820	600	600	700	418	418	1,260
15	2,450	8,280	6,650	24,000	7,460	4,570	700	418	500	418	418	1,380
16	3,200	12,000	5,470	20,800	6,650	3,570	700	500	500	335	600	1,850
17	3,070	16,400	4,820	15,600	5,910	2,570	700	600	500	335	500	1,380
18	2,090	12,000	4,200	12,700	6,380	4,320	1,040	920	600	335	700	1,100
19	1,850	7,730	4,070	9,960	5,340	3,820	920	1,850	418	500	600	1,000
20	2,090	32,100	3,570	9,180	4,570	3,320	920	1,610	418	335	600	920
21	2,040	33,600	3,570	8,430	4,070	2,570	700	1,500	600	335	335	800
22	2,330	25,100	2,940	8,000	3,570	2,330	700	1,150	418	418	500	800
23	2,450	14,800	2,940	7,460	3,320	2,090	700	1,040	335	500	600	700
24	4,440	19,700	2,700	6,380	3,070	1,850	700	1,040	500	500	700	700
25	27,300	29,100	4,950	5,600	2,700	1,970	920	920	418	700	700	600
26	22,800	24,700	17,600	4,820	2,450	1,850	1,150	920	335	700	600	600
27	13,600	14,900	14,100	4,950	2,330	2,330	1,150	810	335	920	700	600
28	8,280	12,500	12,700	4,570	2,280	1,970	1,150	700	500	920	600	600
29	5,730	....	12,400	4,320	2,330	1,500	1,150	700	335	700	700	500
30	5,340	....	11,200	10,100	2,330	1,380	1,040	920	335	700	700	500
31	4,320	....	9,490	....	2,090	....	920	700	....	500	......	500

NOTE.—Daily discharges Jan. 1 to Feb. 6 slightly affected at times by anchor ice. Open-channel rating applied throughout. Discharges Dec. 9 to 31 affected by ice. These have been corrected and verified by intercomparisons with other stations in the Susquehanna drainage. Daily discharges Jan. 1 to Dec. 8 have been obtained from a well-defined rating curve below 6 feet. The upper part of the curve is based on one measurement at 16.3 feet.

Monthly discharge of Susquehanna River at Binghamton, N. Y., for 1909.

[Drainage area, 2,400 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	27,300	810	5,970	2.49	2.87	A.
February	33,600	2,450	12,300	5.12	5.33	A.
March	17,600	2,700	7,480	3.12	3.60	A.
April	24,000	4,320	9,670	4.03	4.50	A.
May	20,600	2,090	7.700	3.21	3.70	A.
June	5,470	1,380	2,700	1.12	1.25	A.
July	1,380	600	928	.387	.45	B.
August	1,850	418	838	.349	.40	B.
September	700	335	476	.198	.22	B.
October	920	335	480	.200	.23	B.
November	810	335	607	.253	.28	B.
December	1,850	500	863	.360	.42	C.
The year	33,600	335	4,170	1.74	23.25	

SUSQUEHANNA RIVER AT WYSOX, PA.

This station, which was established September 2, 1908, by Messrs. Meikleham & Dinsmore, through whose courtesy the records of discharge below are published, is located at the highway bridge about one-half mile from Wysox station, on the Lehigh Valley Railroad, and is just above the junction with Lanning Creek. The bridge spans both Lanning Creek and Susquehanna River, but a point of land separates them for all stages below about 7 feet.

The datum of the steel tape gage attached to the bridge is 682.36 feet above sea level. Conditions of flow are probably permanent. Measuring conditions are good except for extreme low stages, when the current is very sluggish. Low-water measurements are made at a riffle 0.7 mile above the bridge. A good rating curve has been developed.

Discharge measurements of Susquehanna River at Wysox, Pa., in 1909.

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 24	669	5,630	5.75	13,800
May 4	758	8,470	9.38	37,600
June 4	642	4,000	3.40	3,290

Daily gage height, in feet, of Susquehanna River at Wysox, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.69	4.64	7.05	6.95	13.28	3.68	3.15	2.60	2.30	2.25	2.38	2.58
2	2.32	4.08	6.30	6.78	15.78	3.60	3.05	2.50	2.24	2.22	2.37	2.65
3	2.80	3.98	5.95	6.95	11.85	3.48	2.96	2.50	2.20	2.18	2.36	2.68
4	2.82	4.18	5.90	7.14	9.65	3.35	2.94	2.48	2.20	2.17	2.38	2.70
5	2.98	4.22	5.60	7.00	9.10	4.40	2.88	2.48	2.24	2.17	2.40	2.69
6	5.02	4.60	5.10	6.70	8.15	5.50	2.84	2.58	2.22	2.16	2.39	2.60
7	8.60	7.85	5.06	6.98	7.30	5.12	2.76	2.48	2.18	2.15	2.37	2.58
8	6.80	7.75	5.22	7.72	7.38	4.43	2.74	2.36	2.16	2.16	2.34	2.64
9	5.40	6.70	5.10	7.50	6.72	4.09	2.74	2.30	2.18	2.15	2.30	2.38
10	4.78	5.60	5.40	6.92	6.18	4.03	2.72	2.26	2.26	2.14	2.30	2.40
11	4.64	5.60	8.35	6.28	6.10	6.68	2.67	2.24	2.34	2.14	2.29	2.51
12	4.55	5.55	8.45	5.85	6.80	5.58	2.58	2.22	2.32	2.36	2.27	2.63
13	4.02	5.46	7.25	5.56	6.28	4.87	2.62	2.28	2.31	2.30	2.34	2.68
14	3.95	5.30	6.56	7.05	5.72	5.87	2.62	2.22	2.40	2.24	2.32	3.62
15	3.80	5.50	6.10	12.25	5.96	5.67	2.56	2.20	2.35	2.33	2.30	3.20
6	4.00	5.42	5.75	11.05	5.74	5.00	2.53	2.36	2.34	2.31	2.27	3.47
17	3.94	7.23	5.34	9.50	5.62	4.56	2.50	2.58	2.32	2.30	2.26	3.56
18	3.82	7.70	5.05	7.85	5.36	5.05	2.50	2.40	2.30	2.28	2.25	3.48
19	3.78	6.60	4.85	7.05	5.15	5.05	2.55	2.42	2.29	2.26	2.26	3.36
20	3.65	9.00	4.70	6.60	4.85	4.62	2.72	2.92	2.26	2.25	2.28	3.56
21	4.05	13.26	4.60	6.38	4.65	4.24	2.70	2.90	2.22	2.30	2.29	3.32
22	4.05	11.85	4.44	6.20	4.46	3.96	2.54	2.78	2.24	2.24	2.26	3.12
23	4.04	10.02	4.25	6.14	4.26	4.05	2.62	2.69	2.21	2.32	2.24	3.00
24	4.66	9.98	4.17	5.85	4.15	3.95	2.02	2.60	2.30	2.35	2.24	2.98
25	9.75	13.05	4.20	5.46	4.04	3.76	2.57	2.58	2.26	2.40	2.34	2.84
26	11.45	11.30	6.50	5.15	3.94	3.65	2.67	2.54	2.23	2.50	2.48	2.78
27	8.92	9.65	8.45	4.96	3.82	3.53	2.98	2.50	2.21	2.58	2.50	2.73
28	7.05	7.95	7.85	4.90	3.74	3.50	2.78	2.44	2.20	2.60	2.51	2.60
29	6.05	....	7.90	4.85	3.84	3.38	2.67	2.42	2.18	2.48	2.48	2.58
30	5.40	....	7.60	7.46	3.90	3.29	2.66	2.36	2.27	2.46	2.55	2.70
31	4.95	....	7.15	....	3.80	....	2.62	2.32	....	2.45	....	2.65

Daily discharge, in second-feet, of Susquehanna River at Wysox, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,840	8,500	21,700	21,000	67,000	5,050	3,150	1,500	800	760	980	1,400
2	810	6,120	17,000	19,750	86,000	4,500	2,700	1,300	750	720	970	1,700
3	2,150	5,700	14,900	21,000	57,000	4,300	2,600	1,300	650	600	960	1,780
4	2,200	6,500	14,500	22,000	39,750	3,750	2,550	1,280	650	580	980	1,820
5	2,500	6,750	13,000	21,200	35,700	7,500	2,300	1,280	750	580	1,000	1,800
6	10,150	8,300	10,750	19,250	29,000	12,700	2,250	1,470	720	570	990	1,500
7	32,200	27,000	10,400	21,100	23,250	10,800	2,000	1,280	600	560	970	1,400
8	20,000	26,000	11,200	26,000	23,750	7,500	1,980	1,050	570	570	940	1,680
9	12,000	19,200	10,750	24,500	19,300	6,500	1,980	800	600	560	880	980
10	8,750	13,000	12,000	20,600	16,200	6,100	1,960	760	775	550	880	1,000
11	8,500	13,000	37,000	17,000	16,000	19,100	1,920	690	940	550	850	1,120
12	8,000	12,750	31,250	14,500	20,000	13,000	1,470	665	920	950	790	1,660
13	6,060	12,500	23,000	12,800	17,000	9,500	1,550	780	900	880	940	1,780
14	5,600	11,700	18,500	21,700	13,750	14,500	1,550	720	1,000	750	920	4,400
15	5,200	12,750	16,000	60,000	15,200	13,500	1,430	650	950	930	880	3,000
16	6,000	17,600	13,750	50,000	14,000	10,000	1,400	960	940	900	790	3,800
17	5,500	22,750	11,800	38,700	13,400	8,000	1,300	1,400	920	880	775	4,250
18	5,220	26,000	10,500	27,000	12,000	10,300	1,300	1,000	880	800	760	3,850
19	5,150	18,700	9,500	21,700	11,000	10,300	1,420	1,030	850	775	775	3,500
20	4,750	35,000	8,750	18,750	9,500	8,500	1,860	2,250	775	760	800	4,250
21	6,090	67,000	8,800	17,250	8,500	7,000	1,750	2,200	720	880	850	3,300
22	6,090	57,000	7,700	16,500	7,700	5,760	1,410	1,900	750	750	775	2,900
23	6,080	42,500	7,000	16,250	7,000	6,000	1,550	1,800	700	920	750	2,500
24	4,760	42,000	6,600	14,500	6,500	5,750	500	1,500	880	950	750	2,400
25	40,250	66,000	6,650	12,500	6,100	5,000	1,460	1,400	775	1,000	940	2,100
26	54,000	27,500	18,250	11,000	5,700	4,750	1,690	1,250	730	1,100	1,080	1,900
27	34,300	40,000	31,800	10,050	5,250	4,250	2,500	1,100	700	1,400	1,100	1,850
28	21,700	27,750	27,000	9,750	5,000	4,200	2,000	1,050	650	1,500	1,120	1,500
29	15,600	....	27,500	9,500	5,500	3,750	1,690	1,030	600	1,080	1,080	1,400
30	12,000	....	25,200	24,200	5,750	3,700	1,590	960	790	1,060	1,300	1,800
31	10,000	....	22,250	....	5,200	....	1,550	920	....	1,050	....	1,700

NOTE.—These discharges are based on a rating curve that is well defined.

Monthly discharge of Susquehanna River at Wysox, Pa., for 1909.

[Drainage area, 7,930 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	54,000	810	11,700	1.48	1 71
February	67,000	5,700	24,300	3.06	3.19
March	37,000	6,600	16,300	2.06	2.38
April	60,000	9,500	21,300	2.69	3.00
May	86,000	5,000	19,600	2.47	2.85
June	19,100	3,700	7,850	.990	1.10
July	3,150	500	1,820	.230	.27
August	2,250	650	1,200	.150	.17
September	1,000	570	774	.098	.11
October	1,500	550	836	.105	.12
November	1,300	750	919	.116	.13
December	4,400	980	2,260	.285	.33
The year	86,000	500	8,960	1.14	15.36

SUSQUEHANNA RIVER AT WILKES-BARRE, PA.

This station is located at the Market Street Bridge, Wilkes-Barre. No important tributaries enter Susquehanna River for several miles above or below the station.

The chain gage was established on the bridge by the United States Geological Survey, March 30, 1899. The United States Weather Bureau has also maintained gage heights records at this point since 1888, using a gage on the left pier. The datum of the United States Geological Survey gage was placed 4 feet below the datum of the Weather Bureau gage to obviate negative readings, and was soon after adopted by the Weather Bureau. The records of stage at this station are utilized by the Weather Bureau for the purpose of flood predictions. The United States Geological Survey determinations of the regimen of flow are of value for navigation and power purposes. The 1909 discharge measurements have been furnished by the Water-Supply Commission of Pennsylvania.

The datum of the United States Geological Survey gage has remained constant since the establishment in 1899. Records obtained by the Weather Bureau prior to the adoption of the Geological Survey gage should have 4 feet added to reduce them to the present datum. Discharge measurements are made from the bridge.

The discharge at this point is frequently affected by ice during the winter, and water is often backed up many feet by ice gorges. Conditions of flow are subject to change at irregular intervals. A fairly good rating curve has been developed.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

Discharge measurements of Susquehanna River at Wilkes-Barre, Pa., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	Kenneth Grant	802	13,900	20.69	100,000
May 4	.....do	662	11,600	15.58	59,200

Daily gage height, in feet, of Susquehanna River at Wilkes-Barre, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	8.8	10.6	9.6	17.8	4.5	3.9	2.7	2.5	2.3	2.5	2.6
2	2.3	9.5	9.4	9.4	22.3	4.3	3.6	2.7	2.5	2.3	2.5	2.6
3	2.4	9.5	8.3	9.2	20.7	4.2	3.4	2.7	2.4	2.3	2.5	2.7
4	2.7	9.0	8.0	9.6	15.6	4.0	3.3	2.6	2.4	2.3	2.5	2.7
5	3.2	9.2	7.8	9.6	13.9	4.0	3.2	2.6	2.4	2.2	2.5	2.7
6	5.7	9.5	7.0	9.3	12.6	6.1	3.2	2.6	2.3	2.2	2.4	2.7
7	9.8	11.5	6.5	9.0	11.0	7.5	3.1	2.5	2.2	2.3	2.3	2.7
8	10.5	11.0	6.5	9.7	10.8	6.8	3.0	2.5	2.2	2.2	2.4	2.7
9	8.5	10.0	6.8	10.2	10.1	5.8	3.0	2.4	2.2	2.3	2.4	2.5
10	6.8	8.3	6.9	9.7	9.1	5.4	3.0	2.4	2.2	2.2	2.4	2.8
11	5.9	8.5	9.5	8.9	9.3	5.2	2.9	2.3	2.4	2.2	2.4	2.4
12	5.7	7.7	12.2	8.1	9.0	8.9	2.9	2.3	2.3	2.4	2.4	2.3
13	5.4	7.4	11.0	7.4	9.5	7.5	2.8	2.3	2.2	2.6	2.4	2.3
14	5.4	7.1	9.6	7.5	8.8	6.5	2.8	2.3	2.2	2.6	2.4	3.1
15	6.5	7.2	9.2	13.5	8.0	7.4	2.7	2.3	2.4	2.5	2.4	4.1
16	5.8	8.8	8.1	17.0	8.1	7.8	2.7	2.3	2.4.	2.5	2.3	4.0
17	6.5	10.8	7.4	14.7	7.9	6.6	2.7	2.3	2.5	2.4	2.3	3.7
18	5.9	11.0	6.9	12.5	7.2	6.3	2.7	2.3	2.4	2.4	2.3	4.0
19	5.5	10.5	6.5	10.7	6.8	6.9	2.6	2.5	2.4	2.4	2.3	3.7
20	5.6	11.5	6.1	9.5	6.7	6.8	2.6	2.5	2.4	2.3	2.3	3.1
21	5.6	17.4	5.9	9.0	6.3	7.0	2.5	2.7	2.3	2.3	2.3	3.2
22	5.7	17.4	5.7	8.7	5.9	5.4	2.7	2.9	2.3	2.3	2.3	3.0
23	6.0	15.6	5.4	8.5	5.7	5.0	2.8	2.9	2.3	2.3	2.3	3.0
24	6.0	14.6	5.2	8.6	5.4	4.7	2.8	2.9	2.4	2.4	2.3	3.2
25	10.4	17.1	5.1	7.8	5.2	4.8	2.8	2.8	2.2	2.4	2.3	3.0
26	16.0	17.8	7.7	7.2	4.9	5.2	2.7	2.8	2.3	2.4	2.3	2.9
27	14.5	14.7	11.2	6.8	4.7	4.8	2.7	2.8	2.3	2.5	2.3	2.7
28	11 5	12.6	11.8	6.5	4.8	4.4	2.7	2.6	2.2	2.5	2.5	2.7
29	9.0	......	11.2	6.4	4.7	4.3	2.9	2.6	2.3	2.5	2.5	2.6
30	7.6	......	11.0	8.0	4.5	4.1	2.9	2.5	2.2	2.5	2.6	2.3
31	7.0	......	10.5	......	4.6	......	2.8	2.5	......	2.5	......	2.3

NOTE.—Ice conditions prevailed from about Jan. 14 to 24 and Feb. 1 to 6.

Daily discharge, in second-feet, of Susquehanna River at Wilkes-Barre, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,090	12,000	32,500	27,300	78,900	5,970	4,250	1,660	1,360	1,090	1,360	1,510
2	1,090	8,500	26,300	26,300	118,000	5,360	3,500	1,660	1,360	1,090	1,360	1,510
3	1,220	6,500	21,000	25,300	103,000	5,070	3,040	1,660	1,220	1,090	1,360	1,660
4	1,660	6,000	19,600	27,300	62,700	4,520	2,820	1,510	1,220	1,090	1,360	1,660
5	2,600	7,000	18,700	27,300	51,600	4,520	2,600	1,510	1,220	970	1,360	1,660
6	10,100	10,000	15,200	25,800	43,700	11,600	2,600	1,510	1,090	970	1,220	1,660
7	28,300	37,400	13,200	24,400	34,600	17,400	2,390	1,360	970	1,090	1,090	1,660
8	31,900	34,600	13,200	27,800	33,500	14,400	2,190	1,360	970	970	1,220	1,660
9	21,900	29,400	14,400	30,400	29,900	10,500	2,190	1,220	970	1,090	1,220	1,360
10	14,400	21,000	14,800	27,800	24,800	9,000	2,190	1,220	970	970	1,220	1,820
11	10,800	21,900	26,800	23,900	25,800	8,300	2,000	1,090	1,220	970	1,220	1,220
12	10,100	18,200	41,400	20,100	24,400	23,900	2,000	1,090	1,090	1,220	1,220	1,090
13	9,000	16,900	34,600	16,900	26,800	17,400	1,820	1,090	970	1,510	1,220	1,090
14	7,500	15,600	27,300	17,400	23,400	13,200	1,820	1,090	970	1,510	1,220	2,390
15	6,500	16,000	25,300	49,100	19,600	16,900	1,660	1,090	1,220	1,360	1,220	4,790
16	5,500	23,400	20,100	72,800	20,100	18,700	1,660	1,090	1,220	1,360	1,090	4,520
17	5,000	33,500	16,900	56,800	19,100	13,600	1,660	1,090	1,360	1,220	1,090	3,740
18	5,000	34,600	14,800	43,100	16,000	12,400	1,660	1,090	1,220	1,220	1,090	4,520
19	4,500	31,900	13,200	33,000	14,400	14,800	1,510	1,360	1,220	1,220	1,090	3,740
20	4,000	37,400	11,600	26,800	14,000	14,400	1,510	1,360	1,220	1,090	1,090	2,390
21	4,500	75,800	10,800	24,400	12,400	15,200	1,360	1,660	1,090	1,090	1,090	2,600
22	5,000	75,800	10,100	22,900	10,800	9,000	1,660	2,000	1,090	1,090	1,090	2,190
23	5,000	62,700	9,000	21,900	10,100	7,600	1,820	2,000	1,090	1,090	1,090	2,190
24	5,500	56,100	8,300	22,400	9,000	6,600	1,820	2,000	1,220	1,220	1,090	2,600
25	31,400	73,600	7,950	18,700	8,300	6,930	1,820	1,820	970	1,220	1,090	2,190
26	65,500	78,900	18,200	16,000	7,260	8,300	1,660	1,820	1,090	1,220	1,090	2,000
27	55,400	56,800	35,700	14,400	6,600	6,930	1,660	1,820	1,090	1,360	1,090	1,660
28	37,400	43,700	39,000	13,200	6,930	5,660	1,660	1,510	970	1,360	1,360	1,660
29	24,400	....	35,700	12,800	6,600	5,360	2,000	1,510	1,090	1,360	1,360	1,510
30	17,800	....	34,600	19,600	5,970	4,790	2,000	1,360	970	1,360	1,510	1,090
31	15,200	....	31,900	....	6,280	....	1,820	1,360	....	1,360	....	1,090

NOTE.—These discharges are based on a rating curve that is well defined. The estimated discharge during periods of ice conditions is based on climatological data and intercomparison with other Susquehanna River stations.

Monthly discharge of North Branch of Susquehanna River at Wilkes-Barre, Pa., for 1909.

[Drainage area, 9,810 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	65,500	1,090	14,500	1.48	1.71	B.
February	78,900	6,000	33,800	3.45	3.59	B.
March	41,400	7,950	21,400	2.18	2.51	A.
April	72,800	12,800	27,200	2.77	3.09	A.
May	118,000	5,970	28,200	2.87	3.31	A.
June	23,900	4,520	10,600	1.08	1.20	A.
July	4,250	1,360	2,080	.212	.24	A.
August	2,000	1,090	1,450	.148	.17	B.
September	1,360	970	1,120	.114	.13	B.
October	1,510	970	1,190	.121	.14	B.
November	1,510	1,090	1,210	.123	.14	B.
December	4,790	1,090	2,140	.218	.25	B.
The year	118,000	970	11,900	1.21	16.48	

SUSQUEHANNA RIVER AT DANVILLE, PA.

This station is located at Mill Street Bridge in Danville. It is 52 miles below Wilkes-Barre and 11 miles above the mouth of West Branch of Susquehanna River. There are no important tributaries within several miles of the station. It was established March 25, 1899, by the United States Geological Survey. It is now being maintained by the Water-Supply Commission of Pennsylvania, from whom the tables of daily gage heights and discharge measurements made by engineers of the commission are obtained.

The Susquehanna at this point is paralleled on the north side by the Pennsylvania Canal.

On March 9, 1904, the bridge and chain gage were carried away in an ice freshet, and from that date until March 24, 1905, after the new steel bridge was completed, and when a chain gage was installed on the bridge, observations were made from temporary gages and were constantly liable to error for stages less than 5 feet. With the exception of this period the datum of the chain gage has remained constant during the period of maintenance of the station.

The discharge during the winter is considerably affected by ice. Conditions of flow at this point are permanent, and an excellent rating curve has been developed. Discharge measurements are made from the bridge.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

Discharge measurements of Susquehanna River at Danville, Pa., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 7	Kenneth Grant	1,240	9,150	9.41	40,200
June 25	....do	842	3,090	3.98	8,430

Daily gage height, in feet, of Susquehanna River at Danville, Pa., for 1909.

[Ed. F. Bell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.7	5.1	9.3	8.2	13.4	3.8	3.41	2.42	2.10	1.88	2.18	2.22
2	2.9	4.4	8.1	7.6	17.7	3.8	3.21	2.39	2.08	1.83	2.18	2.28
3	2.9	3.9	7.2	7.5	16.9	3.7	3.06	2.32	2.04	1.88	2.20	2.25
4	3.0	3.7	6.7	7.6	13.75	3.5	2.94	2.27	2.00	1.94	2.18	2.28
5	3.7	4.1	6.5	7.8	11.95	3.5	2.86	2.24	2.00	1.94	2.13	2.26
6	4.9	4.7	6.2	7.5	10.75	4.0	2.79	2.22	1.94	1.92	2.10	2.28
7	6.5	7.6	5.7	7.4	9.6	4.9	2.71	2.20	1.92	1.90	2.08	2.32
8	8.8	8.3	5.5	7.5	8.8	6.0	2.62	2.16	1.90	1.88	2.10	2.30
9	7.9	8.3	5.4	7.6	8.6	5.4	2.60	2.14	1.88	1.86	2.09	2.48
10	6.1	7.3	5.7	7.7	7.9	4.7	2.62	2.10	1.90	1.84	2.08	......
11	5.1	7.3	6.9	7.3	7.7	4.4	2.57	2.06	1.98	1.84	2.08	......
12	4.9	6.9	9.15	6.8	7.6	4.3	2.47	2.04	2.04	2.15	2.06	......
13	4.8	6.5	9.2	6.7	7.7	6.7	2.44	2.02	2.02	2.32	2.08	......
14	4.1	6.2	8.4	7.0	7.6	5.8	2.44	2.00	2.00	2.26	2.09	3.69
15	3.9	6.9	7.5	10.05	6.9	5.3	2.42	2.00	2.04	2.25	2.08	3.69
16	3.5	7.65	6.9	14.15	6.5	6.5	2.42	2.00	2.04	2.18	2.08	3.92
17	4.4	9.25	6.4	12.45	6.6	5.9	2.42	2.12	2.04	2.26	2.08	3.45
18	......	9.2	6.0	11.0	6.3	5.4	2.40	2.10	2.12	2.15	2.07	3.48
19	......	9.2	5.5	9.4	5.8	5.6	2.36	2.07	2.09	2.12	2.02	3.39
20	......	10.15	5.2	8.6	5.6	5.6	2.18	2.08	2.05	2.10	1.98	......
21	......	13.55	5.0	7.8	5.4	5.4	2.26	2.16	2.02	2.06	2.02	......
22	......	14.2	4.8	7.5	5.1	4.9	2.26	2.15	1.99	2.03	2.02	......
23	......	13.1	4.6	7.4	4.9	4.4	2.40	2.42	1.96	2.00	2.02	......
24	......	12.65	4.5	7.5	4.7	4.1	2.46	2.52	2.07	2.08	2.02	......
25	7.6	13.3	4.3	7.2	4.5	4.0	2.54	2.48	2.04	2.11	2.04	......
26	11.6	14.4	5.4	6.7	4.3	4.4	2.44	2.42	2.07	2.10	2.03	......
27	12.1	12.35	7.0	6.2	4.1	4.27	2.38	2.30	2.00	2.11	2.05	......
28	9.75	10.3	9.5	5.8	4.1	3.92	2.36	2.26	1.99	2.11	2.07	......
29	8.0	......	9.2	5.6	4.1	3.72	2.36	2.24	1.94	2.16	2.14	......
30	6.7	......	9.0	7.1	3.9	3.57	2.51	2.19	1.92	2.21	2.22	......
31	5.7	......	8.7	......	3.8	......	2.54	2.16	......	2.22	......	......

NOTE.—Ice conditions prevailed about as follows: Jan. 1 to 5, Jan. 17 to 24, and Dec. 9 to 31.

Daily discharge, in second-feet, of Susquehanna River at Danville, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,300	13,600	40,500	32,300	78,600	7,220	5,640	2,350	1,620	1,210	1,790	1,880
2	1,300	10,000	31,600	28,300	132,000	7,220	4,880	2,280	1,580	1,120	1,790	2,010
3	1,500	7,660	25,700	27,600	120,000	6,800	4,340	2,110	1,500	1,210	1,830	1,940
4	1,500	6,800	22,700	28,300	82,400	6,000	3,920	1,990	1,420	1,310	1,790	2,010
5	3,000	8,560	21,500	29,600	63,800	6,000	3,650	1,920	1,420	1,310	1,680	1,970
6	12,500	11,500	19,700	27,600	52,700	8,100	3,430	1,880	1,310	1,280	1,620	2,010
7	21,500	28,300	16,900	27,000	42,900	12,500	3,170	1,830	1,280	1,240	1,580	2,110
8	36,700	33,000	15,800	27,600	36,700	18,600	2,900	1,740	1,240	1,210	1,620	2,060
9	30,300	33,000	15,200	28,300	35,200	15,200	2,840	1,700	1,210	1,170	1,600	1,800
10	19,100	26,300	16,900	28,900	30,300	11,500	2,000	1,620	1,240	1,140	1,580	1,600
11	13,600	26,300	23,900	26,300	28,900	10,000	2,760	1,540	1,380	1,140	1,580	1,500
12	12,500	23,900	39,400	23,300	28,300	9,520	2,480	1,500	1,500	1,720	1,540	1,300
13	12,000	21,500	39,700	22,700	28,900	22,700	2,400	1,460	1,460	2,110	1,580	1,300
14	8,560	19,700	33,700	24,500	28,300	17,400	2,400	1,420	1,420	1,970	1,600	2,800
15	7,660	23,900	27,600	46,600	23,900	14,700	2,350	1,420	1,500	1,940	1,580	6,000
16	6,000	28,600	23,900	86,800	21,500	21,500	2,350	1,420	1,500	1,790	1,580	5,500
17	6,000	40,100	20,900	68,800	22,100	18,000	2,350	1,660	1,500	1,970	1,580	4,500
18	5,500	39,700	18,600	54,900	20,300	15,200	2,300	1,620	1,660	1,720	1,560	5,500
19	5,000	39,700	15,800	41,300	17,500	16,400	2,200	1,560	1,600	1,660	1,460	4,500
20	5,000	47,500	14,200	35,200	16,400	16,400	1,790	1,580	1,520	1,620	1,380	2,900
21	5,500	80,200	13,100	29,600	15,200	15,200	1,970	1,750	1,460	1,540	1,460	3,000
22	6,000	87,300	12,000	27,600	13,600	12,500	1,970	1,720	1,400	1,480	1,460	2,600
23	6,000	75,500	11,000	27,000	12,500	10,000	2,300	2,350	1,350	1,420	1,460	2,600
24	6,000	70,800	10,500	27,600	11,500	8,560	2,460	2,620	1,560	1,580	1,460	3,000
25	28,300	77,600	9,520	25,700	10,500	8,100	2,670	2,510	1,500	1,640	1,500	2,600
26	60,500	89,600	15,200	22,700	9,520	10,000	2,400	2,350	1,560	1,620	1,480	2,500
27	65,300	67,800	24,500	19,700	8,560	9,380	2,250	2,060	1,420	1,640	1,520	2,000
28	44,200	48,800	42,100	17,400	8,560	7,750	2,200	1,970	1,400	1,640	1,560	2,000
29	30,900	....	39,700	16,400	8,560	6,880	2,200	1,920	1,310	1,750	1,700	1,800
30	22,700	....	38,200	25,100	7,660	6,280	2,590	1,810	1,280	1,850	1,880	1,500
31	16,900	....	35,900	....	7,220	....	2,670	1,750	....	1,880	....	1,300

NOTE.—Discharge during backwater from ice conditions estimated on the basis of climatological data and comparisons with the discharge at other stations in the Susquehanna River drainage.

Monthly discharge of Susquehanna River at Danville, Pa., for 1908.

[Drainage area, 11,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	65,300	[1] 1,300	16,200	1.46	1.68	B.
February	89,600	6,800	38,800	3.50	3.64	A.
March	42,100	9,520	23,700	2.14	2.47	A.
April	86,800	16,400	31,800	2.86	3.19	A.
May	132,000	7,220	33,000	2.97	3.42	A.
June	22,700	6,000	11,900	1.07	1.19	A.
July	5,640	1,790	2,800	.252	.29	A.
August	2,620	1,420	1,850	.167	.19	A.
September	1,660	1,210	1,440	.130	.14	A.
October	2,110	1,120	1,540	.139	.16	A.
November	1,880	1,380	1,590	.143	.16	A.
December	[1] 6,000	[1] 1,300	2,580	.232	.27	B.
The year	132,000	1,120	13,800	1.24	16.80	

[1] Estimated.

SUSQUEHANNA RIVER AT HARRISBURG, PA.

This station is located at the Walnut Street Bridge at Harrisburg. Daily observations of stage were begun at Harrisburg in 1890 by E. Mather, president of the Harrisburg Water Board. The original gage is located in the pump well at the pump house of the city waterworks, the well being connected with the river by two large mains. On July 18, 1904, a chain gage was installed on the Walnut Street Bridge. The readings are now furnished by the United States Weather Bureau, which has maintained the station since July 15, 1906.

The records of discharge at this station are of value in connection with power development and navigation problems.

The river is divided into two channels at this point by Foster Island, which is overflowed at times of flood.

Conodoguinet Creek enters Susquehanna River from the west about 2 miles above the gaging station. Paxton Creek enters from the northeast, about 1½ miles below the station. The Pennsylvania Canal parallels the river on the left side.

The datums of both gages have remained constant since their establishment. For full information regarding the two gages, changes in conditions of flow, etc., see Water-Supply Papers 109 and 167. The discharge at this point is affected by ice. Conditions of flow here have been relatively permanent during the last few years, and a good rating curve has been developed. Discharge measurements are made from the bridge.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

Daily gage height, in feet, of Susquehanna River at Harrisburg, Pa., for 1909.

[E. R. Demain, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.8	3.5	7.6	5.3	11.1	2.6	2.4	0.9	0.5	0.4	0.7	0.5
2	.8	3.1	6.4	4.9	15.6	2.5	2.3	.9	.4	.3	.7	.5
3	1.0	2.8	5.7	4.7	15.5	2.4	2.1	.8	.4	.3	.7	.5
4	1.4	2.7	5.3	4.5	12.3	2.4	1.8	.8	.4	.3	.6	.6
5	1.6	2 5	5.2	4.6	10.0	2.3	1.7	.7	.4	.3	.6	.6
6	1.8	2.6	5.0	4.6	8.8	2.8	1.6	.7	.4	.3	.6	.6
7	2.5	3.4	4.6	4.5	7.8	4.2	1.5	.6	.3	.3	.5	.6
8	4.7	4.9	4.3	4.4	6.8	4.1	1.4	.6	.3	.2	.5	.7
9	5.3	5.9	4.3	5.0	6.2	4.3	1.3	.6	.3	.2	.5	.3
10	4.5	5.5	4.5	5.4	5.8	4.0	1.3	.5	.4	.2	.5	.2
11	3.8	5.8	4.8	5.2	5.3	4.0	1.2	.5	.6	.2	.5	.3
12	3.2	5.5	5.8	4.7	5.3	3.8	1.2	.5	.5	.5	.5	.5
13	2.9	5.0	6.8	4.3	5.0	4.0	1.1	.4	.5	.6	.5	.6
14	2.6	4.6	6.3	4.3	4.9	4.6	1.1	.4	.4	.7	.5	2.3
15	2.5	4.6	5.6	7.6	4.7	4.3	1.0	.4	.4	.7	.5	2.8
16	2.1	5.6	5.1	10.9	4.3	4.6	1.0	.4	.6	.8	.4	3.0
17	1.8	8.3	4.6	10.2	4.1	4.7	1.0	.5	.6	.8	.5	2.5
18	1.2	9.2	4.2	8.5	4.0	4.3	1.0	.6	.5	.8	.5	2.0
19	1.2	8.0	4.0	7.2	3.8	4.4	.9	.9	.4	.7	.4	1.5
20	1.4	7.6	3.7	6.2	3.5	4.1	.9	.9	.4	.7	.4	1.3
21	1.7	8.9	3.5	5.9	3.4	3.8	.9	.7	.4	.6	.4	2.2
22	2.0	9.8	3.3	6.0	3.3	3.4	.9	.7	.4	.6	.4	2.0
23	2.0	9.1	3.1	6.3	3.1	3.1	.9	.7	.4	.6	.4	2.2
21	2.1	9.4	3.0	6.7	3.0	2.8	.9	.7	.4	.8	.4	2.0
25	2.5	11.9	3.0	6.5	2.9	2.6	1.0	.7	.4	.8	.4	2.2
26	6.5	12.7	3.0	5.8	2.7	2.6	1.0	.8	.4	.8	.4	2.0
27	9.4	10.9	4.2	5.4	2.7	2.6	1.0	.8	.4	.8	.4	1.9
28	8.1	8.9	5.3	4.9	2.5	2.8	1.1	.6	.5	.8	.5	1.8
29	6.6	....	6.0	4.6	2.6	2.6	1.0	.6	.5	.8	.5	1.7
30	5.3	....	5.7	4.7	2.7	2.4	1.0	.5	.4	.7	.5	1.4
31	4.6	....	5.5	....	2.7	....	.9	.5	....	.7	....	1.5

NOTE.—Feb. 26, maximum 13.0 feet at 6 a. m.; Apr. 16, maximum 11.2 feet from 2 to 7 p. m.; May 2, maximum 16.0 feet from 5 p. m. to midnight; river frozen Dec. 9 to 13 and 18 to 31.

Daily discharge in second-feet, of Susquehanna River at Harrisburg, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,310	29,400	98,000	56,800	170,000	18,800	16,800	5,820	3,960	3,570	4,830	3,960
2	5,310	24,400	75,500	50,200	281,000	17,800	15,800	5,820	3,570	3,210	4,830	3,960
3	6,360	21,000	63,400	47,100	278,000	16,800	14,000	5,310	3,570	3,210	4,830	3,960
4	8,740	19,800	56,800	43,800	197,000	16,800	11,600	5,310	3,570	3,210	4,380	4,380
5	10,100	17,800	55,100	45,400	146,000	15,800	10,800	4,830	3,570	3,210	4,380	4,380
6	11,600	18,800	51,900	45,400	121,000	21,000	10,100	4,830	3,570	3,210	4,380	4,380
7	17,800	28,100	45,400	43,800	102,000	39,200	9,400	4,380	3,210	3,210	3,960	4,380
8	47,100	50,200	40,700	42,200	82,900	37,800	8,740	4,380	3,210	2,870	3,960	4,830
9	56,800	66,700	40,700	51,900	71,900	40,700	8,100	4,380	3,210	2,870	3,960	3,000
10	43,800	60,000	43,800	58,400	65,000	36,400	8,100	3,960	3,570	2,870	3,960	2,500
11	33,600	65,000	48,600	55,100	56,800	36,400	7,490	3,960	4,380	2,870	3,960	2,000
12	25,600	60,000	65,000	47,100	56,800	33,600	7,490	3,960	3,960	3,960	3,960	2,500
13	22,100	51,900	82,900	40,700	51,900	36,400	6,910	3,570	3,960	4,380	3,960	4,000
14	18,800	45,400	73,700	40,700	50,200	45,400	6,910	3,570	3,570	4,830	3,960	15,800
15	17,800	45,400	61,700	98,000	47,100	40,700	6,360	3,570	3,570	4,830	3,960	21,000
16	14,000	61,700	53,500	165,000	40,700	45,400	6,360	3,570	4,380	5,310	3,570	23,300
17	11,600	111,000	45,400	150,000	37,800	47,100	6,360	3,960	4,380	5,310	3,960	17,800
18	7,490	129,000	39,200	115,000	36,400	40,700	6,360	4,380	3,960	5,310	3,960	12,500
19	7,490	106,000	36,400	90,400	33,600	42,200	5,820	5,820	3,570	4,830	3,570	9,000
20	8,740	98,000	32,200	71,900	29,400	37,800	5,820	5,820	3,570	4,830	3,570	7,000
21	10,800	123,000	29,400	66,700	28,100	33.600	5,820	4,830	3,570	4,380	3,570	6,500
22	13,200	141,000	26,900	68,400	26,900	28,100	5,820	4,830	3,570	4,380	3,570	6,000
23	13,200	127,000	24,400	73,700	24,400	24,400	5,820	4,830	3,570	4,380	3,570	6,000
24	14,000	133,000	23,300	81,000	23,300	21,000	5,820	4,830	3,570	5,310	3,570	6,000
25	17,800	188,000	23,300	77,400	22,100	18,800	6,360	4,830	3,570	5,310	3,570	6,000
26	77,400	207,000	23,300	65,000	19,900	18,800	6,360	5,310	3,570	5,310	3,570	6,000
27	133,000	165,000	39,200	58,400	19,900	18,800	6,360	5,310	3,570	5,310	3,570	5,500
28	108,000	123,000	56,800	50,200	17,800	21,000	6,910	4,380	3,960	5,310	3,960	5,000
29	79,200	....	68,400	45,400	18,800	18,800	6,360	4,380	3,960	5,310	3,960	5,000
30	56,800	....	63,400	47,100	19,900	16,800	6,360	3,960	3,570	4,830	3,960	4,500
31	45,400	....	60,000	....	19,900	....	5,820	3,960	....	4,830	....	4,500

NOTE.—Daily discharges for open-water conditions are based on a well-defined rating curve. Discharges for frozen periods of Dec. 9 to 13 and 18 to 31 are estimated on the basis of other Susquehanna River stations and climatological data.

Monthly discharge of Susquehanna River at Harrisburg, Pa., for 1909.

[Drainage area, 24,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	133,000	5,310	30,600	1.27	1.46	A.
February	207,000	17,800	82,800	3.45	3.59	A.
March	98,000	23,300	49,900	2.08	2.40	A.
April	165,000	40,700	66,400	2.77	3.09	A.
May	281,000	17,800	70,900	2.95	3.40	A.
June	47,100	15,800	29,600	1.23	1.37	A.
July	16,800	5,820	7,970	.332	.38	A.
August	5,820	3,570	4,600	.192	.22	A.
September	4,380	3,210	3,690	.154	.17	A.
October	5,310	2,870	4,280	.178	.21	A.
November	4,830	3,570	3,960	.165	.18	A.
December	23,300	2,000	6,960	.290	.33	A.
The year	281,000	2,000	29,700	1.24	16.80	

SUSQUEHANNA RIVER NEAR McCALL FERRY, PA.

The cable from which discharge measurements were made at this station is located about 1 mile above the village of McCall Ferry in a narrow and rocky part of Susquehanna River, about 20 miles above its mouth. The two principal gages to which the measurements are referenced are gage No. 2, about three-fourths of a mile below McCall Ferry, and gage No. 5, about 2 miles below McCall Ferry. This station was established May 17, 1902, by Mr. Boyd Ehle. The gage heights for 1909 were furnished by Pennsylvania Water & Power Co, The station was maintained to determine the discharge of the river for the McCall Ferry power development and to check the accuracy of the records obtained at Harrisburg.

The datum of each gage has remained constant since its establishment. The gage readings give the elevation of the water surface above sea level direct. Gage No. 2, which is located in the tailrace of the power house was used until February 28, 1906, when operations at the dam caused backwater to affect the relation between discharge and gage heights. All readings since then have been referred to gage No. 5, which is located at the foot of Cullys Falls, entirely out of influence of the dam.

The discharge is affected by ice during severe winters. Discharge measurements made at this station have been referenced to both gages. Conditions of flow are permanent, and an excellent rating curve has been developed for each gage.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

Daily gage height, in feet, of Susquehanna River at McCall Ferry, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	101.1	105.4	112.6	108.2	118.0	103.6	103.4	101.4	101.0	100.7	100.6	101.1
2	101.1	104.8	110.5	107.9	123.0	103.6	103.1	101.2	100.9	100.6	101.2	101.0
3	101.2	104.0	109.2	107.5	124.6	103.4	102.9	101.3	100.8	100.5	101.3	100.8
4	101.4	103.7	108.6	107.0	119.9	103.3	102.6	101.2	100.7	100.3	101.0	100.6
5	101.9	103.8	108.4	106.8	116.3	103.4	102.3	101.2	100.6	100.5	101.1	100.8
6	102.4	104.2	108.0	107.0	113.9	103.6	102.3	101.1	100.3	100.4	101.2	100.6
7	103.0	105.1	107.2	106.8	112.4	105.4	102.2	101.2	100.2	100.5	101.4	100.6
8	106.4	107.4	106.9	106.6	111.0	106.4	102.1	101.0	100.9	100.5	100.6	101.0
9	107.5	109.9	107.1	107.3	109.9	106.6	102.0	100.9	100.9	100.6	100.3	100.7
10	107.2	109.5	107.4	108.2	109.1	106.7	101.9	100.7	100.7	100.4	101.0	100.2
11	106.8	109.7	107.8	107.8	108.5	106.4	101.7	100.5	100.8	100.4	100.6	100.0
12	106.0	109.4	108.7	107.3	108.0	106.0	101.6	100.8	101.0	100.7	100.8	100.2
13	104.6	108.4	110.0	106.8	107.7	105.9	101.6	100.5	100.6	100.6	100.6	101.0
14	104.5	107.8	110.4	106.8	107.6	107.1	101.5	100.8	100.9	101.0	100.5	101.5
15	104.0	107.5	109.1	109.2	107.4	107.0	101.6	100.6	101.3	100.9	100.4	104.3
16	103.7	107.7	108.1	116.5	107.0	106.9	101.4	100.4	101.0	101.0	100.6	104.0
17	102.9	112.6	107.5	116.5	106.5	106.9	101.4	100.7	101.0	101.1	100.9	103.5
18	102.8	114.7	106.9	113.9	106.0	106.7	101.3	100.9	100.9	100.6	100.9	103.0
19	102.4	113.4	106.1	111.8	105.7	106.4	101.3	100.8	100.8	101.2	100.8	102.5
20	101.8	112.5	105.4	110.1	105.4	106.3	101.6	100.7	100.7	101.3	101.0	101.4
21	101.7	113.8	105.3	109.6	105.1	105.8	101.4	101.0	100.8	101.2	100.7	101.5
22	101.9	115.2	105.1	109.7	105.2	105.5	101.3	101.1	101.0	101.1	100.5	101.2
23	102.2	114.7	104.8	109.8	105.2	105.0	101.4	100.8	100.9	101.0	100.7	101.4
24	102.8	115.3	104.6	110.1	104.8	104.4	101.3	101.1	100.9	101.1	100.9	101.5
25	103.2	118.3	104.5	110.9	104.5	104.1	101.3	101.0	100.7	100.7	100.8	101.7
26	105.3	120.3	104.5	110.7	104.0	104.0	101.2	101.0	100.5	100.3	100.5	101.8
27	114.5	118.0	105.3	110.4	103.9	103.8	101.3	101.0	100.4	101.2	100.7	101.6
28	114.9	114.7	107.5	109.7	103.8	103.8	101.4	101.1	100.7	101.3	100.8	101.5
29	112.2	....	109.3	109.4	103.7	103.9	101.6	101.0	101.0	101.2	100.4	101.4
30	109.1	....	108.9	108.9	103.7	103.6	101.5	100.9	100.7	101.3	100.5	101.4
31	107.1	....	108.6	....	103.9	....	101.4	101.0	....	101.1	....	101.5

NOTE.—Readings were made on gage No. 5, below Cullys Falls. Discharge probably unaffected by ce during the winter periods, except for short intervals of a day or two.

Monthly discharge, in second-feet, of Susquehanna River at McCall Ferry, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,760	34,200	108,000	59,500	187,000	20,400	19,000	7,120	5,330	4,190	3,850	5,760
2	5,760	29,400	82,500	56,700	269,000	20,400	17,000	6,200	4,930	3,850	6,200	5,330
3	6,200	23,300	69,000	53,000	297,000	19,000	15,600	6,650	4,550	3,530	6,650	4,550
4	7,120	21,100	63,300	48,400	218,000	18,300	13,700	6,200	4,190	2,950	5,330	3,850
5	9,650	21,800	61,400	46,600	162,000	19,000	11,900	6,200	3,850	3,530	5,760	4,550
6	12,500	24,800	57,600	48,400	126,000	20,400	11,900	5,760	2,950	3,230	6,200	3,850
7	16,300	31,800	50,200	46,600	106,000	34,200	11,300	6,200	2,690	3,530	7,120	3,850
8	42,900	52,100	47,500	44,700	88,300	42,900	10,800	5,330	4,930	3,530	3,850	5,330
9	53,000	76,000	49,300	51,200	76,000	44,700	10,200	4,930	4,930	3,850	2,950	4,190
10	50,200	72,000	52,100	59,500	68,100	45,600	9,650	4,190	4,190	3,230	5,330	2,690
11	46,600	73,900	55,800	55,800	62,300	42,900	8,600	3,530	4,550	3,230	3,850	2,200
12	39,400	71,000	64,200	51,200	57,600	39,400	8,090	4,550	5,330	4,190	4,550	2,690
13	27,900	61,400	77,000	46,600	54,800	38,500	8,090	3,530	3,850	3,850	3,850	5,330
14	27,100	55,800	81,400	46,600	53,900	49,300	7,600	4,550	4,930	5,330	3,530	7,600
15	23,300	53,000	68,100	69,000	52,100	48,400	8,090	3,850	6,650	4,930	3,230	25,600
16	21,100	54,800	58,500	164,000	48,400	47,500	7,120	3,230	5,330	5,330	3,850	23,300
17	15,600	108,000	53,000	164,000	43,800	47,500	7,120	4,190	5,330	5,760	4,930	19,700
18	15,000	138,000	47,500	126,000	39,400	45,600	6,650	4,930	4,930	3,850	4,930	16,300
19	12,500	119,000	40,300	98,000	36,800	42,900	6,650	4,550	4,550	6,200	4,550	13,100
20	9,120	107,000	34,200	78,100	34,200	42,000	8,090	4,190	4,190	6,650	5,330	7,120
21	8,600	125,000	33,400	72,900	31,800	37,600	7,120	5,330	4,550	6,200	4,190	7,600
22	9,650	145,000	31,800	73,900	32,600	35,100	6,650	5,760	5,330	5,760	3,530	6,200
23	11,300	138,000	29,400	74,900	32,600	31,000	7,120	4,550	4,930	5,330	4,190	7,120
24	15,000	147,000	27,900	78,100	29,400	26,300	6,650	5,760	4,930	5,760	4,930	7,600
25	17,600	192,000	27,100	87,100	27,100	24,000	6,650	5,330	4,190	4,190	4,550	8,600
26	33,400	224,000	27,100	84,800	23,300	23,300	6,200	5,330	3,530	2,950	3,530	9,120
27	135,000	187,000	33,400	81,400	22,600	21,800	6,650	5,330	3,230	6,200	4,190	8,090
28	141,000	138,000	53,000	73,900	21,800	21,800	7,120	5,760	4,190	6,650	4,550	7,600
29	103,000	....	70,000	71,000	21,100	22,600	8,090	5,330	5,330	6,200	3,230	7,120
30	68,100	....	66,100	66,100	21,100	20,400	7,600	4,930	4,190	6,650	3,530	6,500
31	49,300	....	63,300	....	22,600	....	7,120	5,330	....	5,760	....	6,000

NOTE.—No correction made for ice effect, except Dec. 30 and 31, for which estimates were slightly reduced.

Monthly discharge of Susquehanna River at McCall Ferry, Pa., for 1909.

[Drainage area, 26,800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	141,000	5,760	33,500	1.25	1.44	A.
February	224,000	21,100	90,200	3.37	3.51	A.
March	108,000	27,100	54,300	2.03	2.34	A.
April	164,000	44,700	72,600	2.71	3.02	A.
May	297,000	21,100	76,300	2.85	3.29	A.
June	49,300	18,300	33,100	1.24	1.38	A.
July	19,000	6,200	9,170	.342	.39	A.
August	7,120	3,230	5,120	.191	.22	A.
September	6,650	2,690	4,550	.170	.19	A.
October	6,650	2,950	4,720	.176	.20	A.
November	6,650	2,950	4,540	.169	.19	A.
December	25,600	2,200	8,010	.299	.34	A.
The year	297,000	2,200	32,600	1.22	16.51	

CHENANGO RIVER BASIN.

DESCRIPTION.

Chenango River rises in the central part of Madison County, N. Y., and flows southward into the Susquehanna at Binghamton. It is approximately 70 miles long, and its drainage area comprises about 1,580 square miles. Its headwater valleys lie at an elevation of about 1,200 feet above sea level, and its mouth is 864 feet above tide. Its bed is, as a rule, composed of sand and gravel, and the stream is bordered in many places by bottom lands subject to overflow. A portion of the headwaters are diverted across the Chenango-Mohawk divide through Oriskany Creek to feed the summit level of the Erie Canal.

Considerable power is developed at Binghamton and at Port Dickinson, 3 miles above.

CHENANGO RIVER AT BINGHAMTON, N. Y.

This station, which is located at the Court Street Bridge at Binghamton, was established July 31, 1901, and has since been maintained in cooperation with the New York State engineer's department.

Tioughnioga River enters Chenango River from the northwest about 14 miles above the gaging station. Chenango River enters Susquehanna River about three-fourths of a mile below the gaging station, but a slight rift a short distance downstream from the bridge cuts off backwater from the Susquehanna at ordinary stages.

In estimating the run-off of Chenango River the area directly tributary to storage reservoirs, from which diversion is made to supply the Erie Canal, has been deducted from the total natural drainage area. The diversion area of six reservoirs at the head of Chenango

River, whose outflow is turned into Erie Canal through Limestone Creek, is 30 square miles. The diversion area of De Ruyter reservoir, at the head of Tioughnioga River, whose outflow is turned into Erie Canal through Limestone Creek, is 18 square miles. These two areas have been subtracted from the natural drainage area of 1,580 square miles, giving an effective area of 1,532 square miles. This estimate is approximate, as no allowance for direct inflow to feeder channels from additional areas, nor for waste into the original stream, has been made. The gross area from which more or less run-off is diverted is about 105 square miles.

About 1 mile upstream is the dam of the Binghamton Cold Storage Co. This is a low structure with 5-foot head, and constructed of large blocks of bluestone, laid dry, and allowing a large amount of leakage. Owing to this leakage, and to the fact that the water wheels run continuously night and day, the regimen of the stream below is not materially affected, and fluctuations in gage height are due almost entirely to natural causes. The next dam upstream is at Willards, about 16 miles above Binghamton and 2 miles above Chenango Forks.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station. During the winter months the discharge is usually very little affected by the presence of ice. The rating curve for low and medium stages has been fairly well developed; the high-water estimates, however, may be considerably in error, due to lack of sufficient discharge measurements and backwater effects from Susquehanna River. No discharge measurements were made during 1909. Measurements made during 1910 indicate, however, that conditions of flow have remained constant at this station. Discharge measurements are made from the bridge.

Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1909.

[H. L. Smith, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	6.1	8.25	8.55	10.9	5.95	5.4	5.1	4.9	4.8	5.15	5.4
2	5.1	5.95	7.8	8.7	12.3	5.8	5.35	5.15	4.9	4.95	5.0	5.3
3	5.2	6.2	7.65	9.2	10.2	5.8	5.3	5.15	4.9	5.0	5.1	5.2
4	5.3	6.15	7.75	9.2	10.6	5.8	5.15	5.1	4.9	4.95	5.1	5.2
5	6.4	6.2	7.0	8.9	9.95	6.0	5.2	5.0	4.9	4.9	5.1	5.4
6	11.3	8.2	6.9	8.9	8.9	7.4	5.15	5.0	4.9	4.9	5.0	5.2
7	9.8	10.1	7.05	9.8	9.5	6.52	5.2	5.1	4.9	4.9	4.8	5.2
8	7.35	9.0	6.8	10.3	8.75	6.2	5.15	4.85	4.9	4.9	5.1	5.2
9	6.65	7.55	6.7	9.5	8.28	6.0	5.1	5.05	4.9	4.85	4.95	4.95
10	6.65	7.10	8.6	8.6	7.7	6.3	5.1	5.05	5.0	4.85	5.05	5.15

Daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1909—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	6.55	8.15	11.0	8.2	9.2	7.3	5.1	5.1	5.2	4.9	5.0	5.15
12	6.5	7.48	9.9	7.7	9.15	6.6	5.1	4.9	5.2	5.0	5.0	5.0
13	5.8	7.28	8.45	7.4	8.0	6.3	5.0	4.9	5.2	5.0	5.05	5.2
14	5.75	7.2	8.2	9.6	7.6	7.48	5.0	4.8	5.1	5.1	5.0	5.2
15	6.15	8.35	7.7	13.15	7.85	6.9	5.0	4.8	5.1	5.0	5.0	6.35
16	6.0	9.4	7.2	11.9	7.52	6.4	4.9	4.85	5.1	5.0	5.0	6.15
17	5.7	10.6	7.15	10.2	7.3	6.2	4.9	5.0	5.0	4.95	5.0	5.65
18	5.65	9.2	6.8	9.3	7.25	6.75	5.2	5.0	4.95	4.95	5.0	5.6
19	5.5	7.9	6.75	8.5	6.95	6.7	5.2	5.2	4.9	4.95	5.05	5.4
20	5.6	15.4	6.7	8.3	6.75	6.35	5.0	5.15	4.85	4.95	5.05	5.35
21	5.75	15.7	6.6	8.0	6.5	6.1	5.0	5.15	4.9	4.95	5.0	5.4
22	5.8	13.05	6.4	7.95	6.35	5.98	5.0	5.0	4.9	4.95	5.1	5.45
23	5.9	10.25	6.3	7.6	6.3	6.02	5.0	5.2	4.8	5.1	5.2	5.4
24	6.65	11.9	6.35	7.2	6.2	6.0	5.1	5.0	5.0	5.2	5.4	5.35
25	13.8	14.65	8.15	6.95	6.1	5.7	5.45	5.1	5.0	5.4	5.2	5.35
26	12.6	13.05	11.65	6.8	6.0	5.7	5.4	4.7	4.9	5.2	5.2	5.3
27	9.7	10.3	10.35	6.7	5.95	5.6	5.25	4.95	4.95	5.2	5.25	5.3
28	8.1	9.5	9.9	6.6	5.95	5.6	5.15	4.6	5.0	5.15	5.3	5.25
29	7.2	....	9.7	6.55	6.1	5.55	5.2	4.95	5.0	5.1	5.2	5.35
30	7.1	....	9.25	8.4	6.0	5.5	5.2	5.05	4.8	5.1	5.4	5.25
31	6.85	....	8.7	....	6.0	....	5.15	4.9	....	4.95	....	5.2

NOTE.—Ice conditions prevailed from about Dec. 21 to 31 and also for short intervals at other times during the winter periods.

Daily discharge, in second-feet, of Chenango River at Binghamton, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	305	1,210	4,440	4,950	9,160	1,020	460	235	115	70	270	460
2	235	1,020	3,700	5,220	11,800	850	420	270	115	142	170	380
3	305	1,340	3,460	6,090	7,860	850	380	270	115	170	235	305
4	380	1,280	3,620	6,090	8,590	850	270	235	115	142	235	305
5	1,620	1,340	2,470	5,560	7,410	1,080	305	170	115	115	235	460
6	9,920	4,360	2,320	5,560	5,560	3,060	270	170	115	115	170	305
7	7,140	7,680	2,540	7,140	6,620	1,780	305	235	115	115	70	305
8	2,990	5,740	2,180	8,040	5,300	1,340	270	92	115	115	235	305
9	1,960	3,300	2,040	6,620	4,490	1,080	235	202	115	92	142	142
10	1,960	2,620	5,040	5,040	3,540	1,480	235	202	170	92	202	270
11	1,820	4,270	9,350	4,360	6,090	2,920	235	235	305	115	170	270
12	1,760	3,190	7,320	3,540	6,000	1,900	235	115	305	170	170	170
13	850	2,880	4,780	3,060	4,020	1,480	170	115	305	170	202	305
14	798	2,760	4,360	6,790	3,380	3,190	170	70	235	235	170	305
15	1,280	4,610	3,540	13,600	3,780	2,320	170	70	235	170	170	1,550
16	1,080	6,440	2,760	11,100	3,250	1,620	115	92	235	170	170	1,280
17	745	8,590	2,690	7,860	2,920	1,340	115	170	170	142	170	695
18	695	6,090	2,180	6,260	2,840	2,110	305	170	142	142	170	645
19	550	3,860	2,110	4,860	2,400	2,040	305	305	115	142	202	460
20	645	18,200	2,040	4,520	2,110	1,550	170	270	92	142	202	420
21	798	18,900	1,900	4,020	1,760	1,210	170	270	115	142	170	380
22	850	13,400	1,620	3,940	1,550	1,060	170	170	115	142	235	350
23	960	7,950	1,480	3,380	1,480	1,110	170	305	70	235	305	300
24	1,960	11,100	1,550	2,760	1,340	1,080	235	170	170	305	460	300
25	14,900	16,700	4,270	2,400	1,210	745	505	235	170	460	305	300
26	12,400	13,400	10,600	2,180	1,080	745	460	35	115	305	305	250
27	6,960	8,040	8,130	2,040	1,020	645	342	142	142	305	342	250
28	4,190	6,620	7,320	1,900	1,020	645	270	10	170	270	380	250
29	2,760	....	6,960	1,820	1,210	598	305	142	170	235	305	250
30	2,620	....	6,180	4,700	1,080	550	305	202	70	235	460	250
31	2,250	....	5,220	....	1,080	....	270	115	....	142	....	250

NOTE.—Daily discharges Jan. 1 to Dec. 20 based on a well-defined rating curve. Daily discharge Jan. 1 to Feb. 6 and Dec. 1 to 20 may be somewhat in excess due to slight ice conditions for short intervals. Daily discharge Dec. 21 to 30 estimated on the basis of daily discharge at other stations in Susquehanna drainage.

Monthly discharge of Chenango River at Binghamton, N. Y., for 1909.

[Drainage area, 1,530 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	14,900	235	2,830	1.85	2.13	B.
February	18,900	1,020	6,670	4.36	4.54	A.
March	10,600	1,480	4,130	2.70	3.11	A.
April	13,600	1,820	5,180	3.39	3.78	A.
May	11,800	1,020	3,900	2.55	2.94	A.
June	3,190	550	1,410	.922	1.03	A.
July	505	115	269	.176	.20	A.
August	305	10	177	.116	.13	A.
September	305	70	155	.101	.11	A.
October	460	70	179	.117	.13	A.
November	460	70	234	.153	.17	A.
December	1,550	142	402	.263	.30	C.
The year	18,900	10	2,130	1.39	18.57	

CHEMUNG RIVER BASIN.

DESCRIPTION.

Chemung River is formed near Painted Post, in the southeastern part of of Steuben County, N. Y., by the confluence of Cohocton and Tioga rivers. Cohocton River, the north branch, drains the southern slope of the divide at the head of Keuka and Canandaigua lakes. Its drainage area lies wholly in the State of New York, and principally in Steuben County, and comprises approximately 630 square miles above the mouth. Tioga River rises in Tioga County, Pa., and flows northward, crossing the State line near Lawrenceville, Pa. The last 15 miles of its course lies in New York State. It has about 1,330 square miles of drainage area above its mouth. About 5 miles from its mouth the Tioga receives from the left Canisteo River, which rises in the northeast corner of Allegany County and flows in a southeasterly direction, draining with its tributaries, the southern part of Steuben County. Its drainage area comprises about 540 square miles.

Chemung River proper is about 40 miles long. It flows eastward through the towns of Corning, Elmira, and Chemung and enters the Susquehanna at Athens, Bradford County, Pa. Near Chemung the river crosses the State line into Pennsylvania, and about 2 miles farther east it reenters New York, where it flows for a distance of about 4 miles, when it again crosses into Pennsylvania for the last 5 miles of its course. The drainage area above the mouth measures about 2,520 square miles.

In general the Chemung is sluggish throughout its course, flowing over a wide gravelly bed in a series of rifts and pools, and one or the other of the banks is usually low and subject to frequent overflows.

The cities of Corning and Elmira have built extensive dikes to confine the waters at all stages. The stream has a yearly range of from about 100 second-feet to about 30,000 second-feet. One of the greatest floods recorded was on June 1, 1889. It was preceded by a phenomenal rainfall, aggregating several inches in a few hours, during the night of May 31. The discharge has been estimated at 67 second-feet per square mile from 2,055 square miles or 138,000 second-feet.[1]

CHEMUNG RIVER AT CHEMUNG, N. Y.

This station is located at the Suspension highway bridge midway between Willawana, Pa., and Chemung, N. Y., and is about one-half mile upstream from the State line and 1 mile below the Erie Railroad bridge. It was established September 7, 1903, to obtain general statistical data regarding the flow of the Chemung, and is maintained in cooperation with the New York State engineer's department.

The Chemung was formerly paralleled by a canal taking its supply from dams across the stream. This canal has been abandoned, and the diversion dams are no longer in existence. At present the largest water-power development is at Elmira, N. Y. There are no dams between Elmira, N. Y., and the mouth of Chemung River.

The datum of the chain gage attached to the bridge has remained the same during the maintenance of the station.

Conditions for obtaining accurate discharge during the open period are only fair. At extreme high water the left bank is flooded, and at low stages there is more or less change in conditions of flow from year to year. On account of the numerous small riffs, considerable needle ice forms in this stream during the winter months. This collects under the ice in the smooth section at the gage and causes backwater which makes estimates liable to considerable error.

Discharge measurements are made from the bridge. Information in regard to this station is contained in the reports of the State engineer and surveyor, State of New York.

Discharge measurements of Chemung River at Chemung, N. Y., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 23	C. C. Covert	305	1,600	4.60	3,290
Aug. 19	.....do	205	234	1.82	156
Dec. 21[a]	.....do	220	1,110	2.82	232

[a] Complete ice cover. Average thickness of ice 0.40 foot. Gauge height to top of ice 2.88 feet.

[1] Report of Francis Collingwood, C. E., on the protection of the city of Elmira, N. Y., against floods.

Daily gage height, in feet, of Chemung River at Chemung, N. Y., for 1909.

[D. L. Orcutt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	......	4.72	5.33	15.39	2.95	2.66	1.80	1.70	1.80	1.91	1.88
2	......	......	4.44	5.37	15.15	2.79	2.43	1.80	1.67	1.72	1.94	1.93
3	......	......	4.64	5.47	9.61	2.72	2.40	1.80	1.70	1.72	1.85	1.93
4	......	......	4.56	5.19	7.73	2.64	2.30	1.80	1.76	1.69	1.85	1.79
5	......	......	4.06	4.93	6.67	3.29	2.28	1.78	1.74	1.68	1.85	1.90
6	4.93	......	3.64	5.03	5.91	6.85	2.27	1.78	1.60	1.74	1.80	1.79
7	5.20	7.16	4.14	6.15	5.81	4.97	2.26	1.76	1.71	1.72	1.66	1.80
8	3.38	5.16	4.26	5.85	5.27	4.10	2.20	1.77	1.69	1.70	1.82	1.80
9	3.07	4.38	4.18	5.08	4.82	3.66	2.15	1.72	1.72	1.74	1.96	1.87
10	3.20	4.11	5.92	4.79	4.99	3.70	2.12	1.71	1.74	1.76	1.93	......
11	3.42	4.32	7.48	4.45	4.77	7.12	2.09	1.66	1.90	1.74	1.90	1.85
12	2.96	3.60	5.54	4.25	4.37	5.29	2.08	1.66	1.80	1.80	1.86	......
13	2.86	3.68	5.08	4.19	4.18	4.40	2.10	1.68	1.74	1.74	1.84	......
14	......	3.52	4.84	8.02	4.23	6.04	1.96	1.65	1.96	1.76	1.88	......
15	......	3.84	4.56	10.73	4.23	5.52	1.96	1.72	1.76	1.95	1.76	......
16	......	4.46	4.21	7.50	4.29	4.50	1.98	1.66	1.84	1.84	1.85	......
17	......	3.80	3.93	6.31	4.05	3.98	1.94	1.82	1.89	1.88	1.73	......
18	......	3.76	3.64	5.48	3.83	4.57	1.88	1.84	1.80	1.78	1.70	......
19	......	3.65	3.56	5.01	3.68	4.33	1.90	1.78	1.86	1.85	1.70	......
20	......	7.37	3.57	4.66	3.57	3.75	1.90	1.92	1.64	1.76	1.78	......
21	......	7.70	3.45	4.61	3.43	3.44	1.88	1.84	1.82	1.78	1.78	2.82
22	......	6.44	3.27	4.65	3.32	3.26	1.89	1.82	1.80	1.88	1.74	......
23	......	7.33	3.17	4.59	3.23	3.38	2.01	1.71	1.78	1.92	1.86	......
24	6.96	10.06	3.04	4.15	3.14	3.43	2.03	1.85	1.74	1.84	1.72	......
25	9.31	11.01	3.21	3.92	3.11	3.36	2.00	1.80	1.81	1.94	1.72	......
26	6.70	6.93	3.27	3.67	3.03	3.00	2.02	1.82	1.76	2.08	2.01	......
27	5.18	6.06	4.73	3.57	2.99	2.84	2.04	1.82	1.70	2.10	1.92	......
28	4.48	5.41	4.87	3.53	3.03	2.81	1.93	1.80	1.86	2.05	1.89	......
29	3.88	......	5.27	3.87	3.43	2.66	1.94	1.83	1.78	2.02	1.94	......
30	3.48	......	5.17	8.75	3.31	2.78	1.87	1.66	1.88	1.99	1.88	......
31	......	......	5.05	......	3.08	......	1.80	1.76	......	2.00	......	......

NOTE.—Ice conditions prevailed from about Jan. 1 to 5, 14 to 23, Jan. 31 to Feb. 6, and Dec. 9 to 31.

Daily discharge, in second-feet, of Chemung River at Chemung, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	300	1,000	3,530	4,870	46,200	898	655	140	105	140	184	172
2	300	900	2,990	4,970	45,000	757	491	140	96	112	198	194
3	300	1,000	3,370	5,210	18,100	701	470	140	105	112	160	194
4	300	1,000	3,210	4,550	11,400	640	405	140	126	102	160	136
5	1,500	1,000	2,330	3,970	8,320	1,250	392	133	119	99	160	180
6	3,970	2,000	1,700	4,190	6,320	8,800	386	133	75	119	140	136
7	4,570	9,670	2,460	6,940	6,060	4,050	379	126	108	112	93	140
8	1,360	4,480	2,660	6,160	4,730	2,390	340	130	102	105	148	140
9	1,020	2,870	2,530	4,300	3,730	1,720	310	112	112	119	207	150
10	1,150	2,410	6,340	3,670	4,100	1,780	292	108	119	126	194	150
11	1,410	2,770	10,600	3,000	3,630	9,560	274	93	180	119	180	150
12	907	1,640	5,380	2,640	2,860	4,780	269	93	140	140	164	150
13	816	1,750	4,300	2,540	2,530	2,910	280	99	119	119	156	160
14	700	1,540	3,770	12,400	2,610	6,650	207	90	207	126	172	180
15	600	1,980	3,210	22,800	2,610	5,330	207	112	126	202	126	200
16	600	3,020	2,580	10,700	2,710	3,100	216	93	156	156	160	210
17	600	1,920	2,120	7,360	2,310	2,200	198	148	176	172	116	220
18	500	1,870	1,700	5,230	1,970	3,230	172	156	140	133	105	230
19	500	1,710	1,590	4,140	1,750	2,780	180	133	164	160	105	230
20	500	10,300	1,600	3,470	1,600	1,850	180	189	87	126	133	230
21	500	11,300	1,450	3,310	1,420	1,440	172	156	148	133	133	230
22	500	7,700	1,230	3,390	1,290	1,220	176	148	140	172	119	230
23	1,000	10,200	1,120	3,270	1,180	1,360	230	108	133	189	164	230
24	9,110	19,900	985	2,480	1,090	1,420	242	160	119	156	112	230
25	17,000	24,000	1,160	2,110	1,060	1,340	225	140	144	198	112	230
26	8,400	9,020	1,230	1,740	975	945	236	148	126	269	230	230
27	4,440	6,710	3,550	1,600	936	799	247	148	105	280	189	230
28	3,060	5,060	3,840	1,550	975	774	194	140	164	252	176	230
29	2,040	......	4,730	2,030	1,420	655	198	152	133	236	198	230
30	1,480	......	4,500	14,900	1,280	749	168	93	172	220	172	230
31	1,200	......	4,230	......	1,020	......	140	126	......	225	......	230

NOTE.—Daily discharges for open-water period obtained from a well-defined rating curve. Daily discharges for ice periods estimated on the basis of discharge at other stations in the Susquehanna drainage.

Monthly discharge of Chemung River at Chemung, N. Y., for 1909.

[Drainage area, 2,440 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	17,000	300	2,280	0.934	1.08	B.
February	24,000	900	5,310	2.18	2.27	A.
March	10,600	985	3,100	1.27	1.46	A.
April	22,800	1,550	5,320	2.18	2.43	A.
May	46,200	936	6,170	2.53	2.92	A.
June	9,560	640	2,540	1.04	1.16	A.
July	655	140	275	.113	.13	A.
August	189	90	130	.053	.06	A.
September	207	75	132	.054	.06	A.
October	280	99	159	.065	.07	A.
November	230	93	156	.064	.07	A.
December	230	136	196	.080	.09	D.
The year	46,200	75	2,150	.890	11.80	

WEST BRANCH SUSQUEHANNA BASIN.

DESCRIPTION.

The West Branch of Susquehanna River rises in the mountains of Cambria County, at an elevation of not less than 2,000 feet above sea level, flows northeastward, and then southeastward into the Susquehanna above Sunbury. Its length is about 425 miles, and its drainage area, measured at the mouth, comprises approximately 7,030 square miles, all in Pennsylvania.

The topography of the basin is rugged. The bed of the river, as a rule, is composed of gravel and sand, but rocky ledges occur at some points. The banks of main stream and tributaries are generally high, and there are few low grounds subject to overflow. The fall of the stream is variable, but is much greater above Queens Run than below, where the river traverses a wide, fertile, well-cultivated valley. Few forested areas remain. Facilities for artificial storage are probably good, and the flow of many of the tributaries might no doubt be regulated to considerable extent. The river was navigable, by means of the canal along its banks, to Lock Haven and beyond, prior to 1889, there being four canal dams on the stream, the ponds of which were used for navigation. The flood of 1889 so damaged the upper portion of the canal that it was not operated subsequent to that date above Muncy. From Muncy to Northumberland it was operated as late as 1897. No water was flowing in the canal at the Williamsport gaging station in 1895.

WEST BRANCH OF SUSQUEHANNA RIVER AT WILLIAMSPORT, PA.

This station is located at the Market Street Bridge in Williamsport. Lycoming Creek enters Susquehanna River from the north about 2 miles above the station, and Loyalsock Creek, also from the north, enters about 2 miles below the station. It was established March 1, 1895, by George D. Snyder, who was at that time city engineer of Williamsport. A standard chain gage was installed on the bridge by the United States Geological Survey August 16, 1901. The gage is now maintained by the United States Weather Bureau, from whom the daily readings are obtained.

The datum of the gage has been unchanged since the establishment of the station. The discharge is usually affected by ice during the winter period. Conditions of flow at this point are constant, and a good rating curve has been developed. There is a dam about one-half mile above the station, but it is believed that it has no effect on the relation of discharge to gage height. Discharge measurements are made from the bridge or by wading.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

Daily gage height, in feet, of West Branch of Susquehanna River at Williamsport, Pa., for 1909.

[Henry H. Guise, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	2.5	6.4	4.2	[a]21.0	2.6	2.3	0.5	0.3	0.3	0.5	0.4
2	1.3	1.8	5.5	4.0	19.4	2.3	2.0	.5	.3	.3	.5	.4
3	1.3	2.4	5.0	3.9	14.1	2.2	1.8	.5	.3	.2	.4	.3
4	1.3	2.2	5.8	3.8	11.3	2.1	1.5	.5	.3	.2	.4	.3
5	1.4	2.6	5.2	3.7	9.7	3.3	1.4	.5	.3	.2	.3	.3
6	2.8	2.8	4.7	3.5	8.4	5.3	1.3	.5	.2	.2	.3	.3
7	5.3	7.0	4.2	4.1	7.3	4.9	1.2	.4	.2	.2	.3	.3
8	4.8	7.4	4.0	6.0	6.4	4.5	1.1	.4	.2	.2	.3	.3
9	3.8	6.2	3.9	6.4	5.6	3.9	1.0	.4	.2	.2	.3	.2
10	2.8	5.1	4.5	5.7	5.1	3.9	1.0	.4	.2	.2	.3	.2
11	2.6	5.5	6.3	5.1	5.0	3.8	1.0	.4	.3	.2	.3	.3
12	2.6	4.6	7.0	4.6	4.9	4.5	.9	.3	.3	.2	.3	.3
13	2.7	4.5	6.3	4.2	4.5	4.4	.8	.3	.3	.5	.3	.3
14	2.0	4.3	5.7	5.8	4.1	4.7	.7	.3	.2	.6	.3	1.5
15	1.5	5.6	5.2	[b]12.3	3.8	6.4	.7	.3	.2	.7	.3	2.3
16	2.3	9.5	4.7	10.8	3.7	5.5	.7	.3	.2	.7	.3	1.8
17	3.3	12.0	4.2	8.4	3.4	4.5	.7	.3	.2	.6	.3	1.6
18	2.5	10.2	3.8	6.9	3.2	5.0	.6	.5	.2	.5	.3	1.7
19	2.5	8.2	3.5	5.9	3.0	4.3	.6	.6	.2	.5	.2	2.0
20	2.3	8.1	3.3	5.4	2.7	3.6	.6	.5	.2	.4	.2	1.6
21	2.0	8.2	3.1	5.0	2.6	3.2	.6	.5	.2	.4	.3	.7
22	2.0	7.4	3.0	5.1	2.5	2.8	.6	.5	.2	.4	.3	.7
23	2.1	6.6	2.8	6.4	2.4	2.5	.7	.5	.2	.4	.3	.7
24	2.2	8.9	2.6	6.7	2.3	2.3	.7	.4	.3	.4	.3	.7
25	5.8	14.5	2.6	6.0	2.2	2.3	1.0	.4	.4	.5	.3	.7
26	10.8	12.0	3.9	5.6	2.1	2.5	1.1	.4	.4	.6	.4	.6
27	9.3	9.3	6.0	5.1	2.0	2.4	.9	.4	.4	.6	.4	.6
28	7.4	7.6	5.1	4.8	2.5	2.2	.8	.4	.3	.6	.4	.6
29	5.7	......	5.0	4.8	3.0	2.5	.7	.4	.3	.6	.4	.5
30	4.6	......	4.8	9.6	3.0	2.4	.6	.4	.3	.6	.4	.5
31	4.0	......	4.5	......	2.8	......	.5	.3	......	.5	......	.4

[a] Maximum gage height for day, 21.0 feet, at 7.30 a. m.
[b] Maximum gage height, 12.8 feet, at 2 p. m.

NOTE.—Ice conditions prevailed about as follows: Jan. 1 to 5, Jan. 12 to 13, Jan. 16 to 24, Feb. 3 to 5, and Dec. 18 to 31.

Daily discharge, in second-feet, of West Branch of Susquehanna River at Williamsport, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,200	5,230	19,900	10,400	141,000	5,490	4,720	930	630	630	930	775
2	1,200	3,500	15,800	9,690	124,000	4,720	3,980	930	630	630	930	775
3	1,000	2,500	13,600	9,360	70,000	4,470	3,500	930	630	495	775	630
4	1,000	2,000	17,200	9,030	47,400	4,220	2,830	930	630	495	775	630
5	2,000	2,500	14,500	8,710	37,400	7,470	2,620	930	630	495	630	630
6	6,020	6,020	12,300	8,090	30,200	14,900	2,410	930	495	495	630	630
7	14,900	22,900	10,400	10,000	24,400	13,200	2,210	775	495	495	630	630
8	12,800	24,900	9,690	18,100	19,900	11,500	2,010	775	495	495	630	630
9	9,030	19,000	9,360	19,900	16,200	9,360	1,820	775	495	495	630	495
10	6,020	14,000	11,500	16,700	14,000	9,360	1,820	775	495	495	630	495
11	5,490	15,800	19,500	14,000	13,600	9,030	1,820	775	630	495	630	630
12	5,000	11,900	22,900	11,900	13,200	11,500	1,630	630	630	495	630	630
13	4,500	11,500	19,500	10,400	11,500	11,200	1,440	630	630	930	630	630
14	3,980	10,800	16,700	17,200	10,000	12,300	1,260	630	495	1,090	630	2,830
15	2,830	16,200	14,500	54,600	9,030	19,900	1,260	630	495	1,260	630	4,720
16	2,000	36,300	12,300	44,100	8,710	15,800	1,260	630	495	1,260	630	3,500
17	1,500	52,400	10,400	30,200	7,780	11,500	1,260	630	495	1,090	630	3,050
18	1,200	40,400	9,030	22,400	7,170	13,600	1,090	930	495	930	630	2,500
19	1,000	29,100	8,090	17,600	6,580	10,800	1,090	1,090	495	930	495	2,000
20	1,000	28,500	7,470	15,400	5,750	8,400	1,090	930	495	775	495	1,500
21	1,200	29,100	6,870	13,600	5,490	7,170	1,090	930	495	775	630	1,200
22	1,200	24,900	6,580	14,000	5,230	6,020	1,090	930	495	775	630	1,000
23	1,800	20,900	6,020	19,900	4,970	5,230	1,260	930	495	775	630	1,000
24	3,000	32,900	5,490	21,400	4,720	4,720	1,260	775	630	775	630	800
25	17,200	73,600	5,490	18,100	4,470	4,720	1,820	775	775	930	630	800
26	44,100	52,400	9,360	16,200	4,220	5,230	2,010	775	775	1,090	775	800
27	35,100	35,100	13,600	14,000	3,980	4,970	1,630	775	775	1,090	775	700
28	24,900	25,900	14,000	12,800	5,230	4,470	1,440	775	630	1,090	775	600
29	16,700	....	13,600	12,800	6,580	5,230	1,260	775	630	1,090	775	600
30	11,900	....	12,800	36,800	6,580	4,970	1,090	775	630	1,090	775	500
31	9,690	....	11,500	....	6,020	....	930	630	....	930	......	500

NOTE.—Discharge during the periods of backwater from ice conditions estimated on the basis of climatological data and comparisons with the discharge at other stations in the Susquehanna River drainage.

Monthly discharge of West Branch of Susquehanna River at Williamsport, Pa., for 1909.

[Drainage area, 5,640 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	44,100	....	8,080	1.43	1.65	B.
February	73,600	....	23,200	4.11	4.28	A.
March	22,900	5,490	12,300	2.18	2.51	A.
April	54,600	8,090	17,900	3.17	3.54	A.
May	141,000	3,980	21,800	3.87	4.46	A.
June	19,900	4,220	8,720	1.55	1.73	A.
July	4,720	930	1,810	.321	.37	A.
August	1,090	630	807	.143	.16	A.
September	775	495	577	.102	.11	A.
October	1,260	495	803	.142	.16	A.
November	930	495	675	.120	.13	A.
December	4,720	....	1,190	.211	.24	B.
The year	141,000	....	8,040	1.44	19.34	

JUNIATA RIVER BASIN.

DESCRIPTION.

Juniata River rises in the mountains of Bedford, Blair, and Somerset counties, Pa., at a general elevation of about 2,000 feet above the sea, though the divide between its waters and those of the Ohio attains in places an elevation of 2,800 feet. The river has two chief upper divisions, the Frankstown and the Raystown Branches; from their union, a few miles southeast of Huntingdon, the main river winds eastward to the point where it enters the Susquehanna at Duncans Island. The length of the river below the branches is about 75 miles, and the total drainage area, measured at the mouth, comprises 3,530 square miles.

The Frankstown Branch rises in northwestern Bedford County and flows first northeast, then southeast, to the point where it receives the Raystown Branch, its length being about 50 miles and its drainage area measuring 933 square miles; the Raystown Branch rises in eastern Somerset County and flows east and northeast to its union with the Frankstown Branch, its length being about 70 miles and its drainage area 909 square miles.

The valley of the main river is very narrow, the banks are generally high, and there is little low land to be overflowed. The bed, is, as a rule, of gravel or sand, with rock a little below or in places at the surface. For elevations and slope see Water-Supply Paper 109.

The whole basin of the river is traversed from southwest to northeast by a number of parallel ranges, across and between which the river and its tributaries wind. There are no lakes in the region, but facilities for artificial storage are good. Two miles above Hollidaysburg is an artificial reservoir, formerly used as a feeder for a canal. This reservoir has an area of about 600 acres and a depth of 20 feet, and is formed by a dam 850 feet long and 30 feet high, built mainly of earth. A small amount of power could be used here. A canal extends up the river to Huntington, following the stream closely for the entire distance. The Pennsylvania Railroad also follows the main river, the Frankstown Branch, and the Little Juniata almost to the summit of the mountains. There is very little manufacturing in the basin, and there are no mills of importance on the main stream below the mouth of the Raystown Branch. Little power is used from the canal, but a large amount might be developed, especially at the locks, where considerable water wastes.

The river has a large number of tributaries, but these offer few or no precipitous falls and fewer rapids than the main river, except where they cut through the ranges from one valley to an adjacent one. Their flow is variable, their banks vary in height, and they sometimes overflow considerable areas of bottom land.

JUNIATA RIVER AT NEWPORT, PA.

This station is located at the steel highway bridge about 800 feet east of the public square at Newport. Buffalo Creek enters the river from the west about 1 mile above the station. There are no important tributaries between Newport and the mouth of the Juniata, a distance of about 12 miles. This station was established March 21, 1899, by the United States Geological Survey, and was discontinued from July 15, 1906, to January 6, 1907. It is now being maintained by the Pennsylvania State Water Supply Commission, from whom the tables of daily gage heights and discharge measurements made by engineers of the commission are obtained.

The datum of the chain gage attached to the bridge has remained constant during the maintenance of the station. Discharge measurements are made from the bridge. Conditions of flow are liable to change from year to year. A good rating curve has been developed for high and medium stages, and at low stages it is fairly good.

Discharge data for this station prior to 1905 have been revised and republished in Water-Supply Paper 109.

The following discharge measurement was made by Kenneth Grant:

May 13, 1909; width, 541 feet; area, 1,600 square feet; gage height, 4.40 feet; discharge, 4,820 second-feet.

Daily gage height, in feet, of Juniata River at Newport, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	3.8	5.9	4.1	8.1	3.51	3.68	2.90	2.70	2.70	2.92	2.70
2	3.1	3.35	5.35	4.0	7.8	3.49	3.54	2.92	2.86	2.75	2.99	2.74
3	3.15	3.3	5.1	4.0	7.0	3.47	3.38	2.94	2.85	2.74	2.82	2.70
4	3.2	3.35	5.3	3.9	6.65	3.52	3.22	2.80	2.72	2.76	2.92	2.76
5	3.1	3.6	5.25	3.85	6.3	4.00	3.18	2.82	2.86	2.75	2.79	2.76
6	3.8	3.85	5.15	3.9	5.85	4.60	3.08	2.86	2.80	2.74	2.84	2.70
7	4.5	4.1	5.0	4.0	5.45	4.56	3.05	2.80	2.84	2.75	2.88	2.78
8	3.8	3.85	5.05	4.0	5.15	4.32	3.09	2.78	2.70	2.74	2.76	2.74
9	3.6	3.6	5.15	4.1	4.85	4.60	3.10	2.78	2.86	2.74	2.91	2.72
10	3.35	3.85	5.15	4.0	4.6	5.05	2.99	2.82	2.92	2.70	2.75	2.60
11	3.35	4.6	5.4	4.05	4.75	5.32	2.96	2.72	2.92	2.72	2.96	2.81
12	3.5	4.4	5.3	4.0	4.65	5.79	2.98	2.82	2.93	3.15	2.78	2.92
13	3.4	4.25	4.95	4.0	4.3	5.96	3.04	2.78	2.85	3.00	2.79	3.10
14	3.05	4.3	4.75	5.35	4.27	5.29	2.96	2.78	2.90	3.06	2.78	4.82
15	3.0	4.5	4.6	[a]10.75	4.14	4.95	2.98	2.69	2.75	3.05	2.75	4.92
16	3.6	5.8	4.6	9.15	4.13	4.56	3.00	2.66	2.91	3.02	2.92	4.38
17	3.15	7.3	4.4	7.1	3.98	4.32	3.17	3.05	2.89	3.00	2.77	3.88
18	3.1	6.9	4.2	6.25	3.89	5.26	3.10	3.50	2.80	2.92	2.86	3.38
19	3.55	6.0	4.2	5.55	3.82	4.90	3.08	3.50	2.82	2.98	2.82	2.90
20	3.25	5.7	4.0	5.2	3.78	4.33	3.01	3.18	2.76	2.78	2.85	3.19
21	3.6	5.55	4.0	6.05	3.74	4.08	3.00	3.05	2.85	2.90	2.72	3.28
22	3.65	5.1	4.0	7.25	3.80	3.92	2.90	2.98	2.72	2.90	2.84	3.40
23	3.6	4.95	3.9	8.45	3.96	3.82	2.98	2.94	2.82	2.86	2.82	3.58
24	3.6	8.8	3.9	8.25	3.92	3.78	3.00	2.95	2.72	3.11	2.71	3.71
25	4.1	[b]11.95	3.8	7.2	3.79	3.72	3.00	2.78	2.75	3.16	2.76	3.72
26	8.0	9.7	4.15	6.6	3.72	3.71	3.46	2.88	2.86	3.16	2.72	3.78
27	5.95	7.55	4.5	6.05	3.68	3.68	2.94	2.76	2.95	3.22	2.75	3.58
28	4.95	6.55	4.3	5.55	3.72	3.92	2.98	2.76	2.94	3.22	2.74	3.50
29	4.45	......	4.3	5.2	3.78	3.82	2.90	2.86	2.70	3.10	2.76	3.45
30	4.05	......	4.1	6.05	3.76	3.70	2.89	2.85	2.76	3.02	2.77	3.50
31	4.0	......	4.15	......	3.66	......	2.89	2.87	......	2.98	......	3.45

[a] Maximum 11.3 feet at 5 p. m.

[b] Maximum 12.2 feet at 8 a. m.

NOTE.—No notes regarding ice furnished; data from other Susquehanna River stations indicates that the discharge was affected by ice Jan. 18 to 24 and Dec. 20 to 31

Daily discharge, in second-feet, of Juniata River at Newport, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,040	2,470	8,570	3,230	16,400	1,830	2,200	845	610	610	871	610
2	1,120	1,530	6,840	2,970	15,200	1,790	1,890	871	797	668	962	656
3	1,190	1,440	6,080	2,970	12,300	1,750	1,580	897	785	656	749	610
4	1,270	1,530	6,690	2,710	11,000	1,850	1,300	725	633	679	871	679
5	1,120	2,020	6,540	2,590	9,870	2,970	1,240	749	797	668	714	679
6	2,470	2,590	6,230	2,710	8,410	4,610	1,090	797	725	656	773	610
7	4,330	3,230	5,780	2,970	7,160	4,500	1,040	725	773	668	821	702
8	2,470	2,590	5,930	2,970	6,230	3,830	1,100	702	610	656	679	656
9	2,020	2,020	6,230	3,230	5,340	4,610	1,120	702	797	656	858	633
10	1,530	2,590	6,230	2,970	4,610	5,930	962	749	871	610	668	500
11	1,530	4,610	7,000	3,100	5,040	6,750	923	633	871	633	923	737
12	1,810	4,050	6,690	2,970	4,760	8,220	949	749	884	1,190	702	871
13	1,620	3,640	5,630	2,970	3,770	8,760	1,030	702	785	975	714	1,120
14	1,040	3,770	5,040	6,840	3,690	6,660	923	702	845	1,060	702	5,250
15	975	4,330	4,610	27,400	3,340	5,630	949	599	668	1,040	668	5,540
16	2,020	8,250	4,610	20,600	3,310	4,500	975	566	858	1,000	871	3,990
17	1,190	13,300	4,050	12,600	2,920	3,830	1,220	1,040	833	975	690	2,660
18	800	11,900	3,500	5,700	2,690	6,570	1,120	1,810	725	871	797	1,580
19	700	8,890	3,500	7,460	2,520	5,480	1,090	1,810	749	949	749	845
20	600	7,930	2,970	6,380	2,420	3,850	989	1,240	679	702	785	700
21	700	7,460	2,970	9,050	2,330	3,180	975	1,040	785	845	633	700
22	800	6,080	2,970	13,200	2,470	2,760	845	949	633	845	773	600
23	1,000	5,630	2,710	17,700	2,870	2,520	949	897	749	797	749	600
24	1,500	19,100	2,710	16,900	2,760	2,420	975	910	633	1,130	622	600
25	3,230	32,900	2,470	13,000	2,450	2,290	975	702	668	1,210	679	500
26	16,000	22,900	3,360	10,900	2,290	2,260	1,730	821	797	1,210	633	500
27	8,730	14,300	4,330	9,050	2,200	2,200	897	679	910	1,300	668	500
28	5,630	10,700	3,770	7,460	2,290	2,760	949	679	897	1,300	656	500
29	4,190	....	3,770	6,380	2,420	2,520	845	797	610	1,120	679	450
30	3,100	....	3,230	9,050	2,380	2,240	833	785	679	1,000	690	450
31	2,970	....	3,360	....	2,150	....	833	809	....	949	....	450

NOTE.—Daily discharge during the frozen periods estimated on the basis of comparisons with other Susquehanna River stations and climatological data. Other daily discharges are based on a rating curve well defined above 3,000 second-feet and fairly well defined below.

Monthly discharge of Juniata River at Newport, Pa., for 1909.

[Drainage area, 3,480 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	16,000	....	2,540	0.730	0.84	B.
February	32,900	1,440	7,560	2.17	2.26	B.
March	8,570	2,470	4,790	1.38	1.59	A.
April	27,400	2,590	7,930	2.28	2.54	A.
May	16,400	2,150	5,080	1.46	1.68	B.
June	8,760	1,750	3,970	1.14	1.27	B.
July	2,200	833	1,110	.319	.37	B.
August	1,810	566	861	.247	.28	B.
September	910	610	755	.217	.24	B.
October	1,300	610	891	.256	.30	B.
November	962	622	745	.214	.24	B.
December	5,540	....	1,140	.328	.38	B.
The year	32,900	....	3,080	.885	11.99	

BROAD CREEK AT MILL GREEN, MD.

Broad Creek rises in the northern part of Harford County, Md., flows southeastward, and then northeastward into the Susquehanna. Its fall is gradual, the bed is of gravel or sand, the banks are generally low, and the flow is variable.

This station is located at the steel highway bridge in the village of Mill Green. No important tributaries enter Broad Creek in the immediate vicinity of Mill Green. The station is about 8 miles above the junction of Broad Creek with the Susquehanna. It was established December 14, 1904, and was discontinued March 31, 1909. The observer was paid by the Maryland State weather service.

This station was established to determine the daily distribution of flow of Broad Creek for power development.

The datum of the chain gauge attached to the bridge has remained constant since the establishment of the station. The discharge is often affected by ice during the winter period. Conditions of flow have remained practically constant during the maintenance of the station, and a good low-water rating curve has been developed. Although no inspection of this station has been made since May, 1908, the records for 1909 are believed to be fairly accurate.

Daily gage height, in feet, and daily discharge, in second-feet, of Broad Creek at Mill Green, Md., for 1909.

[E. J. Treakle, observer.]

Day.	January.		February.		March.		Day.	January.		February.		March.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	2.28	14	2.45	23	2.45	23	16	2.31	16	2.50	26	2.52	27
2	2.38	19	2.42	21	2.62	33	17	2.31	16	2.48	25	2.50	26
3	2.30	15	2.29	15	2.50	26	18	2.30	15	2.40	20	2.51	27
4	2.30	15	2.25	13	2.85	51	19	2.30	15	2.39	20	2.52	27
5	3.05	69	2.28	14	2.75	43	20	2.30	15	2.56	30	2.58	31
6	2.58	31	2.34	17	2.58	31	21	2.26	13	2.42	21	2.49	25
7	2.45	23	2.32	16	2.70	39	22	2.28	14	2.42	21	2.48	25
8	2.35	18	2.38	19	2.74	42	23	2.32	16	2.52	27	2.49	25
9	2.30	15	2.32	16	2.90	55	24	2.45	23	3.35	100	2.54	28
10	2.26	13	3.20	84	3.10	74	25	2.60	32	2.62	33	2.92	57
11	2.29	15	2.45	23	2.72	41	26	2.39	20	2.58	31	2.62	33
12	2.28	14	2.32	16	2.58	31	27	2.35	18	2.52	27	2.55	29
13	2.30	15	2.31	16	2.71	40	28	2.32	16	2.49	25	2.50	26
14	2.30	15	2.32	16	2.62	33	29	2.31	16			2.49	25
15	2.30	15	2.45	23	2.56	30	30	2.31	16			2.45	23
							31	2.31	16			2.40	20

NOTE.—No ice conditions reported. Probable ice conditions during parts of January and February. The daily discharges are based on a rating curve that is well defined between 11 and 94 second-feet. As given, the discharges for some days in January and February may be too large, owing to probable ice conditions.

Monthly discharge of Broad Creek at Mill Green, Md., for 1909.

[Drainage area, 16.4 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	69	13	18.8	1.15	1.33	B.
February	100	13	26.4	1.61	1.68	B.
March	74	20	33.7	2.05	2.36	B.

DEER CREEK NEAR CHURCHVILLE, MD.

Deer Creek rises in the southern part of York County, Pa., and flows southeastward into the Susquehanna near Stafford, Harford County, Md. It is about 35 miles long and drains an area of 128 square miles.

The gaging station, which was established to determine the daily distribution of flow of Deer Creek for power development, is located at the highway bridge about 3 miles north of Churchville. All tributaries in the vicinity of the station are unimportant. The station is located about 1 mile above Coolbranch Run and about 8 miles above the junction of Deer Creek with the Susquehanna. It was established December 14, 1904, and was discontinued March 31, 1909. The observer was paid by the Maryland State weather service.

The datum of the chain gage attached to the bridge has not been changed since the establishment of the station. The discharge is often affected by ice during the winter period. Conditions of flow have remained constant during the maintenance of the station and an excellent low-water rating curve has been developed.

Although no inspection of this station has been made since May, 1908, the records for 1909 are believed to be fairly accurate.

Daily gage height, in feet, and daily discharge, in second-feet, of Deer Creek near Churchville, Md., for 1909.

[R. H. Archer, observer.]

Day.	January.		February.		March.		Day.	January.		February.		March.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	1.90	150	1.80	126	2.15	226	16	2.12	216	2.18	235	2.40	315
2	1.85	138	2.00	178	2.45	335	17	1.90	150	2.32	285	2.40	315
3	1.90	150	2.00	178	2.35	296	18	1.98	172	2.10	209	2.38	307
4	1.80	126	1.90	150	2.70	445	19	2.00	178	2.05	194	2.32	285
5	2.38	307	1.95	164	2.00	178	20	2.12	216	2.68	436	2.38	307
6	2.92	561	1.90	150	2.05	194	21	2.05	194	2.30	277	2.30	277
7	2.18	235	1.90	150	2.20	242	22	1.90	150	2.25	260	2.20	242
8	2.00	178	1.90	150	2.68	436	23	2.05	194	2.15	226	2.20	242
9	2.00	178	1.98	172	2.88	539	24	2.35	296	3.38	842	2.25	260
10	1.95	164	3.28	777	2.88	539	25	2.45	335	2.85	522	3.00	605
11	1.95	164	2.45	335	2.60	400	26	2.35	296	2.45	335	2.40	315
12	1.95	164	2.20	242	2.58	391	27	2.10	209	2.40	315	2.65	422
13	1.90	150	2.20	242	2.60	400	28	2.10	209	2.35	296	2.50	355
14	1.92	156	2.10	209	2.65	422	29	2.00	178			2.40	315
15	2.00	178	2.10	209	2.50	355	30	2.10	209			2.32	285
							31	1.88	145			2.22	249

NOTE.—No ice notes. Probable ice conditions during parts of January and February. The daily discharges are based on a rating curve that is well defined between 72 and 920 second-feet. These may be in excess for some days in January and February because of probable ice conditions.

Monthly discharge of Deer Creek near Churchville, Md., for 1909.

[Drainage area, 141 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	561	126	205	1.45	1.67	B.
February	842	126	281	1.99	2.07	B.
March	605	178	339	2.40	2.77	A.

GUNPOWDER RIVER DRAINAGE BASIN.

DESCRIPTION.

The headwaters of Gunpowder River lie in York County, Pa., near the Maryland line. Thence the river flows southeastward through Baltimore County, Md., and empties into Chesapeake Bay about 10 miles northeast of Baltimore. The river, though small, has steep slopes, and the powers have considerable value on account of their proximity to a large city. A portion of the water supply for Baltimore is taken from this river at Loch Raven, and the city has purchased all the power rights below this place. Little Gunpowder Falls, which is tributary below the fall line, has the same general characteristics as the larger river. Throughout its entire length it forms the boundary between Harford and Baltimore counties, Md. There are several small power developments.

GUNPOWDER FALLS AT GLENCOE, MD.

This station is located at a steel highway bridge near the Pennsylvania Railroad station at Glencoe. It is about three-fourths of a mile above Piney Creek, which enters Gunpowder Falls from the west. It was established December 15, 1904, and was discontinued March 31, 1909. The observer was paid by the Maryland State weather service.

This station was established to determine the daily distribution of flow of Gunpowder Falls for power development. Between 50 and 60 second-feet are continuously diverted from this stream above Glencoe for the water supply of Baltimore, Md.

The datum of the chain gage attached to the bridge has remained constant since the establishment of the station. The discharge is sometimes affected by ice during the winter months. Conditions of flow are liable to change at this station. A good rating curve has been developed for low stages.

Although no inspection of this station has been made since May, 1908, the records for 1909 are believed to be fairly accurate.

Daily gage height, in feet, and daily discharge, in second-feet, of Gunpowder Falls, at Glencoe, Md., for 1909.

[Samuel Wilhelm, observer.]

Day.	January.		February.		March.		Day.	January.		February.		March.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	1.42	80	2.18	150	2.28	230	16	2.15	201	2.20	212	2.45	273
2	2.22	80	2.50	150	2.30	235	17	3.98	200	2.22	217	2.40	260
3	1.70	119	2.25	150	2.25	224	18	4.00	200	2.02	174	2.40	260
4	1.60	104	1.88	149	2.82	381	19	3.25	200	2.08	186	2.38	255
5	2.35	248	1.90	152	2.52	292	20	3.25	200	2.45	273	2.40	260
6	2.65	329	1.92	156	2.40	260	21	2.85	200	2.15	201	2.30	235
7	2.15	201	1.85	144	2.42	265	22	2.85	200	2.20	212	2.30	235
8	2.25	224	1.88	149	2.55	300	23	2.90	200	3.62	668	2.22	217
9	2.00	170	1.92	156	2.62	320	24	3.08	200	3.55	640	2.20	212
10	1.95	161	2.45	273	3.82	748	25	2.88	401	2.95	424	2.78	369
11	1.92	156	2.40	260	3.15	492	26	2.32	240	2.50	286	2.45	273
12	1.90	152	2.25	224	2.80	375	27	2.20	212	2.40	260	2.30	235
13	1.82	138	2.20	212	2.85	391	28	2.02	174	2.32	240	2.42	265
14	1.85	144	2.10	190	2.85	391	29	2.00	170	......	......	2.30	235
15	1.88	149	2.20	212	2.60	314	30	2.00	170	......	......	2.28	230
							31	2.00	170	......	......	2.22	217

NOTE.—Ice jams Jan. 2, 17 to 24, Feb. 1 to 3. Ice gone Jan. 26 and Feb. 4. Discharge estimated for ice periods on above dates. The daily discharges, except as noted, are based on a rating curve that is well defined between 135 and 1,310 second-feet.

Monthly discharge of Gunpowder Falls River at Glencoe, Md., for 1909.

[Drainage area, 160 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	401	80	181	1.48	1.71	D.
February	668	144	240	1.84	1.92	C.
March	748	212	298	2.21	2.55	B.

NOTE.—The first three columns give the actual discharge past the Glencoe station. The last two columns include the diversion of 55 second-feet (value approximate) to obtain the actual discharge per square mile and run-off depth in inches from the drainage basin as a whole. See description.

LITTLE GUNPOWDER FALLS NEAR BELAIR, MD.

This station is located at a steel highway bridge on the road from Belair to Kingsville. It is about 5 miles southwest of Belair. Wildcat Branch enters the stream from the north about one-half mile below the station. It was established December 13, 1904, and was discontinued March 31, 1909. The observer was paid by the Maryland State weather service.

This station was established to determine the daily distribution of flow of Little Gunpowder Falls for power development.

The datum of the chain gage attached to the bridge has remained constant since the establishment of the station. The discharge is sometimes affected by ice during the winter period. Conditions of flow are liable to change. A fairly good rating curve has been developed for low stages.

Although no inspection has been made of this station since May, 1908, the records for 1909 are believed to be fairly accurate.

Daily gage height, in feet, and daily discharge, in second-feet, of Little Gunpowder Falls near Belair, Md., for 1909.

[George Unkart, observer.]

Day.	January.		February.		March.		Day.	January.		February.		March.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	1.60	53	1.70	64	1.76	71	16	1.62	55	1.74	69	1.85	82
2	1.64	57	1.68	62	1.87	85	17	1.70	64	1.81	77	1.88	86
3	1.52	45	1.61	54	1.90	89	18	1.70	64	1.70	64	1.86	84
4	1.54	47	1.56	49	2.07	114	19	1.72	66	1.66	60	1.85	82
5	2.14	126	1.56	49	1.96	97	20	1.62	55	2.06	113	1.85	82
6	2.02	106	1.62	55	1.93	93	21	1.76	71	1.76	71	1.82	79
7	1.68	62	1.56	49	1.98	100	22	1.60	53	1.75	70	1.83	80
8	1.68	62	1.56	49	2.15	128	23	1.72	66	1.80	76	1.80	76
9	1.71	65	1.62	55	2.24	144	24	1.85	82	2.84	273	1.82	79
10	1.58	51	2.62	221	2.72	244	25	1.86	84	2.11	121	2.62	221
11	1.52	45	1.88	86	2.16	129	26	1.82	79	1.82	79	1.95	96
12	1.62	55	1.72	66	1.96	97	27	1.70	64	1.85	82	1.86	84
13	1.49	42	1.73	68	2.04	109	28	1.58	51	1.79	75	2.00	103
14	1.56	49	1.69	63	2.06	113	29	1.68	62			1.87	85
15	1.72	66	1.70	64	1.96	97	30	1.70	64			1.84	81
							31	1.69	63			1.82	79

NOTE.—No ice notes. Probable ice conditions during parts of January and February.
The daily discharges are based on a rating curve that is well defined between 34 and 136 second-feet. These discharges may be in excess for some days in January and February because of probable ice conditions.

Monthly discharge of Little Gunpowder Falls near Belair, Md., for 1909.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	126	42	63.8	1.48	1.71	C.
February	273	49	81.6	1.90	1.98	C.
March	244	71	103	2.40	2.77	B.

PATAPSCO RIVER DRAINAGE BASIN.

DESCRIPTION.

Patapsco River is formed by the junction of North Branch and South or Piney Branch near Marriottsville, Md., and flows in a southeasterly direction into Chesapeake Bay, 13 miles south of Baltimore. Both branches rise in the central part of Maryland, and the whole basin, which has an area of about 350 square miles, lies within that State.

The drainage basin is hilly and largely under cultivation. It has no lakes or artificial reservoirs, and the flow of the stream is variable. The freshets do not, however, cause very large rises of the water because of the steep slope of the stream. The usual range of stage within a year is about 3 or 4 feet.

The bed is in most places of rock, the banks are of rock, and very little of the land is subject to overflow. The Baltimore & Ohio Railroad follows the stream closely throughout nearly its entire length.

The river carries a small volume of water, but as it has considerable slope a large number of water powers have been developed along its course, especially in the vicinity of the fall line. These, though small, are made valuable by their proximity to Baltimore.

PATAPSCO RIVER AT WOODSTOCK, MD.

This station, which is lcoated at the highway bridge near the railroad station at Woodstock, Md., about 1½ miles below the junction of North and South branches, was established August 6, 1896, and discontinued March 31, 1909, to determine the daily distribution of flow in connection with extension and development of water power. The observer was paid by the Maryland State weather service during 1909.

The datum of the chain gage attached to the bridge has remained the same since the establishment of the station. The discharge is frequently affected by ice during the winter period. Conditions of flow are relatively permanent, although subject to change at times of extreme flood. A good rating curve has been developed.

The following discharge measurement was made by Bolster and Stevens:

July 15, 1909: Width, 93.5 feet, area, 77 square feet; gage height, 3.64 feet; discharge, 106 second-feet.

Daily gage height, in feet, and daily discharge, in second-feet, of Patapsco River at Woodstock, Md., for 1909.

[William Donovan, observer.]

Day.	January.		February.		March.		Day.	January.		February.		March.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	3.9	198	3.8	159	4.25	358	16	4.2	332	4.45	468	4.6	561
2	3.6	95	4.0	240	4.25	358	17	4.2	332	4.3	383	4.35	410
3	3.75	142	3.95	219	4.25	358	18	3.7	124	4.2	332	4.35	410
4	3.75	142	3.9	198	4.95	817	19	3.7	124	4.25	358	4.3	383
5	4.0	240	3.85	178	5.55	1,350	20	3.95	219	4.35	410	4.35	410
6	4.6	561	3.85	178	4.9	777	21	3.85	178	4.05	262	4.3	383
7	4.15	308	3.85	178	4.9	777	22	3.85	178	4.1	285	4.2	332
8	3.8	159	3.9	198	4.85	739	23	4.0	240	4.4	438	4.25	358
9	3.85	178	4.15	308	5.05	898	24	4.3	383	5.15	983	4.25	358
10	3.8	159	6.0	1,790	5.5	1,300	25	4.75	665	4.9	777	4.8	701
11	3.8	159	4.7	629	4.95	817	26	4.6	561	4.35	410	4.45	468
12	3.7	124	4.6	561	4.8	701	27	4.45	468	4.3	383	4.4	438
13	3.65	110	4.5	497	4.7	629	28	4.1	285	4.3	383	4.3	383
14	3.8	159	4.65	595	4.6	561	29	4.05	262	......	......	4.25	358
15	3.8	159	4.55	529	4.6	561	30	4.1	285	......	......	4.25	358
							31	3.9	198	......	......	4.25	358

NOTE.—No ice notes. Probable ice conditions during parts of January and February.
The daily discharges are based on a rating curve that is well defined between 42 and 860 second-feet. These discharges may be in excess for some days in January and February because of probable ice conditions.

Monthly discharge of Patapsco River at Woodstock, Md., for 1909.

[Drainage area, 251 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	665	95	249	0.992	1.14	B.
February	1,790	159	440	1.75	1.82	B.
March	1,350	332	570	2.27	2.62	A.

POTOMAC RIVER DRAINAGE BASIN.

DESCRIPTION.

Potomac River is formed by the junction of its North and South branches, about 15 miles below Cumberland, Md., from which it flows in a southeasterly direction into Chesapeake Bay. For its entire length it forms the southern boundary of the State of Maryland and the northern boundary of the States of West Virginia and Virginia. It drains a total area of about 14,500 square miles.

North Branch of Potomac River rises in the Allegheny Mountains near the west corner of Maryland, and South Branch in the Alleghenies in Virginia and West Virginia. These branches with their tributaries and the tributaries of the main stream as far down as the

Shenandoah drain a series of narrow and generally fertile valleys lying between the parallel ranges which make up the system of the Alleghenies in this region. Their slopes are not, as a rule, very great, and their beds are of gravel and sand. The slopes of their drainage basins, however, are usually very steep, and after a rain the water collects quickly in the rivers. There are few lowlands to be overflowed and no lakes whatever in the region; consequently these streams, and with them Potomac River, are subject to sudden and very heavy freshets in wet seasons, and in dry seasons their discharge becomes small.

The slopes of the tributary basin of Shenandoah River are in many places steep, but the valley through which the Shenandoah flows is in general broader and more lands are subject to overflow. The slope of the river itself is as a rule greater than the slope of the tributaries above mentioned.

From the junction of its North and South branches below Cumberland, Md., the Potomac cuts through the mountains at nearly right angles. Its valley is narrow, its slope in many places great. The bed is generally gravel and bowlders, with ledge rock at little depth, or in places appearing at the surface. The banks are usually high and are not subject to overflow. It crosses the fall line a few miles above Washington and reaches tidewater at Georgetown.

The Baltimore & Ohio Railroad follows the river for its entire length, and the Norfolk & Western and Cumberland Valley railroads cross the stream. The Chesapeake & Ohio Canal follows it from Cumberland to Georgetown.

As a water-power stream the principal disadvantage of the Potomac is the great variability of its flow. Good rock foundations for dams can generally be found at small depth; the banks are, as a rule, favorable; and there are several sites where large falls could be rendered available. A very insignificant amount of power has been developed.

The Great Falls of the Potomac, located about 15 miles above Washington, offers one of the best undeveloped power sites along Potomac River.

The surface water resources of the Potomac River basin have been discussed in detail in Water-Supply Paper 192.

POTOMAC RIVER AT POINT OF ROCKS, MD.

This station, which is located at the steel highway bridge at Point of Rocks, Md., was established February 17, 1895, to obtain information regarding the daily distribution of flow of the river. In conjunction with the stations on Monocacy River near Frederick, Md., and on Goose Creek near Leesburg, Va., it is of particular value for determining the discharge available at the undeveloped power at Great Falls, where the Potomac crosses the fall line with a fall of about 90 feet. The drainage area above these three stations is about 93 per cent of the drainage area at Great Falls. Hence the discharge from the remaining 7 per cent can be estimated and added to the discharge at Point of Rocks plus that at Frederick and Leesburg without any appreciable error in the final resulting discharge at Great Falls. It will, however, be necessary to deduct the discharge of the Washington Aqueduct, amounting to about 101 second-feet per day. The intake of the aqueduct is immediately above the head of Great Falls on the Maryland side.

Catoctin Creek enters Potomac River about one-third mile above the station from the Virginia side. Monocacy River enters from the Maryland side about 6 miles below the station. The Chesapeake & Ohio Canal parallels the Potomac on the Maryland side. The average discharge of the canal approximates from 75 to 100 second-feet and is not included in the discharges given in the tables below.

The conditions of flow at this station are practically permanent. The discharge is controlled by a rock ledge a few hundred feet below the station and extending completely across the river with the exception of one relatively unimportant channel. The discharge is rarely affected by ice.

The datum of the chain gage, which is attached to the bridge from which measurements are made, has been maintained at a constant elevation since September 2, 1902. Prior to this date the datum was 0.45 foot higher than at present.

The present rating curve is considered very accurate and should require relatively no change in the future.[1] The observer at this point was paid by the Maryland State weather service from January 1 to March 31, 1909.

Discharge measurements of Potomac River at Point of Rocks, Md., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 13	Bolster and Stevens	967	2,740	1.19	2,520
Oct. 9	Bolster and Mathers	851	2,030	.54	871

[1] Discharge data prior to 1907 have been revised and republished in Water-Supply Paper U. S. Geol. Survey No. 192.

Daily gage height, in feet, of Potomac River at Point of Rocks, Md., for 1909.

[G. H. Hickman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	2.2	4.1	2.3	3.3	2.3	2.6	0.7	0.9	0.78	1.1	0.9
2	1.6	2.0	3.8	2.3	3.2	2.1	2.4	.8	.85	.75	1.05	.95
3	1.6	1.9	3.6	2.2	3.1	2.1	2.1	.9	.8	.7	1.0	.9
4	1.5	1.9	3.5	2.2	3.0	3.25	1.9	.95	.8	.65	.95	.91
5	1.5	1.8	4.1	2.2	2.9	3.0	1.7	1.05	.75	1.0	.85	.95
6	1.9	1.8	3.8	2.2	2.8	2.9	1.6	1.05	.8	.9	.9	.9
7	2.6	1.9	3.7	2.1	2.7	5.0	1.5	1.05	.85	.85	.95	.9
8	2.4	1.9	3.5	2.1	2.6	4.4	1.4	1.0	.9	.8	.9	1.0
9	2.2	2.0	3.4	2.1	2.4	3.5	1.3	.95	.85	.6	.95	1.1
10	2.0	2.2	3.4	2.0	2.3	3.3	1.2	.9	.95	.85	1.05	1.2
11	1.9	3.1	3.3	2.0	2.3	3.7	1.2	1.0	.95	.6	1.0	1.55
12	1.8	4.3	3.3	2.0	2.7	4.6	1.2	1.0	.9	1.05	.95	1.4
13	1.7	4.2	3.3	1.9	2.6	4.2	1.2	.95	.9	.95	.8	1.35
14	1.7	3.7	3.1	2.8	2.5	3.9	1.15	.9	.85	1.1	.85	1.4
15	1.6	3.3	2.9	4.6	2.4	3.4	1.2	.85	.85	1.4	.8	2.45
16	1.7	3.4	2.8	12.25	2.3	3.8	1.2	.98	1.1	1.5	1.05	2.45
17	1.6	3.3	2.7	7.1	2.1	3.4	1.0	1.4	1.15	1.4	.95	2.41
18	2.4	3.5	2.5	5.5	2.1	3.4	1.0	1.2	1.0	1.2	.9	2.2
19	2.3	3.5	2.4	4.4	2.0	4.9	1.0	1.75	1.0	1.15	.95	1.7
20	2.2	3.4	2.3	3.8	2.1	4.4	1.0	1.55	1.0	1.05	.9	1.4
21	2.2	3.4	2.2	3.7	2.1	3.7	.9	1.4	.95	1.0	.95	1.35
22	2.1	3.4	2.1	7.2	2.2	2.8	.9	1.2	1.0	1.0	.95	1.4
23	2.2	3.5	2.1	6.9	4.2	2.5	.9	1.15	.95	.95	1.0	1.4
24	3.0	4.0	2.1	6.8	5.8	2.6	.8	1.1	1.05	.95	1.05	1.35
25	4.2	6.8	2.0	6.6	4.4	2.4	.8	1.05	1.0	1.0	1.0	1.3
26	6.5	6.5	2.0	6.4	3.8	2.2	.8	1.0	.95	1.7	.95	1.35
27	4.3	5.4	2.0	6.0	3.4	2.3	.8	.95	.9	2.0	.85	1.4
28	3.7	4.6	2.1	5.2	3.0	3.5	.8	.9	.9	1.55	.9	1.65
29	3.0	....	2.2	4.4	2.8	3.6	.8	.8	.85	1.3	.9	1.6
30	2.7	....	2.2	3.4	2.6	3.5	.9	.8	.8	1.25	.95	1.4
31	2.4	....	2.3	....	2.5	....	.8	.9	....	.95	....	1.7

NOTE.—Slight ice conditions Dec. 26 to 31. Observer states ice was 6 to 8 inches thick from Dec. 24 to Jan. 15, 1910.

Daily discharge, in second-feet, of Potomac River at Point of Rocks, Md., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,090	5,750	14,600	6,130	10,500	6,130	7,330	1,240	1,740	1,440	2,250	1,740
2	3,700	5,020	13,000	6,130	10,000	5,380	6,520	1,480	1,610	1,360	2,120	1,860
3	3,700	4,670	12,000	5,750	9,530	5,380	5,380	1,740	1,480	1,240	1,990	1,740
4	3,390	4,670	11,500	5,750	9,070	10,200	4,670	1,860	1,480	1,120	1,860	1,760
5	3,390	4,330	14,600	5,750	8,620	9,070	4,010	2,120	1,360	1,990	1,610	1,860
6	4,670	4,330	13,000	5,750	8,180	8,620	3,700	2,120	1,480	1,740	1,740	1,740
7	7,330	4,670	12,500	5,380	7,750	19,800	3,390	2,120	1,610	1,610	1,860	1,740
8	6,520	4,670	11,500	5,380	7,330	16,300	3,090	1,990	1,740	1,480	1,740	1,990
9	5,750	5,020	11,000	5,380	6,520	11,500	2,800	1,860	1,610	1,010	1,860	2,250
10	5,020	5,750	11,000	5,020	6,130	10,500	2,520	1,740	1,860	1,610	2,120	2,520
11	4,670	9,530	10,500	5,020	6,130	12,500	2,520	1,990	1,860	1,010	1,990	3,540
12	4,330	15,700	10,500	5,020	7,750	17,400	2,520	1,990	1,740	2,120	1,860	3,090
13	4,010	15,200	10,500	4,670	7,330	15,200	2,520	1,860	1,740	1,860	1,480	2,940
14	4,010	12,500	9,530	8,180	6,920	13,500	2,380	1,740	1,610	2,250	1,610	3,090
15	3,700	10,500	8,620	17,400	6,520	11,000	2,520	1,610	1,610	3,090	1,480	6,720
16	4,010	11,000	8,180	74,300	6,130	13,000	2,520	1,940	2,250	3,390	2,120	6,720
17	3,700	10,500	7,750	33,500	5,380	11,000	1,990	3,090	2,380	3,090	1,860	6,560
18	6,520	11,500	6,920	22,900	5,380	11,000	1,990	2,520	1,990	2,520	1,740	5,750
19	6,130	11,500	6,520	16,300	5,020	19,200	1,990	4,170	1,990	2,380	1,860	4,010
20	5,750	11,000	6,130	13,000	5,380	16,300	1,990	3,540	1,990	2,120	1,740	3,090
21	5,750	11,000	5,750	12,500	5,380	12,500	1,740	3,090	1,860	1,990	1,860	2,960
22	5,380	11,000	5,380	34,200	5,750	8,180	1,740	2,520	1,990	1,990	1,860	2,790
23	5,750	11,500	5,380	32,100	15,200	6,920	1,740	2,380	1,860	1,860	1,990	2,790
24	9,070	14,100	5,380	31,500	24,800	7,330	1,480	2,250	2,120	1,860	2,120	2,660
25	15,200	31,500	5,020	30,100	16,300	6,520	1,480	2,120	1,990	1,990	1,990	2,530
26	29,400	29,400	5,020	28,800	13,000	5,750	1,480	1,990	1,860	4,010	1,860	2,660
27	15,700	22,300	5,020	26,100	11,000	6,130	1,480	1,860	1,740	5,020	1,610	2,790
28	12,500	17,400	5,380	21,100	9,070	11,500	1,480	1,740	1,740	3,540	1,740	3,460
29	9,070	....	5,750	16,300	8,180	12,000	1,480	1,480	1,610	2,800	1,740	3,330
30	7,750	....	5,750	11,000	7,330	11,500	1,740	1,480	1,480	2,660	1,860	2,790
31	6,520	....	6,130	....	6,920	....	1,480	1,740	....	1,860	....	3,610

NOTE.—These discharges are based on a rating curve that is well defined.
Discharges Dec. 22 to 31 have been reduced 10 per cent from the open-water curve to allow for ice conditions.

Monthly discharge of Potomac River at Point of Rocks, Md., for 1909.

[Drainage area, 9,650 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	29,400	3,090	6,950	0.720	0.83	A.
February	31,500	4,330	11,300	1.17	1.22	A.
March	14,600	5,020	8,700	.902	1.04	A.
April	74,300	4,670	16,700	1.73	1.93	A.
May	24,800	5,020	8,660	.897	1.03	A.
June	19,800	5,380	11,000	1.14	1.27	A.
July	7,330	1,480	2,700	.280	.32	A.
August	4,170	1,240	2,110	.219	.25	A.
September	2,380	1,360	1,780	.184	.21	A.
October	5,020	1,010	2,190	.227	.26	A.
November	2,250	1,480	1,850	.192	.21	A.
December	6,720	1,740	3,130	.324	.37	B.
The year	74,300	1,010	6,370	.658	8.94	

NOTE.—Above table does not include discharge of Chesapeake & Ohio Canal.

SHENANDOAH RIVER AT MILLVILLE, W. VA.

This station is located at a ferry about one-fourth mile above the Baltimore & Ohio Railroad station at Millville, W. Va. It was established April 15, 1895, and was discontinued March 31, 1909. The station was also temporarily discontinued April 1 to June 30, 1907, during which period the discharge has been estimated from the discharge of the Potomac at Point of Rocks. It is located about 4½ miles above the junction of the Shenandoah with the Potomac at Harpers Ferry, W. Va.

No important tributaries enter the Shenandoah between the junction of the South and North forks of the Shenandoah at Riverton, Va., and Harpers Ferry, W. Va.

Records of discharge at this point are used in conjunction with the Point of Rocks records to determine the distribution of the flow of the Potomac above Harpers Ferry and also to show the daily distribution of flow of the Shenandoah River drainage and for power development.

Discharge measurements were made from a cable of 500 feet span. The tree which supported the cable on the left bank was blown down in a storm a short time after the station was discontinued. The datum of the vertical staff gage, which is located about 200 feet below the cable on the left bank, has remained constant since the establishment of the station.

Conditions of flow at this station are fairly permanent and a good rating curve has been developed for low and medium stages. It is uncertain at high stages owing to lack of discharge measurements. The banks overflow at high stages. Ice affects the flow to a greater or lesser extent during the winter period.[1]

[1] Discharge data prior to 1907 have been revised and republished in Water-Supply Paper 192.

Although no inspection of this station has been made since May, 1908, the records for 1909 are believed to be fairly accurate.

Daily gage height, in feet, and daily discharge, in second-feet, of Shenandoah River, at Millville, W. Va., for 1909.

[W. R. Nicewarner, observer.]

Day.	January. Gage height.	January. Discharge.	February. Gage height.	February. Discharge.	March. Gage height.	March. Discharge.	Day.	January. Gage height.	January. Discharge.	February. Gage height.	February. Discharge.	March. Gage height.	March. Discharge.
1	1.5	1,580	2.2	2,750	3.0	4,370	16	2.0	2,380	2.6	3,530	2.2	2,750
2	2.35	3,040	2.1	2,560	2.8	3,940	17	2.2	2,750	2.6	3,530	2.1	2,560
3	2.3	2,940	2.0	2,380	2.8	3,940	18	2.3	2,940	2.5	3,330	2.0	2,380
4	2.0	2,380	2.0	2,380	3.0	4,370	19	2.5	3,330	2.5	3,330	1.95	2,290
5	2.0	2,380	1.9	2,200	3.1	4,600	20	2.4	3,130	2.5	3,330	1.9	2,200
6	2.0	2,380	1.8	2,030	2.9	4,150	21	2.3	2,940	2.9	4,150	1.8	2,030
7	3.0	4,370	1.8	2,030	2.85	4,040	22	2.2	2,750	2.95	4,260	1.8	2,030
8	2.9	4,150	1.8	2,030	2.8	3,940	23	2.5	3,330	2.9	4,150	1.75	1,950
9	2.5	3,330	1.8	2,030	2.75	3,840	24	4.7	9,200	3.5	5,570	1.75	1,950
10	2.3	2,940	2.0	2,380	2.6	3,530	25	5.1	10,600	3.6	5,830	1.7	1,870
11	2.0	2,380	3.5	5,570	2.65	3,630	26	4.5	8,520	3.8	6,380	1.7	1,870
12	2.0	2,380	4.5	8,520	2.55	3,430	27	3.2	4,840	3.55	5,700	1.8	2,030
13	1.95	2,290	3.7	6,100	2.5	3,330	28	3.0	4,370	3.3	5,080	2.0	2,380
14	1.8	2,030	3.2	4,840	2.4	3,130	29	2.8	3,940	......	......	2.2	2,750
15	1.8	2,030	2.9	4,150	2.3	2,940	30	2.6	3,530	......	......	2.1	2,560
							31	2.5	3,330	......	......	2.0	2,380

NOTE.—No ice notes. The daily discharges are based on a rating curve that is well defined between 480 and 11,000 second-feet.

Monthly discharge of Shenandoah River at Millville, W. Va., for 1909.

[Drainage area, 3,000 square miles.]

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Per square mile.	Run-off (depth in inches on drainage area).	Accuracy.
January	10,600	1,580	3,630	1.21	1.40	B.
February	8,520	2,030	3,930	1.31	1.36	B.
March	4,600	1,870	3,010	1.00	1.15	B.

MONOCACY RIVER NEAR FREDERICK, MD.

This station, which is located at the county bridge on the toll road leading from Frederick to Mount Pleasant, Md., is about 3½ miles northeast of Frederick, and was established August 4, 1896, to obtain information regarding the flow of Monocacy River, which is the principal stream entering the Potomac between the Point of Rocks station and Great Falls. (See Potomac River at Point of Rocks, Md.)

The station is about 3,000 feet below Tuscarora Creek, which enters from the right, and about 2,000 feet above Israel Creek, which enters from the left.

The datum of the chain gage attached to the bridge has been maintained the same since the establishment of the station. Discharge measurements are made from the bridge or by wading. The discharge is liable to be affected by ice more or less during the winter months. Conditions of flow at this station change somewhat from year to year, requiring changes in the rating curves.[1]

The observer at this station was paid by the Maryland State weather service from January 1 to March 31, 1909.

Discharge measurements of Monocacy River near Frederick, Md., 1909.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
July 14	G. C. Stevens	218	4.16	142
Do.	R. H. Bolster	225	4.16	146
Sept. 30 [a]	Stevens and Mathers	48	3.81	59.4

[a] Measurement by wading above bridge.

Daily gage height, in feet, of Monocacy River near Frederick, Md., for 1909.

[E. L. Derr, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.15	5.35	6.35	5.25	5.75	4.7	4.7	3.9	3.7	3.8	3.9	3.9
2	4.65	5.05	6.45	5.25	5.55	4.6	4.5	4.0	3.7	3.8	3.9	3.9
3	4.35	4.85	9.45	5.25	5.45	4.5	4.5	4.0	3.7	3.75	3.9	3.9
4	4.35	4.85	12.45	5.15	5.35	5.1	4.5	3.9	3.7	3.7	3.8	3.9
5	4.45	4.85	8.45	5.15	5.25	6.4	4.4	3.9	3.8	3.7	3.8	3.9
6	5.55	4.75	7.85	5.15	5.15	8.4	4.4	3.9	3.7	3.7	3.8	3.9
7	5.45	4.75	7.15	5.05	5.05	7.8	4.3	3.9	3.7	3.8	3.8	3.9
8	4.55	5.05	7.05	4.95	5.25	5.4	4.3	3.9	3.7	3.8	3.8	4.0
9	4.45	5.15	8.55	4.95	5.05	7.4	4.2	3.8	3.7	3.8	4.1	4.0
10	4.45	12.2	8.35	4.85	4.95	7.8	4.2	3.8	4.9	3.75	4.0	4.0
11	4.55	13.45	7.75	4.85	5.05	7.1	4.2	3.8	4.5	3.8	4.0	4.0
12	4.45	6.65	6.75	4.75	4.95	6.0	4.2	3.8	4.2	4.6	3.9	4.0
13	4.45	6.35	6.75	4.75	4.85	5.8	4.2	3.8	4.1	4.5	3.9	7.2
14	4.45	6.05	6.75	8.05	4.75	5.7	4.2	3.8	3.9	4.2	3.9	14.5
15	4.55	8.35	6.75	8.95	4.65	5.6	4.2	3.8	3.9	4.1	3.9	9.6
16	4.55	7.35	6.65	6.45	4.55	5.4	4.2	3.9	4.4	4.0	3.9	7.5
17	6.35	9.35	6.35	6.05	4.55	5.1	4.15	5.2	4.2	3.9	3.9	4.5
18	6.25	6.45	5.85	5.75	4.55	8.1	4.1	5.1	4.1	3.9	3.9	4.4
19	5.85	6.45	5.75	5.55	4.45	7.4	4.0	4.1	3.95	3.8	3.9	4.2
20	5.15	12.45	5.55	7.55	4.45	5.1	4.0	4.1	3.95	3.8	3.9	4.3
21	4.85	7.45	5.45	10.35	4.85	5.1	4.0	4.0	3.9	3.8	3.9	4.5
22	4.65	7.45	5.35	8.55	5.85	4.8	4.0	3.9	3.9	3.9	3.9	4.3
23	4.65	9.05	5.25	8.05	5.15	4.7	4.0	3.8	3.85	3.9	4.0	4.2
24	5.45	15.85	5.25	9.25	5.05	4.6	4.1	3.8	4.05	3.9	4.0	4.1
25	8.45	12.45	6.40	8.45	4.85	4.6	4.1	3.8	3.85	4.1	4.0	4.1
26	8.85	7.45	8.15	6.45	4.75	4.6	4.0	3.8	3.85	4.0	3.9	4.1
27	6.65	7.25	7.15	6.25	4.65	6.8	4.0	3.8	3.85	3.9	3.9	4.2
28	6.05	7.15	6.05	6.05	7.45	5.4	3.9	3.8	3.75	3.9	3.9	4.2
29	6.05		5.85	5.95	7.25	5.0	3.9	3.7	3.75	3.9	3.9	4.2
30	5.85		5.35	5.85	5.85	4.8	3.9	3.7	3.8	3.9	3.9	4.2
31	5.75		5.25		4.85		3.9	3.7		3.9		4.3

NOTE.—Ice conditions Jan. 19 to 20 and Dec. 23 to 31: Frozen along banks and below bridge during the latter half of December.

[1] Discharge data prior to 1907 have been revised and republished in Water-Supply Paper 192.

Daily discharge, in second-feet, of Monocacy River near Frederick, Md., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	140	608	1,210	560	818	320	320	79	38	57	79	79
2	301	468	1,280	560	708	282	247	102	38	57	79	79
3	198	381	3,950	560	657	247	247	102	38	48	79	79
4	198	381	6,970	514	608	491	247	79	38	38	57	79
5	240	381	3,000	514	560	1,240	214	79	57	38	57	79
6	708	340	2,440	514	514	2,960	214	79	38	38	57	79
7	657	340	1,830	468	468	2,400	183	79	38	57	57	79
8	264	468	1,750	424	560	632	183	79	38	57	57	102
9	240	514	3,100	424	468	2,040	154	57	38	57	127	102
10	240	6,710	2,910	381	424	2,400	154	57	402	48	102	102
11	264	8,020	2,360	381	468	1,790	154	57	247	57	102	102
12	240	1,430	1,500	340	424	969	154	57	154	282	79	102
13	240	1,210	1,500	340	381	846	154	57	127	247	79	1,880
14	240	1,000	1,500	2,620	340	789	154	57	79	154	79	9,120
15	264	2,910	1,500	3,480	301	734	154	57	79	127	79	4,100
16	264	2,000	1,430	1,280	264	632	154	79	214	102	79	2,130
17	1,210	3,860	1,210	1,000	264	491	140	537	154	79	79	247
18	1,140	1,280	876	818	264	2,670	127	491	127	79	79	214
19	700	1,280	818	708	240	2,040	102	127	90	57	79	154
20	500	6,970	708	2,180	240	491	102	127	90	57	79	183
21	381	2,090	657	4,850	381	491	102	102	79	57	79	247
22	301	2,090	608	3,100	876	360	102	79	79	79	79	183
23	301	3,570	560	2,620	514	320	102	57	68	79	102	130
24	657	10,500	560	3,760	468	282	127	57	114	79	102	100
25	3,000	6,970	1,240	3,000	381	282	127	57	68	127	102	100
26	3,380	2,090	2,720	1,280	340	282	102	57	68	102	79	100
27	1,430	1,920	1,830	1,140	301	1,540	102	57	68	79	79	120
28	1,000	1,830	1,000	1,000	2,090	632	79	57	48	79	79	120
29	1,000	......	876	938	1,920	446	79	38	48	79	79	120
30	876	......	608	876	876	360	79	38	57	79	79	120
31	818	......	560	......	381	......	79	38	......	79	......	150

NOTE.—These discharges are based on a rating curve that is fairly well defined between 57 and 4,500 second-feet. Discharge estimated Jan. 19 to 20 and Dec. 23 to 31 because of ice.

Monthly discharge of Monocacy River near Frederick, Md., for 1909.

[Drainage area, 660 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	3,380	140	690	1.05	1.21	A.
February	10,500	340	2,560	3.88	4.04	B.
March	6,970	560	1,710	2.59	2.99	A.
April	4,850	340	1,350	2.05	2.29	A.
May	2,090	240	564	.855	.99	A.
June	2,960	247	982	1.49	1.66	A.
July	320	79	150	.227	.26	A.
August	537	38	99.2	.150	.17	A.
September	402	38	94.0	.142	.16	A.
October	282	38	85.6	.130	.15	A.
November	127	57	80.8	.122	.14	A.
December	9,120	79	664	1.01	1.16	B.
The year	10,500	38	752	1.14	15.22	

GOOSE CREEK NEAR LEESBURG, VA.

Goose Creek, the largest and most important tributary of the Potomac between the mouth of Monocacy and Great Falls, rises on the eastern slopes of the Blue Ridge in Loudoun and Fauquier counties, Va. The stream flows in an easterly direction and discharges into the Potomac near Edwards Ferry, Md., about 18 miles above Great Falls. The drainage area is about 384 square miles, the most of which lies in Loudoun County.

The gaging station, which is located at Evergreen Mills, about 7 miles directly south of Leesburg, Va., the most convenient railroad station, and about 10 miles above the mouth of the stream, was established July 12, 1909, to obtain data for use in water-power development. Little River enters Goose Creek about 1 mile above the station and Sycoline and Tuscarora creeks are tributary below.

A vertical staff gage is spiked to a tree on the left bank immediately below the tail race of the grist and lumber mill at this point. Measurements are made between the mill and dam, either by wading or from the highway bridge. The dam is constructed of timber and rock and at low stages most of the water passes through it. The mill race carries water at all times, three or four times more when the mill is running than when it is idle. This variation in flow causes variation in the gage heights, ranging from a few hundredths to about 0.15 foot, but as the mill is run only four or five hours a day, the fluctuation has a relatively small effect on the accuracy of the estimates.

Discharge measurements of Goose Creek near Leesburg, Va., in 1909.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 19 [a]	G. C. Stevens	0.83	53.2
Aug. 19 [b]	.....do	.97	81.7

[a] Left channel 5.8 second-feet; right channel, 39.3 second-feet; mill race, mill not running, 8.1 second-feet.
[b] Left channel, 6.1 second-feet; right channel, 44.4 second-feet; mill running, 31.2 second-feet.

NOTE.—These measurements were made by wading.

Daily gage height, in feet, of Goose Creek near Leesburg, Va., for 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.75	0.64	0.80	1.25	1.20	16	1.05	.92	.92	1.08	1.50	1.60
2		.78	.62	.78	1.26	1.10	17	1.05	3.00	.98	1.04	1.40	1.34
3		.80	.64	.78	1.28	1.08	18	1.02	1.10	1.05	1.00	1.35	1.32
4		.83	.70	.76	1.36	1.10	19	1.00	1.00	.95	1.00	1.40	1.10
5		.76	.75	.85	1.40	1.06	20	.95	.90	.90	1.00	1.40	1.10
6		.75	74	.75	1.35	1.08	21	.85	.86	.85	.98	1.35	1.08
7		.80	.75	.66	1.30	1.10	22	.84	.84	.80	1.20	1.40	1.06
8		.80	.72	.65	1.45	1.12	23	.80	.82	.82	1.00	1.50	1.08
9		.82	.74	.64	1.35	1.08	24	.80	.76	1.10	1.20	1.20	1.10
10		.85	1.00	.64	1.45	1.12	25	.82	.74	1.00	1.40	1.10	1.10
11		.78	1.20	.62	1.50	1.10	26	.80	.70	.96	1.30	1.15	1.06
12	1.03	.79	1.10	.80	1.40	1.20	27	.80	.66	.92	1.38	1.10	1.08
13	1.05	.76	1.00	1.40	1.35	2.00	28	.80	.66	.88	1.30	1.08	1.08
14	1.02	.75	.90	1.25	1.40	4.00	29	.80	.62	.85	1.35	1.10	1.10
15	1.02	.85	.88	1.15	1.45	3.00	30	.79	.60	.82	1.38	1.15	1.10
							31	.81	.60		1.30		1.08

NOTE.—Creek was frozen over Dec. 20 to 31. Maximum thickness of ice was 4 inches from Dec. 25 to 31.

Daily discharge, in second-feet, of Goose Creek near Leesburg, Va., for 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	42	29	49	142	130	16	95	69	69	102	210	240
2	......	46	27	46	145	106	17	95	743	80	93	182	166
3	......	49	29	46	150	102	18	88	106	95	84	168	160
4	......	54	36	44	171	106	19	84	84	74	84	182	106
5	......	44	42	57	182	97	20	74	65	65	84	182	90
6	......	42	41	42	168	102	21	57	59	57	80	168	80
7	......	49	42	32	155	106	22	55	55	49	130	182	80
8	......	49	39	30	196	111	23	49	52	52	84	210	70
9	......	52	41	29	168	102	24	49	44	106	130	130	60
10	......	57	84	29	196	111	25	52	41	84	182	106	60
11	......	46	130	27	210	106	26	49	36	76	155	118	50
12	91	48	106	49	182	130	27	49	32	69	177	106	50
13	95	44	84	182	168	370	28	49	32	62	155	102	50
14	88	42	65	142	182	1,150	29	49	27	57	168	106	40
15	88	57	62	118	196	743	30	48	25	52	177	118	40
							31	51	25	......	155	......	40

NOTE.—These discharges are based on a rating curve that is fairly well defined between 50 and 1,370 second-feet. Discharges Dec. 20 to 31 were estimated because of ice conditions.

Monthly discharge of Goose Creek near Leesburg, Va., for 1909.

[Drainage area, 338 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July 12-31	95	48	67.8	0.201	0.15	B.
August	743	25	71.5	.212	.24	B.
September	130	27	63.5	.188	.21	B.
October	182	27	95.5	.283	.33	B.
November	210	102	163	.482	.54	B.
December	1,150	....	160	.473	.55	C.

RAPPAHANNOCK RIVER DRAINAGE BASIN.

RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA

Rappahannock River rises on the eastern slope of the Blue Ridge, in Rappahannock and Fauquier counties, Va., and takes a general southeasterly course to Chesapeake Bay, into which it discharges at a point about 36 miles from Cape Charles. The length of its course in a straight line is about 132 miles, and its drainage area measures approximately 2,700 square miles.[1] It crosses the fall line, with considerable fall, at the city of Fredericksburg; below that point it is a sluggish, tidal, navigable stream, spreading out in places to a width of several miles. There are no lakes in the basin, and the flow of the river is exceedingly variable. The bed is generally of rock overlain with gravel and sand, and the banks are in most places high enough to confine the stream except at high freshets. The slope of the stream is not uniform but is broken by falls at several places. At

[1] Reports on the water powers of the United States: Tenth Census, vol. 16, 1885, p. 553.

Fredericksburg the elevation of the river above tide is zero; 35½ miles above it is 252 feet, showing a fall of 7.1 feet per mile. The average annual rainfall in this basin is about 42 inches. The principal tributary is the Rapidan, which enters from the right 10 or 12 miles above Fredericksburg and drains about 745 square miles. No important tributary enters between the mouth of the Rapidan and Fredericksburg.

The gaging station, which was established September 19, 1907, in cooperation with the Fredericksburg Power Co., by whom the cable and equipment were furnished, is located about 3½ miles above the city. The records of discharge are important in determining the amount of power available between the station and Fredericksburg. The station is located at a pool a few hundred feet above a rocky control and is about 1½ miles above the dam of the power company. The discharge is probably not affected by backwater, as there is considerable fall between the station and the dam.

The original staff gage was destroyed February 14, 1908, and was replaced on February 20, 1908, by a chain gage under the cable. The datum, which is the same for both gages, has been maintained at a constant elevation.

The discharge is likely to be affected by ice during the winter period. Conditions of flow at the station are probably permanent. At extreme low water the current is very sluggish and accurate discharge measurements are difficult. A good low-water rating curve has been developed.

Discharge measurements of Rappahannock River near Fredericksburg, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 20	G. C. Stevens	445	1,650	1.12	439
Sept. 8[a]	Bolster and Stevens			.70	242

[a] Measurement made by wading below dam, and includes flow in canal and river. The discharge is probably too high, due to increased flow from storage at dam.

Daily gage height, in feet, of Rappahannock River near Fredericksburg, Va., for 1909.

[J. W. Franklin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	2.45	2.72	2.14	2.17	1.78	2.20	1.10	1.12	0.72	0.78	0.90
2	2.75	2.38	2.55	2.10	2.24	1.70	1.85	1.32	.98	.71		.94
3	2.52	2.22	2.50	2.07	2.10	1.85	1.60	1.60	.85	.70		.86
4	2.68	2.12	4.42	2.02	2.02	3.82	1.50	1.22	.82	.68		.84
5	2.95	2.15	3.22	2.02	1.92	5.55	1.45	1.12	.82	.67		.86
6	5.75	2.10	2.78	1.92	1.84	5.05	1.40	1.22	.82	.65		.86
7	3.55	2.05	3.00	1.90	1.84	3.40	1.48	1.22	.75	.70		.86
8	2.95	2.10	3.45	1.87	1.82	4.65	1.45	1.15	.72	.70	.81	.91
9	2.70	2.15	2.98	1.82	1.77	4.10	1.40	1.10	.74	.70	.82	.94
10	2.60	5.18	3.00	1.82	1.80	4.00	1.30	1.05	.79	.70	.85	.90

Daily gage height, in feet, of Rappahannock River near Fredericksburg, Va., for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.55	4.95	2.78	1.77	1.80	4.18	1.28	1.00	1.00	.68	.90	.90
12	2.38	3.40	2.52	1.77	1.90	3.45	1.28	.82	1.47	.68	.94	.90
13	2.25	2.90	2.51	1.80	1.80	2.80	1.28	.80	1.32	1.78	.92	1.12
14	2.32	2.72	2.88	6.47	1.72	6.65	1.20	.72	1.00	1.25	.94	3.54
15	2.45	2.65	2.68	6.10	1.67	5.65	1.28	.82	.90	1.04	.90	2.36
16	2.78	2.55	2.38	3.77	1.62	3.42	1.55	1.02	.83	.92	.90	1.78
17	2.72	2.55	2.28	3.24	1.57	2.95	1.38	1.55	1.12	.92	.94	1.30
18	2.62	2.42	2.25	2.97	1.52	3.52	1.30	1.95	1.59	.88	.92	1.35
19	2.55	2.32	2.25	2.82	1.46	2.85	1.25	1.55	1.28	.82	.92	1.26
20	2.42	3.72	2.20	2.68	1.42	2.55	1.20	1.22	1.14	.78	.90	1.12
21	2.52	3.20	2.15	2.64	1.80	2.22	1.12	1.22	1.04	.80	.84	1.02
22	3.25	2.92	2.15	2.80	4.94	2.12	1.05	1.75	.94	.79	.82	1.13
23	3.45	2.95	2.10	2.87	3.42	2.02	1.00	1.15	.87	.78	.88	1.16
24	4.78	4.35	2.05	3.17	2.84	2.00	.90	1.00	1.02	.82	.99	1.02
25	4.55	4.22	2.08	2.92	2.54	1.90	1.08	.95	1.43	.80	1.06	1.06
26	3.50	3.25	2.58	2.50	2.30	1.80	1.00	.92	1.04	.82	1.06	1.07
27	2.90	3.08	2.20	2.37	2.32	1.90	.90	.85	1.00	.82	.97	1.12
28	2.60	2.90	2.35	2.30	2.60	1.88	.90	.80	.96	.80	.93	1.16
29	2.48	......	3.15	2.24	2.37	2.78	.80	1.15	.86	.78	.91	1.04
30	2.78	......	2.58	2.17	2.07	2.72	.85	1.32	.74	.79	.92	1.07
31	2.62	......	2.28	......	1.87	......	1.02	1.42	......	.78	......	1.13

NOTE.—Gage chain stolen Nov. 1. New chain in place Nov. 8. No ice conditions noted by observer. Since this station is located in a deep pool where the water becomes very sluggish at low stages, it is quite probable that the gage heights were affected by ice for short periods during the winter.

Daily discharge, in second-feet, of Rappahannock River near Fredericksburg, Va., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4,210	2,040	2,500	1,570	1,620	1,080	1,660	400	414	212	233	285
2	2,550	1,930	2,210	1,520	1,720	985	1,180	569	329	208	234	307
3	2,160	1,690	2,120	1,470	1,520	1,180	865	865	262	205	236	267
4	2,430	1,540	6,140	1,400	1,400	4,690	750	486	249	199	237	258
5	2,910	1,590	3,420	1,400	1,270	9,350	698	414	249	196	239	267
6	9,960	1,520	2,600	1,270	1,160	7,880	645	486	249	190	240	267
7	4,100	1,440	3,000	1,240	1,160	3,790	729	486	222	205	242	267
8	2,910	1,520	3,900	1,200	1,140	6,760	698	435	212	205	244	290
9	2,460	1,590	2,960	1,140	1,070	5,340	645	400	219	205	249	307
10	2,290	8,250	3,000	1,140	1,110	5,100	550	370	236	205	262	285
11	2,210	7,590	2,600	1,070	1,110	5,530	534	340	340	199	285	285
12	1,930	3,790	2,160	1,070	1,240	3,900	534	249	718	199	307	285
13	1,740	2,820	2,140	1,110	1,110	2,640	534	240	569	1,080	296	414
14	1,840	2,500	2,780	12,300	1,010	12,900	470	212	340	510	307	4,080
15	2,040	2,380	2,430	11,100	949	9,660	534	249	285	364	285	1,900
16	2,600	2,210	1,930	4,580	889	3,830	808	352	254	296	285	1,080
17	2,500	2,210	1,780	3,460	830	2,910	626	808	414	296	307	550
18	2,320	2,000	1,740	2,940	773	4,040	550	1,310	854	276	296	598
19	2,210	1,840	1,740	2,670	710	2,720	510	808	534	249	296	518
20	2,000	4,470	1,660	2,430	670	2,210	470	486	428	233	285	414
21	2,160	3,380	1,590	2,360	1,110	1,690	414	486	364	240	258	352
22	3,480	2,850	1,590	2,640	7,560	1,540	370	1,050	307	236	249	421
23	3,900	2,910	1,520	2,760	3,830	1,400	340	435	272	233	276	442
24	7,110	5,960	1,440	3,330	2,710	1,380	285	340	352	249	334	352
25	6,480	5,630	1,490	2,850	2,190	1,240	388	312	676	240	376	376
26	4,000	3,480	2,260	2,120	1,810	1,110	340	296	364	249	376	382
27	2,820	3,150	1,660	1,920	1,840	1,240	285	262	340	249	324	414
28	2,290	2,820	1,890	1,810	2,290	1,210	285	240	318	240	302	442
29	2,090	......	3,290	1,720	1,920	2,600	240	435	267	233	290	364
30	2,600	......	2,260	1,620	1,470	2,500	262	569	219	236	296	382
31	2,320	......	1,780	......	1,200	......	352	666	......	233	......	421

NOTE.—Discharge Nov. 2 to 7 interpolated. No correction made for possible backwater from ice conditions.

Monthly discharge of Rappahannock River near Fredericksburg, Va., for 1909.

[Drainage area 1,590 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,960	1,740	3,120	1.96	2.26	A.
February	8,250	1,440	3,040	1.91	1.99	A.
March	6,140	1,440	2,370	1.49	1.72	A.
April	12,300	1,110	2,640	1.66	1.85	A.
May	7,560	670	1,630	1.03	1.19	A.
June	12,900	985	3,750	2.36	2.63	A.
July	1,660	240	566	.356	.41	A.
August	1,310	212	486	.306	.35	A.
September	854	212	362	.228	.25	B.
October	1,080	190	270	.170	.20	B.
November	376	233	282	.177	.20	B.
December	4,080	258	557	.350	.40	A.
The year	12,900	190	1,580	.994	13.45	

MISCELLANEOUS DISCHARGE MEASUREMENTS IN NORTH ATLANTIC COAST DRAINAGE BASINS.

The following miscellaneous discharge measurements were made in North Atlantic coast drainage basins during 1908–9:

Miscellaneous discharge measurements in North Atlantic coast drainage basins in 1908–9.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
1908.				*Feet.*	*Sec.-ft.*
Oct. 3	Rock Creek	Potomac River	Massachusetts Avenue, Washington, D. C.	1.05	28.7
Nov. 11	do	do	do	1.05	28.4
Dec. 10	do	do	do	1.12	33.9
Dec. 12	do	do	do	2.00	154
1909.					
July 5[a]	Eastbrook Mill Stream.	Union River	Near Eastbrook Corner, Me.		21.5
Do[b]	do	do	do		12.3
May 20[c]	Sebasticook River	Kennebec River	At Burnham, Me		889
Sept. 23	Pawtuxet River	Atlantic Ocean	Providence pumping station Pettaconsett, R. I.	9.80	37.5
Oct. 30	Connecticut River	do	Waterford toll bridge, about 5 miles from Littleton, N. H.	([d])	1,290
Aug. 6	Swift River	Chicopee River	¾ mile below Enfield, Mass.	[e]18.71	89.7
Do	Middle Branch Swift River.	Swift River	1½ miles from Enfield, Mass.		24.0
Aug. 4	Middle Branch of Westfield River.	Westfield River	At mouth, near Huntington, Mass.		[f]5.0

[a] Measurement from highway bridge on road from Eastbrook Corner to Waltham, about one-half mile from former and below mouth of Bog River. Reference point to water surface was 4.86 feet. Reference point was probably end of floor plank 1 foot from right abutment, downstream side of bridge.
[b] Measurement from highway bridge on road from Eastbrook Corner to Molasses Pond, and above Bog River. The stream is the outlet of Scammonds Pond. Distance reference point to water surface was 4.50 feet. Reference point was probably end of floor plank 1 foot from right abutment.
[c] Measurement made from railroad bridge. Reference point is top of bottom chord 5.5 feet from end inclined post on right bank, downstream truss. Distance to water surface, 16.21 feet.
[d] Reference point is top corner of pin plate at first vertical, about 51 feet from left abutment, downstream side of bridge. Distance to water surface, 29.30 feet.
[e] Distance reference point to water surface. Location of reference point unknown.
[f] Discharge estimated.

Miscellaneous discharge measurements in North Atlantic coast drainage basins in 1908-9—Continued.

Date.	Stream.	Tributary to—	Locality.	Gauge height.	Discharge.
1908.				*Feet.*	*Sec. ft.*
Aug. 26	Middle Branch of Westfield River.	Westfield River	At bridge ¼ mile above mouth, near Huntington, Mass.	a 17.9	15
Oct. 11	do	do	Wading, 700 feet above bridge ¼ mile above mouth, near Huntington.	a 18.0	6.9
Aug. 4	West Branch of Westfield River.	Westfield River	Wading, ½ mile above Huntington, Mass.	b 22.50	34.5
Oct. 11	do	do	Highway bridge at Huntington, Mass.	b 22.64	23.8
July 31	Battenkill River	Hudson River	Battenville, N. Y	6.04	141
Do	do	do	do	5.72	43
July 22	Fish Creek	do	Burgoyne, N. Y	1.40	124
Sept. 2 c	Ramapo River	Passaic River	Mahwah, N. J	d 2.47	54.9
Do	do	do	do	d 2.72	58.5
Aug. 23 e	Neversink River	Delaware River	Godeffroy, N. Y		169
Nov. 20 f	do	do	do		76
Do g	do	do	do		9.2
July 21	Susquehanna River	Atlantic Ocean	At Sidney, N. Y	h 26.72	298
Apr. 24	do	do	At Owego, N. Y	i 2.80	9,780
Jan. 24	Rock Creek	Potomac River	Massachusetts Avenue, Washington, D. C.	2.07	178
Do	do	do	do	2.05	165
Feb. 11	do	do	do	2.04	169
Do	do	do	do	1.85	129
Feb. 15	do	do	do	1.52	77.6
Apr. 13	do	do	do	1.37	66.1
Do	do	do	do	1.37	61.7
May 17	do	do	do	1.21	45.7
Nov. 29	do	do	do	.96	17.5

a Distance reference point to water surface. Reference point was center of two nails driven side by side in upstream wooden 2 by 4 joist of fence 34.7 feet from upstream side, right abutment.
b Distance from reference point to water surface. Reference point is outer edge of guard rail at eleventh post from left abutment, upstream side of highway bridge near railroad station at Huntington, Mass.
c Measurement poor, due to a change in stage of 0.52 foot.
d Measurement by wading below bridge. Weather Bureau gage.
e Measurement made in tailrace of power plant.
f Discharge of Neversink River measured at the inflow to the power dam. This dam was washed out Jan. 22, 1910.
g Measurement made above Basher Kill; shows leakage when power plant is shut down.
h Distance from top of hand rail to water surface at a point 30 feet from left downstream side of bridge.
i Gage on downstream end of right pier.

SUMMARIES OF DISCHARGE PER SQUARE MILE.

The following tables of summaries of discharge per square mile are given to allow of ready comparison of relative rates of run-off from different areas in the North Atlantic Coast drainage basins.

They show in a general way the seasonal distribution of run-off and the effect of snow, ground, surface, and artificial storage; but the most important fact worth noting is the almost entire lack of uniformity or agreement between any two streams. It indicates that the discharge of each stream is a law unto itself, and that all projects dependent upon stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible.

Summary of discharge, in second-feet per square mile, for stations in North Atlantic coast drainage basins for 1909.

Station.	Drainage area.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
NEW ENGLAND STATES.	*Sq. m.*													
St. John River at Fort Kent, Maine	5,280	0.81	0.38	0.60	2.80	7.82	1.35	1.63	0.94	1.83	2.23	1.18	0.83	1.87
Aroostook River at Fort Fairfield, Maine	2,230	.48	.40	.77	6.32	7.40	1.08	1.63	1.23	2.66	3.05	2.19	1.52	2.39
St. Croix River near Woodland, Maine	1,420	1.64	1.11	1.81	5.24	3.30	1.63	1.38	1.40	2.90	3.09	1.82	1.51	2.24
Machias River at Whitneyville, Maine	465	2.17	2.95	4.37	8.88	4.97	2.58	.86	.43	2.32	2.90	3.08	2.06	3.13
East Branch of Union River near Waltham, Maine	123	....	....	....	....	....	....	....	.35	1.28	4.20	....	....	....
Branch Lake Stream near Ellsworth, Maine	31	....	....	....	....	....	....	2.15	1.71	1.53	1.66	1.76	2.25	....
West Branch of Penobscot River at Millinocket, Maine	1,880	.74	.43	.72	1.30	4.97	2.46	1.76	1.23	1.21	1.20	1.18	1.16	1.53
Penobscot River at West Enfield, Maine	6,600	.72	.50	1.10	5.61	5.86	1.98	1.29	.77	1.61	2.35	1.73	1.45	2.08
East Branch of Penobscot River at Grindstone, Maine	1,100	.60	.40	.70	4.61	6.89	3.55	1.69	.70	2.25	2.62	1.75	1.34	2.26
Mattawamkeag River at Mattawamkeag, Maine	1,500	.62	.59	1.27	8.27	6.47	1.13	.99	.36	1.11	2.89	2.27	1.87	2.33
Piscataquis River near Foxcroft, Maine	286	1.03	.52	1.75	13.0	7.06	.87	.35	.18	3.09	2.10	1.56	1.57	2.76
Kenduskeag Stream near Bangor, Maine	191	2.82	1.42	5.15	13.1	3.10	.53	.33	.13	1.82	2.38	2.73	2.19	2.97
Kennebec River at the Forks, Maine	1,570	.30	.57	.57	1.73	5.11	2.52	2.06	1.63	1.15	.80	.88	.56	1.49
Kennebec River at Bingham, Maine	2,660	.40	.65	.75	3.38	6.24	2.32	1.53	1.19	1.02	1.03	.85	.61	1.67
Kennebec River at Waterville, Maine	4,270	.51	.76	.95	3.91	4.89	1.98	1.11	.69	.97	.88	.81	.71	1.51
Sebasticook River at Pittsfield, Maine	314	.98	1.58	2.46	10.6	2.64	.94	.96	.86	.95	1.32	1.53	1.74	2.21
Cobbosseecontee Stream at Gardiner, Maine	240	.65	.72	1.28	4.75	1.02	.99	.89	.91	.94	.91	.94	.92	1.24
Androscoggin River at Errol dam, N. H.	1,095	.69	.70	.80	3.02	5.67	2.89	1.29	1.25	1.12	.86	.98	.99	1.69
Androscoggin River at Rumford Falls, Maine	2,090	.65	.78	.84	4.88	4.83	1.91	.88	.79	.89	.78	.85	.76	1.57
Presumpscot River at ontlet of Sebago Lake, Maine	436	1.15	1.19	1.39	1.12	1.41	1.53	1.49	1.49	1.46	1.47	1.52	1.48	1.39
Saco River near Center Conway, N. H.	385	.88	.91	1.82	9.06	6.70	1.79	.69	.42	.78	.85	.85	.71	2.12
Saco River at West Buxton, Maine	1,550	.86	.91	1.80	7.74	4.83	1.86	.78	.52	.44	.81	.56	.73	1.82
Pemigewasset River at Plymouth, N. H.	615	1.10	1.35	1.79	11.0	6.10	1.84	.58	.41	.79	.76	.79	.63	2.26
Merrimac River at Franklin Junction, N. H.	1,460	1.05	1.61	1.67	6.85	3.34	1.49	.85	.80	1.01	1.08	.75	.72	1.77
Merrimac River at Garvins Falls, N. H.	2,340	.97	1.47	1.74	6.07	2.86	1.23	.55	.45	.54	.57	.5[illegible]	.58	1.47
Merrimac River at Lawrence, Mass.	4,452	.68	1.56	1.70	3.40	1.95	.95	.45	.38	.37	.42	.39	.50	1.06
Souhegan River at Merrimac, N. H.	168	....	....	....	....	....	....	....	.23	.21	.23	.23	.41	....
South Branch of Nashua River, Clinton, Mass.	118.2	.92	3.96	3.29	3.75	1.88	.98	.36	.30	.32	.14	.56	.83	1.42
Sudbury River at Framingham, Mass.[a]	75.2	.61	3.54	2.68	2.66	1.55	.37	([b])	([c])	.23	([d])	.13	.41	.97
Lake Cochituate at Cochituate, Mass.[a]	18.9	.63	3.19	2.12	2.14	1.22	.60	.18	.43	.66	.14	.37	.56	1.00
Branch River at Branch Village, R. I.	93	....	....	....	....	....	....	....	....	....	.65	.64	.79	....
Pawtuxet River at Harris, R. I.	103	....	....	....	....	....	....	....	....	.18	.16	.27	.74	....
Wood River at Hope Valley, R. I.	72	....	....	....	....	....	....	....	....	.75	.92	1.04	1.17	....
Connecticut River at Orford, N. H.	3,300	.82	1.21	1.10	7.70	4.36	1.18	.45	.25	.44	.72	.72	.63	1.63
Connecticut River at Sunderland, Mass.	7,700	.78	1.56	1.91	7.32	3.69	1.38	.42	.38	.33	.57	.52	.59	1.62
Passumpsic River near St. Johnsbury, Vt.	237	....	....	....	....	....	1.15	.54	.46	.65	.73	.78	.66	....
White River near Sharon, Vt.	686	....	....	....	....	....	1.23	.34	.28	.24	.33	.38	.34	....
Ashuelot River at Hinsdale, N. H.	440	.79	1.43	1.82	4.89	1.75	.90	.28	.27	.19	.24	.21	.27	1.09
Millers River at Wendell, Mass.	354	....	....	....	....	....	....	.62	.38	.32	.22	.16	.25	....
Deerfield River at Hoosac Tunnel, Mass.	257	....	....	....	....	....	....	....	....	.78	.80	.61	.54	....
Deerfield River at Shelburne Falls, Mass.	501	1.46	2.46	1.80	10.1	2.69	1.38	.30	.50	.62	.63	.57	.48	1.92
Burnshirt River near Templeton, Mass.	8.4	....	....	....	....	....	.77	.17	.14	.20	.39	.33	.51	....
Quaboag River near West Brimfield, Mass.	150	....	....	....	....	....	....	....	....	.48	.42	.40	.66	....

[a] Attention is called to the fact that the Sudbury River records do not give the actual run-off of the river (which would include the effect of storage in the wet season and draft from storage in the dry season from the tributary reservoirs and streams as well as the loss by evaporation from them), but the natural flow of the basin without storage, as nearly as this flow can be measured and adjusted for the change in volume of stored water, without, however, taking into account the actual loss of water by evaporation from the water surfaces of the existing reservoirs and streams in this drainage basin. It may be said that this method of figuring the yield is common for waterworks or public supplies, and is used also in the Nashua and Croton records, but for streams utilized chiefly for production of power the effect of storage as well as the loss by evaporation is included in the yield or run-off measurements and records.

[b] −0.19. [c] −0.04. [d] −0.05.

Summary of discharge, in second-feet per square mile, for stations in North Atlantic coast drainage basins for 1909—Continued.

Station.	Drainage area.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
NEW ENGLAND STATES—continued.	*Sq. m.*													
Westfield River at Knightville, Mass.	162	....	....	....	.....	....	....	....	....	.47	.43	.39	.59	....
Westfield Little River near Blandford, Mass.	43	1.85	5.35	4.35	6.00	2.42	.68	.18	.31	.22	.24	.27	1.09	1.91
Housatonic River near Gaylordsville, Conn.	1,020	1.23	3.21	2.66	3.89	2.44	1.24	.51	.66	.46	.44	.38	.62	1.48
HUDSON RIVER.														
Hudson River at North Creek, N. Y.	804	.77	1.59	1.47	7.82	6.41	1.69	.84	.96	1.00	.89	.92	.53	2.08
Hudson River at Thurman, N. Y.	1,550	.71	1.74	1.68	6.25	5.07	1.81	.72	.62	.59	.51	.54	.52	1.73
Hudson River at Mechanicville, N. Y.	4,500	1.16	2.58	2.05	5.73	3.78	1.34	.44	.34	.32	.35	.37	.35	1.57
Schroon River at Riverbank, N. Y.	534	.48	1.63	1.95	7.43	4.93	2.08	.64	.19	.20	.21	.35	.41	1.71
Sacandaga River at Wells, N. Y.	263	1.74	3.54	2.09	13.7	7.76	1.72	.33	.17	.09	.12	.22	.28	2.65
Sacandaga River at Northville, N. Y.	740	1.53	3.58	2.14	12.4	5.70	1.76	.30	.26	.10	.21	.25	.34	2.38
Sacandaga River near Hadley, N. Y.	1,050	1.60	3.64	2.14	11.7	5.98	1.58	.36	.34	.21	.29	.37	.43	2.39
Mohawk River at Little Falls, N. Y.	1,310	1.63	2.63	4.20	4.50	3.15	.22	1.04	.63	.41	.57	1.13	1.18	1.86
Mohawk River at Dunsbach Ferry, N. Y.	3,440	2.21	4.01	2.81	5.12	2.77	1.09	.44	.33	.38	.52	.70	.66	1.75
West Canada Creek at Twin Rock Bridge, N. Y.	364	3.85	4.29	2.83	10.1	7.09	1.50	.68	.55	.55	.92	1.13	.45	2.85
West Canada Creek at Kast Bridge, N. Y.	574	....	5.26	2.32	.....	5.21	1.41	.75	.58	....	.99	1.31	....	....
East Canada Creek at Dolgeville, N. Y	256	2.41	5.04	2.09	12.1	4.80	1.95	.86	.82	.80	1.04	1.17	.86	2.83
Schoharie Creek at Prattsville, N. Y.	240	2.62	5.09	3.21	4.35	2.81	1.21	.21	.15	.11	.12	.12	.37	1.70
Kinderhook Creek at Rossman, N. Y.	331	1.61	4.02	2.59	3.35	1.63	.80	.23	.25	.18	.22	.20	.27	1.28
Esopus Creek near Olivebridge, N. Y.	239	3.39	6.44	3.43	5.35	3.51	1.62	.33	.44	.24	.23	.18	.66	2.15
Esopus Creek at Kingston, N. Y.	324	3.72	7.39	3.43	4.51	....	....	....	....	....	....	....	....	....
Esopus Creek at Mount Marion, N. Y.	378	3.30	7.47	4.04	4.65	3.38	1.75	.37	.44	.26	.26	.22	.84	2.25
Rondout Creek at Rosendale, N. Y.	380	3.92	6.00	3.42	3.19	3.16	1.48	.31	.39	.28	.31	.25	1.02	1.98
MIDDLE ATLANTIC STATES.														
Passaic River near Chatham, N. J.	101	1.80	4.34	2.35	2.96	1.48	.26	.17	.37	.16	.11	.14	1.28	1.28
Raritan River at Boundbrook, N. J.	800	1.79	3.78	2.21	.....	....	....	....	....	....	....	....	....	....
East Branch Delaware River at Hancock, N. Y.	920	3.60	6.10	3.02	4.39	4.08	1.05	.31	.26	.20	.21	.24	.50	1.97
Delaware River at Port Jervis, N. Y.	3,250	2.80	5.60	2.88	3.54	3.72	1.27	.32	.22	.12	.12	.13	.39	1.73
Delaware River at Riegelsville, N. Y.	6,430	2.10	4.60	2.63	3.06	3.17	1.16	.48	.35	.28	.28	.26	.59	1.53
West Branch Delaware River at Hancock, N. Y.	680	3.07	5.41	2.69	3.85	3.41	1.68	.28	.19	.10	.12	.12	.30	1.74
Mongaup River near Rio, N. Y.	189	....	....	....	.....	....	....	....	....	.26	.26	.25	....	....
Paulins Kill at Columbia, N. J.	179	1.85	4.21	2.26	2.57	2.59	.80	.60	....	....	....	....	....	....
Lehigh River at South Bethlehem, Pa.	.....	....	....	....	.....	2.72	1.14	.64	.39	.36	.34	.30	.95	....
Tohickon Creek at Point Pleasant, Pa.	102	2.40	5.39	2.25	2.72	.96	.51	.07	.04	.03	.04	.11	1.50	1.33
Neshaminy Creek below forks, Pa.	139	2.06	4.13	2.29	2.40	1.25	.55	.13	.14	.08	.07	.14	.94	1.18
Schuylkill River near Philadelphia, Pa.	1,920	.98	2.64	1.45	1.45	1.21	.32	.10	.09	.11	.12	.12	.65	.77
Perkiomen Creek near Frederick, Pa.	152	1.64	3.70	2.28	2.18	1.45	.53	.24	.15	.15	.17	.23	1.37	1.17
Susquehanna River at Binghamton, N. Y.	2,400	2.49	5.12	3.12	4.03	3.21	1.12	.39	.35	.20	.20	.25	.36	1.74
Susquehanna River at Wysox, Pa.	7,930	1.48	3.06	2.06	2.69	2.47	.99	.23	.15	.10	.10	.12	.28	1.14
Susquehanna River at Wilkes-Barre, Pa.	9,810	1.48	3.45	2.18	2.77	2.87	1.08	.21	.15	.11	.12	.12	.22	1.21
Susquehanna River at Danville, Pa.	11,100	1.46	3.50	2.14	2.86	2.97	1.07	.25	.17	.13	.14	.14	.23	1.24
Susquehanna River at Harrisburg, Pa.	24,000	1.27	3.45	2.08	2.77	2.95	1.23	.33	.19	.15	.18	.16	.29	1.24
Susquehanna River near McCall Ferry, Pa.	26,800	1.25	3.37	2.03	2.71	2.85	1.24	.34	.19	.17	.18	.17	.30	1.22
Chenango River at Binghamton, N. Y.	1,530	1.85	4.36	2.70	3.39	2.55	.92	.18	.12	.10	.12	.15	.26	1.39
Chemung River at Chemung, N. Y.	2,440	.93	2.18	1.27	2.18	2.53	1.04	.11	.05	.05	.06	.06	.08	.89
West Branch Susquehanna River at Williamsport, Pa.	5,640	1.43	4.11	2.18	3.17	3.87	1.55	.32	.14	.10	.14	.12	.21	1.46
Juniata River at Newport, Pa.	3,480	.79	2.17	1.38	2.28	1.46	1.14	.32	.25	.22	.26	.21	.47	.91
Broad Creek at Mill Green, Md.	16.4	1.15	1.61	2.05	.....	....	....	....	....	....	....	....	....	....
Deer Creek near Churchville, Md.	141	1.45	1.99	2.40	.....	....	....	....	....	....	....	....	....	....
Gunpowder Falls at Glencoe, Md.	160	1.48	1.84	2.21	.....	....	....	....	....	....	....	....	....	....
Little Gunpowder Falls near Belair, Md.	43	1.48	1.90	2.40	.....	....	....	....	....	....	....	....	....	....
Patapsco River at Woodstock, Md.	251	.99	1.75	2.27	.....	....	....	....	....	....	....	....	....	....
Potomac River at Point of Rocks, Md.	9,650	.72	1.17	.90	1.73	.90	1.14	.28	.22	.18	.23	.19	.32	.66
Shenandoah River at Millville, W. Va.	3,000	1.21	1.31	1.00	.....	....	....	....	....	....	....	....	....	....
Monocacy River near Frederick, Md.	660	1.05	3.88	2.59	2.05	.86	1.49	.23	.15	.14	.13	.12	1.01	1.14
Goose Creek near Leesburg, Va.	338	....	....	....	.....	....	....	....	.21	.19	.28	.48	.47	....
Rappahannock River near Fredericksburg, Va.	1,590	1.96	1.91	1.49	1.66	1.03	2.36	.36	.31	.23	.17	.18	.35	.99

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